RUTGERS
School of Public Health

Course Title: Advanced Regression Methods for Public Health Studies

Course Number: **BIST 0610J**

Course Location: Room 2A, School of Public Health, Piscataway, NJ

Course Date & Time: Tuesday, 3:00 – 5:00 PM

Course Instructor: Liangyuan Hu, PhD., Associate Professor,
Biostatistics, Rutgers School of Public Health,
liangyuan.hu@rutgers.edu & 732-235-4664

Office Hours: Tuesday, 2:00 - 2:50PM, Room 209

Required Course Text: Kleinbaum, D., Kupper, L., Muller, K., and Rosenberg, E. (2013). Applied Regression Analysis and Other Multivariable Methods, 5th Ed. Nelson Education.

Draper, N.R., and Smith, H. (1998). Applied Regression Analysis, 3rd Ed. Wiley [Note: statistical regression theory based book]

Additional/Supplemental Readings/Resources:

(1) Smith, J. and Cody, R. (2006). Applied Statistics and the *SAS*® Programming Language, 5th Ed. Prentice Hall, NJ
(2) Hosmer, D. and Lemeshow, S. (2000). Applied Logistic Regression, 2nd Ed., John Wiley and Sons.

Course Description: This is an **intermediate to advanced level** course of regression methods that emphasizes the theoretical concepts and applications of regression models for public health studies. It is taught at BIST MPH/MS level. It covers simple and multiple linear regression models, including analysis of variance (ANOVA) and co-variance (ANCOVA) and binary regression logistic regression. Model building, model diagnostics, building hypothesis testing, and interpretation as well as theoretical properties of parameter estimation and inference will be taught. **The theory part will use matrix and linear algebra.**

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

1. Integrate relevant scientific background to design experimental and observational studies in biomedical, clinical and public health research.
2. Use statistical computer packages to organize, analyze and report collected data;
3. Apply statistical methods to biomedical, clinical and public health research;

4. Review and critique statistical methods and interpretations presented in published research studies, presentations or reports; and
5. 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 http://sph.rutgers.edu/ for additional competencies addressed by this course for other degrees and concentrations.

Special Circumstances During COVID-19 (For Spring 2023):

To keep our on-campus communities safe, compliance with all current guidance and policies as set forth in the Guide to Returning to Rutgers is required at all times and without exception. Students, faculty, staff, or visitors who do not comply with these policies will not be permitted to remain on-site. The use of face-coverings indoors *IS* required in classrooms and offices as well as shared spaces (such as hallways and bathrooms). Rutgers employees and students must use the My Campus Pass symptom checker, a self-screening application, each day when traveling to campus or entering a Rutgers building. Please remember to wash your hands, wear a mask while indoors, particularly in crowded spaces and groups, and stay up-to-date on university guidance by consulting the Guide to Returning to Rutgers and the university's COVID-19 website.

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

a. Understand the concepts and assumptions of regression;
b. Use mathematical expressions to generalize the concepts and methods.
c. Develop the ability to apply these concepts correctly using statistical software;
d. Develop the ability to interpret the results of an analysis properly; and
e. Become well-versed in the application of core statistical techniques (Biostatistical inference, linear regression, generalized linear model among many others)

Competency	Course Objectives(s)	Lessons	Assessment(s)
1	a, b, d	1, 4, 12	Assignment 1, Exams,

			Data analysis Project
2	c	1-14	Assignments 1 – 6, Data analysis Project
3	c, d, e	1-14	Assignments 1 – 6, Exams, Data analysis Project
4	a, d, e	1-14	Data analysis Project
5	d, e	1-14	Assignments 1 – 6, Data analysis Project

Course Requirements and Grading:

- Course evaluation

1.	Midterm Examination (in class)	30 %
2.	Homework (6 assignments)	25 %
3.	Data analysis project presentation	20 %
4.	Data analysis project report	25 %
	Total:	100 %

- Data analysis project: A group of students (3 per group) will complete a full analysis (linear regression) of **a set of data that contains a continuous measured response and multiple covariates (at least 7 covariates)**. Each group provides a set of data, which should NOT be for any group member's fieldwork. The emphasis should be on the statistical methodology and how it is applied. A plan for the analysis project will be due on March 7th. The plan should include a full description of the background, the data set and variables to be used, a set of clearly defined hypotheses and, when possible, an initial outline of what statistical methods might be used. The final report is due on April 25th. The final project presentation will take place on May 2nd.

- Grading policy
  1. Homework will be collected at the beginning of lecture on due date. Unless notifying the instructor beforehand, later submission of homework will NOT be graded.
  2. On all homework assignments/problem sets, students are encouraged to discuss with one another, but **work should be carried out and written up independently**. If any two identical write-ups are found, both homework assignments are considered failed.
  3. It is the students' responsibility to make their papers legible. Unreadable work will NOT be graded.
  4. 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. Otherwise, 50% of the points will be taken away.
  5. Grading Scale: 94 – 100   A

90 – <94	A-
87 – <90	B+
84 – <87	B
80 – <84	B-
77 – <80	C+
70 – <77	C
<70	F

Course Schedule: This table provides a general plan for the course; some deviations may be necessary

Session	Date	Week	Topic	Online 30
Session 1: Simple Linear Regression (one covariate)	01/17	1	Measuring association; Correlation coefficient; Introduction on simple linear regression model assumptions and interpretation (chap 4,6)	Instruction
	01/24	2	Inference on correlation coefficient; derivation of regression parameter estimation and inference procedure; examples; (chap 5,7)	Instruction
	01/31	3	Model checking: residual analysis; Strength of association. (chap 14.1-14.4); HW1 DUE	Instruction
Session 2: Multiple Linear Regression (multiple covariates)	02/07	4	Different types of residuals; Introduction of matrix algebra Understanding concept of projection;	Instruction
	02/14	5	Model and assumptions, derivation of parameter estimation and inference procedure using matrix; applications (chap 8, 11) HW2 DUE	Instruction
	02/21	6	Development of F-tests and their application; Formulation of hypotheses and interpretation.	Instruction
	02/28	7	Introduction to ANCOVA and confounding; general hypothesis testing (chap 9, 10); Interaction effects in MLR; examples (chap 12, 13); HW3 DUE	Instruction

	03/07	8	No class; HW4 DUE; Data analysis plan DUE.	
	03/14		Spring break (No class)	
	03/21	9	Midterm exam	
Session 3: Logistic Regression Model	03/28	10	Model building and checking. (chap14,16);	Instruction
	04/04	11	diagnostic procedures for MLR; multicollinearity	Instruction
	04/11	12	Logistic regression models I: grouped data inference; Introduction of generalized linear model regarding logistic regression and maximum likelihood estimation (MLE) procedure; HW5 DUE	Instruction
	04/18	13	Parameter estimation and inference; goodness-of-fit test; model checking; examples;	Instruction
	04/25	14	Logistic regression models II: ungrouped data; Inference procedure for the model in ungrouped data format. HW6 DUE; Data analysis report DUE	Instruction
	05/02	15	Final project presentation	

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 https://tlt.rutgers.edu/canvas.

School of Public Health Honor Code: The School of Public Health Honor Code is found in the student bulletin (sph.rutgers.edu/academics/catalog/index.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_requirements.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.

Withdrawal/Refund Schedule: Students who stop attending their course(s) without processing an 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/registration/school_calendars.html