DEPARTMENT: Biostatistics and Bioinformatics

COURSE NUMBER: 502   **SECTION NUMBER:** 1

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

COURSE TITLE: Statistical Methods III

INSTRUCTOR NAME: *José Binongo*, Ph.D.

INSTRUCTOR CONTACT INFORMATION

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PHONE: (404) 727 9575

SCHOOL ADDRESS OR MAILBOX LOCATION: Rollins School of Public Health
Emory University
1518 Clifton Road
Atlanta, Georgia 30322

OFFICE HOURS: Thursday 12:30 pm – 1:30 pm

Teaching Assistant: To be announced

COURSE DESCRIPTION

We start with data analytic methods not covered in BIOS 500 & BIOS 501 (Statistical Methods I & II): two-way ANOVA, polynomial regression, count regression, Kaplan-Meier analysis, multiple imputation, propensity scores. After the first exam, we focus on multilevel modeling of intra- and inter-individual change. Other hierarchical models will also be examined to analyze other types of clustered data. As in the prerequisite courses, we will learn how to specify an appropriate model so that specific research questions of interest can be addressed in a methodologically sound way. Students will use SAS to perform the statistical analyses.

MPH /MSPH/PHD FOUNDATIONAL PUBLIC HEALTH KNOWLEDGE LEARNING OBJECTIVES:

- Explain the role of quantitative methods and sciences in describing and assessing a population's health

MPH/MSPH FOUNDATIONAL COMPETENCIES:

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

COURSE LEARNING OBJECTIVES:

Upon completing this course, students will be able to:
- for cross-sectional data: perform two-way ANOVA and multiple comparison procedures, polynomial regression, count regression
- for time-to-event data: perform Kaplan-Meier analysis and construct Cox proportional hazard regression models
- for longitudinal data: build multilevel models to track intra- and inter-individual change over time of a continuous or binary outcome
- examine the assumptions and limitations of the statistical procedures
- use SAS judiciously to perform appropriate data analyses
- have hands-on experience analyzing a longitudinal data set from start to finish
- communicate in writing the statistical methods used and the results of the analysis

EVALUATION:

Assignment	Percentage	Due Dates
Weekly Homework Assignments	50	Every Tuesday at 10:00 am
Exam 1	20	Friday Oct 5 at 11:59 p.m.
Exam 2	20	Thursday Nov 16 at 11:59 p.m.
Project	10	Tuesday Dec 4 at 10 a.m.

Grading Scale

Students will be assigned a grade based on a 100-point scale. Grades are calculated using the following points for each letter grade:

Grade	Percentage Range
A	95 – 100
A-	90 – 94
B+	85 – 89
B	80 – 84
B-	76 – 79
C	66 – 75
F	(Below 66)

ASSIGNMENTS & ASSESSMENTS:

I. Weekly Homework

The only way to master the concepts taught in this course is by applying them in various situations. The homework problems are chosen to help reinforce the concepts and to prepare you for applying them to real-life data.

II. Exams I and II

Exam 1 is on cross-sectional data analysis, and Exam II is on longitudinal data analysis. You will also be asked to analyze a data set using the tools you have learned.

III. Project

One of the objectives of this course is to give you the opportunity to acquire the skills necessary for the appropriate statistical analysis of real data -- the kind you may use later in the workplace. The skills learned in this course are best synthesized when you get your hands on a real dataset. You will thus be asked to do a project. The details will be provided after the fall break.

Briefly, you will work with a group to analyze a data set from beginning to end: from deciding on questions and hypotheses, to deciding on the data manipulation techniques and statistical procedures needed to do the analyses, to running the procedures, to interpreting the results, to writing the 3-page research report.

ALIGNMENT OF COMPETENCIES, LEARNING OBJECTIVES & ASSESSMENTS:

MPH/MSPH Foundational Competencies assessed	Representative Assignment
1. Analyze quantitative and qualitative data using biostatistics, informatics, computer-based programming & software, as appropriate	weekly homework
2. Interpret results of data analysis for public health research, policy or practice.	exams I and II, and project

Course Learning Objectives assessed	Representative Assignment
1. perform two-way ANOVA and multiple comparison procedures, polynomial regression, count regression	weekly homework
2. perform Kaplan-Meier analysis and construct Cox proportional hazard regression models	weekly homework
3. build multilevel models to track intra- and inter-individual change over time of a continuous or binary outcome	weekly homework
4. examine the assumptions and limitations of the statistical procedures	exams I and II
5. use SAS judiciously to perform data analyses	exams I and II, and project
6. have hands-on experience analyzing a longitudinal data set from start to finish	project

7. communicate in writing the statistical methods used and the results of the analysis	project

For course information and updates, regularly check course website on <u>Canvas</u>.

COURSE POLICIES:

<u>**Textbook:**</u> Judith D. Singer & John B. Willett (2003), *Applied Longitudinal Analysis*, Oxford University Press. The first half of the book is on longitudinal data analysis; the second half is on survival analysis.

<u>**Computer Requirements**</u>: Computer hardware, software, and peripherals compatible with Canvas usage are required. Please note that an iPad or similar mobile device does not provide the needed functionality for all of the Canvas tools. Please consult the Canvas Help site for general information about operating systems, browsers, communication software, and printers. Finally, this course requires the use of SAS on Citrix.

