CAREERS

A CAREER AS AN EPIDEMIOLOGIST

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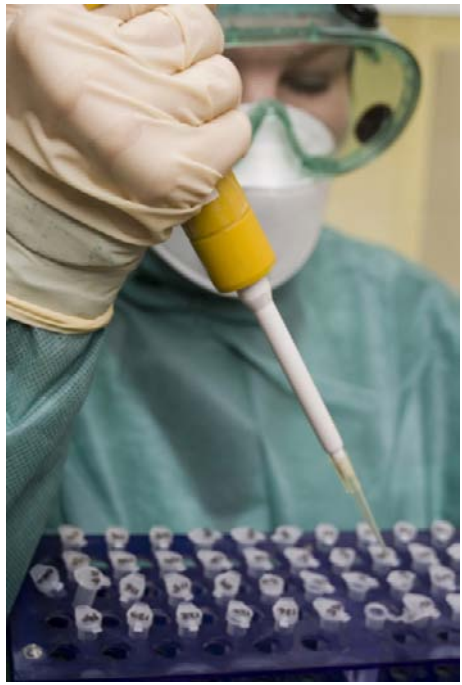
EPIDEMIOLOGIST

PUBLIC HEALTH SPECIALISTS SEARCHING FOR THE CAUSES AND CURES OF DISEASES AND EPIDEMICS

EPIDEMIOLOGISTS ARE OFTEN REFERRED TO AS MEDICAL DETECTIVES. MUCH like any other detective, they hunt for clues, carry out investigations, and verify facts. But rather than chase down criminals, epidemiologists search for the causes and patterns of diseases in populations in order to prevent or control them.

Epidemiology differs from other medical specialties in its fundamental approach to health. Whereas clinical medicine deals with individual patients, epidemiology is concerned with the health of entire populations. Epidemiologists study all kinds of diseases and disabilities including:

- **Chronic diseases**
- **Infectious diseases**
- **Illnesses that result from various environmental exposures**
- **Illnesses that are related to genetic traits**
- **Injuries**
- **Mental illnesses**



Epidemiologists make major contributions to the health of populations at the local and national level, as well as globally. As the fundamental science underlying public health practice, epidemiology provides all the tools

that are required for the study of public health problems and the design of adequate control measures. They also provide scientific data to help governments, health agencies, healthcare providers, and communities deal with epidemics and other health issues. They are employed by local, state and federal government agencies; hospitals and other healthcare facilities; colleges and universities; research laboratories and pharmaceutical companies; and other public and private-sector organizations.

The field of epidemiology has played a critical role in many important discoveries over the years. Here are just a few:

They helped explain and find ways to stop the spread of such communicable diseases as cholera and measles.

They contributed to the linking of risk factors with specific chronic diseases, including two of the greatest causes of death in developed countries – cardiovascular disease and cancer.

They discovered the critical role that folic acid has in the prevention of neural tube defects in infants, which led to the development of prevention strategies, such as the fortification of certain foods with folic acid.

They established the association of smoking with heart disease and lung cancer.

They showed that AIDS is linked to certain sexual practices and the sharing of hypodermic needles.

They noted a surprising number of cases of a deadly form of pneumonia in China, leading to the identification of the virus that causes SARS.

At a minimum, a master's degree in epidemiology from a school of public health is required in order to work as an epidemiologist. Many epidemiologists go on to earn a doctorate in epidemiology in order to deepen their knowledge and expand their career opportunities. Some epidemiologists also hold additional professional degrees, such as medicine or nursing.

To be successful in this field, you should excel in the sciences and have a comfortable grasp of mathematical concepts, since statistical analysis is a key aspect of epidemiology. Good communications skills are also essential, including listening, speaking and writing. Moreover, a curious and open mind will help you go far in this field.

WHAT YOU CAN DO NOW

FOR STARTERS, YOU SHOULD TAKE AS MANY SCIENCE AND MATHEMATICS courses as possible. It's important to build a solid foundation in these areas prior to entering any epidemiology program. It's also a good idea to contact several epidemiology programs that interest you to ask about their prerequisites so that you're all set when application time rolls around. If you find these courses uninteresting or too difficult, epidemiology is most likely not the right career choice for you. On the other hand, if you are comfortable with numbers and are excited by science, a rewarding career in this field may be in your future.

For an innovative way to experience what it's like to be an epidemiologist, check out a website where you can play an educational game called "Outbreak at WatersEdge." This interactive online game was developed by the Midwest Center for Life-Long Learning in Public Health at the University of Minnesota School of Public Health. In this game, you play the role of an intern at a Department of Public Health, helping to trace the source of an outbreak of severe diarrhea.

The adddress is:
www.mclph.umn.edu/watersedge

After playing this game, you may be inspired to seek out a real-world internship, part-time job or volunteer position. This could be at a health department, academic institution, research laboratory or hospital. This experience will not only look good on your résumé and college application, but will also help you to determine if epidemiology might be your true calling. You might also develop some important contacts along the way that will prove helpful down the road.

It would be beneficial for you to meet with some working epidemiologists so that you can see first-hand what they do, and have the opportunity to ask questions. It would be a good idea to meet with several to learn about the different types of opportunities in this field.

Another way that you can broaden your knowledge and experience is to visit science and history museums. Also consider attending science camps and pre-college summer programs at colleges and universities. Scholarships may be available to attend some of these programs. For a listing of internships and other relevant programs, visit the website www.Cogito.org, an online community for academically talented youth interested in science and math.

