School of Public Health
University at Albany

Department of Epidemiology and Biostatistics

Biostatistics Program

State University of New York
School of Public Health
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SCHOOL OF PUBLIC HEALTH
DEPARTMENT OF EPIDEMIOLOGY AND BIOSTATISTICS
BIOSTATISTICS PROGRAM

Dr. David Strogatz, *Chair*

The Department of Epidemiology and Biostatistics is the University at Albany's center for graduate work in biostatistics. Students prepare for careers in public health, government statistics, biostatistics for clinical research, environmental statistics, as well as academically-oriented careers in teaching and research in mathematical sciences. Course work is coupled with formal involvement in research projects, often in multi-disciplinary collaborations with researchers at the New York State Department of Health, the Albany Medical Center or with faculty in other University at Albany departments and institutes. Degree offerings include the M.S. in Biostatistics, the Ph.D. with dissertation research in biostatistical theory and its application, and the biostatistics-centered MPH. The Dr.P.H. also offers a concentration in biostatistics. Faculty work with students one on one to find the particular balance of course work, the area of application or collaboration and the program breadth to suit an individual's interests and goals. All students are expected to understand the basic theory and modern methodologies associated with biostatistics by the time they graduate, so they can apply up-to-date biostatistical methods to applied scientific problems and utilization of governmental health related data bases. Recipients of the doctoral degree are expected to develop innovative method-ologies either through mathematically related scientific research or through development of new linkages between relevant contemporary statistical methodology and specific areas of public health practice.

Financial Support

Many graduate students are supported and/or receive tuition scholar- ships as teaching assistants or as research assistants on multi-disciplinary collaborative research projects. Preference is given to doctoral students, but a high percentage of M.S. students have been given assistantship support throughout their studies. Also, many M.S. projects have been drawn from assistantship experiences. Outstanding Ph.D. students may qualify for one of the University's Presidential Fellowships.

MASTER OF SCIENCE PROGRAM

Admission Requirements

In addition to the general University admission requirements, applicants to the M.S. program are expected to have a major in mathematics, statistics, the biological, physical, or computer science. Linear algebra, multi-variate calculus and computer programming are required for the successful comple-tion of the program.

Degree Requirements

The M.S. program in Biostatistics stresses theory and methodology to provide students with skills that can be applied to many areas, including health care, economics, social, biological and environ-mental sciences and the development of observational studies and survey techniques. The M.S. program may also lead toward a doctoral degree with research focused on statistics, biometry, mathematics or econometrics.

Biostatistics Sequence (36 credits minimum)

1. Statistics (18 credits: courses as advised, including STA 669; with departmental approval, a thesis may be presented in place of STA 669.)

2. Biology, epidemiology or public health courses (6 credits minimum: courses as approved by advisor).

3. Supporting courses (0-12 credits, as approved by the advisor for the biostatistics sequence).

4. Satisfactory completion of a special field examination.

5. Recommended courses: STA 554/55, STA 558/59, and at least one of STA 556, STA 560, STA 562, STA 564 or STA 566.

Part-time study
Part-time study is permitted in the M.S. program. University policy requires that all degree requirements be completed in six years.

DOCTORAL PROGRAM

Admission Requirements

In addition to the general University requirements for admission to graduate study, applicants to the graduate program in Biostatistics are expected to:

1. have a bachelor's degree with a major in mathematics, statistics, computer
science, the biological, physical or social sciences. Linear algebra, multi-variate calculus and computer
programming are required for the successful completion of the program.

2. provide three letters of recommendation from academic advisors or other faculty members familiar with the applicant. For candidates whose academic record predates the application by five years or more, letters of recommendation may be submitted by supervisors.

3. submit official scores of the Graduate Record Examination or Medical College Aptitude Test.

Degree Requirements

The Ph.D. program of study and research normally takes four years of full-time study and research beyond the baccalaureate. The general program require-ments call for a minimum of two years of full-time graduate study (60 credits), or the equivalent, and at least one additional year devoted to the research and writing of an acceptable dissertation. Students must also adhere to the University's requirements as described in the Graduate Bulletin.

During the first two years of study, the student obtains a general educa-tion in statistical theory and methodology. The student develops a program of course work under the guidance of a faculty advisor and, upon successful completion of the course work, usually receives a master's degree at the end of the second year. A master's degree is

not a prerequisite, but the requirements for one of the master's degree programs described above must be completed by the end of the second year.