<u>**Weekly Homework**</u>: A new homework set will be posted every Wednesday evening. It is due every Tuesday before class at 2:30 pm. Students must turn in a hardcopy of their homework. Email attachments are not accepted.

You may work together to do the homework problems. However, what you turn in must represent your own understanding of the material. *Students who have an identical response to a homework question will **not** receive credit*.

Some of the assigned problems may not be graded. However, students will be penalized for turning in assignments that are substantially incomplete, even if they completed the graded problems.

Late submissions will not be accepted and will receive a grade of zero.

If you cannot make it to class on the due date, you may put your homework in my mailbox on the 2nd floor GCR before the due date, and let me know that you have done so. Homework may not be submitted as an email attachment.

<u>**Exams I and II**</u>: Exams may be downloaded on Tuesday. You have until Friday 11:59 p.m. to upload an electronic copy of your response. A link on Canvas to download the exam and upload your response will be provided. You may use your notes, book and even the Internet. However, *you may not discuss the content of the course with anybody from the day you receive the exam to the day you turn in your response. Any violations will be reported to the Honor Committee.*

Attendance: Attendance is not mandatory. Get the name and phone number of several students in this class to call if you miss class, to ask questions when you need help, or, better yet, to form study groups.

Discussion Board: Please be sure to read other students' posts before posting your question. This will help prevent duplicate posts and duplicate responses. Moreover, please refrain from adding emotional language to your question. When you stay focused on the content of the question, clearly specifying the source of your confusion, I am able to assist you. Emotionally charged statements do not help me in clarifying the confusion. The discussion board is designed to encourage learning and help you synthesize the materials being taught.

Presentation: Communicating effectively in writing and verbally is critical to public health research and practice. MPH graduates are expected to demonstrate these skills in written assignments. Clarity and accuracy are expected in submission of assignments. Keep in mind that spell check and grammar check features of software programs such as Microsoft Word are not sufficient. Please read over all submissions carefully for content, spelling, punctuation, and grammar before turning them in.

BIOS 502 is a course that focuses on interpretation, and it is important that students in their homework or exam learn to provide only relevant information. SAS provides lots of irrelevant output. Points will be taken off when students paste SAS output directly onto their Word document without filtering the output. Students need to demonstrate the ability to process and transform the output into a form that is understood by people who do not take this course.

Re-grading: Although every effort will be made to mark your work accurately, sometimes mistakes happen. If you suspect that your work has been graded incorrectly, return the paper to the TA within a week, stating your claim in writing.

The following claims will be considered for re-grading homework assignments and exams: (1) points are not totaled correctly, (2) your answer to a question is essentially correct but stated slightly differently than the grader's expectation.

Considering re-grades takes up valuable time and resources that TAs and the instructor would rather spend helping you understand material. The following claims will not be considered for re-grading: (1) arguments about the number of points lost, (2) arguments about question wording.

Communicating with the Instructor: There are two primary modes of communication for this class: the discussion board as well as electronic mail. *Email should be used only for messages that are private in nature*. The instructor will answer questions within 24-48 hours.

Extra Help: Before deciding to see the TA or me, get your questions answered by

posting them on the discussion board on Canvas in the appropriate week folder. Many students will benefit from your question. Please be reminded that the discussion board is designed to encourage learning. In this light, students are expected to be respectful of their peers.

If you need in-office help with class material: (1) Attend the next available TA office hours. Alternatively, (2) email the person you want to see requesting an appointment. Please e-mail at least 24 hours in advance.

Ongoing Course Feedback: Although I've taught this course several times before, I regard teaching this course as a pilot and I invite you to participate in it, with me, on that basis. I value your feedback because it tells me how we can improve on what we've been doing and what we need to continue doing. Please feel free to email me constructive feedback. I define constructive feedback as that which I can do something about. Finally, I reserve the right to alter the course content and the pedagogic approach as the course unfolds.

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

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.

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:

1	4-Sep	Review: logarithmic transformation, multiple linear regression one-way & two-way ANOVA, polynomial regression
2	11-Sep	Review: logistic regression, dummy & effect coding, ROC curves
3	18-Sep	Missing data & multiple imputation
4	25-Sep	Count regression
5	2-Oct	Kaplan-Meier analysis (Chapter 13)
		Take-home Exam 1 (due on Oct 5th, 11:59 p.m.)
6	9-Oct	Fall break
7	16-Oct	Propensity scores
8	23-Oct	Introduction to longitudinal data analysis (Chapters 1 & 2)
9	30-Oct	Statistical modeling of longitudinal data (Chapters 3 & 4)
10	6-Nov	Error covariance structure (Chapter 7)
11	13-Nov	Time-unstructured data, time-varying covariates, categorical time (Chapter 5)
		Take-home Exam 2 (due on Nov 16th, 11:59 p.m.)
12	20-Nov	Hierarchical linear models (recorded lecture)
13	27-Nov	Generalized linear mixed effects models
14	4-Dec	Cox proportional hazards regression (Chapters 14 & 15); **Project** to be turned in (due at 10:00 a.m.)
15	11-Dec	Project presentations