DEPARTMENT OF BIOSTATISTICS

Introduction

The Department of Biostatistics in the Gillings School of Global Public Health is recognized as a worldwide leader in research and practice. The B.S.P.H. in biostatistics provides highly qualified undergraduates with a curriculum consisting of a strong mathematical foundation; advanced coursework in statistical applications, theory, and computing; and an understanding of the public health sciences.

The undergraduate major in biostatistics prepares students to apply quantitative methods to design studies, implement methods, analyze data, and interpret results across a range of disciplines.

The degree provides an excellent foundation for continued studies (primarily graduate school in biostatistics, statistics, data science, or medical school). The job market for B.S.P.H. biostatistics graduates is strong, with previous students employed in a variety of fields including public health, pharmaceuticals, and medicine. This undergraduate program is believed to be the first undergraduate degree in biostatistics in the country.

Advising

The academic coordinator and director of undergraduate studies advise biostatistics undergraduates. Undergraduate students are encouraged to meet regularly with these advisors and review their Tar Heel Tracker each semester. Departmental academic advising is particularly important for those students who are considering proceeding to graduate school, pursuing a second major, or pursuing the dual B.S.P.H.−M.S. degree. Further information may be obtained through the departmental website (http://sph.unc.edu/bios/bios-degrees/).

Facilities

The Department of Biostatistics has a student library, a student study room, and computer facilities for its students.

Graduate School and Career Opportunities

In recent years, the majority of undergraduate biostatistics students from this program have chosen to attend medical school or graduate school in biostatistics (or other closely related fields) following graduation. More than 65 percent of recent graduates have entered medical school or graduate programs (primarily biostatistics) immediately following graduation. Recent graduates are attending top-ranked medical schools at Johns Hopkins University, Vanderbilt University, University of Virginia, Duke University, and UNC−Chapel Hill. Biostatistics graduate programs where students have matriculated immediately following completion of this undergraduate program include the University of Washington−Seattle, Harvard, UNC−Chapel Hill, Johns Hopkins University, and the University of Michigan.

Previous graduates who chose to seek employment have taken positions in the pharmaceutical industry, contract research organizations (CROs), and medical settings. Examples of employers of recent graduates include Duke Clinical Research Institute, Blue Cross Blue Shield, IQVIA, Rho, PPD, National Institutes of Environmental Health Science, and Research Triangle Institute. Traditionally, career opportunities have been outstanding for skilled biostatisticians.

Major

- Biostatistics Major, B.S.P.H. (https://catalog.unc.edu/undergraduate/programs-study/biostatistics-major-bsph/)

Professors

Kevin Anstrom, Jianwen Cai, David J. Couper, Michael G. Hudgens, Joseph G. Ibrahim, Anastasia Ivanova, Gary G. Koch, Michael R. Kosorok, Lisa M. LaVange, Yun Li, Danyu Lin, Feng-Chang Lin, Yufeng Liu, James Stephen Marron, Andrew B. Nobel, John S. Preisser, Bahjat Qaqish, Todd A. Schwartz, Richard Smith, Kinh Truong, Donglin Zeng, Haibo Zhou, Hongtu Zhu, Fei Zou.

Associate Professors

Robert Agans, Jamie L. Crandell, Tanya Garcia, Annie Green Howard, Quefeng Li, Michael Love, Jane Monaco, Naim Rashid, Daniela Sotres-Alvarez, Xianming Tan, Di Wu, Baiming Zou.

Assistant Professors

Yuchao Jiang, Didong Li, Bonnie Shook-Sa.

Adjunct Professors

Haoda Fu, Eric Laber, Sean Simpson, Wei Sun, Sonia Thomas, William Valdar, Clarice Weinberg, Richard Zink.

Adjunct Assistant Professors

Matthew Biggs, Liddy Chen, Charles Pepe-Ranney, Shanshan Zhao, Zhengwu Zhang, Xiaojing Zheng.

Adjunct Instructors

Jane Eslinger, Kinsey Helton, Marcus Herman-Giddens, Jeff Laux, Vincent Toups.

