



EMORY

ROLLINS
SCHOOL OF
PUBLIC
HEALTH

DEPARTMENT: Biostatistics and Bioinformatics

COURSE NUMBER: 525 **SECTION NUMBER:** 1

CREDIT HOURS: 2 **SEMESTER:** Fall 2020

COURSE TITLE: Longitudinal and Multilevel Data Analysis

CLASS HOURS AND LOCATION: TBD

INSTRUCTOR NAME: Howard Chang

INSTRUCTOR CONTACT INFORMATION

Teaching Assistant(s):

COURSE DESCRIPTION

This course introduces students to regression techniques commonly used in analyzing longitudinal and multilevel data that are frequently encountered in biomedical and public health research. This course draws motivating examples from environmental and social epidemiology, health services research, clinical studies, and behavioral sciences. The course focuses on data analysis and interpretation. Students will gain practical experience using R/SAS/Stata for statistical computing.

Target audience: This is a required course for MPH students in BIOS in the fall of their second year. It is also an elective course for PhD students and other graduate students interested in advanced modeling techniques.

Prerequisites: Prerequisites a previous matrix-based regression course (e.g. BIOS 507).

MPH/MSPH FOUNDATIONAL COMPETENCIES:

- Analyze quantitative and qualitative data using biostatistics, informatics, computer-based programming and software, as appropriate
- Interpret results of data analysis for public health research, policy and practice

CONCENTRATION COMPETENCIES:

B_{MPH}2: Design clinical and observational studies, including sample size estimation, in collaborative research teams.

B_{MPH}3: Use statistical software for data management and exploratory data analysis.

B_{MPH}4: Apply regression modeling techniques for continuous, categorical, time-to-event, longitudinal and multilevel data.

COURSE LEARNING OBJECTIVES

See course description and competencies.

EVALUATION

Homework (25%) Several problem sets will be assigned. The problem sets provide experience managing and analyzing data in their preferred software.

Participation (5%) Students are expected to attend all lectures. Students are encouraged to ask questions and participate in discussions.

Midterm (35%) A take-home independent data analysis project will be assigned. Evaluation is based on a written report which will consist of sections on motivation/goals, data description, analytic approach, analysis results, and discussion. The report will include a lay abstract that communicates your findings to a broad audience without statistical training.

Final Exam (35%) A take-home independent data analysis project will be assigned in which students will analyze the patterns and factors affecting the prevalence of a disease. Evaluation is based on a written report which will consist of sections on motivation/goals, data description, analytic approach, results, and discussion. The report will include a discussion of the public health and policy implications of the findings.

Grading: A (93-100), A- (90-92), B+ (87-89), B (83-86), B- (80-82), C (60-79), F (<59).

COURSE STRUCTURE

MPH/MSPH Foundational Competency assessed	Representative Assignment
Analyze quantitative and qualitative data using biostatistics, informatics, computer-based programming and software, as appropriate	Homework assignments and exams will involve analysis of real data sets

Interpret results of data analysis for public health research, policy or practice	Homework assignments and exams will involve interpretation of results from exploratory analyses and regression modeling.
BIOS Concentration Competencies assessed	Representative Assignment
Design clinical and observational studies, including sample size estimation, in collaborative research teams.	One homework assignment will cover power and sample size calculation.
Use statistical software for data management and exploratory data analysis.	Homework assignments and exams will require programming in R or a similar language.
Apply regression modeling techniques for continuous, categorical, time-to-event, longitudinal and multilevel data.	Data analysis projects will require students to apply regression modeling techniques for longitudinal and multilevel data.

COURSE POLICIES

Students are expected to attend lectures and ask questions during class.

There is no assigned textbook. Lecture notes, and supplementary journal articles and book chapters will be provided on Canvas.

As the instructor of this course I endeavor to provide an inclusive learning environment. However, if you experience barriers to learning in this course, do not hesitate to discuss them with me and the Office for Equity and Inclusion, 404-727-9877.

RSPH POLICIES

Accessibility and Accommodations

Accessibility Services works with students who have disabilities to provide reasonable accommodations. In order to receive consideration for reasonable accommodations, you must contact the Office of Accessibility Services (OAS). It is the responsibility of the student to register with OAS. Please note that accommodations are not retroactive and that disability accommodations are not provided until an accommodation letter has been processed.

Students who registered with OAS and have a letter outlining their academic accommodations are strongly encouraged to coordinate a meeting time with me to discuss a protocol to implement the accommodations as needed throughout the semester. This meeting should occur as early in the semester as possible.

Contact Accessibility Services for more information at (404) 727-9877 or accessibility@emory.edu. Additional information is available at the OAS website at <http://equityandinclusion.emory.edu/access/students/index.html>

Honor Code

You are bound by Emory University's Student Honor and Conduct Code. RSPH requires that all material submitted by a student fulfilling his or her academic course of study must be the original work of the student. Violations of academic honor include any action by a student indicating dishonesty or a lack of integrity in academic ethics. *Academic dishonesty refers to cheating, plagiarizing, assisting other students without authorization, lying, tampering, or stealing in performing any academic work, and will not be tolerated under any circumstances.*

The RSPH Honor Code states: "Plagiarism is the act of presenting as one's own work the expression, words, or ideas of another person whether published or unpublished (including the work of another student). A writer's work should be regarded as his/her own property."

(http://www.sph.emory.edu/cms/current_students/enrollment_services/honor_code.html)

COURSE CALENDAR

The following is a tentative list of topics. The schedule will be periodically updated and available on Canvas.

- Exploratory analysis for longitudinal/multilevel data
- Repeated measures ANOVA
- Linear mixed effect models (random intercept and random slopes)
- Non-linear mixed effect models
- Generalized linear mixed effect models (GLMM) for binary and count data
- Generalized estimating equations
- Higher-level GLMM
- Missing data and drop out
- Sample size and power considerations

Additional advanced topics may include:

- Latent growth curves, growth mixture models
- Temporal and spatial auto-correlation models
- Bayesian hierarchical models
- Mixed effect model for ordinal and nominal data
- Transition models