If you are now (or will soon be) a junior or senior in high school, look into entering the Young Epidemiology Scholars (YES) Competition, sponsored by the Robert Wood Johnson Foundation and the College Board. The YES Competition awards up to 120 college scholarships each year to high school juniors and seniors who conduct outstanding, original research projects that apply epidemiological methods of analysis to a health-related issue. For more information about this competition, visit:
www.collegeboard.com/yes

HISTORY OF THIS CAREER

EPIDEMIOLOGY EVOLVED FROM A COMBINATION OF MANY OTHER DISCIPLINES including medicine, sociology, demography and statistics. It was not until the 19th century that epidemiology became a distinct field with its own concepts, methods and philosophy. However, the general concept that the environment influences disease occurrence and that many diseases are contagious can be traced back to antiquity. The first known writings that discussed contagious infection appeared in *On Contagion*, penned in the middle of the 16th century by Giralamo Fracastoro, an Italian (1478–1553). He is believed to be the first person to explicitly state that diseases result directly from specific contagions, although he had no notion of microorganisms, and the microscope had not yet been invented.

In 1662, John Graunt (1620-1674) published *Natural and Political Observations Made Upon the Bills of Mortality*. It contained an analysis of the mortality rolls (lists of deaths) in London before the Great Plague and presented one of the first life tables and time trends for many diseases. He provided statistical evidence for many theories on disease, and also refuted many widespread ideas about them.

The French Revolution at the end of the 18th century had a huge impact on the development of the epidemiologic approach to disease. It stimulated an interest in public health and preventive medicine, and allowed several individuals from the lower classes to assume positions of leadership in medicine. One of those individuals, Pierre Charles-Alexandre Louis (1787-1872), conducted several observational studies. Using quantitative reasoning, he demonstrated that bloodletting was not efficacious therapy in the treatment of disease and helped reverse a trend toward its increasing use in medical practice. While he was not the first person to use statistical methods in medicine, he emphasized their importance, and his influence became widespread, primarily through his students both in England and in the United States. Many of his students went on to become leading contributors to the field of epidemiology.

One of those students was William Farr (1807-1883), who pioneered the use of statistics in epidemiology and introduced important concepts such as the death rate, dose-response, herd immunity, and cohort effect. He and two other students of Louis, William Guy and William Budd, founded the Statistical Society of London. Two other students, Oliver Wendell Holmes and George Shattuck, Jr., founded the American Statistical Society.

John Snow (1813-1858), a physician, became well known for suppressing an 1854 outbreak of cholera in London. Through a meticulous and logical examination of the facts, he identified the cause of the outbreak as a public water pump on Broad Street. He had the handle of the water pump removed, and soon after that the outbreak ended. This is considered a major event in the history of public health, earning Dr. Snow the widely accepted title of the founder of modern epidemiology.

The word “epidemiology” was coined in the mid-19th century to describe the scientific study of epidemics. Epidemiology continued to grow and develop, particularly in Britain and America, confronting the challenges of urban crowding, large-scale immigration, and the threats of infection and disease on their military forces.

Twentieth century combat brought epidemiologists into the war effort. The US Centers for Disease Control and Prevention (CDC) was originally established as the World War II Office of Malaria Control in War Areas, becoming the Communicable Disease Center in 1946, the Centers for Disease Control in 1980, and receiving its present name in 1992. The CDC’s Epidemic Intelligence Service was established in response to concern about importation of exotic diseases from Asia, a concern arising during the Korean War.

Graduate education in public health began in the early 1900s. Formal accreditation was initiated in the mid-1940s, when 10 schools of public health were recognized by the American Public Health Association (APHA), the nation's largest individual public health membership organization. In 1974, the independent Council on Education for Public Health (CEPH) was established by APHA and the Association of Schools of Public Health (ASPH), the national organization representing deans, faculty and students of accredited schools of public health.

The Department of Epidemiology at the Johns Hopkins Bloomberg School of Public Health is the oldest and among the largest epidemiology department in the world. In 1919, Dr. Wade Hampton Frost was appointed resident lecturer in epidemiology and headed the newly formed Epidemiology Department. In 1927, Dr. Frost organized a conference on epidemiology, held at Johns Hopkins, which played a major role in encouraging the development and institutionalizing of epidemiology in health departments across the country. In 1930, Dr. Frost became the first professor of epidemiology in the United States.

In the early 20th century, mathematical methods were introduced into epidemiology by Ronald Ross, Anderson Gray McKendrick, and others. In 1954, the results of an important study, called the British Doctors Study, was published. The study, led by Richard Doll and Austin Bradford Hill, demonstrated strong statistical support linking tobacco smoking to lung cancer.

In the second half of the 20th century, epidemiology flourished. Epidemiology departments were established in many universities, a growing number of companies began hiring epidemiologists, funding for research dramatically expanded, methodological and technological capabilities improved, professional societies and journals proliferated, and coverage of epidemiology in the mass media greatly increased. In the final quarter of the 20th century, powerful computers, information technology, and more rigorous methodological approaches transformed epidemiology into the most fundamental basic science of public health. In the 1990s, epidemiology made enormous progress, including advances in genetic epidemiology and the development of molecular epidemiology.

Now, in the 21st century, epidemiologists specializing in genetics are poised to be at the forefront of the medical revolution, which is being led by the Human Genome Project and the progress being made in computing power and powerful statistical methods of analysis. Many opportunities are now available for epidemiologists to evaluate the interplay between genes and the environment and how this interaction affects the biological processes that underlie disease.

