BIOSTATISTICS MS PROGRAM OF STUDIES
STUDENT HANDBOOK
2021-2022

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Welcome to the Department of Biostatistics! This Handbook outlines the requirements, policies, and procedures for the operation of our graduate programs. Please keep in mind that policies may change. The department will make every effort to communicate changes in requirements, procedures, or policies.

CONTACT INFORMATION:

For all inquiries, please contact Mary Morris, Department Assistant at:

mary.morris@unmc.edu
Phone: 402-559-4112

Department of Biostatistics
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Omaha, NE 68198-4375

POLICIES

All Biostatistics students are bound by the policies and regulations below. Students should consult the UNMC Graduate Studies Catalogs & Policies for a complete listing of all policies and regulations.

Designation of Advisor / Advisory Committee

Within 6 months (8 months for part-time students) after matriculation, students must designate their academic Advisor (and Advisory Committee if selecting the thesis option) using the Advisor/Supervisor Selection process in Seguidor. All students are required to meet with their advisory committee and document the meeting minutes in Seguidor every 6 months until degree completion.

Program of Studies (POS)

Within 7 months (9 months for part-time students) after matriculation, the student will schedule an Advisory Meeting in Seguidor to discuss their *Program of Studies* (POS). The POS includes designation of all required courses, options for electives (which may be TBD), and the general area of research for the thesis (if applicable). After incorporating any necessary revisions to the POS, the approved POS must be entered into Seguidor. The Program of Studies is a "living" document; however, any changes in the program or in the thesis topic (if applicable) must be approved by the Advisory/Advisory Committee and the action reported to the Graduate Studies Office via Seguidor.

Independent Development Plan (IDP)

Within 12 months (both full- and part-time students) of matriculation, each student must complete an Individual Development Plan using myIDP and the completion certificate must be uploaded into Seguidor.

Academic Integrity

The University of Nebraska Medical Center has established a policy on academic integrity and professional conduct. This policy may be found in the UNMC Graduate Studies Catalogs & Policies. All graduate students are expected to adhere scrupulously to this policy. Cheating, academic misconduct, fabrication, and plagiarism are viewed as serious matters and will lead to disciplinary action as described in the Procedural Rules Relating to Student Discipline under Student Policies.

Disabilities

Students with disabilities are encouraged to contact the coordinator of each course for a confidential discussion of their individual needs for academic accommodation. It is the policy of the University to provide flexible and individualized accommodation to students with documented disabilities; however, faculty are not required to provide accommodation without prior approval. To be eligible to receive reasonable accommodation, students must be registered with the Services for Students with Disabilities (SSD) office. Once the request has been approved, an individualized accommodation plan will be formulated and an official "Letter of Disability Accommodation" will be issued to the student. To register, contact Jennifer Papproth, MS at 402-554-2872 or jepapproth@unmc.edu .

Nondiscrimination

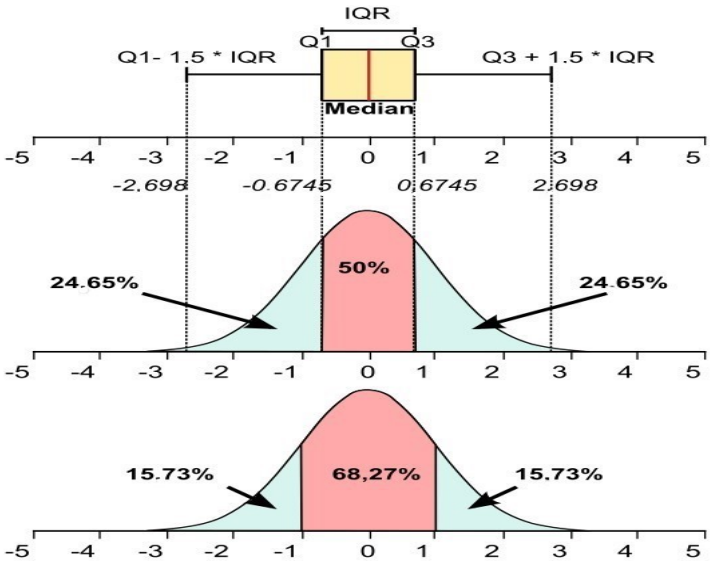
The University of Nebraska Medical Center (UNMC) is committed to creating a diverse and inclusive work and learning environment free from discrimination and harassment. UNMC is dedicated to creating an environment where everyone feels valued, respected and included. UNMC does not discriminate based on race, color, ethnicity, national origin, sex, pregnancy, sexual orientation, gender identity, religion, disability, age, genetic information, veteran status, marital status, and/or political affiliation in its programs, activities, or employment. UNMC complies with all local, state and federal laws prohibiting discrimination, including Title IX, which prohibits discrimination on the basis of sex. The following persons have been designated to handle student inquiries:
Discrimination or Disability Inquiries: Philip D. Covington, Ed.D., Vice Chancellor for Student Success, Student Life Center – Office# 2033, Telephone: 402-559-4437, Email: philip.covington@unmc.edu ; Title IX Inquiries: Carmen Sirizzotti, MBA, Title IX Coordinator, Administrative Building (ADM), Office# 2010, Telephone: 402-559-2717, Email: csirizzotti@unmc.edu