Students must pass two PRELIMINARY EXAMINATIONS. These exams are offered regularly and students normally sit for them at the end of the second year of study. One is in the area of mathematical statistics and probability and the other is in the area of statistical methodology and applied statistics. The courses required for the preliminary examinations are offered each year, and they can be satisfactorily completed in two years. Students entering the doctoral program are encouraged to take some work (3-9 credit hours) in mathematics and at least six graduate credit hours in departments other than Biostatistics.

After successfully passing the preliminary examinations, the student begins the process of specialization. As soon as possible, the student selects a dissertation advisor. A committee is formed to guide the student's subsequent progress toward the degree. Readiness to begin the dissertation is marked by completion of the qualifying examination, which should take place within 18 months after passing the preliminary examinations. Upon completion of the qualifying examination, the student advances to candidacy and begins work on the dissertation.

Part-Time Study

While part-time study is permitted in the doctoral program, applicants should be aware that the University requires at least one academic year of full-time study and that probably two or more years of full-time work toward a doctoral degree will be necessary if the student hopes to complete the requirements within eight years (the University's limit). Preference is given to students who are able to pursue their studies primarily on a full-time basis.

Research Tool

The research tool requirement for the doctoral degree is met by satisfactorily demonstrating computer literacy; competency is evaluated by the faculty.

Admission to Candidacy

A student is admitted to candidacy for the degree of Doctor of Philosophy upon the following:

1. satisfactory record in course and research study (minimum GPA of 3.0);

2. completion of the University's residence requirement;

3. satisfactory completion of research tool requirement;

4. satisfactory completion of the preliminary and qualifying examinations; and

5. approval by the student's committee of a proposed dissertation topic.

Dissertation

The dissertation is based on independent research by the candidate and should constitute a significant original contribution to the area of biostatistics. The dissertation committee consists of at least three members, all of whom must hold the rank of assistant professor or above. One of the committee members must be from outside the

Department of Epidemiology and Biostatistics. Outside readers may be included at the discretion of the committee. The dissertation must be approved by and successfully defended before the dissertation committee; the defense is open to the University community.

Academic Advising

Each student is assigned an advisor who assists the student in selecting courses, a project and a dissertation topic. Students meet with their advisors at least once each semester to discuss progress in the program and to establish goals for the next term.

COURSE LISTINGS

STA 550 Introduction to Computing (1)
An introduction to the use of micro and main-frame computers. Communications between computers and the use of statistical and word processing soft-ware packages will be included. Prerequisites: None

STA 551 Survey Instrument Design (1)
An introduction to the design of instruments to collect data for research purposes. Topics to include wording of questions, pretesting, coding, keying, internal validation, instructions to interviewers and issues of privacy and security. Prerequisites: None

STA 552 Principles of Statistical Inference I (3)
An introduction to descriptive statistics, measures of central tendency and variability, probability distributions, sampling, estimation, confidence intervals and hypothesis testing. Computing is introduced and used throughout the course. STA 552 and STA 553 satisfies the core requirement in statistics for programs in the School of Public Health. Prerequisites: None

STA 553 Principles of Statistical Inference II (3)
Continuation of STA 552. Topics includes correlation, regression, analysis of variance, analysis of contingency tables and non-parametric statistics. Computing is used throughout the course. STA 552 and STA 553 satisfies the core requirement in statistics for programs in the School of Public Health. Prerequisites: STA 552 or equivalent

STA 554 Introduction to Theory of Statistics I (3)
A mathematical treatment of principles of statistical inference. Topics include probability, random variables and random vectors, univariate and multivariate distributions and an introduction to estimation. Appropriate for graduate students in other discip-lines and for preparation for the second actuarial examination. Prerequisites: Calculus and Linear Algebra. Equivalent to Mat 554. Students may not receive credit for Mat 554 and STA 554.

STA 555 Introduction to Theory of Statistics II (3)
Continuation of STA 554. Topics include methods of estimation, theory of hypothesis testing, sufficient statistics, efficiency and linear models. Appropriate for graduate students in other disciplines and for preparation for the second actuarial examination. Prerequisites: STA 554, Mat 554 or equivalent.