WHERE YOU MIGHT WORK

EPIDEMIOLOGISTS GENERALLY WORK IN MEDICAL, RESEARCH, ACADEMIC OR government settings. According to a recent survey, nearly 50 percent are employed in government; another 12 percent work in management, scientific, and technical consulting services firms; and eight percent are in private hospitals. Where you end up working if you become an epidemiologist will depend largely on whether you become a clinical or research epidemiologist, and what level of education you achieve.

Clinical epidemiologists work primarily in consulting roles at hospitals. Some clinical epidemiologists work in outpatient settings.

Research epidemiologists work at colleges and universities, schools of public health, medical schools, and research and development services firms. They are also employed by pharmaceutical companies, private hospitals, other healthcare organizations, consulting firms, research laboratories, and large medical corporations.

Governments at the federal, state and local level employ a large number of epidemiologists, both clinical and research. Epidemiologists are in demand at county, city and state departments of health. The US Department of Health and Human Services, the federal government's principal agency for protecting the health of Americans, is an employer of many epidemiologists. The department includes more than 300 programs and many different agencies under its umbrella. Among them is the Centers for Disease Control and Prevention (CDC), which provides job opportunities for epidemiologists across the US, as well as abroad. Many epidemiologists launch their career with the CDC's Epidemic Intelligence Service (EIS), a two-year postgraduate program of on-the-job training and service.

The National Institutes of Health (NIH), another agency of the US Department of Health and Human Services, is also a large employer of epidemiologists. With 27 institutes and centers, it is the primary federal agency for conducting and supporting medical research. It is headquartered in Bethesda, Maryland.

Epidemiologists also work for international agencies, such as the World Health Organization (WHO). WHO is the directing and coordinating authority for health within the United Nations system.

DESCRIPTION OF WORK DUTIES

- **Designing a research study**
- **Conducting research to determine disease trends among large populations**
- **Collecting data and analyzing the findings using statistical methods**
- **Sharing and obtaining data from colleagues**
- **Recording information into a database**
- **Writing reports, papers and articles**
- **Speaking to the public and colleagues about research findings**
- **Consulting with people on the phone or in person regarding their research**
- **Developing and testing theories regarding the causes and spread of disease**
- **Investigating and identifying risk factors for disease**
- **Developing strategies to combat the spread, occurrence and death from disease**
- **Conducting public health surveillance to monitor the distribution of diseases**

Epidemic Investigations

Epidemiologists are called on to investigate all kinds of disease outbreaks, or epidemics. Epidemiologists do fieldwork to determine what causes a particular disease, what the risks are, who is at risk, where the disease is most likely to occur, trends over time, what sort of exposures its victims have in common, and how to prevent further incidences. Epidemiological investigations require meticulous attention to detail in collecting information about all of the cases. Epidemiologists must also collect details about all possible associated factors, such as dietary intake, occupation, living conditions, and unusual recent experiences. Investigations should have the ability to make connections among seemingly isolated events.

Epidemiologists pay particular attention to the index case, which is the first identified case of a condition. In most infectious disease epidemics, this is the case that introduced the infection into the affected community. Information is also gathered about healthy people in the same community to figure out why they have not been affected.

During an investigation, epidemiologists first need to confirm the existence of an epidemic by noting from past surveillance data the number of cases suspected, and comparing this with the number of cases initially reported. They also need to discuss the occurrence of the disease with physicians or others who have seen or reported cases.

Some other basic steps that epidemiologists follow during an outbreak investigation include:

- **Checking the validity of information received**
- **Verifying the diagnosis**
- **Informing and engaging the public throughout the investigation**
- **Searching for additional cases to determine whether there is an outbreak**
- **Establishing a clear definition of the disease**
- **Making arrangements for laboratory support**
- **Verifying the diagnosis of potential secondary cases**
- **Characterizing each case in terms of time, place and person**
- **Hypothesizing what is causing the outbreak or identifying the sources**
- **Developing analytic studies to try to ascertain whether the hypothesis is correct**
- **Conducting control measures**

Data Collection and Analysis

The initial phase of an epidemic investigation consists of collecting data. Epidemiologists use a variety of tools to collect data, including questionnaires and interviews. The data collected must be organized according to time, place and person. The population at risk should be identified and a hypothesis developed concerning the occurrence of the disease. If appropriate, biological specimens to measure markers of disease progression should be collected and transported to the laboratory. Laboratory tests are used to confirm the diagnosis, identify the agent that caused the disease, and measure immunological responses. Techniques of molecular biology, particularly DNA typing and the identification of biomarkers, have greatly enhanced the precision of epidemic investigations.

To analyze data, epidemiologists use statistical methods to extract information from the raw data they receive. In doing so, epidemiologists must take into account various hereditary, behavioral, environmental, and healthcare factors. They also look at such factors as ethnicity, race, age, lifestyle, economics and sexual orientation.

After the analysis is complete, epidemiologists develop and implement control and prevention measures. They may also implement continued surveillance activities to evaluate the effectiveness of the control and prevention measures.

Epidemiological Studies

Epidemiologists design and carry out studies that investigate potential associations between disease and diet, lifestyle, genetics, or other factors within populations. This type of research yields information about the distribution and determinants of disease or other health outcomes for further study.

Epidemiological studies are aimed at identifying causal relationships between exposures (such as to alcohol or smoking, biological agents, stress, or chemicals) and illness and death. The application of these study methods has contributed substantially to scientists' understanding of disease causation, and thereby to the control and prevention of many conditions of great public health importance.