BACKGROUND

Biostatistics is the science that applies statistical theory and methods to the solution of problems in the biomedical and public health sciences. The main areas of effort for biostatisticians include collaborative research and consulting, methodological research, and education. In collaborative research, biostatisticians work on research studies with investigators in the biomedical and health sciences. The biostatisticians' responsibilities include analysis of data and interpretation of results. Equally important, however, is the responsibility to collaborate in the designing and conducting of the study to ensure consistency with good statistical practice. Methodological research, such as developing statistical models to describe biomedical and public health phenomena, is conducted to enhance the existing bodies of knowledge in theoretical and applied biostatistics. Biostatisticians educate others about biostatistics through the teaching of graduate and continuing education courses, seminars, collaborative research, and consulting activities.

The M.S. program in Biostatistics at UNMC is designed for individuals with adequate quantitative training in college and a genuine interest in supporting / contributing to the conduct of research in biomedical and/or public health sciences. It provides rigorous training in advanced statistical analysis, computing, and consulting on statistical applications in a broad spectrum of biomedical and public health science problems. The primary goal of the program is to prepare the students for data science careers as biostatisticians in any life science related environment, such as universities, public health or government agencies, and data analyst in pharmaceutical/biotech industrials or any private health-related organizations.

Upon enrolling in a biostatistics M.S. program, students take courses in statistical methods and theory. The methods courses focus on ways to select and apply statistical techniques that are appropriate for different types of problems from biomedicine and public health. The theory courses provide rigorous instruction in the formal mathematical structure underlying the statistical techniques. Heavy use is made of computers in most biostatistics courses. Required and elective courses from other public health or biomedical fields are also included in the program of study.



ADMISSION

Any applicant who has received a Bachelor's in a quantitatively oriented field from an accredited institution and shows promise for successfully completing all M.S. degree requirements will be considered for admission to this program. In addition to satisfying general UNMC graduate studies requirements for admission, applicants must have a GPA of 3.00 or higher on the 4.00-scale system in courses taken during their earlier degree studies and a grade of B (or 3.00 on a 4.0 scale) or higher in courses required as prerequisites for the program. The prerequisites for the program are a mathematics background consisting of undergraduate courses: calculus I, calculus II, multivariable calculus, linear algebra, and introductory statistics. Prospective applicants who do not have this background must acquire it prior to admission to the program.

The Graduate Record Examination (GRE) is encouraged, but not required for applicants that meet or exceed all admissions requirements. The GRE is required for applicants that have had to retake any of the pre-requisite courses or have received a grade of B- or lower in any quantitative coursework. Applicant's whose native language is not English must also take the Test of English as a Foreign Language (TOEFL) and achieve a score of 80 or higher on the internet-based test or achieve a score of 6.5 or higher on The International English Language Testing System (IELTS). Final admission decisions will be made by the Program Admission Committee.

Applicants are required to complete the online **Schools of Public Health Application Service (SOPHAS) application.** All application materials need to be submitted through SOPHAS. Prospective students should visit the Department of Biostatistics admissions page for department specific admission requirements.

PROGRAM COMPETENCIES

Upon graduation, a student with an M.S. in Biostatistics should be able to address the following competencies:

CODE NAME	CONTENT
BIOSMS1	Demonstrate knowledge and skills necessary to conduct biostatistical research.
BIOSMS2	Think critically and creatively to solve problems in Biostatistics.
BIOSMS3	Effectively communicate biostatistical results
BIOSMS4	Apply appropriate statistical methods for estimation and inference, using a software package for data management, statistical analyses, and data presentation.
BIOSMS5	Apply statistical methods for quality control and data cleaning to already collected data, verify assumptions of statistical tests and models, and implement appropriate methods to address any issues discovered.
BIOSMS6	Evaluate the strengths and limitations of study design and statistical analyses of public health and biomedical studies.

PROGRAM REQUIREMENTS

Students enrolled in the M.S. program in Biostatistics are required to complete a minimum of 36 credit hours in course work beyond the bachelor's level. There are two program options: non-thesis and thesis. Students choosing the non-thesis option are required to pass a written comprehensive exam. Students who fail the written comprehensive exam can retake the exam or move to the thesis option. Students in the thesis option will work with an advisory committee to complete a written thesis and present the research outcome from the thesis in a public forum.

Upon matriculation, all students will be assigned an academic advisor, who will help develop a personalized plan for completing the MS in Biostatistics program and evaluate academic progress in the program. Advisors will be faculty in the Department of Biostatistics. Advisors will work with students to complete an individualized program of study by the end of the first semester of enrollment. For students selecting the thesis option, an advisory committee, consisting of the students' advisor and a minimum of two more members, will be responsible for supervising the student's thesis work toward earning the MS degree. **The advisory committee must be formed by the time the student has completed 18 credit hours and will meet at least once every term until graduation.**

In addition to the requirements specified by the Biostatistics M.S. program, the student must satisfy other requirements specified by the College of Public Health (COPH) and the UNMC Graduate Studies Program. These requirements are described in the UNMC Graduate Studies Catalogs & Policies.