STA 556 Introduction to Bayesian Inference I (3)
Topics include subjective probability, axiomatic development and applications of utility, basic concepts of decision theory, conjugate and

locally uniform prior distributions. Prerequisites: STA 552 or equivalent. Equivalent to Mat 556. Students may not receive credit for Mat 556 and STA 556.

STA 557 Introduction to Bayesian Inference II
Continuation of STA 556. Topics include limiting posterior distributions, estimation and hypothesis testing, preposterior distributions and their application to the design of statistical investigations. Prerequisites: STA 556 or equivalent. Equivalent to Mat 557. Students may not receive credit for STA 557 and Mat 557.

STA 558 Methods of Data Analysis I (3)
Statistical methodology emphasizing exploratory approaches to data. Elementary notions of modeling and robustness. Overview of inferential techniques in current use. Criteria for selection and application of methods. Use of computing facilities to illustrate and implement methods. Regression and analysis of variance are the primary topics. Prerequisites: STA 552 or equivalent. Equivalent to Mat 558. Students may not receive credit for STA 558 and Mat 558.

STA 559 Methods of Data Analysis II (3)
Continuation of STA 558. Topics include clustering, multi-variate analyses, sequential and non-parametric methods. Prerequisites: STA 558 or equivalent. Equivalent to Mat 558. Students may not receive credit for STA 559 and Mat 558.

STA 560 Introduction to Stochastic Processes I (3)
An introduction to applied stochastic processes. Topics include Markov chains, queuing theory, renewal theory, Poisson processes and extensions, epidemic and disease models. Prerequisites: STA 552 or an introductory probability course. Equivalent to Mat 560. Students may not receive credit for STA 560 and Mat 560.

STA 561 Introduction to Stochastic Processes II (3)
Continuation of STA 560. More advanced topics in Markov chains, queuing theory, renewal theory, Poisson processes and extensions, epidemic and disease models. Prerequisites: STA 560 or permission of the instructor.

STA 562 Design of Experiments I (3)
Principles in the design and analysis of controlled experiments. Topics include general linear hypotheses, multiple classifications, Latin squares and factorial designs. Prerequisites: STA 552 or equivalent. Equivalent to Mat 562. Students may not receive credit for STA 562 and Mat 562.

STA 563 Design of Experiments II (3)
Continuation of STA 562. More advanced designs, information and efficiency, an introduction to response surface methodology. Prerequisites: STA 562 or equivalent.

STA 564 Sample Survey Methodology I (3)
Principles of survey sampling and analysis. Topics include simple random sampling, stratified sampling, cluster sampling and multistage sampling. Prerequisites: STA 553 or equivalent. Equivalent to Mat 564. Students may not receive credit for STA 564 and Mat 564.

STA 565 Sample Survey Methodology II (3)
Continuation of STA 564. Topics include more complex designs in stratified sampling, cluster sampling and multistage

sampling. An introduction to cost studies, non-sampling errors and miscellaneous topics. Prerequisites: STA 564 or equivalent.

STA 566 Analysis of Categorical Data I (3)
Introduction to the analysis of categorical data. Topics include rates, ratios and proportions, relative risk, Cochran-Mantel-Haenszel procedures, linear and log-linear models for categorical data, maximum likelihood estimation and tests of hypotheses. Prerequisites: STA 552 or equivalent. Equivalent of Mat 566. Students may not receive credit for STA 566 and Mat 566.

STA 567 Analysis of Categorical Data II (3)
Continuation of STA 566. Topics include more complex linear and log-linear models for categorical data, goodness of fit measures and tests of hypotheses.
Prerequisites: STA 566 or equivalent.

STA 568 Statistical Ecology (3)
Density estimates for closed and open populations using simple and multiple marking methods. Mortality and survival estimation, population dynamics. Spatial patterns in one and two-species populations. Characterization of many-species populations. Prerequisites: STA 553 or equivalent. Equivalent to Mat 568. Students may not receive credit for STA 568 and Mat 568.

STA 569 Survey of Statistics (3)
A survey of hypothesis testing and estimation theory. Recommended for secondary teachers and graduate students in mathematics education. Prerequisites: STA 553 or equivalent. Equivalent to Mat 569. Students may not receive credit for STA 569 and Mat 569.

