

Course Title: Longitudinal Data Analysis

Course Number: BIST 0750

Course Pre- and Co-requisite(s): *BIST 0613 (Biostatistics Theory I), BIST 0614 (Biostatistics Theory II), BIST 0610 (Advanced Regression Methods for Public Health Studies), BIST 0615 (categorical data analysis), and a working knowledge of the SAS and R statistical analysis packages.*

Course Location: 3A/3B SPH Piscataway

Course Date & Time: Tuesday, 3-5pm

Course Instructor: Jason Roy, Professor
Department of Biostatistics and Epidemiology
Rutgers School of Public Health
jason.roy@rutgers.edu

Office Hours: TBD and by appointment

Course Assistant: None

Course Website: canvas.rutgers.edu

Recommended Course Text: Diggle, Heagerty, Liang, and Zeger (2012). Analysis of Longitudinal Data, 2nd Edition. Oxford University Press

Course Description: Longitudinal data consists of multiple measures over time on a sample of individuals. The analysis of longitudinal data requires much more sophisticated methodologies due to the correlation introduced by repeated measurements. This course covers modern statistical techniques for longitudinal data from a methodological and theoretical perspective. Topics include mixed effects models, GEE, causal inference and time-dependent confounding (g-methods), and methods for dealing with informative dropouts.

Selected Concentration Competencies Addressed: Each Concentration identifies competencies for each degree offered. The competencies addressed in this course for the PhD include:

- (a) *Apply new and existing probability and statistical models to address public health or medical problems;*
- (b) *Demonstrate understanding of fundamental probability theory and statistical models to solve public health research questions*
- (c) *Design experimental and observational studies in biomedical, clinical and public health research;*
- (d) *Conduct complex statistical analyses for a broad range of applications;*
- (e) *Use statistical computer packages to organize, analyze and report collected data*
- (f) *Communicate the results of statistical studies both in writing and orally to investigators and lay community members.*

Please visit the Concentration webpages on the School of Public Health's website at sph.rutgers.edu for additional competencies addressed by this course for other degrees and concentrations.

Course Objectives: By the completion of this course, students will be able to:

- a) *Identify the special features of longitudinal designs, describe how these features might relate to the analysis. Manipulate the data in a way suitable for longitudinal analysis.*
- b) *Graphically explore and present the longitudinal data.*
- c) *Understand the theoretical background of longitudinal data analysis and modeling.*
- d) *Plan and design a longitudinal study. Use an appropriate method to analyze a particular study and interpret the result.*
- e) *Predict the impact of missing data on standard statistical inference and for a particular situation, be able to choose between the common approaches for handling missing values.*
- f) *Use statistical packages to analyze the longitudinal data.*

Course Requirements and Grading: *In this section, Instructor should include*

The course grade will be based on homework assignments, the midterm exam, the final exam, a project, and class participation. The relative weight given to each of these components is

• <i>Homework</i>	<i>20%</i>
• <i>Participation in weekly discussions</i>	<i>20%</i>
• <i>Final Project</i>	<i>60%</i>
<i>Total:</i>	<i>100%</i>

a.

Homework: Homework will be assigned throughout the semester, as either readings for discussion or problems to work out.

Project & Presentation: Critically review methodological papers on longitudinal analysis. The papers must be approved by the instructor by Thanksgiving break. Students are required to present their work in video recording (max 10 minutes) and provide a summary report. All video recordings should be posted in course website and a written report submitted to Canvas (due 3pm, Dec 14). Students will watch the videos from the other BIST 0750 students and provide 'critical' reviews. Details will be provided in early November.

- *Please add the school-wide uniform grading scale:*

<i>Grading Policy: 94 – 100</i>	<i>A</i>
<i>90 – <94</i>	<i>A-</i>
<i>87 – <90</i>	<i>B+</i>
<i>84 – <87</i>	<i>B</i>
<i>80 – <84</i>	<i>B-</i>
<i>77 – <80</i>	<i>C+</i>

70 – <77 C
 <70 F

Course Schedule: This table provides a general plan for the course; some deviations may be necessary. Please visit the course web in the Canvas on a regular basis to check any update. 'Online 30' will be synchronous (discussion with me on the advanced readings). The assigned papers will be updated weekly via Canvas.

Week	Date	Course Topic	0750 addition topics	Assignments/ Assessments
1	Sep 7	Review of generalized linear models; causation vs prediction. Introduction of longitudinal studies; definition, features and objectives of longitudinal data	Discussion of this week's lecture topic assigned reading for next week: A Note on Bootstraps and Robustness	
2	Sep 14	Exploratory data analysis; data structure	Review of linear mixed models	
3	Sep 21	Linear models (I) – Introduction of mean model; inference procedure	Review of linear mixed models	
4	Sep 28	Linear models (II) : introduction of covariance model and its Inference procedure	Review of linear mixed models	
5	Oct 5	Linear mixed model (I)	Review of GEE	
6	Oct 12	Linear mixed model (II): prediction of the response	Review of GEE	
7	Oct 19	Review		
8	Oct 26	Midterm		
9	Nov 2	Generalized linear model (I): general introduction, marginal model and generalized estimation equation	Weighted GEE for missing data	
10	Nov 9	Generalized linear model (II): logistic for binary data and	Nonignorable dropout / sensitivity analysis	

		log-linear for count data		
11	Nov 16	Generalized linear mixed effects models (GLMM)	Nonignorable dropout / sensitivity analysis	
12	Nov 23	Generalized Linear model (III): Modeling for binary and ordinal data	Causal inference with time-dependent confounding	
13	Nov 30	Causal inference with time-dependent confounding: g-methods	Causal inference with time-dependent confounding	
14	Dec 7	Missing data analysis in longitudinal data analysis:	Causal inference with time-dependent confounding	
15	Dec 14	No in person class Watch presentations from other students	Provide critical feedback for other 0750 students	Final reports due

Learning Management System: Canvas will be used extensively throughout the semester for course syllabus, assignments, announcements, communication and/or other course-related activities. It is the student's responsibility to familiarize themselves with Canvas and check it regularly. If you have difficulties accessing Canvas, please inform the instructor and Canvas Support (help@canvas.rutgers.edu). Canvas is accessible at canvas.rutgers.edu.

