# BIOSTATISTICS

**GMS 6827 Advanced Clinical Trial Methods 3 Credits, Max 9 Credits**
**Grading Scheme:** Letter Grade
Statistical principles and methods used in the design and analysis of clinical trials. Rotating topics include group sequential designs, adaptive clinical trials, and Statistical Monitoring of Clinical Trials.
**Prerequisite:** consent of instructor.

**PHC 6020 Clinical Trial Methods 3 Credits**
**Grading Scheme:** Letter Grade
Basic statistical concepts and methods used in clinical trials and the statistical principles and methods including phase I to IV clinical trials.
**Prerequisite:** STA 6208/STA 6209 , STA 6326/STA 6327, or equivalent

**PHC 6022 Design and Conduct of Clinical Trials 3 Credits**
**Grading Scheme:** Letter Grade
Scientific evaluation of health care interventions by clinical trials and the ethics, principles, and conduct of clinical trials in an epidemiological context. Complex issues in analyzing and interpreting clinical trials.
**Prerequisite:** STA 2023 (Introduction to Statistics I) or equivalent, and permission of the instructors. Students are expected to have basic statistical knowledge.

**PHC 6050C Biostatistical Methods I 3 Credits**
**Grading Scheme:** Letter Grade
Biostatistical data analysis using linear models; theory and practice of regression and analysis of variance in the health sciences.
**Prerequisite:** basic knowledge of data analysis, linear algebra, and calculus III, and consent of instructor.

**PHC 6051 Biostatistical Methods II 3 Credits**
**Grading Scheme:** Letter Grade
Biostatistical data analysis using generalized linear models, generalized linear mixed models, semiparametric and nonparametric regression, and neural networks; theory and practice in the health sciences.
**Prerequisite:** consent of instructor and Biostatistical Methods I.

**PHC 6059 Introduction to Applied Survival Analysis 3 Credits**
**Grading Scheme:** Letter Grade
Survival analysis is about the analysis of time-to-event data. The goal of this course is to help you understand the fundamental concepts of survival analysis and their applications in epidemiology and biomedical sciences. Basic concepts from probability and introductory statistics will be reviewed as needed.
**Prerequisite:** Prior training in statistics (PHC 6052 or equivalent) and knowledge of multiple regression (PHC 6053 or equivalent). R programming experience will also be helpful.

**PHC 6063 Biostatistical Consulting 3 Credits**
**Grading Scheme:** Letter Grade
Providing training for M.S. and Ph.D students in Biostatistics on the statistical aspects of research problems.
**Prerequisite:** Biostatistical Methods I and II or consent of the instructor. ;
**Corequisite:** All faculty teaching this course have completed at least 18 graduate semester hours in the teaching discipline and hold at least a master's degree.

**PHC 6064 Survey of Advanced Biostatistical Methods for the Health Sciences 3 Credits**
**Grading Scheme:** Letter Grade
Uniquely blends the fundamentals of biostatistical inference with an introduction to advanced statistical techniques critical for the analysis of the growing compendium of health-related data. Topics span the analysis of high-dimensional, categorical, and longitudinal data from the health sciences. Applications utilize the statistical software packages R and SAS.
**Prerequisite:** PHC 6052 or permission of instructor.

**PHC 6075 Biostatistical Literacy 3 Credits**
**Grading Scheme:** Letter Grade
Research in the health sciences requires appropriate study design, statistical analysis and interpretation of results. This course introduces basic concepts and techniques, including types of data, inference, and regression, necessary to read, interpret, and critically evaluate statistical results in health science literature relevant to the interests of the student.
**Prerequisite:** graduate students in the health sciences and requires a basic knowledge of mathematics, including algebra (for example, MAC 1105 and MAC 1114, or MAC 1140, or equivalent).

**PHC 6084 Bayesian Biostatistical Methods 3 Credits**
**Grading Scheme:** Letter Grade
Introduces students to Bayesian statistics with special emphasis on practical implementation in diverse areas such as clinical trials, survival analysis, longitudinal studies, disease mapping, and bioinformatics. Students will be able to fit Bayesian models to analyze real data sets using freely available software such as WinBUGS and R.
**Prerequisite:** PHC 6092 and PHC 6050C and PHC 6051 or equivalent.