COURSEWORK

The MS program in Biostatistics is 36 credit hours to be completed in two years by full-time students taking 18 credit hours per year, and four years by part-time students. All courses taken through the College of Public Health (COPH) are offered both on-campus and online.

Core Courses (8 courses/24 credit hours – required for both thesis and non-thesis options)

- BIOS 801 Biostatistics Theory I
- BIOS 802 Biostatistics Theory II
- BIOS 810 Introduction to SAS Programming
- BIOS 815 Biostatistical Computing
- BIOS 818 Biostatistical Methods II
- BIOS 823 Categorical Data Analysis
- BIOS 824 Survival Data Analysis
- BIOS 829 Introduction to Biostatistical Machine Learning

Required Public Health Course (1 course/3 credits)

- HPRO 830 Foundations of Public Health

Non-thesis option:

Electives (9 credit hours – at least 6 credit hours in Biostatistics)

- BIOS 825 Correlated Data Analysis

- BIOS 835 Design of Medical Studies
- BIOS 896 Research Other Than Thesis in Biostatistics
- BIOS 898 Special Topics in Biostatistics
- EPI 820 Epidemiology in Public Health
- EPI 845 Epidemiologic Methods
- EPI 945 Analytic Epidemiologic Methods
- Other relevant courses upon departmental approval

Thesis option:

Thesis (3 credit hours)

- BIOS 899 Thesis

Electives (6 credit hours – at least 3 credit hours in Biostatistics)

- BIOS 825 Correlated Data Analysis
- BIOS 835 Design of Medical Studies
- BIOS 896 Research Other Than Thesis in Biostatistics
- BIOS 898 Special Topics in Biostatistics
- EPI 820 Epidemiology in Public Health
- EPI 845 Epidemiologic Methods
- EPI 945 Analytic Epidemiologic Methods
- Other relevant courses upon departmental approval

TYPICAL PLAN OF DIDACTIC COURSE STUDY FOR STUDENTS ENTERING WITH ALL PRE-REQUISITES SATISFIED

Typical Course Schedule for a Full-time M.S. Student

Option A: Non-thesis			
First Year			
Fall		**Spring**	
BIOS 801	Biostatistics Theory I	BIOS 802	Biostatistics Theory II
BIOS 810	Intro to SAS Programming	BIOS 823	Categorical Data Analysis
BIOS 818	Biostatistical Methods II	TBD	BIOS / STAT / EPI Elective
Second Year			
Fall		**Spring**	
BIOS 815	Biostatistical Computing	TBD	Intro to Biostatistical Learning
BIOS 824	Survival Data Analysis	BIOS 829	BIOS / STAT / EPI Elective
HPRO830	Foundations of Public Health	TBD	Any Graduate Elective

Option B: Thesis			
First Year			
Fall		Spring	
BIOS 801	Biostatistics Theory I	BIOS 802	Biostatistics Theory II
BIOS 810	Intro to SAS Programming	BIOS 823	Categorical Data Analysis
BIOS 818	Biostatistical Methods II	TBD	BIOS / STAT / EPI Elective
Second Year			
Fall		Spring	
BIOS 815	Biostatistical Computing	TBD	BIOS / STAT / EPI Elective
BIOS 824	Survival Data Analysis	BIOS 829	Intro to Biostatistical Learning
HPRO830	Foundations of Public Health	BIOS 899	Thesis in Biostatistics

COMPREHENSIVE EXAM

The comprehensive exam is designed to test the student's basic biostatistics knowledge and skills acquired in the following Biostatistics courses: BIOS 801, BIOS 802, BIOS 818, and BIOS 823. The exam is made up of two sections: Theory and Application. In the Theory section, students are required to solve problems based on the materials from BIOS 801and BIOS 802; the application section covers BIOS 818 and BIOS 823. The exam is an in-class, proctored exam that will last between 4 to 5 hours.

The preparation and the administration of the comprehensive exam is overseen by the Program Graduate Examination Committee. A student will have at most two attempts to pass the comprehensive exam. The comprehensive exam is administrated in August. Students that fail the comprehensive exam in a section have the option to either take the make-up exam for the failed section in December or move to the thesis option. Student's failing the comprehensive exam twice may be switched to the thesis option or disenrolled at the discretion of the Program Graduate Committee. Switching to the thesis option after a comprehensive exam failure may extend the amount of time needed to complete the degree. The comprehensive exam timing is designed to ensure that students will meet the requirement of completion of the comprehensive exam at least 5 weeks before commencement.

COURSE DESCRIPTIONS

Please refer to the Biostatistics course descriptions in the UNMC Catalog; these descriptions are also provided in an Appendix at the end of this document.

THESIS

The Master's thesis is a data analysis project or substantive methodology research with a written report. A student who selects this option for the MS competency evaluation needs to identify a faculty mentor from the Department of Biostatistics and work on a project under the faculty's supervision for 3 credit hours. When the thesis is completed, the student will then present his or her work orally in a public forum.

Thesis Submission Format

The thesis must meet departmental and UNMC format requirements and timeline. Consult the Thesis & Graduation Instructions for M.S. Students (Thesis Option) ("The Format Guide") - for use by students admitted to UNMC Graduate Studies Programs.

