Course Title: Advanced Regression Methods for Public Health Studies

Course Number: BIST 0610J

Course Location: RM 1A, School of Public Health, Piscataway, NJ

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

Course Instructor: Yaqun Wang, PhD., Assistant Professor, Biostatistics, Rutgers School of Public Health, yaqun.wang@rutgers.edu & (732) 235-4056

Office Hours: Tuesday, 1:40 - 2:40PM, Swing office B


Additional/Supplemental Readings/Resources:


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:

- Integrate relevant scientific background to design experimental and observational studies in biomedical, clinical and public health research;
- Use statistical computer packages to organize, analyze and report collected data;
- Apply statistical methods to biomedical, clinical and public health research;
- Review and critique statistical methods and interpretations presented in published research studies, presentations or reports; and
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/](http://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:

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

**Course Requirements and Grading:**

- **Course evaluation**
  1. Midterm Examination (in class) \(30\%\)
  2. Final Examination (in class) \(30\%\)
  3. Homework (6 assignments) \(25\%\)
  4. Data analysis report \(15\%\)
  Total: \(100\%\)

- Data analysis report: A group of students (2 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 will be due on March 20th. The plan should include a full description of 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 24th.

- **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.

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

<table>
<thead>
<tr>
<th>Date</th>
<th>Week</th>
<th>Session 1: Simple Linear Regression (one covariate)</th>
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</thead>
<tbody>
<tr>
<td>01/16</td>
<td>1</td>
<td>Measuring association; Correlation coefficient; Introduction on simple linear regression model assumptions and interpretation (chap 4,6)</td>
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<tr>
<td>01/23</td>
<td>2</td>
<td>Inference on correlation coefficient; derivation of regression parameter estimation and inference procedure; examples; (chap 5,7)</td>
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<tr>
<td>01/30-02/06</td>
<td>3</td>
<td>Model checking: residual analysis; Strength of association. (chap 14.1-14.4); HW1 DUE</td>
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<tr>
<th>Date</th>
<th>Week</th>
<th>Session 2: Multiple Linear Regression (multiple covariates)</th>
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<tbody>
<tr>
<td>02/06</td>
<td>4</td>
<td>Different types of residuals; Introduction of matrix algebra; Understanding concept of projection;</td>
</tr>
<tr>
<td>02/13</td>
<td>5</td>
<td>Model and assumptions, derivation of parameter estimation and inference procedure using matrix; applications (chap 8, 11) HW2 DUE</td>
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<tr>
<td>02/20</td>
<td>6</td>
<td>Development of F-tests and their application: Formulation of hypotheses and interpretation. (chap 9, 10)</td>
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<tr>
<td>02/27</td>
<td>7</td>
<td>Introduction to ANCOVA and confounding; general hypothesis testing; (chap 9, 10); HW3 DUE</td>
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<tr>
<td>03/06</td>
<td>8</td>
<td>Interaction effects in MLR; examples (chap 12, 13); HW4 DUE</td>
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<tr>
<td>03/13</td>
<td></td>
<td>Spring break (No class)</td>
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<tr>
<td>03/20</td>
<td>9</td>
<td>Model building and checking. (chap14,16); Data analysis plan DUE</td>
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<tr>
<th>Date</th>
<th>Week</th>
<th>Session 3: Logistic Regression</th>
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<tbody>
<tr>
<td>03/27</td>
<td>10</td>
<td>Midterm exam based on lecture notes 1-7</td>
</tr>
<tr>
<td>04/03</td>
<td>11</td>
<td>diagnostic procedures for MLR; multicollinearity</td>
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</tbody>
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Model | Date | Week | Topic
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| | 04/10 | 12 | Logistic regression models I: grouped data inference; Introduction of generalized linear model regarding logistic regression and maximum likelihood estimation (MLE) procedure; HW5 DUE
| 04/17 | 13 | Parameter estimation and inference; goodness-of-fit test; model checking; examples;
| 04/24 | 14 | Logistic regression models II: ungrouped data; Inference procedure for the model in ungrouped data format. HW6 DUE; Data analysis report DUE
| 05/08 | 15 | Final Exam

**Learning Management System:** Moodle 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 Moodle and check it regularly. If you have difficulties accessing Moodle, please inform the instructor and Moodle Support (moodlehelp@ca.rutgers.edu). Moodle is accessible at moodle.rutgers.edu.

**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.

**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