RUTGERS
School of Public Health

Course Title: Generalized Linear Models

Course Number: BIST 0725

Course Pre- and Co-requisite(s): BIST 0601 (Advanced Regression)
            BIST 0613 (Biostatistics Theory I)
            BIST 0614 (Biostatistics Theory II)

Course Location: Public Health - Piscataway 234

Course Date & Time: Mondays 12:30–2:30 PM

Course Instructor: Wei Vivian Li, PhD, Assistant Professor, vivian.li@rutgers.edu

Office Hours: Mondays 2:30-3:30 PM

Course Assistant: None

Course Website: https://rutgers.instructure.com/courses/177254

Course Text:

Dobson, A.J. and Barnett, A.G., 2008. An introduction to generalized linear models. Chapman and Hall/CRC.

Gelman, A. and Hill, J., 2006. Data analysis using regression and multilevel/hierarchical models. Cambridge university press.

Course Description: This course covers the theory and inferential methods for generalized linear models. Specific topics include linear, logistic, and Poisson regression; overdispersion; likelihood-based inference and estimating equations; algorithms; and applications.

Selected Concentration Competencies Addressed: The competencies addressed in this course for the PhD in *Biostatistics* include*:*

- Apply new and existing probability and statistical models to address public health or medical problems
- Review and critique statistical methods and interpretations presented in published research studies, presentations or reports
- Conduct complex statistical analyses for a broad range of applications
- Use statistical computer packages to organize, analyze and report collected data
- Communicate the results of statistical studies both orally and in writing to senior statisticians and other investigators

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:

- Recognize and understand the properties of exponential families
- Identify natural parameters and link functions from exponential families
- Understand the connection between linear and generalized linear models (GLMs)
- Estimate parameters from GLMs
- Understand overdispersion and recognize possible remedies
- Recognize which GLMs are appropriate for which statistical questions
- Implement GLMs in practice
- Interpret output from GLMs

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

1.	Homework	30%
2.	Participation	10%
3.	Midterm project	25%
4.	Final exam	35%

Grading Policy:
$$94 - 100 \quad A$$
$$90 - <94 \quad A-$$
$$87 - <90 \quad B+$$
$$84 - <87 \quad B$$
$$80 - <84 \quad B-$$
$$77 - <80 \quad C+$$
$$70 - <77 \quad C$$
$$<70 \quad F$$

1. On all homework assignments/problem sets, students are encouraged to discuss with one another, but work should be carried out and written up independently
2. It's the students' responsibility to make their papers legible. Unreadable work will NOT be graded.
3. The students are asked to answer each question as accurately and concisely as possible. If it is necessary to attach the computer output with the homework assignment, ONLY the "essential" segments are required. Do NOT submit the complete output section or the log file.
4. Unless you notify the instructor beforehand, late homework will NOT be graded. Late homework will be graded with a 10% per day penalty.

Course Schedule:

Week	Date	Course Topic	Online30
1	Jan 24	Review of model fitting	TBA
2	Jan 31	Introduction to generalized linear models • Exponential family • GLM theory • Examples	TBA
3	Feb 7	Estimation of GLMs • Newton-Raphson method • Fisher's method of scoring	TBA

		• IRLS	
4	Feb 14	Inference for GLMs • Goodness of fit statistics • Wald test • Likelihood ratio test • Score test	TBA
5	Feb 21	Logistic regression • Logistic regression model • Regression diagnostics • Example	TBA
6	Feb 28	Multinomial response models • The multinomial logit model • Models for ordinal response data	TBA
7	Mar 7	Poisson models for count data • The Poisson model • Overdispsersion	TBA
8	Mar 14	Spring break	
9	Mar 21	Models for Count Data With Overdispersion • Negative Binomial regression • Zero-inflated models	TBA
10	Mar 28	Generalized linear models • Coefficient of determination • ANOVA • Analysis of covariance models	TBA
11	Apr 4	**Midterm Presentation**	TBA
12	Apr 11	Survival models	
13	Apr 18	Simulation methods • Simulation for statistical inferences • Simulation for checking statistical procedures and model fitting	TBA
14	Apr 25	The Bootstrap method • Nonparametric and parametric bootstrap • Bootstrap in regression models • Confidence intervals and testing	TBA
15	May 2	Review	
16	May 9	**Final Exam**	

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