

PSY 7650
Longitudinal Research Design & Analysis

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Required Materials

Fargo, J. D. (2006). *Quantitative methods in the behavioral and health sciences using the R statistical environment*.

Fitzmaurice, G. M., Laird, N. M., & Ware, J. H. (2004). *Applied longitudinal analysis*. Hoboken, NJ: Wiley.

Raudenbush, S., Bryk, A., Cheong, Y., & Congdon, R. (2004). *HLM6: Hierarchical linear modeling*. Lincolnwood, IL: SSI. (Order from: <http://www.ssicentral.com/hlm/index.html>)

HLM 6 Student Version: <http://www.ssicentral.com/hlm/downloads.html>

R: <http://www.r-project.org/>

Purpose of Course

EDUC/PSY 7650 is designed to help students develop the necessary skills required to conduct well-planned behavioral and educational longitudinal research and thoughtful statistical analyses of the resulting data. Knowledge gained in this course will build upon concepts learned in prior research methodology and data analysis courses. Students will learn how to differentiate and appropriately select the best statistical methods for use in various longitudinal research designs. As the theoretical is secondary to the applied approach to data analysis, students will learn how to 1) use HLM software (free to students) and the R statistical programming environment (free to all) to analyze longitudinal data and 2) interpret and communicate the statistical output using the guidelines of the Publication Manual of the American Psychological Association (5th edition). This course will only emphasize methods for manifest or observed, rather than latent or unobserved, variables.

Prerequisites

Successful completion of EDUC/PSY 7610 or an equivalent course in multiple linear regression.

Course Structure

This is a lecture and applied skills course and students will be expected to demonstrate their learning via classroom participation, written assignments, and a presentation. The purpose of class lectures is to elaborate on interesting or difficult material presented in the text, conduct skill-building exercises and demonstrations, and to provide a forum for class discussions. There will be several computer lab meetings throughout the duration of the course.

Preparing For Class and Attendance

The student is expected to read assigned chapters and any assigned readings **BEFORE** each class session in order to be prepared for classroom activities and discussion (see 'Summaries' below). Additional readings will be posted on WebCT. Please note that this is a 3-credit course, requiring approximately 9 hours of study time outside of class per week. Although roll is not taken, the difficult nature of this course requires regular class attendance and participation. Students should also not miss class lectures as some material covered in class will not be covered in the text. All information covered in the text and lectures will be fair game for examination questions. The instructor encourages all students who have or anticipate attendance difficulties to discuss these issues with him.

Course Learning Objectives

1. Methodological issues in the design of longitudinal studies
 - A. Characterize different types of sampling and how they determine analysis type and interpretation
 - B. Evaluate sample size and power in longitudinal designs
 - C. Understand the effect of attrition/missing data on results
 - D. Know what is meant by clustering and how clustered analyses differ from non-clustered analyses
 - E. Differentiate between 'long' and 'short' data formats
2. Generalized linear models: Logistic, Poisson, and multinomial regression
 - A. Understand the mathematical fundamentals
 - B. Know how to properly conduct analyses using R
 - C. Competently interpret results
3. Case-control studies
 - A. Articulate strengths & limitations
 - B. Choose appropriate analytical method
 - C. Conduct analyses with R
 - D. Know how to interpret results in terms of odds ratios
4. Cohort studies
 - A. Articulate strengths & limitations
 - B. Choose appropriate analytical method
 - C. Conduct analyses with R
 - D. Know how to interpret results in terms of risk ratios
5. Survival time studies
 - A. Articulate strengths & limitations
 - B. Differentiate between discrete and continuous time studies
 - C. Choose appropriate analytical method
 - D. Conduct analyses with R
 - E. Know how to interpret results in terms of hazards
6. Experimental studies/Randomized controlled trials
 - A. Articulate strengths & limitations
 - B. Choose appropriate analytical method
 - C. Conduct analyses with R
 - D. Know how to interpret results in terms of group differences
7. Mixed-effects or multi-level longitudinal models
 - A. In the context of these methods, define and know how to specify:
 - i. Fixed effects
 - ii. Random effects
 - iii. Variance components
 - iv. Time-varying covariates
 - v. Time-invariant covariates
 - vi. Polynomial covariates
 - vii. Dummy variables
 - viii. Level 1, 2, etc. in multilevel models
 - B. Learn how to use/program HLM6 and R to conduct longitudinal analyses
 - C. Interpret output from statistical software in terms of change over time, group differences, individual differences, and change over time as a function of both group or individual differences