ADVISING

Academic Advisor: Students admitted to the program will be assigned an **initial academic advisor** who may be consulted for advice on all the academic issues and the program. The Graduate Program Director is also available for general consultation. The student may change advisor with the approval of the Graduate Program Director who will also inform the original advisor of this switch.

M.S. Thesis Advisor: The semester prior to registering for thesis credit students should identify, in consultation with the academic advisor, professor(s) from the program's graduate faculty who will serve as the student's thesis advisor(s). The thesis advisor(s) are expected to meet with students on a weekly basis at the advisor's discretion for research guidance.

Advisory Committee (Thesis option only): At least one month before registering for thesis hours, the student should form the Advisory Committee chaired by his/her thesis advisor. The Advisory Committee consists of at least 3 graduate faculty members with at least two members being program graduate faculty. This committee has the responsibility for reading the thesis and conducting the thesis defense.

SATISFACTORY ASSESSMENT THROUGHOUT THE PROGRAM

General Scholarship Requirements

Students are expected to perform at the level of B or above in any graded (A/B/C/D/F) course that is offered for graduate credit. A minimum grade of C may be acceptable for graduate-level courses, but receipt of two grades of C may be cause for dismissal. The core curriculum courses (BIOS 801, 802, 810, 815, 818, 823, 824, and 829) with grades below C will need to be retaken and passed with a B or better. No more than two courses with a C grade will be counted toward degree requirements. For courses that are retaken, the better grades are used to calculate the student's cumulative GPA for academic progress evaluation.

Any grade below C is not acceptable for graduate credit and may be cause for dismissal. Likewise, a grade of F in any Pass/Fail course (e.g., non-thesis research, Master's Thesis, Practicum) may be grounds for dismissal. A student failing to receive a minimum acceptable grade in a course for graduate credit may not continue their program of studies without permission of their Advisory/Supervisory Committee or the program Graduate Committee. The Committee's recommendation, along with an appropriate explanation and justification, must be submitted to the Graduate Studies Office. Recommendations for dismissal require approval by the Dean of Graduate Studies.

Graduate students must maintain a cumulative GPA of at least 3.0 in order to be considered in good academic standing. Any student who fails to maintain a cumulative GPA of at least 3.0 at the end of any given semester may not continue his/her Program of Study without special permission of the Dean for Graduate Studies acting on the recommendation of the appropriate Graduate Committee or Advisory/Supervisory Committee. Hence, upon notification of a student's poor academic standing, the appropriate Committee must submit to the Dean for Graduate Studies a letter that includes 1) a review of the student's academic status (including any other information relevant to the student's performance), and 2) their recommendation for continuation or dismissal. If continuation is recommended, the letter must also include 3) a remediation plan for returning to good academic standing, and 4) any additional conditions established by the Committee for remaining in the program. Students permitted by the Dean for Graduate Studies to continue in the Graduate Studies program will be placed on academic probation and must remove the probationary status (i.e. return to a cumulative GPA of at least 3.0) within the next twelve (12) months. Failure to remove probationary status within this time frame, and/or to meet any other conditions established for remaining in the program, represents grounds for dismissal.

The above minimum scholarship requirements apply to ALL students enrolled in ANY course for graduate credit. Additional requirements may exist for certain graduate programs and departments as set forth in the Programs and Curriculum Requirements section of this Catalog, at websites maintained by each program, or in documents provided to students at the time of admission.

If a student finds it necessary to withdraw from the program, they should provide a notice as soon as possible—especially if supported financially by the program. In the case of teaching or research assistants, students are expected to complete the semester once it has begun. Similarly, the program will provide a student with as much advance notice as possible if the student is dropped from the program for reasons of poor performance. The student must also be registered during the semester of graduation.

Annual Progress Review

The Departmental Graduate Program Committee will conduct an annual review for students' academic progress in the program regarding the course work and research progress (if applicable). For the students who lack adequate progress, a remedy plan will be provided by the committee.

Coursework Transfer

The student may request a transfer of no more than 50% of the course requirements (other than thesis) from an accredited graduate program. The residency requirement is that at least 50% of the course requirements (other than thesis) be completed within a consecutive 18-month period, with the further provision that the courses be taken after receipt of the master's degree or equivalent. After the student is enrolled in the biostatistics M.S. program at University of Nebraska Medical Center (UNMC), the transfer request will be reviewed by the Graduate Program Director or, if already identified, the student's academic advisor (academic advisor will be assigned to students by the Graduate Program Director). A recommendation for approving or rejecting the request for credit transfer will be made on a case-by-case basis. The student who does not received an approval for credit transfer, will need to take additional courses as recommended by either the Graduate Program

Director or the academic advisor (if assigned) to satisfy the 60-credit hour requirement (see link). Students must provide, at minimum, the syllabus for the course under evaluation. Other documentation may be requested, as needed.

Expired Coursework

A course may not apply towards degree requirements if was completed more than seven years prior to the passing of the preliminary examination.

Graduate Studies Timelines for Graduation

Students taking the non-thesis option graduation requirements.

Students taking the thesis option graduation requirements.

