Biostatistics

Head
- Joseph E. Cavanaugh

Graduate degrees: MS in biostatistics; PhD in biostatistics
Graduate certificate: biostatistics
Faculty: https://www.public-health.uiowa.edu/biostatistics-faculty-list/
Website: https://www.public-health.uiowa.edu/biostat/
The Department of Biostatistics prepares students for professional and academic careers in biostatistics. Graduates find positions in pharmaceutical, health care, and research companies and institutions; in universities and government agencies; and as consultants. The department also provides training for non-biostatistics students.

Biostatistics faculty members work closely with both clinical and basic science investigators on the University of Iowa health sciences campus in the design and analysis of research projects. The department has research expertise representing a broad array of methodological areas of statistics and biostatistics, including clinical trials, computational statistics, Bayesian modeling and inference, high-dimensional data analysis, statistical genetics and genomics, bioinformatics, informatics, statistical and machine learning, spatial and spatio-temporal modeling, time series analysis, survival data analysis, longitudinal data analysis, network analysis, causal inference, comparative effectiveness studies, model selection, epidemic modeling, and syndromic surveillance. Many of these areas represent current, cutting-edge areas of disciplinary focus in a rapidly evolving field.

In addition to the MS and the PhD degrees in biostatistics, the department offers a subprogram for the Master of Public Health (MPH) degree in biostatistics. See "MPH Subprogram" below.

MPH Subprogram
The Department of Biostatistics offers the biostatistics subprogram for the Master of Public Health degree. The subprogram is designed to train public health professionals for leadership in the analysis of public health data and the design of studies for public health investigations. See the Master of Public Health, MPH in the catalog.

Programs

Graduate Programs of Study

Majors
- Biostatistics subprogram for the Master of Public Health degree
- Master of Science in Biostatistics
- Doctor of Philosophy in Biostatistics

Certificate
- Certificate in Biostatistics

Facilities

Department of Biostatistics resources and activities include three centers. The Biostatistics Consulting Center provides opportunities for students to gain valuable experience working with faculty and staff in the health sciences at the University of Iowa. The Clinical Trials Statistical and Data Management Center serves the statistical design, data management, and analysis needs of a variety of multicenter clinical trials, and among those are Acute to Chronic Pain Signatures (A2CPS) Consortium, Network of Excellence in Neuroscience Clinical Trials (NeuroNEXT), and the Parkinson's Progression Markers Initiative (PPMI). The Center for Public Health Statistics facilitates the collection, analysis, and dissemination of health data in support of the research, teaching, and service missions of the College of Public Health. This includes collaborative relationships in the area of public health statistics including data management and statistical analysis services.

Courses

Biostatistics Courses

BIOS:4110 General Biostatistics
Biostatistics and biostatistical computation; biostatistical aspects of health-related problems; clinical trials; statistical issues in big data problems; disease modeling; disease mapping; genetics and epidemiology; brief introduction to survival and longitudinal analyses.

BIOS:4120 Introduction to Biostatistics
Application of statistical techniques to biological data including descriptive statistics, probability and distributions, sampling distributions, nonparametric methods, hypothesis tests, confidence intervals, analysis of categorical data, and simple linear regression; designed for non-biostatistics majors and MPH students. Requirements: college algebra or ALEKS score of 65% or higher.

BIOS:4510 Data Science Foundations in R
Introduction to use of R tools for data wrangling and communication tasks commonly encountered in biostatistics; topics include preparation and manipulation of analytic datasets, data visualization, tabular summaries, and reporting. Offered spring semesters.

BIOS:5120 Regression Modeling and ANOVA in the Health Sciences
Continuation of BIOS:4120; correlation, simple and multiple linear regression, confounding, interactions, model selection, single and multiple factor ANOVA (analysis of variance) models, contrasts, multiple comparisons, nested and block designs; introduction to mixed models; for non-biostatistics majors. Offered spring semesters. Prerequisites: BIOS:4120. Same as IGPI:5120, STAT:5610.

BIOS:5130 Applied Categorical Data Analysis
Analysis of proportions, risk measures, and measures of association; Mantel-Haenszel method; logistic regression for binary responses and for matched data; logistic regression for multi-category responses; analysis of count data (Poisson regression and negative binomial regression); analysis of clustered data (generalized estimating equations and generalized linear mixed effects model); special topics include the application of propensity score methods; designed for non-biostatistics majors. Offered fall semesters. Prerequisites: BIOS:5120. Same as IGPI:5130.
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<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
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<tbody>
<tr>
<td>BIOS:5310</td>
<td>Research Data Management</td>
<td>3 s.h.</td>
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<tr>
<td>BIOS:5510</td>
<td>Biostatistical Computing</td>
<td>2 s.h.</td>
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<tr>
<td>BIOS:5710</td>
<td>Biostatistical Methods I</td>
<td>4 s.h.</td>
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<tr>
<td>BIOS:5720</td>
<td>Biostatistical Methods II</td>
<td>4 s.h.</td>
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<tr>
<td>BIOS:5730</td>
<td>Biostatistical Methods in Categorical Data</td>
<td>3 s.h.</td>
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<tr>
<td>BIOS:5734</td>
<td>Basic Biostatistical Methods with Genetics Applications</td>
<td>1 s.h.</td>
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<tr>
<td>BIOS:6310</td>
<td>Introductory Longitudinal Data Analysis</td>
<td>3 s.h.</td>
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<tr>
<td>BIOS:6420</td>
<td>Survey Design and Analysis</td>
<td>3 s.h.</td>
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<tr>
<td>BIOS:6610</td>
<td>Statistical Methods in Clinical Trials</td>
<td>3 s.h.</td>
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<tr>
<td>BIOS:6650</td>
<td>Causal Inference</td>
<td>3 s.h.</td>
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<tr>
<td>BIOS:6720</td>
<td>Statistical Machine Learning for Biomedical and Public Health Data</td>
<td>3 s.h.</td>
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<tr>
<td>BIOS:6780</td>
<td>Bayesian Methods and Design</td>
<td>3 s.h.</td>
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<tr>
<td>BIOS:7110</td>
<td>Likelihood Theory and Extensions</td>
<td>4 s.h.</td>
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BIOS:7210 Survival Data Analysis 3 s.h.
Types of censoring and truncation; survival function estimation; parametric inference using exponential, Weibull, and accelerated failure time models; nonparametric tests; sample size calculation; Cox regression with stratification and time-dependent covariates; regression diagnostics; competing risks; topics may include analysis of correlated survival data and/or recurrent events; designed for biostatistics and statistics majors. Offered fall semesters of odd years. Prerequisites: BIOS:5720 and ((STAT:4100 and STAT:4101) or (STAT:5100 and STAT:5101)). Same as IGPI:7210, STAT:7570.