School of Public Health Honor Code: The School of Public Health Honor Code is found in the School Catalog (sph.rutgers.edu/academics/catalog.html). Each student bears a fundamental responsibility for maintaining academic integrity and intellectual honesty in his or her graduate work. For example, all students are expected to observe the generally accepted principles of scholarly work, to submit their own rather than another's work, to refrain from falsifying data, and to refrain from receiving and/or giving aid on examinations or other assigned work requiring independent effort. In submitting written material, the writer takes full responsibility for the work as a whole and implies that, except as properly noted by use of quotation marks, footnotes, etc., both the ideas and the works used are his or her own. In addition to maintaining personal academic integrity, each student is expected to contribute to the academic integrity of the School community by not facilitating inappropriate use of her/his own work by others and by reporting acts of academic dishonesty by others to an appropriate school authority. It should be clearly understood that plagiarism, cheating, or other forms of academic dishonesty will not be tolerated and can lead to sanctions up to and including separation from the Rutgers School of Public Health.

Students with Disabilities: Rutgers University welcomes students with disabilities into all of the University's educational programs. In order to receive consideration for reasonable accommodations, a student must apply for Services by first completing a Registration Form with the Rutgers Office of Disability Services (ODS) at ods.rutgers.edu. The student will also be required to participate in an ODS intake interview and provide documentation. If reasonable accommodations are granted, ODS will provide you with a Letter of Accommodations which should be shared with your instructors as early in your courses as possible.

Commitment to Safe Learning Environment: The Rutgers School of Public Health is committed to helping create a safe learning environment for all students and for the School as a whole. Free expression in an academic community is essential to the mission of providing the highest caliber of

education possible. The School encourages civil discourse, reasoned thought, sustained discussion, and constructive engagement. Provocative ideas respectfully presented are an expected result. An enlightened academic community, however, connects freedom with responsibility. The School encourages all students to disclose any situations where you may feel unsafe, discriminated against, or harassed. Harassment or discrimination of any kind will be not tolerated and violations may lead to disciplinary actions.

Reporting Discrimination or Harassment: If you experience any form of gender or sex-based discrimination or harassment, including sexual assault, sexual harassment, relationship violence, or stalking, know that help and support are available. You may report such incidents to the [RBHS Title IX Office](#) or to the School of Public Health's [Office of Student Affairs](#). Rutgers University has staff members trained to support survivors in navigating campus life, accessing health and counseling services, providing academic and housing accommodations, and more. If you experience any other form of discrimination or harassment, including racial, ethnic, religious, political, or academic, please report any such incidents to the School's [Office of Student Affairs](#). The School strongly encourages all students to report any incidents of discrimination or harassment to the School. Please be aware that all Rutgers employees (other than those designated as confidential resources such as advocates, counselors, clergy and healthcare providers as listed in Appendix A to [Policy 10.3.12](#)) are required to report information about such discrimination and harassment to the School and potentially the University. For example, if you tell a faculty or staff member about a situation of sexual harassment or sexual violence, or other related misconduct, the faculty or staff member must share that information with the [RBHS Title IX Coordinator](#). If you wish to speak to a confidential employee who does not have this reporting responsibility, you can find a list of resources in Appendix A to University [Policy 10.3.12](#). For more information about your options at Rutgers, please visit [Rutgers Violence Prevention and Victim Assistance](#).

Graduate Student Computer Policy: Students are required to possess a personal laptop, no older than approximately two years, that must meet minimum requirements which may be found online at: sph.rutgers.edu/student-life/computer-support.html

Policy Concerning Use of Recording Devices and Other Electronic Communications Systems: When personally owned communication/recording devices are used by students to record lectures and/or classroom lessons, such use must be authorized by the faculty member or instructor who must give either oral or written permission prior to the start of the semester and identify restrictions, if any, on the use of mobile communications or recording devices.

Policy Concerning Use of Turnitin: Students agree that by taking this course all required papers may be subject to submission for textual similarity review to Turnitin.com (directly or via learning management system, i.e. Canvas) for the detection of plagiarism. All submitted papers will be included as source documents in the Turnitin.com reference database solely for the purpose of detecting plagiarism of such papers. Use of the Turnitin.com service is subject to the Usage Policy posted on the Turnitin.com site. Students who do not agree should contact the course instructor immediately.

Withdrawal/Refund Schedule: Students who stop attending their course(s) without submitting a completed [Add/Drop Course](#) form will receive a failing grade. Furthermore, students dropping to zero credits for the semester are considered withdrawn and must submit a completed [Leave of Absence](#) form from the School of Public Health's Office of Student Affairs. The School of Public Health refunds tuition only. Administrative and technology fees are non-refundable. You may find the Withdrawal/Refund Schedule on the School of Public Health website at: sph.rutgers.edu/academics/academic-calendar.html