STA 570 Topics in Education
Selected topics in experimental design, data collection instruments, registries, outcome measures, assessment of agencies and/or programs and qualitative and quantitative methodologies used in evaluation.
Prerequisites: Consent of instructor.

STA571 Topics in Informatics
Selected topics in informatics, information systems, wide area networks, storing, retrieving and analyzing of medical and public health information.

STA 654 Probability and Theory of Statistical Inference I (3)
Univariate and multivariate distribution theory, properties of estimators, large sample theory, confidence intervals and theory of tests. Prerequisites: STA 555 or equivalent.

STA 655 Probability and Theory of Statistical Inference II (3)
Continuation of STA 654. Advanced theory of tests, decision theory and other topics. Prerequisites: STA 654 or equivalent.

STA 656 Design of Clinical Trials (3)
Introduction to topics in the design and analysis of clinical trials and related experiments. Prerequisites: STA 555 or equivalent.

STA 657 Mathematical Models in Demography (3) Introduction to mathematical methods and applications required for natality models, deterministic and stochastic models for population growth. Prerequisites: STA 555 or equivalent.

STA 658 Mathematical

Models in Biometry I (3)
Topics in the mathematical and statistical methods required to model deterministic and stochastic models for phenomenon found in the different areas of biostatistics and the health sciences.
Prerequisites: STA 555 or equivalent.

STA 659 Mathematical Models in Biometry II (3)
Continuation of STA 658. Advanced topics in the mathematical and statistical methods required to model deterministic and stochastic models for phenomenon found in the different areas of biostatistics and the health sciences.
Prerequisites: STA 658 or consent of the instructor.

STA 660 Linear Models I (3)
Topics include the theory of least squares, distribution of quadratic forms, G-inverse, general Gauss-Markov model, estimation, hypothesis tests, confidence intervals for unrestricted and restricted models, regression models and analysis of variance.
Prerequisites: STA 555 or equivalent. Students may not receive credit for STA 661 and Mat 660.

STA 661 Linear Models II (3)
Continuation of STA 660. Topics include advanced analysis of variance and analysis of covariance, repeated measures, mixed and random models.
Prerequisites: STA 660 or equivalent.

STA 662 Multivariate Analysis I (3)
Topics include the basic properties of multi-variate normal distributions and other related distributions, inference in multi-variate cases and principle component analysis.
Prerequisites: STA 555 or the consent of the instructor.

STA 663 Multivariate Analysis II (3)
Continuation of STA 662. Topics include discriminate analysis, canonical correlation analysis and factor analysis.
Prerequisites: STA 662 or the consent of the instructor.

STA 664 Time Series Analysis I (3)
Topics include the study of inference, estimation, prediction, parsimonious description for univariate time-ordered data, various models including Box-Jenkins and classical stationary processes with rational spectral densities.
Prerequisites: STA 555 and STA 559 or consent of the instructor. Equivalent to Mat 664. Students may not receive credit for STA 664 and Mat 664.

STA 665 Time Series Analysis II (3)
Continuation of STA 664. Advanced topics include the study of univariate and multi-variate time-ordered data, various models including Box-Jenkins and classical stationary processes with rational spectral densities.
Prerequisites: STA 664 or consent of the instructor.

STA 666 Survivorship Analysis I (3)
Topics in survival functions, hazard rates, life tables, estimation of survival functions from complete and censored data, fitting parametric models, tests of hypotheses, and covariate models.
Prerequisites: STA 555 or consent of instructor.

STA 667 Survivorship Analysis II (3)
Continuation of STA 666. Advanced topics in the theory of survival functions for complete and censored data, tests of hypotheses, and time dependent covariate models.
Prerequisites: STA 666 or

consent of instructor.

STA 668 Independent Study in Biometry and Statistics (3)
Selected study of a topic in Biometry and Statistics. Prerequisites: Consent of the instructor.

STA 669 Master's Seminar in Biometry and Statistics (3)
Selected topics in statistics. A report is written on the subject studied. Required of all candidates for a master's degree in Biostatistics, except those who write a master's thesis. Prerequisites: Consent of the instructor.

STA 868 Independent Study and Research in Biometry and Statistics (2-5)
Independent study at the doctoral level under the direction of a member of the Biometry and Statistics faculty. May be repeated for credit. Prerequisite: Consent of instructor.

