

Spring 2015

# BIOS 9333 – Applied Longitudinal Data Analysis

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**Georgia Southern University**  
**Jiann-Ping Hsu College of Public Health**  
**BIOS 9333 – Applied Longitudinal Data Analysis**  
**Spring 2015**

**Instructor:** Dr. Haresh Rochani  
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**Phone:** 912.478.1011  
**Email:** [hrochani@georgiasouthern.edu](mailto:hrochani@georgiasouthern.edu)  
**Website:** Folio  
**Time:** Monday & Wednesday, 2:30 – 3:45 PM  
**Location:** Education Bldg 3149  
**Office Hours:** Monday 9 AM to 11 AM  
Tuesday 10 AM to 1 PM

**Prerequisites:** None

**Catalog Description:** This course provides an introduction to longitudinal and clustered data. Topics include the basic concepts of longitudinal data, linear models for longitudinal data, generalized linear models and salient features, generalized estimating equations, generalized linear mixed effects models, missing data and dropouts, sample size and power, repeated measures, and multilevel linear models. 3 hours.

**Required Textbook:** Fitzmaurice, G. M., Laird, N. M., Ware, J. H., Laird, N. M., & Ware, J. H. (2011). Applied longitudinal analysis. Second edition, Hoboken: Wiley. ISBN: 9780470380277

**Reference Texts:** Hedeker, D. R., & Gibbons, R. D. (2006). Longitudinal data analysis. Hoboken, N.J: Wiley-Interscience.

***Biostatistics Concentration Competencies***

**Dr.P.H Biostatistics Concentration Competencies:**

Upon graduation a Biostatistics student with a Dr.P.H should be able to...

1. Demonstrate skills for translating objectives of a public health and biomedical research question into the appropriate biostatistical questions.
2. Design a public health and biomedical investigation in terms of the experimental design, data to be collected to reflect research objectives, number of subjects needed to address the objectives, and specification of appropriate methods for analysis.
3. Develop a theoretical foundation for commonly used topics in inferential statistics such as probability, sampling, discrete and continuous distributions and their moment generating functions, point and interval estimation, likelihood ratio tests, hypothesis testing, and nonparametrics found in advanced analyses of public health and biomedical studies.
4. Compare Bayesian methods to frequentist methods for analyzing data.
5. Evaluate a public health and biomedical research proposal to determine the more appropriate biostatistical analysis methodology, including Bayesian and frequentist approaches.
6. Analyze public health and biomedical data via classical and Bayesian approaches using statistical software packages such as SAS, R/S-plus, and WinBUGS.
7. Develop a protocol for performing meta-analyses of data to be collected to address a question requiring collection of summary data across several sources.
8. Demonstrate use of meta-analytic methods for combining information across public health and biomedical studies.
9. Apply meta-analysis to estimate the sources and magnitude of heterogeneity across public health and biomedical studies.
10. Explain underlying theory in longitudinal data analyses of public health and biomedical studies.
11. Analyze longitudinal data in public health and biomedical studies with appropriate longitudinal data analysis methods.
12. Interpret analytic methods used throughout the literature in biostatistical and public health journals.
13. Interpret results of classical and Bayesian biostatistical analyses so that valid and reliable conclusions regarding a public health and biomedical research question may be drawn from the analyses.
14. Develop new ideas for applying existing biostatistical methods to applications in public health.
15. Develop statistical reasoning skills to work independently on ideas for research in public health and biomedicine.
16. Develop written and oral reports to communicate effectively to research investigators pivotal aspects of a study, including its design, objectives, data, analysis methods, results, and conclusions.
17. Create a collaborative environment for working on written and oral reports and developing critical thinking skills.

