

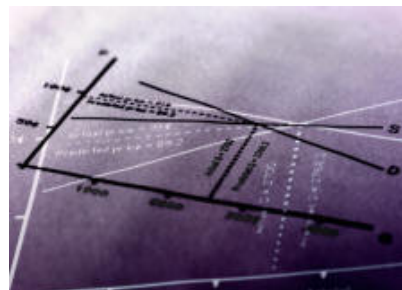
Sloan Career Cornerstone Center

Statistics Overview

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The Field

Statistics is the scientific application of mathematical principles to the collection, analysis, and presentation of numerical data. Statisticians contribute to scientific inquiry by applying their mathematical and statistical knowledge to the design of surveys and experiments; the collection, processing, and analysis of data; and the interpretation of the results. Statisticians may apply their knowledge of statistical methods to a variety of subject areas, such as biology, economics, engineering, medicine, public health, psychology, marketing, education, and sports. Many economic, social, political, and military decisions cannot be made without statistical techniques, such as the design of experiments to gain Federal approval of a newly manufactured drug.



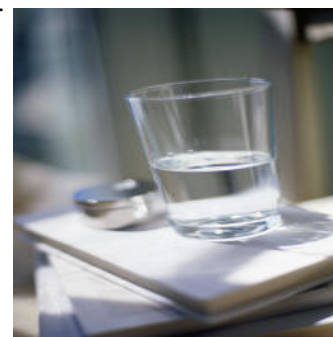
One technique that is especially useful to statisticians is sampling -- obtaining information about a population of people or group of things by surveying a small portion of the total. For example, to determine the size of the audience for particular programs, television-rating services survey only a few thousand families, rather than all viewers. Statisticians decide where and how to gather the data, determine the type and size of the sample group, and develop the survey questionnaire or reporting form. They also prepare instructions for workers who will collect and tabulate the data. Finally, statisticians analyze, interpret, and summarize the data using computer software.



In business and industry, statisticians play an important role in quality control and in product development and improvement. In an automobile company, for example, statisticians might design experiments to determine the failure time of engines exposed to extreme weather conditions by running individual engines until failure and breakdown. Working for a pharmaceutical company, statisticians might develop and evaluate the results of clinical trials to determine the safety and effectiveness of new medications. And, at a computer software firm, statisticians might help construct new statistical software packages to analyze data more accurately and efficiently. In addition to product development and testing, some statisticians also are involved in deciding what products to manufacture, how much to charge for them, and to whom the products should be marketed. Statisticians also may manage assets and liabilities, determining the risks and returns of certain investments.



Statisticians also are employed by nearly every government agency. Some government statisticians develop surveys that measure population growth, consumer prices, or unemployment. Other statisticians work for scientific, environmental, and agricultural agencies and may help determine the level of pesticides in drinking water, the number of endangered species living in a particular area, or the number of people afflicted with a particular disease. Statisticians also are employed in national defense agencies, determining the accuracy of new weapons and the likely effectiveness of defense strategies.



Because statistical specialists are employed in so many work areas, specialists who use statistics often have different professional designations. For example, a person using statistical methods to analyze economic data may have the title econometrician, while statisticians in public health and medicine may hold titles such as biostatistician, biometrician, or epidemiologist.

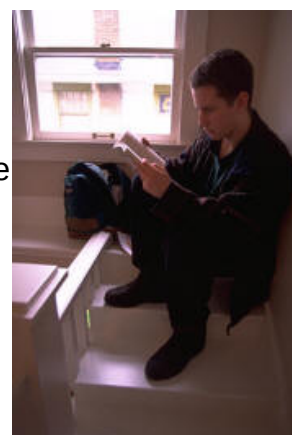
Preparation

Although employment opportunities exist for individuals with a bachelor's degree, a master's degree in statistics or mathematics is usually the minimum educational requirement for most statistician jobs. Research and academic positions in institutions of higher education, for example, require at least a master's degree, and usually a Ph.D., in statistics. Beginning positions in industrial research often require a master's degree combined with several years of experience.