Study Designs Epidemiologists use a range of study designs that are generally categorized as descriptive, analytic and experimental. Although all three can be used in investigating the occurrence of disease, the method that is used the most is descriptive. Once the basic epidemiology of a disease has been described, specific analytic methods can be used to study the disease further, and an experimental approach can be developed to test a hypothesis.

Descriptive

Epidemiologists who work in descriptive studies provide information about the occurrence of disease in a population as well as trends in the frequency of the disease over a period of time. This method begins with surveillance of populations, using vital and health statistics such as death certificates, population census, and surveys. Other information is derived from notified cases of infectious diseases of public health importance, from registries of cancer or other diseases, and from hospital discharge statistics. The data are then collated by time, place, and person.

Analytic

The two main analytic methods are the case-control study and the cohort study. A case-control study is designed to help determine if an exposure, such as to a potentially toxic pesticide, is associated with an outcome, such as a specific disease. The first step is to identify the cases, which are those known to have the outcome, and the controls, which are those known to be free of the outcome. Then, epidemiologists look back in time to learn which subjects in each group had the exposure, comparing the frequency of the exposure in the case group to the control group.

Case-control studies have certain advantages compared to other study designs. They are comparatively quick, inexpensive, and easy. They are particularly appropriate for investigating outbreaks and for studying rare diseases. The case-control study is a systematic extension of routine medical history taking, in which the past histories of patients suffering from the condition of interest are compared to the past histories of persons who do not have the condition of interest, but who are otherwise similar in such particulars as age and sex. Analysis of data about a series of cases and controls may show differences that are statistically significant. Sometimes only small numbers of cases are required to demonstrate significant differences between cases and controls. This makes the case-control study a suitable way to search for causes of rare conditions.

Although case-control studies can be flawed by the presence of biases that are often difficult or even impossible to eliminate, they are a valuable method of investigation because they can be done rapidly and at relatively little expense. The findings can be confirmed or refuted by more rigorous research methods such as cohort studies.

The second analytic approach is the cohort method, which studies two populations: one that has had contact with the suspected causal factor under study and a similar group that has had no contact with the factor. The starting point of a cohort study is the recording of healthy subjects with and without exposure to the agent being studied. Individuals exposed to the agent under study (index subjects) are followed over time and their health status is observed and recorded during the course of the study. In order to compare the occurrence of disease in exposed subjects with its occurrence in non-exposed subjects, the health status of a group of individuals not exposed to the agent under study (control subjects) is followed in the same way as that of the group of index subjects.

An example of a cohort approach is to observe two similar groups of people, one composed of individuals who received blood transfusions and the other of persons who did not. The occurrence of hepatitis prospectively in both groups permits one to make an association between blood transfusions and hepatitis. One would expect that if the transfused blood was contaminated with the hepatitis B virus, the recipient cohort should have a higher incidence of hepatitis than the cohort who did not have a transfusion.

Experimental

In experimental studies, epidemiologists have control over the population groups they are studying. Part of the population receives some sort of treatment, known as an intervention, and the results are compared with those in the control group, none of whom receive the treatment. These human experiments are usually carried out in a randomized controlled-trial design. The randomized controlled trial is a form of human experimentation in which the subjects, usually patients, are randomly allocated to receive either a standard accepted therapeutic or preventive regimen, or an experimental regimen. The purpose of random allocation is to eliminate or minimize bias in the selection of subjects. This greatly enhances the validity of the results. Preferably, the subjects and those observing the trial's results should be unaware of which subjects are receiving the experimental and which the control regimens, thus eliminating the power of suggestion as a factor influencing the response of individuals to the regimen.

An example is the evaluation of the effect of a new drug on a disease. A group of people with the disease is identified, and some members are randomly selected to receive the new drug. If the only difference between the two is use of the drug, the clinical differences between the groups should reflect the effectiveness of the drug. There are very important ethical constraints on the conduct of randomized controlled trials, and it is essential to obtain the informed consent of all human subjects on whom a trial is conducted.

TRUE STORIES OF WORKING PROFESSIONALS

I Work on Helping People With AIDS

"I didn't have a straight path to public health. I went from thinking I was going to be a curator of art, to deciding I was going to be a lawyer, to doing what I'm doing now.

I got my bachelor's degree in an interdisciplinary study combining art, history and politics. After I graduated, I went and lived in San Francisco where I worked for a nonprofit organization involved in environmental causes. Then I worked for three years at a community development organization in a forgotten low-income neighborhood. It was at the height of the AIDS epidemic in 1989, and eventually I ended up working for an AIDS service organization that helped put people in housing. I went to law school for a month but I didn't like it, and then a friend suggested public health school, which I had never thought of before.

I ended up getting an MPH (Master of Public Health) degree and at that time became interested in women's health. When I got into researching women and HIV, I saw that the cause was mostly drugs. So since 1994, I've really been focused on issues related to morbidity around drug use. We're still doing risk-factor studies related to HIV and trying to understand the nature of risk, which I'm interested in, as well as the social and economic aspects related to risk, but interventions are part and parcel because we're well into the third decade of this disease. Much of what I do is

conducting randomized clinical trials. I'm also really interested in stopping the initiation of injections, so different things that fall along the continuum of drug use are among my interests. Another thing that I'm really concerned about is economic development as a form of HIV prevention, which has worked and has evolved into a jewelry-making collective of drug abusers in the city where I work.

