# What is the role of biostatistics in modern medicine?

by Alison Kim Perry

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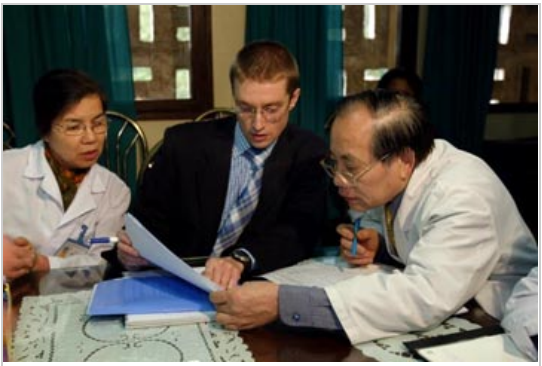

**Medical epidemiologist Dr. Peter Horby (C) of the World Health Organization goes over statistics on Bird Flu with Vietnamese medical staff in 2004.**
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## What is the role of biostatistics in modern medicine?

Most people have heard the statistic that heart disease is the leading cause of death in America today [source: Centers for Disease Control]. But how do we know this fact to be true? Where did that information come from?

Back in 1948, when a lot wasn't known about the factors leading to heart disease and stroke, a health research study -- known as the Framingham Heart Study -- was done on 5,209 people living in the town of Framingham, Mass. These participants hadn't developed any known symptoms of cardiovascular disease and hadn't had a stroke or heart attack. They agreed to be followed over a period of time to help researchers learn what factors lead to both conditions [source: Framingham Heart Study].

The study was landmark in several ways. It showed that there was no one cause for getting a heart attack, and combining information about several risk factors could estimate the risk of someone getting the disease. Thanks to the Framingham Study, (which is still going on today), we now know the major risk factors that lead to cardiovascular disease. To reach these conclusions, researchers simply followed the numbers -- the biostatistics numbers to be exact.

For decades, biostatistics has played an integral role in modern medicine in everything from analyzing data to determining if a treatment will work to developing clinical trials. The University of North Carolina's Gillings School of Global Public Health defines biostatistics as "the science of obtaining, analyzing and interpreting data in order to understand and improve human health" [source: UNC School of Public Health].

Charles McCulloch, Ph.D., professor and head of biostatistics at the University of California at San Francisco, says virtually any medical research study uses biostatistics from beginning to end.

"Statisticians help medical researchers design studies, decide what data to collect, analyze data from medical experiments, help interpret the results of the analyses, and collaborate in writing articles to describe the results of medical research," he explains.

To make it even plainer: biostatistics helps researchers make sense of all the data collected to decide whether a treatment is working or to find factors that contribute to diseases. Most biostatisticians have at least a master's degree and some have doctorates, often combined with master's degree in public health. Most majored in mathematics, statistics or computer science as undergrads. They work for pharmaceutical companies, universities and government agencies like the National Institutes of Health.

Next we'll look at biostatistics in epidemiology.

**Dr Jonas Edward Salk (L), who developed the first vaccine against poliomyelitis, looks on as Dr J V Acius-Ferante vaccinates a woman.**
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## Biostatistics for Epidemiology

When we hear statistics like one in eight women in the U.S. will develop invasive breast cancer over the course of her lifetime or that the risk factors for breast cancer are family history and age, we know that biostatics were instrumental in coming up with these conclusions [source: Breastcancer.org]. Biostatistics is used extensively in epidemiology.

Epidemiology is the basic science of public health. It uses statistics and research methodologies to reach conclusions about diseases within certain population groups and finds the causes and risks of certain diseases [source: Centers for Disease Control].

Although the science of epidemiology began by investigating infectious disease outbreaks, nowadays, it is also concerned with heart disease, cancer, stroke, and injuries [source: Loma Linda University].

Biostatistics is used to determine how diseases develop, progress and spread. For example, biostatisticians use statistics to predict the behavior of an illness like the flu. It's used to help predict the mortality rate, the symptoms and even the time of year people might get it [source: CSIRO]. Another well-known uses of biostatistics in epidemiology, was in research for the development of the polio vaccine in the 1950s.

Before the mid-1950s, most medical research was observation-based. During the mid-1950s, Dr. Paul Meier, a leading medical statistician, introduced the world to **randomization**, a technique where researchers randomly assign one group of patients to receive an experimental treatment while another groups receives a standard treatment. Randomization helps researchers avoid mistakenly tampering with the results by choosing healthier or younger patients to try a new treatment [source: Hevesi].

McCulloch says most people don't realize how important biostatics is to their own medical decisions. For example, you may wonder if that new drug from the pharmaceutical company really works or if it is all hype and a home remedy might be as effective. "Biostatics helps design the clinical trials to make sense out of the data, and help you draw the conclusion whether your home remedies will work or not," he says.

Next, we'll examine the role of biostatistics in cancer research.

- Can epigenetics prevent cancer?


**A breast cancer patient receives a trial medication treatment in the infusion center at the UCSF Comprehensive Cancer Center in San Francisco.**
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## Cancer Research and Biostatistics

Biostatistics is important in finding treatment for new drugs for diseases like cancer. "Cancer therapies tend to be very toxic. If you're a patient, and the usual therapy hasn't worked, you're desperate to find any therapy that offers hope to put you in remission," says Dr. McCulloch.

Biostatisticians look to design a study that tests as few patients as possible and gets them off the drugs quickly, so if they aren't working, they aren't subjected to the harmful side effects, he adds. All the while, the goal is to find which drugs work and ultimately reject the therapies that don't.

Biostatisticians help design, manage and analyze cancer clinical trials. They also help identify the causes and characteristics of cancer. Oncologists rely on these numbers to recommend treatments for their cancer patients. Since cancer is not a "one-size fits all" disease, biostatisticians and oncologists work closely together to identify how factors such as drug interaction, diet and nutrition play a role in cancer. They also examine the traits of cancer and how it occurs in various ages, genders and racial groups to work on prevention and treatment.

"Biostatistics itself is not going to cure cancer," says Dr. McCullouch. "When you do a study where the object is to cure cancer, you're able to answer questions like, 'Does something new work?' or 'Can I get something over the counter that's going to be just as effective?"


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