The training required for employment as an entry-level statistician in the Federal Government, however, is a bachelor's degree, including at least 15 semester hours of statistics or a combination of 15 hours of mathematics and statistics, if at least 6 semester hours are in statistics. Qualifying as a mathematical statistician in the Federal Government requires 24 semester hours of mathematics and statistics, with a minimum of 6 semester hours in statistics and 12 semester hours in an area of advanced mathematics, such as calculus, differential equations, or vector analysis.

In 2004, approximately 230 universities offered a degree program in statistics, biostatistics, or mathematics. Many other schools also offered graduate-level courses in applied statistics for students majoring in biology, business, economics, education, engineering, psychology, and other fields. Acceptance into graduate statistics programs does not require an undergraduate degree in statistics, although good training in mathematics is essential.

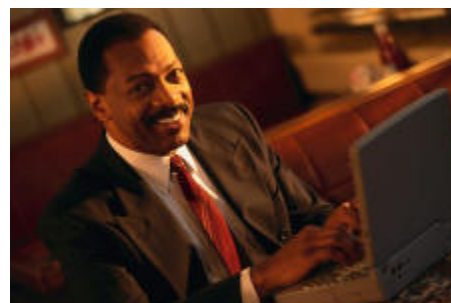


Many schools also offered degrees in mathematics, operations research, and other fields that include a sufficient number of courses in statistics to qualify graduates for some entry-level positions with the Federal Government. Required subjects for statistics majors include differential

and integral calculus, statistical methods, mathematical modeling, and probability theory. Additional courses that undergraduates should take include linear algebra, design and analysis of experiments, applied multivariate analysis, and mathematical statistics.

Because computers are used extensively for statistical applications, a strong background in computer science is highly recommended. For positions involving quality and productivity improvement, training in engineering or physical science is useful. A background in biological, chemical, or health science is important for positions involving the preparation and testing of pharmaceutical or agricultural products. Courses in economics and business administration are helpful for many jobs in market research, business analysis, and forecasting.

Good communications skills are important for prospective statisticians in industry, who often need to explain technical matters to persons without statistical expertise. An understanding of business and the economy also is valuable for those who plan to work in private industry. Beginning statisticians generally are supervised by an experienced statistician. With experience, they may advance to positions with more technical responsibility and, in some cases, supervisory duties. However, opportunities for promotion are greater for persons with advanced degrees. Master's and Ph.D. degree holders usually enjoy independence in their work and may become qualified to engage in research; develop statistical methods; or, after a number of years of experience in a particular area, become statistical consultants.



► Programs

The following is a partial list of universities offering degree programs in Statistics.

• American University • Appalachian State University • Auburn University • Babson College • Barnard College • Bowling Green State University • Brigham Young University--Provo • Brown University • Cal Poly--San Luis Obispo • California State University--East Bay • California State University--Fullerton • Carnegie Mellon University • Case Western Reserve University • Central Michigan University • Columbia University • Cornell University • CUNY--Baruch College • Eastern Kentucky University • Eastern Michigan University • Eastern Washington University • Ferris State University • Florida International University • Florida State University • George Washington University	• Rice University • Rochester Institute of Technology • Roosevelt University • Rutgers--New Brunswick • San Diego State University • St. Cloud State University • SUNY College--Oneonta • Texas A&M University--College Station • Tulane University • University of Akron • University of Alaska--Fairbanks • University of California--Berkeley • University of California--Los Angeles • University of California--Riverside • University of California--Santa Barbara • University of Connecticut • University of Florida • University of Georgia • University of Illinois--Chicago • University of Illinois--Urbana-Champaign • University of Iowa • University of Maryland—Baltimore Cnty • University of Miami • University of Michigan--Ann Arbor
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| <ul style="list-style-type: none"> • Grand Valley State University • Howard University • Iowa State University • Kansas State University • Lehigh University • Loyola University Chicago • Luther College • Master's College and Seminary • Miami University--Oxford • Michigan State University • Mount Holyoke College • New Mexico Institute of Mining and Technology • New York University • North Carolina State University--Raleigh • North Dakota State University • Northwest Missouri State University • Northwestern University • Oakland University • Ohio Northern University • Oklahoma State University • Pennsylvania State University--University Park • Purdue University--West Lafayette | <ul style="list-style-type: none"> • University of Minnesota--Morris • University of Minnesota--Twin Cities • University of Missouri--Columbia • University of Nevada--Las Vegas • University of New Mexico • University of North Carolina--Wilmington • University of North Florida • University of Pennsylvania • University of Pittsburgh • University of Rochester • University of South Carolina--Columbia • University of Tennessee • University of Texas--Dallas • University of Texas--El Paso • University of Texas--San Antonio • University of Vermont • University of Washington • University of Wisconsin--Madison • University of Wyoming • Utah State University • Virginia Tech • Western Michigan University |
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Day in the Life