STA 899 Doctoral Dissertation (3-12 L.U.E.)

May be repeated for credit. Load equivalent only. Prerequisite: Consent of dissertation director.

ADVANCED METHODOLOGICAL COURSES IN OTHER DEPARTMENTS

Department of Epidemiology

EPI 612 Quantitative Methods in Epidemiology (4)

Department of Mathematics and Statistics

MAT 501 Numerical Analysis (3)

MAT 503 A,B Life Contingencies (3) (3)

MAT 510 A,B Real Analysis (3) (3)

MAT 511 Foundations of Analysis (3)

MAT 513 A,B Complex Analysis (3) (3)
MAT 524 Advanced Linear Algebra (3)
MAT 538 Differential Geometry (3)

MAT 570 Combinations (3)

MAT 572 Linear Programming (3)

MAT 575 Optimal Control Theory (3)

MAT 576 Game Theory (3)

MAT 616 Introduction to Ergodic Theory (3)

MAT 646 Introduction to Differentiable Manifolds (3)

MAT 669 Probability Theory (3)

MAT 760 A,B Basic Probability Theory (3) (3)

MAT 865 Topics in Statistics (1-4)

MAT 867 Seminar in Statistics (1-4)

Department of Educational Psychology and Statistics

PSY 633 Nonparametric and Distribution-Free Statistics (3)

PSY 731 Experimental Design (3)

PSY 733 Factor Analysis (3)

PSY 734 Multivariate Analysis with Computer Applications (4)

Department of Sociology

SOC 626 Survey Design and Analysis (3)

SOC 707 Structural Equation Models (3)

SUPPORTING COURSES IN OTHER

DEPARTMENTS

Department of Biomedical Sciences

BMS 505 Biological Basis of Public Health (3)

Department of Epidemiology

EPI 501 Principles and Methods of Epidemiology I (3)

EPI 502 Principles and Methods of Epidemiology II (3)

EPI 604 Cancer Epidemiology (3)

EPI 605 Infectious Disease Epidemiology (3)

EPI 608 Injury Epidemiology (3)

EPI 610 AIDS Epidemiology (3)

EPI 613 Occupational and Environmental Epidemiology (3)

Department of Environmental Health and Toxicology

EHT 590 Introduction to Environmental Health (3)

EHT 670 Contemporary Issues in Environmental Health (3)

EHT 671 Concepts and Issues in Occupational Health Policy I (3)

Department of Health Policy and Management

HPM 501, 502 Introduction to Health Policy and Management (3) (3)

HPM 541 Health Care Systems (3)

HPM 511 Economic Analysis (3)

Department of Sociology

SOC 551, 552 Demographic Techniques (3) (3)

SOC 665 Special Topics in Demography (3)

Notes

1. STA 550, 551, 552 and 553 do not count as credit(s) towards a degree in Biostatistics.

Faculty Research Interests

Edward Hannan, Ph.D.
University of Massachusetts (1973)
Prediction and risk-adjustment of short-term and long-term patient outcomes to assess quality of care, clinical decision analysis.

Syni-an Hwang, Ph.D.
Carnegie-Mellon University (1984)
Statistical Modeling of epidemiological data on environmental and occupational health.

Lawrence Lessner, Ph.D.
University of Southern California Survival Analysis for biological and surveillance data and clinical trials Generalized Linear Models and Estimating Equations, general consulting for biological and public health data Analysis and Modeling of the HIV/AIDS epidemic, use of surveillance data

Robert Pruzek, Ph.D
University of Wisconsin
Measurement, psychometric methods and research design as well as multi-variate analysis and regression.

Andrew Reilly, Ph.D.
State University of New York at Buffalo (1981)
Bayesian inference, missing data, mixture distributions.

Howard H. Stratton, Ph.D.
University of California (1968)
Measurement Error

Models, mixture mortality models, selection bias corrections, hidden marker chains.

Gene Therriault, M.S.P.H.
School of Public Health, University of North Carolina at Chapel Hill (1971) Vital statistics, hospital discharge data, AIDS modeling, data security and confidentiality.

Igor Zurbenko, Ph.D.
Moscow State University (1970), Doctor of Probability and Statistics, Moscow State University (1980) Mathematical statistics, times series analysis and application of time series.