LIST OF BIOSTATISTICSPROGRAM GRADUATE FACULTY AND THEIR RESEARCH INTERESTS

Su Chen. PhD
Associate Professor
PhD Statistics, Oklahoma State University
Dr. Chen's research interests mainly focus on non-/semi-parametric statistical modeling and data analysis on large-scale human genetic & epigenetic (high-dimensional and longitudinal) and intelligent tutoring/learning (cross-sectional and panel) data. She has been actively involved as PI or co-investigator in projects from a broad range of interdisciplinary topics with increasing academic productivity in biostatistics, epidemiology, cyber-security, and artificial intelligence funded by the National Institutes of Health (NIH) and Institute of Education Sciences (IES).

Hongying (Daisy) Dai, PhD
Professor
PhD Statistics, University of Kentucky
Dr. Dai's current research focuses on developing statistical methodology and applying advanced statistical methods in public health research including statistical modeling and assessment for tobacco policy research and national behavioral surveys; social media research using big data (Google Trends, Twitter data, disease surveillance); development of novel statistical methods for big data and high dimensional data, Genome Wide Association Study (GWAS); hierarchical modeling, asymptotic theory, and mixture modeling

Ran Dai, PhD
Assistant Professor
PhD Statistics, University of Chicago
Dr. Dai's research interest is in high dimensional inference in nonparametric modeling and shape-constrained regressions, multiple testing, and causal inference. In particular, she is interested in developing computationally efficient algorithms for these problems with statistical convergence guarantee and valid inference; and applying these methods towards real datasets in the areas of drug development, HIV mutation study and cancer study.

Jianghu (James) Dong, PhD
Assistant Professor
PhD Statistics, Simon Fraser University
Dr. Dong's current research is mainly focus in developing new statistical methodologies to solve the real clinical problems, especially in Diabetes, Chronic Kidney Disease and Kidney Transplant. He is also interested in functional data analysis; longitudinal analysis, survival analysis and joint modeling; clinical trials and measurement error models; cost-effectiveness analysis and decision tree.

Yeongjin Gwon, PhD
Assistant Professor
PhD Statistics, University of Connecticut
Dr. Gwon's research interest is in Bayesian statistical methodology, Bayesian computation, Network meta analysis, Latent class modeling, High-dimensional data, Longitudinal data, and Survival data analysis.

Gleb Haynatzki, PhD, DSc
Professor
PhD Statistics & Applied Probability, University of California-Santa Barbara
DSc Mathematical Sciences, St K Ohridski U, Sofia, Bulgaria, Europe
Dr. Haynatzki's research interest is in statistical models in survival analysis, cancer epidemiology, carcinogenesis, cancer genetics, hereditary cancer, health disparities; quantitative modeling of bone biology and osteoporosis.

Jane Meza, PhD
Professor and Associate Vice Chancellor for Global and Student Support
PhD Statistics, University of Nebraska, Lincoln
Dr. Meza's methodological research focuses on statistical issues related to small-area estimation. These methods have been extended to disease mapping applications and combining national and state data to estimate the probability of a rare event.

Kendra Schmid, PhD
Professor and Assistant Dean of Graduate Studies
PhD Statistics, University of Nebraska, Lincoln
Dr. Schmid's current research is focused on statistical shape analysis using landmark data and in particular, methods for face recognition applications. She is also interested in statistics education.

Lynette Smith, PhD
Associate Professor
PhD Statistics, University of Nebraska, Lincoln
Dr. Smith's current research is focused on spatial prediction of disease incidence and mortality. She is also interested in biomarker development in cancer, clinical trial design, and high dimensional data analysis.

Christopher Wichman, PhD
Assistant Professor & Graduate Program Director
PhD Statistics, University of Nebraska, Lincoln
Dr. Wichman's current research is focused on detecting changes in closed networks using meta data. He is also interested in model misspecification in the presence of zero inflated counts, experimental design, meta-analysis, and social-network analysis.

Fang Yu, PhD
Professor and Director of Center for Collaboration on Research Design and Analysis
PhD Statistics, University of Connecticut
Dr. Yu's current research interest is in developing and applying statistical methods for analyzing high-dimensional data, missing data from biomedical research, and clinical trials.

Ying Zhang, PhD
Professor and Chair
PhD Statistics, University of Washington
Dr. Zhang conducts statistical methodology research in broad areas including non-/semi-parametric

statistical inference, non-/semi-parametric models for panel count and interval-censored data analysis, causal inference, clinical and pragmatic trial design, statistical computing, and machine learning. He also actively collaborates with scientists in the fields of neurodegenerative diseases, neurosciences, cancer, cardiovascular disease, diabetes, sports medicine and community health promotion by providing rigor in study design, statistical analysis plan and scientific interpretation of analytical results.