Professors Emeriti

Shrikant Bangdiwala, Lloyd E. Chambless, Clarence E. Davis, James E. Grizzle, Ronald W. Helms, Lawrence L. Kupper, Keith E. Muller, Dana E. Quade, Pranab K. Sen, Chirayath M. Suchindran, Michael J. Symons.

BIOS−Biostatistics

Undergraduate-level

BIOS 392. Undergraduate Internship. 1-3 Credits.
Academic credit for approved internship experience.

Rules & Requirements
Making Connections Gen Ed: EE- Academic Internship.
Repeat Rules: May be repeated for credit. 6 total credits. 2 total completions.
Grading Status: Letter grade.

BIOS 396. Readings in Biostatistics. 1-12 Credits.
Directed readings or laboratory study. May be taken more than once. Two to six laboratory hours a week.

Rules & Requirements
Repeat Rules: May be repeated for credit; may be repeated in the same term for different topics; 12 total credits. 4 total completions.
Grading Status: Letter grade.

Advanced Undergraduate and Graduate-level

BIOS 500H. Introduction to Biostatistics. 3 Credits.
Access to SAS, Excel required. Permission of instructor for nonmajors. Introductory course in probability, data analysis, and statistical inference designed for B.S.P.H. biostatistics students. Topics include sampling, descriptive statistics, probability, confidence intervals, tests of hypotheses, chi-square distribution, 2-way tables, power, sample size, ANOVA, non-parametric tests, correlation, regression, survival analysis.

Rules & Requirements
Requisites: Prerequisite, MATH 231 and 232; corequisite, BIOS 511.
Grading Status: Letter grade.

BIOS 511. Introduction to Statistical Computing and Data Management. 4 Credits.
Required preparation, previous or concurrent course in applied statistics. Permission of instructor for nonmajors. Introduction to use of computers to process and analyze data, concepts and techniques of research data management, and use of statistical programming packages and interpretation. Focus is on use of SAS for data management and reporting.

Rules & Requirements
Grading Status: Letter grade.

BIOS 512. Data Science Basics. 3 Credits.
Students will gain proficiency with R, data wrangling, data quality control and cleaning, data visualization, exploratory data analysis, with an overall emphasis on the principles of good data science, particularly reproducible research. The course will also develop familiarity with several software tools for data science best practices, such as Git, Docker, Jupyter, Make, and Nextflow.

Rules & Requirements
Grading Status: Letter grade.

BIOS 540. Problems in Biostatistics. 1-15 Credits.
Arrangements to be made with the faculty in each case. A course for students of public health who wish to make a study of some special problem in the statistics of the life sciences and public health. Honors version available.

Rules & Requirements
Repeat Rules: May be repeated for credit. 15 total credits. 4 total completions.
Grading Status: Letter grade.

BIOS 600. Principles of Statistical Inference. 3 Credits.
Required preparation, knowledge of basic descriptive statistics. Major topics include elementary probability theory, probability distributions, estimation, tests of hypotheses, chi-squared procedures, regression, and correlation.

Rules & Requirements
Grading Status: Letter grade.

BIOS 611. Introduction to Data Science. 4 Credits.
Topics will include gaining proficiency with R and Python, data wrangling, data quality control and cleaning, data visualization, exploratory data analysis, and introductory applied optimization, with an overall emphasis on the principles of good data science, particularly reproducible research. Some emphasis will be given to large data settings such as genomics or claims data. The course will also develop familiarity with software tools for data science best practices, such as Git, Docker, Jupyter, and Nextflow.

Rules & Requirements
Requisites: Prerequisites, MATH 232 and 416, and STOR 151.
Grading Status: Letter grade.

BIOS 635. Introduction to Machine Learning. 3 Credits.
This course will be an introductory course to machine learning. The goal is to equip students with knowledge of existing tools for data analysis and to get students prepared for more advanced courses in machine learning. This course is restricted to SPH Master of Public Health students.

Rules & Requirements
Requisites: Prerequisite, BIOS 512 or 650; permission of the instructor for students lacking the prerequisite.
Grading Status: Letter grade.