8. Generalized estimating equations
 - A. Differentiate between population averaged and subject-specific models
 - B. Conduct analyses with R
 - C. Know how to interpret results at the population-averaged or individual level

9. Competency in use of statistical software (e.g., R and HLM)
 - A. Data manipulation
 - B. Data analysis
 - C. Interpreting output
 - D. Graphics

10. Develop skills in reporting of statistical results in APA style
 - A. Master the basics of APA style for communicating results of longitudinal research
 - B. Learn how to create tables and figures in APA style

Grading Criteria
Total = 900 pts

Summaries

22 x 20 pts = 420 pts

A summary or outline of the assigned readings is due on the day the material is covered in class. Each student must compose their own summary. Summaries will be graded based on their thoroughness in summarizing the readings. Each summary must be at least **1**, but no longer than **3 single-spaced pages** using, at a minimum, an **11-point** Arial or Times New Roman font with **1-inch margins** throughout. No summary for the 1st two week's readings is required.

Assignments

3 x 100 pts = 300 pts

Three equally weighted assignments form the basis for learning the practice of statistics at the level required by this course:

- Assignment 1: Longitudinal design
- Assignment 2: Linear mixed-effects models
- Assignment 3: Extensions of LMEs

Assignments require the manipulation or analysis of data and communication of results in APA format (5th Edition). Late assignments will be accepted for a maximum of 50% of their original value. If a student will miss class on the day an assignment is due, please turn in the assignment early or email to the instructor before the deadline to document on-time completion. If emailing, the student **MUST** turn in a paper copy as soon as possible in order to receive credit.

Presentation

1 Presentation (70 pts) + 1 Report (70 pts) + Consultation with Dr. Fargo (20 pts) = 160 pts

Each student will select one analysis technique covered during the course and, using their own, their advisor's data (with approval), or instructor provided data, will conduct an analysis and present the results to the class. No fabricated data please! A full write-up in APA format will be required at the time of the presentation. More information will be distributed later in the course. Data for use in theses or dissertations is permissible. An alternative is to write a 20 page paper on a longitudinal analysis technique not covered in the course.

Grades

The standard grade break down used by Utah State University will be followed to assign the student a letter grade. The final percentage will be determined by dividing the student's total points earned by the total number of possible points:

University Grading Scale:

A 100-93%
A- 92-90%
B+ 89-87%
B 86-83%

B- 82-80%
C+ 79-77%
C 76-73%
C- 72-70%

D+ 69-67%
D+ 60-66%
F Below 60

Miscellaneous

Changes in Assignments and Schedule

The instructor reserves the right to make changes to this syllabus at any time. Changes will be announced in class and posted on WebCT.

Students Needing Assistance with the English Language

Several assignments in this course require English composition. If you feel you need assistance, please visit the USU Writing Center. They have tutors available to help: <http://writingcenter.usu.edu>.

Academic Integrity - "The Honor System"

Each student has the right and duty to pursue his or her academic experience free of dishonesty. The Honor System is designed to establish the higher level of conduct expected and required of all Utah State University students.

The Honor Pledge: To enhance the learning environment at Utah State University and to develop student academic integrity, each student agrees to the following Honor Pledge: "I pledge, on my honor, to conduct myself with the foremost level of academic integrity." A student who lives by the Honor Pledge is a student who does more than not cheat, falsify, or plagiarize. A student who lives by the Honor Pledge:

- Espouses academic integrity as an underlying and essential principle of the Utah State University community;
- Understands that each act of academic dishonesty devalues every degree that is awarded by this institution; and
- Is a welcomed and valued member of Utah State University.

Plagiarism

Plagiarism includes knowingly "representing, by paraphrase or direct quotation, the published or unpublished work of another person as one's own in any academic exercise or activity without full and clear acknowledgment. It also includes the unacknowledged use of materials prepared by another person or agency engaged in the selling of term papers or other academic materials." The penalties for plagiarism are severe. They include warning or reprimand, grade adjustment, probation, suspension, expulsion, withholding of transcripts, denial or revocation of degrees, and referral to psychological counseling.