Cheng Zheng, PhD
Associate Professor
PhD Biostatistics, University of Washington
Dr. Zheng's methodological research interests are in causal inference, measurement error modeling, big data, survival analysis, longitudinal data, and biomarker evaluation.
Dr. Zheng's applied research interests are in cancer, cardiovascular disease, diabetes, obesity, HIV, Nutritional Epidemiology, Environmental Epidemiology, and Behavioral

APPENDIX A: Biostatistics Course Descriptions

BIOS 801 BIOSTATISTICS Theory I 3 Credit Hours

This course is designed to prepare students in the Master of Sciences in Biostatistics to have a solid understanding of the probabilistic tools and language (at a rigorous and advanced calculus level) needed as a foundation of biostatistical inference. Major topics to be covered include probability theory, transformations and expectations of random variables, families of distributions, random vectors, sampling distributions, and convergence.

Prerequisite: Calculus I, II and III, or equivalent courses; and instructor permission.

Cross List: CPH 657

Typically Offered: FALL

BIOS 802 BIOSTATISTICS Theory II 3 Credit Hours

This course is designed to prepare students to have a solid understanding of biostatistical inference. Major topics to be covered include random samples, data reduction, point estimation, hypothesis testing, interval estimation, and prediction for common parametric models.

Prerequisite: BIOS 801 Biostatistics Theory I or an equivalent course, and instructor permission.

Cross List: CPH 658

Typically Offered: SPRING

BIOS 806 BIOSTATISTICS 3 Credit Hours

This course is designed to prepare the graduate student to understand and apply biostatistical methods needed in the design and analysis of biomedical and public health investigations. The major topics to be covered include types of data, descriptive statistics and plots, theoretical distributions, probability, estimation, hypothesis testing, and one-way analysis of variance. A brief introduction to correlation and univariate linear regression will also be given. The course is intended for graduate students and health professionals interested in the design and analysis of biomedical or public health studies; not intended for M.S. students enrolled in the Biostatistics Graduate Program.

Cross List: CPH 506.

Typically Offered: FALL

BIOS 808 BIOSTATISTICS II 3 Credit Hours

This course is designed to prepare the student to understand and apply advanced biostatistical methods needed in the design and analysis of biomedical and public health investigations. The major topics to be covered include multiple linear regression, analysis of covariance, logistic regression, survival analysis, and repeated measures analysis.

Prerequisite: BIOS 806 or an equivalent statistics course. The course is intended for graduate students and health professionals interested in the design and analysis of biomedical or public health studies; not intended for M.S. students enrolled in the Biostatistics Graduate Program.

Cross List: CPH 650.

Typically Offered: SPRING

BIOS 810 INTRODUCTION TO SAS PROGRAMMING 3 Credit Hours

An introduction to programming for statistical and epidemiologic analysis using the SAS Software System. Students will learn to access data from a variety of sources (e.g. the web, Excel, SPSS, data entry) and create SAS datasets. Data management and data processing skills, including concatenation, merging, and sub-setting data, as well as data restructuring and new variable construction using arrays and SAS functions will be taught. Descriptive analysis and graphical presentation will be covered. Concepts and programming skills needed for the analysis of case-control studies, cohort studies, surveys, and experimental trials will be stressed. Simple procedures for data verification, data encryption, and quality control of data will be discussed. Accessing data and summary statistics on the web will be explored. Through in-class exercises and homework assignments, students will apply basic informatics techniques to vital statistics and public health databases to describe public health characteristics and to evaluate public health programs or policies. Laboratory exercises, homework assignments, and a final project will be used to reinforce the topics covered in class. The course is intended for graduate students and health professionals interested in learning SAS programming and accessing and analyzing public use datasets from the web.

Prerequisite: BIOS 806/CPH 506 or an equivalent introductory statistics course, EPI 821/CPH 621, and permission of instructor.

Cross List: CPH 651.

Typically Offered: FALL

BIOS 815 BIOSTATISTICAL COMPUTING 3 Credit Hours

This course is designed for graduate students that are interested in statistical computing. The course will introduce graduate students to the R statistical language, PYTHON and their uses in biostatistical computing. Topics include introductory R, data management and manipulation, loops, vectorising code, writing functions, coding shiny apps, pipe operators, coding numerical methods, resampling methods, data simulation and data visualization. In addition, students will be introduced to PYTHON and the R reticulate package for harnessing the power of PYTHON from within R.

Prerequisite: Biostatistics I (CPH506/BIOS806) or equivalent; Introduction to SAS Programming (CPH651/BIOS810) or instructor permission.

Cross List: CPH 656.

Typically Offered: FALL

BIOS 818 BIOSTATISTICAL METHODS II 3 Credit Hours

This course is designed to prepare the graduate student to analyze continuous data and interpret results using methods of linear regression and analysis of variance (ANOVA). The major topics to be covered include simple and multiple linear regression model specification and assumptions, specification of covariates, confounding and interactive factors, model building, transformations, ANOVA model specification and assumptions, analysis of covariance (ANCOVA), multiple comparisons and methods of adjustment, fixed and random effect specification, nested and repeated measures designs and models, and diagnostic methods to assess model assumptions. Interpretation of subsequent analysis results will be stressed. Concepts will be explored through critical review of the biomedical and public health literature, class exercises, an exam, and a data analysis project. Statistical analysis software, SAS (SAS Institute Inc., Cary, NC, USA.), will be used to implement analysis methods. The course is intended for graduate students and health professionals who will be actively involved in the analysis and interpretation of biomedical research or public health studies.