Statisticians usually work regular hours in comfortable offices. Some statisticians travel to provide advice on research projects, supervise and set up surveys, or gather statistical data. While advanced communications devices such as e-mail and teleconferencing are making it easier for statisticians to work with clients in different areas, there still are situations that require the statistician to be present, such as during meetings or while gathering data. Some in this occupation may have duties that vary widely, such as designing experiments or performing fieldwork in various communities. Statisticians who work in academia generally have a mix of teaching and research responsibilities.

Earnings

According to the U.S. Bureau of Labor Statistics, median annual earnings of statisticians were \$58,620 in May 2004. The middle 50 percent earned between \$42,770 and \$80,690. The lowest 10 percent earned less than \$32,870, while the highest 10 percent earned more than \$100,500. The average annual salary for statisticians in the Federal Government in nonsupervisory, supervisory, and managerial positions was \$81,262 in 2005, while mathematical statisticians averaged \$91,446. According to a 2005 survey by the National Association of Colleges and Employers, starting salary offers for statistics graduates with a bachelor's degree averaged \$43,448 a year.



Employment

According to the U.S. Bureau of Labor Statistics, statisticians held about 19,000 jobs in 2004. Twenty percent of these jobs were in the Federal Government, where statisticians were concentrated in the Departments of Commerce, Agriculture, and Health and Human Services. Another 20 percent were found in State and local governments, including State colleges and universities. Most of the remaining jobs were in private industry, especially in scientific research and development services, insurance carriers, and pharmaceutical and medicine manufacturing. In addition, many professionals with a background in statistics were among the 53,000 postsecondary mathematical science teachers.

Employers

The following are examples of employers of statisticians:

Pharmaceutical and Biotechnology Companies • <u>Abbott Laboratories</u> • <u>Amgen Inc.</u> • <u>Bristol-Myers Squibb Company</u> • <u>Genentech</u> • <u>GlaxoSmithKline</u> • <u>Hoffmann-La Roche Inc.</u> • <u>Johnson & Johnson</u> • <u>Merck & Company</u> • <u>Procter & Gamble Company</u> • <u>Wyeth Pharmaceuticals</u>	U.S. Federal Government • <u>U.S. Army Research Office</u> • <u>National Institute of Health</u> • <u>National Science Foundation</u> • <u>National Institute of Standards and Technology</u> • <u>National Security Agency</u> • <u>Office of Naval Research</u> • <u>United States Census Bureau</u> • <u>U.S. Department of Energy, Office of Energy Research</u>
Communication Companies • <u>Adelphia Communications Corporation</u> • <u>Apple</u> • <u>Cable Networks</u> • <u>Direct TV</u> • <u>Microsoft</u> • <u>Public Broadcasting Service</u> • <u>Sirius Radio</u> • <u>Verizon</u> • <u>Walt Disney Company</u> • <u>XM Radio</u>	State and Local Governments
Educational Institutions • Colleges and Universities • K-12 Schools	Insurance Companies • <u>Aetna, Inc.</u> • <u>AIG</u> • <u>Allstate Insurance Company</u> • <u>Chubb Group of Insurance Companies</u> • <u>Prudential Insurance Company</u>