**Course Objectives:** At the completion of this course the student will be able to:

1. Identify ANOVA Models I, II and III, crossed factors and nested factors (Competencies: 1,2,3, and 6)
2. Perform a repeated measures analysis as a split plot design (Competencies: 1,2,3,6, 10, 11, 12, 14, 16 and 17)
3. Perform a multivariate repeated measures analysis (Competencies: 1,2,3,6, 10, 11, 12, 14, 16 and 17)
4. Perform a repeated measure using the mixed model approach (Competencies: 1,2,3,6, 10, 11, 12, 14, 16 and 17)
5. Be able to select the “best” variance-covariance structure when performing a repeated measures analysis via mixed models (Competencies: 1,2,3,6, 10, 11, 12, 14, 16 and 17)
6. Be able to perform a random intercept analysis (Competencies: 1,2,3,6, 10, 11, 12, 14, 16 and 17)
7. Be able to perform a random intercept and trend analysis (Competencies: 1,2,3,6, 10, 11, 12, 14, 16 and 17)
8. Be able to perform curvilinear trend models and orthogonal polynomials (Competencies: 1,2,3,6, 10, 11, 12, 14, 16 and 17)
9. Be able to identify and assess various covariance patterns (Competencies: 1,2,3,6, 10, 11, 12, 14, 16 and 17)
10. Be able to assess correlation between errors and apply the appropriate ARMA adjustments (Competencies: 1,2,3,6, 10, 11, 12, 14, 16 and 17)
11. Be able to apply GEE models in the analysis of longitudinal data analysis (Competencies: 1,2,3,6, 10, 11, 12, 14, 16 and 17)
12. Be able to perform a mixed-effects logistic regression (Competencies: 1,2,3,6, 10, 11, 12, 14, 16 and 17)
13. Be able to perform a mixed-effects proportional odds model (Competencies: 1,2,3,6, 10, 11, 12, 14, 16 and 17)
14. Be able to perform a mixed-effects multinomial regression analysis, including competing risks (Competencies: 1,2,3,6, 10, 11, 12, 14, 16 and 17)
15. Be able to perform a mixed-effect Poisson Regression and ZIP regression (Competencies: 1,2,3,6, 10, 11, 12, 14, 16 and 17)
16. Determine the different types of missing mechanisms (Competencies: 1,2,3,6, 10, 11, 12, 14, 16 and 17)
17. Identify models for non- ignorable missingness (Competencies: 1,2,3,6, 10, 11, 12, 14, 16 and 17)

**Overview of the content to be covered during the semester:**

<b>Week</b>	<b>Topic</b>	<b>Readings</b>	<b>Assignment</b>
1	Introduction to Longitudinal and Clustered Data	Class notes, Chapter 1 and Chapter 2	TBA
2-3	Overview, Estimation & Statistical inference for linear models for Longitudinal data	Class notes, Chapter 3 and Chapter 4	TBA
4-5	Modeling the mean	Class notes , Chapter 5 and Chapter 6	TBA
6	Modeling the Covariance	Class notes and Chapter 7	TBA
7	Linear Mixed Effects Models	Chapter 8	TBA
8	Fixed Effects versus Random Effects Models.	Chapter 9	TBA
9-10	Marginal Models :Generalized Estimating Equations (GEE) Models	Chapter 11 , Chapter 12 and Chapter 13	TBA
11-12	Generalized Linear Mixed Effects Models	Chapter 14 and Chapter 15	TBA
13	Contrasting Marginal and Mixed effects Models	Chapter 16	TBA
14-15	Missing Data and Dropout : Overview of Concepts and Methods	Chapter 16 and Chapter 17	TBA
16	Multiple Imputation and Weighting Methods in Longitudinal data	Chapter 18	TBA

Samples of your work may be reproduced for search purposes and/or inclusion in the professor's teaching portfolio. You have the right to review anything selected for use, and subsequently ask for its removal.

**Problems will be due within one week of completion of topic**

**Instructional Methods:**

Class meetings will be a combination of lecture, class discussion, and computer software demonstration. Written homework assignments and examinations constitute the basis of student evaluation.

**Exam Schedule and Final Exam:**

Final Exam: May 4, 2015

**Grading:** Weighting of assignments for purposes of grading will be as follows:

Assignments .....	80%
(assesses learning objectives: 1-19, individually*)	
Final Exam .....	20%
(assesses learning objectives: 1-19, integrated*)	
Total Possible	<hr/> 100%

\* *Integrated* refers to assessing all or some of the 14 learning objectives simultaneously, while *individually* refers to assessing the learning objectives as we cover them.

The following point scale will be utilized in grading:

90% - 100%	A
80% - 90%	B
70% - 80%	C
60% - 70%	D

For calculation of your final grade, all grades above will be included.

Your grades **will not** be posted. All exams and assignments will be graded and returned promptly so that students may accurately calculate their grades at any point in time during the semester.

There are times when extraordinary circumstances occur (e.g., serious illness, death in the family, etc.). In such circumstances, and/or if you need additional time to satisfactorily complete any course requirement, please consult with the instructor within a reasonable amount of time.

**Academic Integrity:** Students are expected to follow guidelines outlined in the *Student Conduct Code 2009-10* policy regarding academic dishonesty. Any student found in violation of academic honesty will receive a grade of 'F' for the course. It is the student's responsibility to familiarize him/herself with the student policies and expectations set forth in the *GSU Student Conduct Code 2009-10* (<http://students.georgiasouthern.edu/judicial/>).