Prerequisite: Permission of instructor, calculus (including differential and integral calculus), BIOS 806/CPH 506 or BIOS 816/CPH 516 or an equivalent statistics course, BIOS 810/CPH 651, or equivalent experience with SAS programming.

Cross List: CPH 652.

Typically Offered: SPRING

BIOS 823 CATEGORICAL DATA ANALYSIS 3 Credit Hours

Survey of the theory and methods for the analysis of categorical response and count data. The major topics to be covered include proportions and odd ratios, multi-way contingency tables, generalized linear models, logistic regression for binary response, models for multiple response categories, and log-linear models. Interpretation of subsequent analysis results will be stressed.

Prerequisite: Permission of instructor; BIOS 816/CPH 516 or equivalent course work (eg, calculus, BIOS 806/CPH 506 and BIOS 810/CPH 651 or equivalent experience with SAS programming).

Cross List: CPH 653.

Typically Offered: FALL

BIOS 824 SURVIVAL DATA ANALYSIS 3 Credit Hours

The course teaches the basic methods of statistical survival analysis used in clinical and public health research. The major topics to be covered include the Kaplan-Meier product-limit estimation, log-rank and related tests, and the Cox proportional hazards regression model. Interpretation of subsequent analysis results will be stressed.

Prerequisite: Permission of instructor, calculus (including differential and integral calculus); BIOS 806/CPH 506 or BIOS 816/CPH 516 or an equivalent statistics course; BIOS 810/CPH 651 or equivalent experience with SAS programming.

Cross List: CPH 654.

Typically Offered: FALL/SPR

BIOS 825 CORRELATED DATA ANALYSIS 3 Credit Hours

A survey of the theory and methods for analysis of correlated continuous, binary, and count data. Major topics to be covered include linear models for longitudinal continuous data, generalized estimating equations, generalized linear mixed models, impact of missing data, and design of longitudinal and clustered studies. Interpretation of subsequent analysis results will be stressed. Concepts will be explored through critical review of the biomedical and public health literature, class exercises, two exams, and a data analysis project. Computations will be illustrated using SAS statistical software (SAS Institute Inc., Cary, NC, USA.). The course is intended for graduate students and health professionals who will be actively involved in the analysis and interpretation of biomedical research or public health studies.

Prerequisite: Permission of instructor and BIOS 823/CPH 653.

Cross List: CPH 655.

Typically Offered: SPRING

BIOS 829 INTRODUCTION TO BIOSTATISTICAL MACHINE LEARNING 3 Credit Hours

This course is designed to prepare graduate students to use modern statistical learning methods for modeling and prediction from data. Major topics to be covered include linear regression, classification (logistic regression, linear and quadratic discriminant analysis, K-Nearest Neighbors), resampling methods (cross-validation, the bootstrap), linear model selection and regularization (subset selection, shrinkage methods, dimension reduction), nonlinear approaches (polynomial regression, splines, Generalized Additive Models), tree-based methods (Classification and Regression Trees, bagging, random forests, boosting), support vector machines, unsupervised learning (principal component analysis, clustering). The mathematical level of this course is modest, with only simple matrix operations. An introduction to the statistical programming language *R* will be provided.

Prerequisites: (i) At least one multivariable statistics course, eg BIOS 818, BIOS 823, BIOS 824, BIOS 825 or equivalent; (ii) BIOS 815 Biostatistical Computing; or (iii) equivalent courses with Instructor permission.

Cross List: CPH 665.

Typically Offered: SPRING

BIOS 835 DESIGN OF MEDICAL HEALTH STUDIES 3 Credit Hours

This course is designed to prepare the graduate student to understand and apply principles and methods in the design of biomedical and public health studies, with a particular emphasis on randomized, controlled clinical trials. The major design topics to be covered include sample selection, selecting a comparison group, eliminating bias, need for and processes of randomization, reducing variability, choosing endpoints, intent-to-treat analyses, sample size justification, adherence issues, longitudinal follow-up, interim monitoring, research ethics, and non-inferiority and equivalence hypotheses. Data collection and measurement issues also will be discussed. Communication of design approaches and interpretation of subsequent analysis results also will be stressed. Concepts will be explored through critical review of the biomedical and public health literature, class exercises, and a research proposal. The course is intended for graduate students and health professionals interested in the design of biomedical or public health studies.

Prerequisite: Permission of Instructor, BIOS 806/CPH506 or an equivalent introductory statistics course.

Cross List: CPH 517.

Typically Offered: SPRING

BIOS 896 RESEARCH OTHER THAN THESIS IN BIOSTATISTICS 1-4 Credit Hours

This course is for more advanced students who wish to pursue their research interests in selected areas of Medical Humanities.

Cross List: CPH 677.

Typically Offered: FALL/SP/SU

BIOS 898 SPECIAL TOPICS IN BIOSTATISTICS 1-4 Credit Hours

A course designed for Masters students that focuses on selected topics or problems in Biostatistics.

Cross List: CPH 679.