Career Path Forecast

According to the U.S. Department of Labor, Bureau of Labor Statistics, employment of statisticians is projected to grow more slowly than average for all occupations over the 2004-14 period, because many jobs that require a degree in statistics will not carry the title “statistician.” However, job opportunities should remain favorable for individuals with a degree in statistics. For example, many jobs involve the analysis and interpretation of data from economics, biological science, psychology, computer software engineering, and other disciplines. Despite the limited number of jobs resulting from growth, a number of openings will become available as statisticians transfer to other occupations or retire or leave the workforce for other reasons.



The use of statistics is widespread and growing. Among graduates with a master's degree in statistics, those with a strong background in an allied field, such as finance, biology, engineering, or computer science, should have the best prospects of finding jobs related to their field of study. Federal agencies will hire statisticians in many fields, including demography, agriculture, consumer and producer surveys, Social Security, health care, and environmental quality. Because the Federal Government is one of the few employers that considers a bachelor's degree an adequate entry-level qualification, competition for entry-level positions in the Federal Government is expected to be strong for persons just meeting the minimum qualifications for statisticians. Those who meet State certification requirements may become high school statistics teachers.



Manufacturing firms will hire statisticians with master's and doctoral degrees for quality control of various products, including pharmaceuticals, motor vehicles, aircraft, chemicals, and food. For example, pharmaceutical firms will employ statisticians to assess the effectiveness and safety of new drugs, to decide whether to market them, and to make sure they comply with federal standards. To address global product competition, motor vehicle manufacturers will need statisticians to improve the quality of automobiles, trucks, and their components by developing and testing new designs. Statisticians with knowledge of engineering and the physical sciences will find jobs in research and development, working with teams of scientists and engineers to help improve design and production processes to ensure consistent quality of newly developed products. Many statisticians also will find opportunities developing statistical software for computer software manufacturing firms.



Firms will rely heavily on workers with a background in statistics to forecast sales, analyze business conditions, and help to solve management problems to maximize profits. In addition, consulting firms increasingly will offer sophisticated statistical services to other businesses. Because of the widespread use of computers in this field and the growing number of widely used software packages, statisticians in all industries should have good computer programming skills and knowledge of statistical software.

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Professional Organizations

Professional societies provide an excellent means of keeping current and in touch with other professionals in the field. These groups can play a key role in your development and keep you abreast of what is happening in your field. Associations promote the interests of their members and provide a network of contacts that can help you find jobs and move your career forward. They can offer a variety of services including job referral services, continuing education courses, insurance, travel benefits, periodicals, and meeting and conference opportunities. The following is a partial list of professional associations serving statisticians and employers. A broader list of professional associations is also available at www.careercornerstone.org.



► **American Statistical Association (www.amstat.org)**

The American Statistical Association (ASA) is a scientific and educational society founded in 1839 with the following mission: To promote excellence in the application of statistical science across the wealth of human endeavor.

► **Caucus for Women in Statistics (www.statwomen.org)**

The Caucus for Women in Statistics was formed in 1970 to focus on specific problems associated with the participation of women in statistically oriented professions.

► **Institute of Mathematical Statistics (www.imstat.org)**

The IMS is an international professional and scholarly society devoted to the development, dissemination, and application of statistics and probability. The Institute currently has about 4,000 members in all parts of the world.

► **International Statistical Institute (<http://isi.cbs.nl>)**

Established in 1885, the International Statistical Institute (ISI) is one of the oldest scientific associations operating in the modern world.