There's no typical day for me. The beauty of a career like this is the flexibility. And you just have to be incredibly motivated to make it happen. Some of my work is in Thailand so I'm often there, or in India, where I also do research. I have meetings with students when I'm in town.

Ninety percent of our financial support comes from grants, so I spend many hours writing proposals. I was married on September 2nd, and I had two grants go in for the September 1st deadline, and I love that I got those in. It's just the nature of the beast that we write grants a lot.

What I like best about my career is the freedom, and having ideas and interests and being able to follow them through. It's great to be able to have an idea about something and do the research and see what people have done before. And that freedom trickles all the way down to my days, which are incredibly flexible.

A good analogy is that this type of career is like a huge symphony. There are ups and downs and stressful periods, and then beautiful periods of major activity, and you have to be able to ride all of that. I would love it if the majority of my work was finding things to fulfill my notion of sustainable change that have a lasting impact on people's lives, but to do that within the confines of a three- to five-year funding world is really an accomplishment."

I Work for a Poison Control Center

"I supervise and coordinate all the education and research efforts from within the poison control center and our partnering agencies.

One day of my work week involves administrative management, supervising, reviewing materials, directing staff, grant reporting, and these sorts of duties. Another day of my week includes developing and analyzing data, researching projects, setting up evaluation tools, planning oversights, and supervising our data analysis on a grant that we have related to research. Then the other three days, I'm usually in meetings with community partners, or developing educational materials, and doing education.

The poison control center's mission is to prevent and treat poisonings that occur. So the research that I do can be wide and varying – doing a survey of adults in the community to see if they know that a poison center exists, or to see if they know what poisoning is, or to assess when they would call a poison center – and then see if those answers differ depending on whether they are male or female, or have kids or don't have kids. I can also be setting up programs to impact knowledge awareness, and to see if and when we do educational programs, does it actually change people's knowledge, does it change some of the choices they make, and do they actually know where to get information now.

Since people can call the poison control center 24 hours a day, we have data that's considered real time. For example, there have been many toys recently that have been recalled or that have to be returned to the company because they have lead in them, and we can look through our data and see if we're getting an increased number of lead poisoning calls coming in when the media is active in the community about this issue. Carbon monoxide poisoning is another big issue, and we can keep track of whether we are getting more calls during certain times of the year or when the electricity goes out.

When I was in high school I wanted to go into the medical field. I had a great interest in the human body. I ended up going to school for nursing, and while I was in school I also debated

whether to go to school for a career involving mathematics because I really enjoyed it. During my third year in nursing school I spoke with a career counselor who recommended that since I was so far along in the program, I should consider getting my nursing degree, and then working with statistics and doing research about health. So I took a couple of statistics classes and really liked them. I then graduated with my degree in nursing.

I worked in Minnesota at a medical center for a while as a nurse in the hospital, and I kept getting frustrated because I was seeing the same people return to the hospital and I felt, 'We told you what to do so you wouldn't get sick so why didn't you do it?' I got frustrated with treating people versus preventing them from ever needing to come to the hospital because if they had just known certain things then we could have prevented them from nearly dying or, as sometimes happens, dying. So I went back to school and got my master's degree in public health and decided to do epidemiology because of the math and the investigative component that I really like.

I was going to go into chronic diseases, but ended up getting an internship with the Indian Health Service. People might not be aware that there is a health service provided by the government to Native Americans and Alaska native populations in the United States. I discovered that what they were really dying from – especially in the younger years – were injuries. So I stayed within epidemiology and focused on acute injuries. From there I worked for a while as an injury prevention specialist in my home community. Then I worked for the National Center for Health Statistics, which is part of the Centers for Disease Control. I worked there as a health statistician and then I ended up in my current position. I've been working here at the Poison Control Center for three years.

The thing I like most about my work is that I'm one of those people who has many questions and very few answers. I love that my job is to think of questions and then try to find the answers to them. It just gets me really energized and excited. What I like least is that I often don't have enough time or money to figure out all of the right answers to all of the questions I have. That's sometimes the most frustrating thing.

I'm actively involved in the American Public Health Association. I'm also involved in the State and Territorial Injury Prevention Director's Association. I'm on the Board of Directors for our New Hampshire Public Health Association. I'm also on the steering committee of the American Association of Poison Control Centers' public education committee. I also sit on several local boards and committees such as those involved in suicide prevention and substance abuse prevention.

The poison control center that I work at covers Maine, New Hampshire and Vermont, so I end up doing day trips throughout beautiful New England for meetings and training sessions. Last year, I was also able to go to New York City to help do training, and to northern New York State to present some of my findings. I also went to New Orleans to present at a conference, and to Washington DC to present at a conference. So there are many opportunities to share the answers to your questions."

I Am a Professor at Johns Hopkins University

"I mostly do research. My teaching tends to be in the spring – I teach in the School of Public Health in the third quarter. I teach the cardiovascular epidemiology course, which runs three times a week for an hour and a half, and then I teach the medical students an epidemiology course in April. That course runs for 10 days straight for basically the whole day. Other than that, I give guest lectures, and the rest of the time I do research. Most of my research involves graduate students and fellows who are in the hospital, and working with junior faculty.

On a typical day I come in, check my email, talk to my assistant, and then I look at some papers. I usually have some appointments with students that I am working with, and people come by with issues, or with papers that we're writing together which we discuss. Then I have regularly scheduled conference calls with people who are investigators on studies that I'm involved with throughout the country. We usually talk about every other day.