BIOS 641. Quantitative Methods for Health Care Professionals I. 4 Credits.
Course is designed to meet the needs of health care professionals to appraise the design and analysis of medical and health care studies and who intend to pursue academic research careers. Covers basics of statistical inference, analysis of variance, multiple regression, categorical data analysis. Previously offered as PUBH 741. Permission of instructor.

Rules & Requirements
Grading Status: Letter grade.

BIOS 642. Quantitative Methods for Health Care Professionals II. 4 Credits.
Continuation of BIOS 641. Main emphasis is on logistic regression; other topics include exploratory data analysis and survival analysis. Previously offered as PUBH 742.

Rules & Requirements
Requisites: Prerequisite, BIOS 641.
Grading Status: Letter grade.

BIOS 645. Principles of Experimental Analysis. 3 Credits.
Required preparation, basic familiarity with statistical software (preferably SAS able to do multiple linear regression) and introductory biostatistics, such as BIOS 600. Continuation of BIOS 600. Analysis of experimental and observational data, including multiple regression and analysis of variance and covariance. Previously offered as BIOS 545. Permission of the instructor for nonmajors.

Rules & Requirements
Requisites: Prerequisites, BIOS 600 or SPHG 711.
Grading Status: Letter grade.

BIOS 650. Basic Elements of Probability and Statistical Inference I. 3 Credits.
Required preparation, two semesters of calculus (such as MATH 231, 232). Fundamentals of probability; discrete and continuous distributions; functions of random variables; descriptive statistics; fundamentals of statistical inference, including estimation and hypothesis testing.

Rules & Requirements
Grading Status: Letter grade.

BIOS 660. Probability and Statistical Inference I. 3 Credits.
Required preparation, three semesters of calculus (such as MATH 231, 232, 233). Introduction to probability; discrete and continuous random variables; expectation theory; bivariate and multivariate distribution theory; regression and correlation; linear functions of random variables; theory of sampling; introduction to estimation and hypothesis testing.

Rules & Requirements
Grading Status: Letter grade.

BIOS 661. Probability and Statistical Inference II. 3 Credits.
Distribution of functions of random variables; Helmert transformation theory; central limit theorem and other asymptotic theory; estimation theory; maximum likelihood methods; hypothesis testing; power; Neyman-Pearson Theorem, likelihood ratio, score, and Wald tests; noncentral distributions.

Rules & Requirements
Requisites: Prerequisite, BIOS 660; permission of the instructor for students lacking the prerequisite.
Grading Status: Letter grade.

BIOS 662. Intermediate Statistical Methods. 4 Credits.
Principles of study design, descriptive statistics, sampling from finite and infinite populations, inferences about location and scale. Both distribution-free and parametric approaches are considered. Gaussian, binomial, and Poisson models, one-way and two-way contingency tables.

Rules & Requirements
Requisites: Pre- or corequisites, BIOS 511 and 650.
Grading Status: Letter grade.

BIOS 663. Intermediate Linear Models. 4 Credits.
Required preparation, BIOS 662. Matrix-based treatment of regression, one-way and two-way ANOVA, and ANCOVA, emphasizing the general linear model and hypothesis, as well as diagnostics and model building. Reviews matrix algebra. Includes statistical power for linear models and binary response regression methods.

Rules & Requirements
Grading Status: Letter grade.

BIOS 664. Sample Survey Methodology. 4 Credits.
Fundamental principles and methods of sampling populations, with emphasis on simple, random, stratified, and cluster sampling. Sample weights, nonsampling error, and analysis of data from complex designs are covered. Practical experience through participation in the design, execution, and analysis of a sampling project.

Rules & Requirements
Making Connections Gen Ed: EE- Field Work.
Requisites: Prerequisite, BIOS 650; permission of the instructor for students lacking the prerequisite.
Grading Status: Letter grade.
Same as: STOR 358.

BIOS 665. Analysis of Categorical Data. 3 Credits.
Introduction to the analysis of categorized data: rates, ratios, and proportions; relative risk and odds ratio; Cochran-Mantel-Haenszel procedure; survivorship and life table methods; linear models for categorical data. Applications in demography, epidemiology, and medicine.