**Attendance Policy:** Due to the nature and structure of this course, class attendance is of utmost importance. You are responsible for any material covered or distributed in class, including any announcements made in class, whether or not you are present. Furthermore, federal regulations require attendance be verified prior to distribution of financial aid allotments. Attendance will not be recorded after this initial period.

**Class Participation & Etiquette:** Attendance, attention, and participation are expected for each class! I believe it is important to foster student-teacher and student-student interactions within class, so you will discover that I will ask questions to you throughout the class. Although class participation is not a formal part of your course grade, I will use it as a factor if your final grade is on the border between two letter grades. Otherwise, I do not round final numerical grades to the nearest letter.

On a final note of etiquette, please turn off all cell phones during class, since ring tones are disruptive to others.

**Important Dates to Remember:**

<http://calendar.georgiasouthern.edu/?c=35>

**Disclaimer:** The contents of this syllabus are as complete and accurate as possible. The instructor reserves the right to make any changes necessary to the syllabus and course material. The instructor will make every effort to inform you of changes as they occur. It is the responsibility of the student to know what changes have been made in order to successfully complete the requirements of the course.

**Plagiarism**

"According to the Academic Dishonesty Policy of GSU, Plagiarism includes (but is not limited to):

- A. Directly quoting the words of others without using quotation marks or indented format to identify them.
- B. Using published or unpublished sources of information without identifying them.
- C. Paraphrasing material or ideas without identifying the source.
- D. Unacknowledged use of materials prepared by another person or agency engaged in the selling of term papers or other academic material.

If you are accused of plagiarism by a JPHCOPH, the following policy, as per the Judicial Affairs website ( <http://students.georgiasouthern.edu/judicial/faculty.htm> ) will be enforced:

## **PROCEDURES FOR ADJUDICATING ACADEMIC DISHONESTY CASES**

### **First Offense - In Violation Plea**

1.If the professor and the Dean of Students agree that the evidence is sufficient to warrant a charge of academic dishonesty, the professor should contact the Office of Judicial Affairs to determine if this is a first violation of academic dishonesty. The incident will be reported via the following website:

<http://students.georgiasouthern.edu/judicial/faculty.htm>

2. If it is a first violation, the professor should talk with the student about the violation. If the student accepts responsibility in writing and the professor decides to adjudicate the case, the following procedures will be followed:

a.The student will be placed on disciplinary probation for a minimum of one semester by the Office of Judicial Affairs.

b.The student will be subject to any academic sanctions imposed by the professor (from receiving a 0 on the assignment to receiving a failing grade in the class).

c.A copy of all the material involved in the case (Academic Dishonesty Report Form and the Request For Instructor to Adjudicate Form) and a brief statement from the professor concerning the facts of the case and the course syllabus should be mailed to the Office of Judicial Affairs for inclusion in the student's discipline record.

### **First Offense - Not In Violation Plea (student does not admit the violation)**

If the professor and the Dean of Students agree that the evidence is sufficient to warrant a charge of academic dishonesty, the professor should contact the Office of Judicial Affairs to determine if this is the first or second violation of academic dishonesty. The student will be charged with academic dishonesty and the University Judicial Board or a University Hearing Officer would hear the case. If the student is found responsible, the following penalty will normally be imposed:

a.The student will be placed on Disciplinary Probation for a minimum of one semester by the Office of Judicial Affairs.

b.The student will be subject to any academic sanctions imposed by the professor.

### **Second Violation of Academic Dishonesty**

If the professor and the Dean of Students agree that the evidence is sufficient to warrant a charge of academic dishonesty, and if it is determined this is the second violation, the student will be charged with academic dishonesty and the University Judicial Board or a University Hearing Officer would hear the case.

If the student is found responsible, the following penalty will normally be imposed:

a.Suspension for a minimum of one semester or expulsion.

b.The student will be subject to any academic sanctions imposed by the professor.



**NOT RESPONSIBLE FINDING**

When a student is found not responsible of academic dishonesty, the work in question (assignment, paper, test, etc.) would be forwarded to the Department Chair. It is the responsibility of the

Department Chair to ensure that the work is evaluated by a faculty member other than the individual who brought the charge and, if necessary, submit a final grade to the Registrar. For the protection of the faculty member and the student, the work in question should not be referred back to the faculty member who charged the student with academic dishonesty.

In the case of a Department Chair bringing charges against a student, an administrator at the Dean's level will ensure that the student's work is evaluated in an appropriate manner.

**CONFIDENTIALITY**

In accordance with provisions of the Family Educational Rights and Privacy Act of 1974 and the Georgia Open Records Act, any information related to a violation of academic dishonesty or the outcome of a judicial hearing regarding academic dishonesty, is prohibited and must be treated as confidential by members of the faculty."