Typically Offered: FALL/SP/SU

BIOS 901 ADVANCED BIOSTATISTICS THEORY I 3 Credit Hours

This course is designed to prepare PhD students in Biostatistics to have a solid understanding of statistical theory and **its advanced use** in developing statistical methods for biomedical studies. Major topics to be covered include Theory of probability and distribution, Statistical inference problems, Asymptotic theory, Maximum likelihood theory I, Maximum likelihood theory II, Maximum likelihood theory III, and EM-algorithm.

Cross List: N/A

Typically Offered: FALL

BIOS 902 ADVANCED BIOSTATISTICS THEORY II 3 Credit Hours

This course is designed to give a solid understanding of statistical theory and its advanced use in developing statistical methods for biomedical studies. Major topics to be covered include Extended Likelihood Theory, Quasi-Likelihood and Generalized Estimating Equation (GEE), Missing Data Methodology, Group Sequential Methods for Clinical Trials, Bootstrap Methods, Causal Inference, and Lasso Regularization Methods. It is the second part of the advanced biostatistics theory sequence after BIOS 901.

Cross List: N/A

Typically Offered: SRING

BIOS 918 BIOSTATISTICAL LINEAR MODELS: THEORY AND APPLICATIONS 3 Credit Hours

This course on linear models theory includes topics on linear algebra, distribution theory of quadratic forms, full rank linear models, less than full rank models, ANOVA, balanced random mixed models, unbalanced models and estimation of variance components.

Prerequisite: Linear algebra, BIOS 818, one year of mathematical statistics, and permission of instructor.

Typically Offered: FALL

BIOS 921 ADVANCED PROGRAMMING SAS 3 Credit Hours

The objective of this course is to prepare students in advanced SAS programming. The main topics comprise advanced SAS programming techniques, SAS macro programming, using SQL with SAS, and optimizing SAS programs, which are similar to those covered on the SAS Advanced Programmer Exam offered through the SAS Institute, Inc.

Prerequisite: BIOS 810 or a similar course, and permission of instructor.

Typically Offered: SPRING

BIOS 924 BIOSTATISTICAL THEORY AND MODELS SURVIVAL DATA 3 Credit Hours

The course teaches the statistical theory and models for survival data analysis used in biochemical and public health research. Major topics include parametric, nonparametric, and semiparametric theory and models. The statistical software SAS and R will be used.

Prerequisite: STAT 980 and STAT 982-983 (provided by UNL) or equivalent, BIOS 824 or equivalent, and permission of instructor.

Typically Offered: FALL

BIOS 925 THEORY OF GENERAL LINEAR AND MIXED MODELS IN BIOSTATISTICS 3 Credit Hours

This course focuses on the theory of generalized linear models for both continuous and categorical data. Major topics include generalized linear models, linear mixed models and generalized linear mixed models.

Prerequisite: BIOS 918 or equivalent.

Typically Offered: SPRING

BIOS 935 SEMIPARAMETRIC METHODS FOR BIOSTATISTICS 3 Credit Hours

The fundamental theory and application of semi parametric methods in biomedical and public health studies. The major topics include additive semiparametric models, semiparametric mixed models, generalized semiparametric regression models, bivariate smoothing, variance function estimation, Bayesian semiparametric regression and spatially adaptive smoothing.

Prerequisite: BIOS 925, familiarity with the software R and SAS, and permission of instructor.

Typically Offered: SPRING

BIOS 941 BIOSTATISTICAL CONSULTANT APPLICATION AND PRACTICE 3 Credit Hours

This course is designed to provide the graduate student with a fundamental understanding and insight into the practice of biostatistical consulting and give students practice in the skills required to become an effective consultant. Major topics include an overview of biostatistical consulting, communication skills, methodological aspects including design and analysis considerations, documentation and preparing reports.

Prerequisite: Minimum of 3 graduate-level statistics of biostatistics courses and permission of instructor.

Typically Offered: FALL/SPR

BIOS 970 SEMINAR 1 Credit Hour

Attendance at weekly seminars offered by the department/program, or other activities specific to the degree program (contact the program director for more information).

Typically Offered: FALL/SPR

BIOS 996 DIRECTED READINGS AND RESEARCH 1-9 Credit Hours

This course is specific to doctoral level work in the College of Public Health. Content of this independent study may include research other than thesis, directed readings, and other study of a doctoral level ¿ all under the supervision of a graduate faculty member.

Prerequisite: Doctoral student status and program permission.

Typically Offered: FALL/SP/SU

BIOS 998 DOCTORAL SPECIAL TOPICS 1-4 Credit Hours

This course is for more advanced students who wish to pursue their research interests in selected areas of Medical Humanities.

Prerequisite: Permission of instructor

Crosslist CPH 677

Typically Offered: FALL/SP/SU

BIOS 999 DOCTORAL THESIS 1-15 Credit Hours

The thesis represents original research on a defined problem in biostatistics. The PhD thesis must be a significant, original piece of biostatistical research that makes a contribution to knowledge in the field.

Prerequisite: Permission of instructor.

Typically Offered: FALL/SP/SU

https://www.unmc.edu/gradstudies/current/degree-requirements/_documents-degree-forms/Thesis-Graduation-Instructions-MS-Students.pdf

https://www.unmc.edu/gradstudies/current/degree-requirements/masters-timeline.html

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