One study started out with 4,000 individuals here in Washington County, Maryland, and the government had a large contract whereby four such centers were put together. So our study is now 16,000 people, and there is a staff that follows these participants over time. Initially, we had them visit the clinic, and we took their blood pressure and asked them questions about physical activity, diabetes, and the medications they were taking. We drew blood, did blood tests, and then did measurements of whether or not they had cardiac disease and hardening of the arteries. We have been following them for almost 20 years for heart disease, whether they get heart attacks, strokes, and if they die, why, and whether they're having health problems and, if so, what problems. What we try to do is relate the things they have done way back in their lives to the events that are happening now to see whether we can develop risk factors for future diseases.

These are the kinds of studies epidemiologists do. A key step in my decision to do research full time came when I would see many patients with heart disease who were really very far along. I thought at that stage the treatments might be helpful, but prevention years before could really have made a much bigger difference. So that was the area that I wanted to focus on.

I like designing studies and coming up with new ideas to test whether a new hypothesis works or not. I like working with colleagues and students. The great thing is that we are in an exciting environment where we've got interesting projects and smart people from all over the world coming to visit. We sponsor seminars presenting exciting new information, so that's the plus. The minus is that if you start many new interesting projects, then you have a heavy work load that you have to finish, and all of that work is a challenge. Also, in order to get all of the work done you have to get grants and fill out all the forms. I'm right now working on a large grant. Putting the idea together for a grant is not that hard; reporting them annually is a little more tedious, and making sure all of the budgets are adhered to takes a little bit of time, too.

Most of my studies are in the United States, and the populations that I follow are primarily in Maryland, so in order to work with my staff, I just travel throughout Maryland. Now we also collaborate with centers throughout the United States, so we meet several times a year in different cities for that, and we present our work both nationally and internationally. I travel to present results at the American Heart Association and the American Society of Nephrology. I'm usually gone for about three- to -six days, and the meetings have anywhere from 500 people in a small meeting to 20,000 people for a large meeting where there's a wide range of presentations. You try to communicate your new ideas and findings and why they're important, and other people communicate their ideas and you get energized by what's known and what's unknown.

I went to a very good public high school in Chicago. I had a great chemistry teacher who said that Princeton was the most rigorous university that he knew of, so I went there. I've always liked math so I majored in math. I decided that medicine might be a good combination of math and science, so I majored in theoretical math but I did all the courses for medical school. I attended the MD/PhD medical scientist training program at Johns Hopkins University. The program funded your medical school and it funded your PhD for a total of six years, and I was fortunate to finish in just six years.

After the first two years of medical school I did a few clinical rotations and then I went on to do the PhD in epidemiology. Because I had a great math background, it wasn't very hard for me to get a master's degree in biostatistics, so I also did that. Then I did some research affiliated with ongoing studies on the genetics of cholesterol in families. I shuttled between working with an expert on cholesterol metabolism in the hospital and then going back to talking with an expert at the school of public health who was also an expert on genetic epidemiology and family studies and their analysis. My PhD advisor was an expert on epidemiological study design. So I did a circuit between these three people, and learned something from each one, putting it together in a number of papers. That took about three years, and then I went back to medical school and finished the last year of medical school.

I finished everything and got married in 1992. At the time, I was in the middle of research and doing many interesting things, and it was going well. Since I figured I was likely to do research with most of my time, I took the plunge and decided to do research full time. So I did a postdoctoral fellowship and joined the faculty."

PERSONAL QUALIFICATIONS

YOU WILL FIND THAT MOST EPIDEMIOLOGISTS SHARE CERTAIN PERSONAL characteristics that help them to succeed in this career. Among these characteristics are a curious mind and exceptional problem-solving skills. Of course, epidemiologists must have a high aptitude for, and an interest in, the sciences and mathematics, and need to be very comfortable working with numbers.

Epidemiologists are generally very good at multi-tasking, which involves juggling many different projects at the same time. Likewise, good time management skills are also important. Deadlines have to be met, especially when it comes to submitting grant proposals, which many epidemiologists depend on for funding their research. And in order to put together a winning grant proposal, as well as research reports and journal articles, excellent writing skills are necessary.

Oral presentations are often part of the job description. Therefore, you will find that the best epidemiologists typically excel in public speaking. Good verbal skills are particularly important for those epidemiologists who teach.

Epidemiologists are typically passionate about their work and are dedicated to their careers. They have the ability to think outside of the box, and are generally detail-oriented and organized.

Other personal traits common to most epidemiologists include patience, inquisitiveness and flexibility.

ATTRACTIVE FEATURES OF THIS CAREER

EPIDEMIOLOGISTS CAN MAKE A VERY POSITIVE DIFFERENCE IN THIS WORLD. THEY improve the health and well-being of large numbers of people through their research and findings. There is much satisfaction in this kind of work, and it is a very well-respected and admired profession.

The work is very intellectually challenging. There is typically great variety in the work that they do. New discoveries happen every day, so it is an exciting and dynamic career. Also, if you like to travel, many jobs in this field provide ample opportunity for trips all over the world.

Many places of employment for epidemiologists offer excellent benefits as part of their compensation package. For those who work for the government or receive tenure at a university, job security is also another plus.

UNATTRACTIVE FEATURES

IT TAKES A GREAT INVESTMENT BOTH IN TIME AND MONEY TO BECOME AN epidemiologist. Many years of school are required to enter this field. Once you have completed a four-year bachelor's degree program, you will then need at least a master's degree, which typically takes two years of full-time study. Some epidemiologists go on to earn a doctorate, which requires several more years at a university.