BIOS:7230 Advanced Clinical Trials 3 s.h.
Modules that address advanced topics and issues encountered when conducting a clinical trial; discussions of recent publications and FDA guidance documents dealing with current topics in clinical trials. Prerequisites: (STAT:4101 or STAT:5101) and BIOS:6610. Requirements: familiarity with SAS and R programming.

BIOS:7240 High-Dimensional Data Analysis 3 s.h.
Analysis of high-dimensional data with emphasis on use of penalized regression models such as lasso, elastic net, minimax concave penalty (MCP), smoothly clipped absolute deviation (SCAD), and group lasso; large-scale hypothesis testing and false discovery rate estimation; inference for penalized likelihoods. Prerequisites: (STAT:4100 and STAT:4101) or (STAT:5100 and STAT:5101) and BIOS:5510 and BIOS:5720. Requirements: BIOS:5510 with section subtitle of programming with R.

BIOS:7250 Theory of Linear and Generalized Linear Models 4 s.h.
Theoretical foundations of traditional linear models and generalized linear models; emphasis on modeling structures, estimability and identifiability, estimation and testing. Prerequisites: STAT:5100 and STAT:5101 and BIOS:5720.

BIOS:7270 Scholarly Integrity in Biostatistics 1 s.h.
Responsible conduct of research training; emphasis on issues of particular relevance to biostatisticians and statisticians including authorship, communication, student/mentor relationships, plagiarism, fabrication and falsification of data, bias, Type I/II errors, reproducible research, data confidentiality and security, conflicts of interest, and human/animal subjects. Requirements: graduate standing in biostatistics.

BIOS:7310 Longitudinal Data Analysis 3 s.h.
Statistical models and estimation methods for outcome variables (normal and non-normal) clustered or measured repeatedly in time or space; includes ANOVA based methods, hierarchical linear models, linear mixed models, error structures, generalized estimating equations, and generalized linear mixed models; may include Bayesian approaches; designed for biostatistics and statistics majors. Offered spring semesters of odd years. Prerequisites: (BIOS:5720 and STAT:4100 and STAT:4101) or (STAT:5100 and STAT:5101). Same as IGPI:7310.

BIOS:7330 Advanced Biostatistical Computing 3 s.h.
Advanced topics in biostatistical computing and large or complicated data/models; matrix decomposition, optimization, Bayesian computing, parallel programming, working with campus high performance computing (HPC) resources; topics are explored in R, including package development and efficient R code. Prerequisites: MATH:2700 and BIOS:5510 and STAT:4101. Requirements: BIOS:5510 with section subtitle of programming with R.

BIOS:7410 Analysis of Categorical Data 3 s.h.
Distributions and inference for categorical data; descriptive and inferential methods for contingency tables; theory and application of generalized linear models including methods for parameter estimation and testing, model selection and assessment of model adequacy; models for binary, count, and multi-category outcomes; loglinear models for contingency tables; generalized additive models; generalized linear models for longitudinal and clustered data. Offered spring semesters of even years. Prerequisites: (BIOS:5720 or STAT:5200) and (STAT:5101 or STAT:4101). Same as STAT:7510.

BIOS:7500 Preceptorship in Biostatistics arr.
Work experience using knowledge and skill acquired in classroom; arranged in conjunction with ongoing departmental or collegiate activities or with governmental agencies or private industry; preparation of prospectus and presentation of research results in a department seminar.

BIOS:7600 Advanced Biostatistics Seminar 0-3 s.h.
Current topics; supervised experience in reading and interpreting biostatistical literature. Same as IGPI:7600.

BIOS:7604 Scholarly Integrity in Biostatistics for Postdocs 0 s.h.
Responsible conduct of research training; emphasis on issues of particular relevance to biostatisticians and statisticians including authorship, communication, student/mentor relationships, plagiarism, fabrication and falsification of data, bias, Type I/II errors, reproducible research, data confidentiality and security, conflicts of interest, human/animal subjects. Requirements: postdoctoral research scholar/ fellow standing in biostatistics or statistics.

BIOS:7700 Problems/Special Topics in Biostatistics arr.
Didactic material in biostatistics; may include tutorials, seminars, faculty-directed independent work (e.g. literature search, project, short research project).

BIOS:7800 Independent Study in Biostatistics arr.
In-depth pursuit of an area of special interest in biostatistics requiring substantial creativity and independence.

BIOS:7850 Research in Biostatistics arr.
Research that may lead to a dissertation.