Rules & Requirements
Requisites: Prerequisites, BIOS 645, 650, and 662; permission of the instructor for students lacking the prerequisites.
Grading Status: Letter grade.

BIOS 667. Applied Longitudinal Data Analysis. 3 Credits.
Analysis of variance and multiple linear regression course at the level of BIOS 663 required. Familiarity with matrix algebra required. Univariate and multivariate repeated measures ANOVA, GLM for longitudinal data, linear mixed models. Estimation and inference, maximum and restricted maximum likelihood, fixed and random effects.

Rules & Requirements
Requisites: Prerequisite, BIOS 663; permissions from the instructor for students lacking the prerequisite.
Grading Status: Letter grade.

BIOS 668. Design of Public Health Studies. 3 Credits.
Statistical concepts in basic public health study designs: cross-sectional, case-control, prospective, and experimental (including clinical trials). Validity, measurement of response, sample size determination, matching and random allocation methods.

Rules & Requirements
Requisites: Prerequisites, BIOS 645 and 650.
Grading Status: Letter grade.

BIOS 669. Working with Data in a Public Health Research Setting. 3 Credits.
Provides a foundation and training for working with data from clinical trials or research studies. Topics: issues in study design, collecting quality data, using SAS and SQL to transform data, typical reports, data closure and export, and working with big data.

Rules & Requirements
Requisites: Prerequisite, BIOS 511 or EPID 700; permission of the instructor for students lacking the prerequisite.
Grading Status: Letter grade.

BIOS 670. Demographic Techniques I. 3 Credits.
Source and interpretation of demographic data; rates and ratios, standardization, complete and abridged life tables; estimation and projection of fertility, mortality, migration, and population composition.

Rules & Requirements
Grading Status: Letter grade.

BIOS 672. Topics in Real Analysis, Introduction to Measure Theory. 1 Credits.
Selected topics in calculus, real analysis including Taylor's series, Riemann, Stieltjes and Lebesgue integration, and complex variables. Introduction to measure theory.

Rules & Requirements
Requisites: Corequisite, BIOS 660.
Grading Status: Letter grade.

BIOS 673. Intermediate Statistical Inference. 1 Credits.
This course introduces intermediate concepts and theories in statistical inferences, including multivariate transformation, convergence of random vectors, sufficient and complete statistics, methods of estimation, and advanced problems such as information inequality, unbiased estimators, Bayes estimators, asymptotically efficient estimation, nonparametric estimation, and simultaneous confidence intervals.

Rules & Requirements
Requisites: Prerequisite, BIOS 660; permission of the instructor for students lacking the prerequisite; Corequisite, BIOS 661.
Grading Status: Letter grade.

BIOS 680. Introductory Survivorship Analysis. 3 Credits.
Introduction to concepts and techniques used in the analysis of time to event data, including censoring, hazard rates, estimation of survival curves, regression techniques, applications to clinical trials.

Rules & Requirements
Requisites: Prerequisite, BIOS 661; permission of the instructor for students lacking the prerequisite.
Grading Status: Letter grade.

BIOS 690. Special Topics in Biostatistics. 1-3 Credits.
Field/topical/research seminar. Instructors use this course to offer instruction in particular topics or approaches.

Rules & Requirements
Repeat Rules: May be repeated for credit; may be repeated in the same term for different topics; 6 total credits. 6 total completions.
Grading Status: Letter grade.

BIOS 691. Field Observations in Biostatistics. 1 Credits.
Field visits to, and evaluation of, major nonacademic biostatistical programs in the Research Triangle area. Field fee: $25.

Rules & Requirements
Grading Status: Letter grade.

BIOS 693H. Honors Research in Biostatistics. 3 Credits.
Directed research. Written and oral reports required.

Rules & Requirements
Making Connections Gen Ed: EE- Mentored Research.
Grading Status: Letter grade.

BIOS 694H. Honors Research in Biostatistics. 3 Credits.
Directed research. Written and oral reports required.

Rules & Requirements
Making Connections Gen Ed: EE- Mentored Research.
Grading Status: Letter grade.

Contact Information

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