Despite all those years of school and graduate degrees, the salaries are not as high as you might expect. People don't choose this profession to get rich. First of all, it may be many years before you pay off all of your student loans, if you have them. Moreover, in some positions, notably academic, you have to raise a large percentage of your own wages through grants.

This is not a career where you will receive immediate gratification. The gains, and the satisfaction that goes along with them, are long-term. A frustration for some epidemiologists is that, unlike medical practitioners who work with individuals, they don't get to see the impact of their work in clinical practice. A statistic often quoted by epidemiologists is that it takes 17 years for research findings to alter clinical practice. This career requires great patience and perseverance.

EDUCATION AND TRAINING YOU WILL NEED

THE MINIMUM EDUCATIONAL REQUIREMENT TO WORK AS AN epidemiologist is a master's degree from a school of public health. Some jobs require a doctorate. It is not uncommon for some epidemiology jobs to require a medical degree because only licensed physicians can prescribe drugs.

While you can enter a graduate program in epidemiology straight out of a bachelor's degree program, you will find that most epidemiologists start out working in a related health field such as nursing or medicine, and then go on to study epidemiology in order to advance their career or change its direction.

There are over 300 academic institutions that offer a graduate degree in public health. However, not all of them have an epidemiology department, and most of them are not accredited by the Council on Education for Public Health (CEPH), the nationally recognized accrediting body for schools of public health as well as public health programs.

For a complete listing of accredited schools of public health, visit the CEPH website at www.ceph.org or the American Schools of Public Health website at www.asph.org.

Admission requirements for most epidemiology master's programs include scores from the GRE, MCAT, or GMAT; a college transcript; letters of recommendation; an essay; and a curriculum vitae. Applicants will need to have a bachelor's degree with required courses completed that may include biology, mathematics, statistics, microbiology, biochemistry, anatomy and physiology.

The master's degrees available in the field of epidemiology are:

- **Master of Science – MS or ScM**
- **Master of Health Science – MHS**
- **Master of Public Health – MPH**

You will need to check with the public health schools that you are interested in to find out which degrees they offer, and how they may differ from one another. For example, at the University of Washington School of Public Health and Medicine, students obtaining an MPH generally will seek employment in more practice-oriented settings, such as local or state public health departments, while students earning an MS usually pursue careers in research doing study design and data analysis.

Master's degree programs in epidemiology provide training in the principles and methods of epidemiology and biostatistics and their application to the study of health and disease in human populations. Students learn how to design, conduct, analyze, and interpret research studies. Moreover, students learn how to collect and analyze data; how to interpret empirical findings; and how to develop and maintain surveillance systems.

Typical courses may include:

- **Biostatistics**
- **Statistical methods in clinical trials**
- **Health services research methods**
- **Survey methods in public health**
- **Design and conduct of clinical trials**
- **Clinical epidemiology**
- **Computers for epidemiologists**
- **Field research methods**
- **Advanced epidemiologic methods**
- **Experimental methods in epidemiology**
- **Genetic epidemiology of chronic disease**
- **Introduction to genomics and bioinformatics**
- **Genetics and human disease**
- **Control of infectious disease**

Students can choose a specialty within epidemiology. Options include:

- **Environmental epidemiology**
- **Hospital and molecular epidemiology**
- **Chronic disease epidemiology**
- **Infectious or microbial disease epidemiology**
- **Women's health epidemiology**
- **Psychiatric epidemiology**
- **Alcohol epidemiology**
- **Genetic epidemiology**

Admission to doctoral programs is often limited to those with significant prior training or experience in epidemiology or related fields, including medicine and other health areas, and a master's degree in public health or a related discipline. At the doctoral level, the degrees available are:

- **Doctor of Science (ScD)**
- **Doctor of Public Health (DrPH)**
- **Doctor of Philosophy (PhD)**

These programs provide advanced training to individuals already holding a graduate degree in public health or a related discipline. In order to receive a doctorate, students must complete and defend a doctoral dissertation based on original research on a specific topic in epidemiology.

EARNINGS

THE AVERAGE ANNUAL EARNINGS FOR EPIDEMIOLOGISTS EMPLOYED IN THE US are about $60,000, according to a federal government survey. The lowest earners are at about $35,000, and the highest reach $90,000.

Earnings vary depending on the type of employer and the experience and qualifications of the epidemiologist. Senior-level positions, and the higher salaries that accompany them, are generally filled by those with the most advanced educational qualifications.

Epidemiologists working in management, scientific and technical consulting services earn the highest average annual earnings, at almost $100,000. That is followed by scientific research and development services, with average annual earnings of about $70,000. Epidemiologists working at general medical and surgical hospitals average a little less than $70,000. Local governments and state governments employees are at about $55,000. At colleges, universities and professional schools, the average salary is $50,000.

Epidemiologists working full time are usually provided with medical insurance, paid vacations and holidays, and retirement plans. Government jobs typically come with excellent benefits. Benefits for US government employees working full time generally include paid holidays; sick leave; personal leave days; comprehensive medical benefits; long-term care insurance; group term life insurance; child care assistance; flexible spending accounts; retirement benefits and

pension plan; flexible work schedules; access to employee assistance and referral programs; commuter subsidy programs; telecommuting options; wellness and fitness programs; family-friendly leave policies; and access to continuing education and professional development programs.