**PHC 6088 Statistical Analysis of Genetic Data 3 Credits**
**Grading Scheme:** Letter Grade
An introduction to statistical procedures for genetic studies. This class will emphasize the statistical theory behind methods for analyzing genetic data and its application in useful software tools. This course prepares students for potential research in statistical genetics but is also open to a wider community. \
**Prerequisite:** PHC 6092 and PHC 6050C or equivalent. Permission at the discretion of the instructor may be granted if the student is familiar with linear algebra, maximum likelihood, simple hypothesis testing, and linear regression.

**PHC 6089 Public Health Computing 3 Credits**
**Grading Scheme:** Letter Grade
This course covers using SAS and R to manage and analyze public health data. Students will learn how to import, modify, visualize and perform common analyses of public health data using SAS and R.
**Prerequisite:** PHC 6052 or or approval of the instructor.

**PHC 6092 Introduction to Biostatistical Theory 3 Credits**
**Grading Scheme:** Letter Grade
Concepts and principles of statistical theory, including probability and random variables, parameter estimation, confidence intervals, hypothesis testing, asymptotic analysis, Bayesian inference, statistical decision theory and linear models.
**Prerequisite:** Multivariable calculus or permission of the instructor.

**PHC 6097 Statistical Learning with Applications in Health Sciences 3 Credits**
**Grading Scheme:** Letter Grade
Covers a broad range of methods that are useful for modern data analysis, specifically in the analysis of high-dimensional data. Many of these methods (e.g., deep learning) go far beyond the classical statistical methods and are developed for addressing various problems (e.g., nonlinearity) we encounter in real situations.
**Prerequisite:** PHC 6068 and PHC 6050C and PHC 6051, or the permission of the instructor.

**PHC 6099 Programing Basics for Biostatistics 3 Credits**
**Grading Scheme:** Letter Grade
The Introduction to Biostatistical Computing course is intended to develop your programming skills to perform biostatistical computing. The course will include both R programming language using the RStudio interface and Python programming language using the Anaconda interface. Topics include data structure, file input/output, visualization, data manipulation, basic statistical inference, and reproducible reports using markdown languages.
**Prerequisite:** An introductory course in statistics that covers inference, such as PHC 6052.

**PHC 6736 Statistical and Computational Analysis of Genomic Data 3 Credits**
**Grading Scheme:** Letter Grade
Focuses on statistical and computational methods/tools for next-generation sequencing data analysis. Topics include introduction and analysis of DNA-seq, RNA-seq, ChIP-seq, ATAC-seq, and single-cell genomics. In addition, the course will illustrate how to use R/Bioconductor R packages to handle common types of genomic data.

**PHC 6790 Biostatistical Methods Using SAS 3 Credits**
**Grading Scheme:** Letter Grade
This course is to introduce and prepare students for biostatistical computing using the SAS statistical software. It builds on the knowledge obtained in the Biostatistical Methods I and II courses by reinforcing the material and focusing on application within the SAS framework.
**Prerequisite:** PHC 6050C and PHC 6051, or Instructor determination of equivalent background.

**PHC 6791 Data Visualization in the Health Sciences 3 Credits**
**Grading Scheme:** Letter Grade
Students will learn the foundations of information visualization and sharpen their skills in communicating using health science data. Throughout the semester, we will primarily use R to explore concepts in graphic design, storytelling, data wrangling and plotting, biostatistics, and artificial intelligence as they apply to data-driven communication.
**Prerequisite:** A course in statistics such as PHC 6052 or equivalent. Some familiarity with R statistical software is recommended but not required.

**PHC 6905 Independent Study 1-6 Credits, Max 6 Credits**
**Grading Scheme:** Letter Grade
Independent Study
**Prerequisite:** consent of instructor.