Sexual Harassment

Sexual harassment is defined by the Affirmative Action/Equal Employment Opportunity Commission as any "unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature." If you feel you are a victim of sexual harassment, you may talk to or file a complaint with the Affirmative Action/Equal Employment Opportunity Office located in Old Main, Room 161, or call the AA/EEO Office at 797-1266.

Students with Disabilities

Qualified students with disabilities may be eligible for reasonable accommodations. If a student has a disability that will likely require some accommodation by the instructor, the student must contact the instructor and document the disability through the Disability Resource Center (797-2444 voice, 797-0740 TTY, or toll free at 1-800-259-2966; Room 101 of the University Inn), preferably during the first week of the course. Any request for special consideration relating to attendance, pedagogy, taking of examinations, etc., must be discussed with and approved by the instructor. In cooperation with the Disability Resource Center, course materials can be provided in alternative format, large print, audio, diskette, or Braille."

Withdrawal Policy and "I" Grade Policy

Students are required to complete all courses for which they are registered by the end of the semester. In some cases, a student may be unable to complete all of the coursework because of extenuating circumstances, but not due to poor performance or to retain financial aid. In such cases an 'I' will be submitted as the grade for the semester. The term 'extenuating' circumstances includes: (1) incapacitating illness which prevents a student from attending classes for a minimum period of two weeks, (2) a death in the immediate family, (3) financial responsibilities requiring a student to alter a work schedule to secure employment, (4) change in work schedule as required by an employer, or (5) other emergencies deemed appropriate by the instructor.

EDUC/PSY 7650 Course Schedule

Date	Topic	Reading	Assign Due	Summary
8-Jan	Overview / R	Fargo (2006)		
10-Jan	R	Fargo (2006)		
15-Jan	<i>No Class - MLK Jr. Day - No Class</i>			
17-Jan	R Graphics			
22-Jan	Introduction to Longitudinal Research	Fitzmaurice 1 - 2, Appx A, B		1
24-Jan	Traditional Methods	Fitzmaurice 3		2
29-Jan	Introduction to Modern Methods	Fitzmaurice 4; Weiss 5 - 6		3
31-Jan	Specifying Covariates	Weiss 7		4
5-Feb	Modeling Covariance Matrix	Fitzmaurice 7		5
7-Feb	Linear Mixed-Effects (LME) Models	Fitzmaurice 8	1	6
12-Feb	LME Models in R	Fox (2002)		7
14-Feb	LME Models in R	Everitt 10		8
19-Feb	<i>No Class - President's Day - ATTEND TUESDAY!!! - No Class</i>			
20-Feb(T)	LME Models in R	Pineiro & Bates 4		9
21-Feb	LME Models in R	Pineiro & Bates 5		10
26-Feb	LME Models in HLM	Raudenbush 1 - 2		11
28-Feb	LME Models in HLM			
5-Mar	LME Models in HLM	Hulley 10 - 11		12
7-Mar	Diagnostics	Fitzmaurice 9		13
12-Mar	<i>No Class - Spring Break - No Class</i>			
14-Mar	<i>No Class - Spring Break - No Class</i>			
19-Mar	Generalized Linear Models	Fitzmaurice 10		14
21-Mar	Generalized Estimating Equations	Fitzmaurice 11	2	15
26-Mar	Generalized Estimating Equations in R	Everitt 11		16
28-Mar	Generalized LME Models	Fitzmaurice 12		17
2-Apr	Generalized LME Models in HLM	Raudenbush 5 - 6		18
4-Apr	Generalized LME Models in HLM			
9-Apr	Longitudinal Design Issues	Fitzmaurice 14 - 15		19
11-Apr	Case Control & Cohort	Hulley 7 - 9		20
16-Apr	Analysis of Case-Control & Cohort Studies			
18-Apr	Survival Time Studies	Hoffmann 7		21
23-Apr	Analysis of Survival Time Data In R	Everitt 9		22
25-Apr	Analysis of Survival Time Data In R			
2-May	Presentations		3	