OUTLOOK FOR THIS CAREER

THE OUTLOOK FOR EMPLOYMENT OPPORTUNITIES IN THE FIELD OF epidemiology is a mixed picture. While rapid job growth is predicted through the year 2014, certain types of jobs in this field are expected to be harder to come by than others. Those with doctoral degrees may face a great deal of competition for research positions. That is because US Federal Government funding of medical research is expected to slow down in coming decades, resulting in a more competitive environment for winning and renewing research grants. In addition, if the number of advanced degrees awarded continues to grow, applicants are likely to face even more competition for the limited number of positions.

On the other hand, there is a much more favorable outlook for other types of epidemiology jobs. An increasing focus on monitoring patients at hospitals and healthcare centers to ensure positive patient outcomes will contribute to job growth for epidemiologists specializing in infection control. As hospitals enhance their infection control programs, many will seek to boost the quality and quantity of their staff.

Because employment of epidemiologists is somewhat tied to the healthcare field, general conditions will influence occupational demand. Healthcare occupations will continue to dominate the list of the fastest growing occupations within the coming decades. Advances in medical technology are major causes of rapid growth among health-related occupations. So is the growing aging population, which needs proportionately more healthcare. This population could benefit greatly from the work of epidemiologists, thereby leading to an increased demand for these professionals.

The rapidly expanding healthcare field will also enhance the need for researchers who can provide information to help governments, health agencies, healthcare providers and communities deal with epidemics. The increasing frequency of international travel creates fewer barriers to disease transmission and, therefore, more sudden

outbreaks of severe illnesses are likely, as well as more widespread epidemics. In addition, a heightened awareness of bioterrorism and global infectious diseases should spur the demand for epidemiologists. Treating other growing threats such as the increase in antibiotic resistance, also should result in employment growth.

Epidemiologists will continue to be needed because they contribute greatly to the development of many treatments and medicines that improve human health. The demand for well-trained genetic epidemiologists will also be great matching the rapid growth in the number of biotechnology companies specializing in the identification of human disease genes. It is widely believed that major advances in improvement of health over the next decades will not come from new medical findings or cures, but rather the broader development and application of population-based prevention programs.

STARTING YOUR CAREER

THE LOGICAL PLACE TO BEGIN YOUR JOB HUNT WOULD BE AT THE UNIVERSITY where you get your degree. Comprehensive career services will be provided, and you should make use of these services well before graduation day arrives. The career services office can provide you with a wealth of information, job leads, and alumni contacts.

You will probably have made a number of contacts of your own during the course of your studies. It would be wise to make use of them when it's time to look for your first job, since the best way to land almost any job is through networking. Be sure to ask your professors if they can put you in touch with some of their colleagues.

You might want to look into applying for the Centers for Disease and Prevention Control's (CDC) Epidemic Intelligence Service (EIS), a two-year postgraduate program of service and on-the-job training. For more information, visit the program's website at www.cdc.gov/eis.

The US government has made it very easy to find all of their job opportunities and to apply for them. They are all listed on the website called USAJOBS at www.usajobs.gov. This website is the official job site of the United States Federal Government. You can read about job openings, apply to jobs and post your résumé, all on this website. Job openings at the CDC and the National Institutes of Health are included.

If you're interested in jobs at the local or state government level, check out the website of the Council of State and Territorial Epidemiologists at www.cste.org. You will find all the information you need to apply for any of the jobs listed. Another valuable online job resource can be found at www.PublicHealthJobs.net. This website, run by the Association of Schools of Public Health, offers free registration.

For jobs in the private sector, you will have to do a little more digging. It would be worth it to join several professional associations to make contacts and make use of some of their online career assistance. For one, the American Public Health Association has a job search feature on its website at www.apha.org. So does the Association for Professionals in Infection Control and Epidemiology at www.apic.org. Some professional organizations allow you to become a member while you are still a student of epidemiology, giving you a jump-start on your career by allowing you to make professional contacts and learn about career opportunities early on.

Armed with your advanced degree in epidemiology and some contacts in the field, all it should take is a little perseverance to set you on the path to a rewarding career.

ASSOCIATIONS

- **American College of Epidemiology**
  www.acepidemiology2.org
- **American Public Health Association**
  www.apha.org
- **Association for Professionals in Infection Control and Epidemiology**
  www.apic.org
- **Association of Schools of Public Health**
  www.asph.org
- **Council of State and Territorial Epidemiologists**
  www.cste.org
- **Infectious Diseases Society of America**
  http://www.idsociety.org
- **International Epidemiological Association**
  www.IEAweb.org
- **International Society for Environmental Epidemiology**
  http://www.iseepi.org
- **Society for Epidemiologic Research**
  www.epiresearch.org

PERIODICALS

- **American Journal of Epidemiology**
  http://aje.oxfordjournals.org
- **Annals of Epidemiology**
  www.annalsofepidemiology.org
- **Epidemiology**
  www.epidem.com
- **Epidemiology and Infection**
  http://journals.cambridge.org/action/displayJournal?jid=HYG
- **European Journal of Epidemiology**
  www.springer.com/west/home/public+health?SGWID=4-40467-70-35710057-0
- **Genetic Epidemiology**
  http://www3.interscience.wiley.com/cgi-bin/jhome/35841
- **International Journal of Epidemiology**
  http://ije.oxfordjournals.org/
- **Journal of Clinical Epidemiology**
  http://www.elsevier.com/wps/find/journaldescription.cws_home/525472/description#description
- **Journal of Epidemiology and Community Health**
  http://jech.bmj.com
- **Journal of Exposure Science and Environmental Epidemiology**
  www.nature.com/jes/index.html