**PHC 6937 Special Topics in Public Health 1-6 Credits, Max 12 Credits**
**Grading Scheme:** Letter Grade
Special Topics in Public Health

**PHC 7056 Analysis of Longitudinal Data 3 Credits**
**Grading Scheme:** Letter Grade
Likelihood-based and semiparametric methods for longitudinal data. Methods to deal with missing data in both settings.
**Prerequisite:** STA 6326 , STA 6327   (or equivalent), STA 6207 , STA 6208 (or equivalent), and STA 6246   (or equivalent).

**PHC 7066 Large Sample Theory 3 Credits**
**Grading Scheme:** Letter Grade
Detailed introduction to large sample theory and its application in univariate and multivariate parametric and nonparametric estimation.
**Prerequisite:** STA 6326   and STA 6327 (or equivalent).

**PHC 7068 Biostatistical Computing 3 Credits**
**Grading Scheme:** Letter Grade
In this course, students will learn key algorithms for advanced statistical computing and their applications in biomedical sciences. The course will cover fundamental computational techniques for advanced biostatistical data analysis as well statistical methods for random number generation, convex optimization algorithms, Monte Carlo integration, and stochastic optimization.
**Prerequisite:** PHC 6092 , PHC 6050 , and PHC 6051 , or permission of the instructor.

**PHC 7090 Advanced Biostatistical Methods I 3 Credits**
**Grading Scheme:** Letter Grade
Theory and application for estimation and hypothesis testing for independent data using linear models. Principles of Frequentist and Bayesian estimation and inference. Application using statistical software. Writing data analysis reports.
**Prerequisite:** PHC 6050, PHC 6051, STA 6326, and STA 6327, or permission of the instructor

**PHC 7091 Advanced Biostatistical Methods II 3 Credits**
**Grading Scheme:** Letter Grade
Theory and application for independent and dependent data using generalized linear models and generalized linear mixed models. Bayesian and Frequentist inference. Application using statistical software. Writing data analysis reports.
**Prerequisite:** PHC 7090 Advanced Biostatistical Methods I or equivalent

**PHC 7095 Advanced Statistical Learning for Biostatistics 3 Credits**
**Grading Scheme:** Letter Grade
This is an advanced course in statistical learning, which covers a broad range of methods and their applications in high-dimensional data analysis. Many of these methods go far beyond classical statistical methods and are developed for addressing modern problems we encounter in public health and medical science settings.
**Prerequisite:** PHC 7090 and PHC 7091 or permission of instructor.

**PHC 7925 Biostatistics Journal Club 1-3 Credits, Max 8 Credits**
**Grading Scheme:** S/U
Meeting weekly to present, review, and discuss current articles in biostatistics or statistics journals or discipline-specific (e.g. medicine, public health, epidemiology) articles with substantive biostatistical content.

**PHC 7979 Advanced Research 1-12 Credits**
**Grading Scheme:** S/U
Research for doctoral students before admission to candidacy. Designed for students with a master's degree in the field of study or for students who have been accepted for a doctoral program. Not appropriate for students who have been admitted to candidacy.

**PHC 7980 Research for Doctoral Dissertation 1-15 Credits**
**Grading Scheme:** S/U
Research for Doctoral Dissertation

**STA 6177 Applied Survival Analysis 3 Credits**
**Grading Scheme:** Letter Grade
Focusing on survival analysis, Kaplan-Meier estimates, proportional
hazards model, related tests, phase I, II, and III clinical trials, designs and
protocols.
**Prerequisite:** STA 6327

**STA 6707 Analysis of Multivariate Data 3 Credits**
**Grading Scheme:** Letter Grade
Techniques for analyzing multivariate data. Emphasis on MANOVA
and tests on the structure of the dispersion matrix. Topics will include
discriminant, factor, profile, and cluster analyses.
**Prerequisite:** STA 6208 and facility in a computer language.

**STA 7179 Survival Analysis 3 Credits**
**Grading Scheme:** Letter Grade
Theoretical introduction to statistical inferential procedures useful for
analyzing randomly right censored failure time data.
**Prerequisite:** STA 6177.