SYLLABUS & COURSE INFORMATION

SCHOOL OF PUBLIC HEALTH
UNIVERSITY OF MINNESOTA

PUBH 8452, SECTION 001

Advanced Longitudinal Data Analysis
Fall 2018

COURSE & CONTACT INFORMATION

Credits: 3
Meeting Day(s): M, W
Meeting Time: 09:45 AM - 11:00 AM
Meeting Place: Moos Health Sci Tower 1-435
Course website: https://ay17.moodle.umn.edu/course/view.php?id=15693

Instructor: Xianghua Luo, PhD
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Office Hours: Monday 8:30 AM - 9:30 AM
Office Location: Mayo A427

COURSE DESCRIPTION

Methods of inference for correlated outcome variables, with a special emphasis on repeated measurements in medical studies. Linear/nonlinear models with either normal or non-normal error structures. Random effects. Transitional/marginal models.

Acknowledgments
The contents of PubH 8452 have been developed with the contributions of numerous instructors. Former faculty/instructors, including Drs. Chiung-Yu Huang, Na (Michael) Li, Hongfei Guo, and Saonli Basu all had roles in either the conceptual development or actual content of the current course, and are acknowledged for their contributions.

COURSE PREREQUISITES

- Theory of statistical inference (estimation and testing, asymptotics) at or above the level of PubH8412.
- Linear models (linear algebra, least square, multivariate normal distribution) at or above the level of PubH8401.
- Familiarity with a statistical software package to carry out the computation (including data analysis and simulation). R is highly recommended and will be used throughout by the instructor.
- Or permission of the Instructor.

COURSE GOALS & OBJECTIVES

After taking the course, the students are expected to:

- understand the theory, assumptions and properties of various statistical methods for the analysis of longitudinal data.
- be able to carry out the appropriate analyses (including exploratory) of longitudinal data using suitable statistical software and present the results.

METHODS OF INSTRUCTION AND WORK EXPECTATIONS

Mostly there will be lectures. The notes, reading requirement, and homework will be published online prior to the lecture. Additional reading materials will be distributed in class as needed. Students are strongly encouraged to preview the lecture note and related chapters in the textbook and try out the sample computing code before class and then bring questions to class to promote discussions. Students are encouraged to work as a group for homework.

Work expectations: Students are expected to attend class, participate in class discussion, and complete all assigned homework, presentation, and project.

Like other work in the course, all student to student communication is covered by the Student Conduct Code (https://z.umn.edu/studentconduct).

COURSE TEXT & READINGS

Textbook (Required)
Diggle, Heagerty, Liang and Zeger (2002), Analysis of Longitudinal Data, 2nd Edition, Oxford University Press.

Readings (Optional)

- Hedeker and Gibbons (2006). Longitudinal Data Analysis. Johns Wiley & Sons, Inc. ISBN-10: 0-471-42027-1. ISBN-13: 978-0-471-42027-9.
- Fitzmaurice, Laird and Ware (2004). Applied Longitudinal Analysis. John Wiley and Sons. ISBN: 0-471-21487-6.
- McCullaph and Nelder (1989). Generalized linear models. 2nd Edition, Chapman and Hall. ISBN: 0-412-31760-5.
- Littell, Milliken, Stroup, Wolfinger, and Schabenberger (2006). SAS for Mixed Models, 2nd Edition. SAS Press. ISBN-10: 1-59047-500-3. ISBN-13: 978-1-59047-500-3.
- Verbeke and Molenberghs (2000). Linear Mixed Models for Longitudinal Data. Springer. ISBN: 0-387-95027-3.
- Molenberghs and Verbeke (2005). Models for Discrete Longitudinal Data. Springer. ISBN-10: 0-387-25144-8. ISBN-13: 978-0387-25144-8.
- Pinheiro and Bates (2000). Mixed-Effects Models in S and S-PLUS. Springer. ISBN-10: 0-387-98957-9. ISBN-13: 978-0387-98957-9.

COURSE OUTLINE

Lectures

The following topics will be covered

- Introduction
- Exploratory Data Analysis
- General Linear Models
- General Linear Models: Case Study
- Linear Mixed Models
- Linear Mixed Models: Case Study
- Generalized Linear Models, Quasi-likelihood and Estimating Functions
- GEE Variants and Case Studies
- Likelihood Models for Repeated Binary Data
- Modeling Approaches: Marginal, Random Effects and Transition Models
- Generalized Linear Mixed Models
- Transition Models and Marginalized Models
- Time-Dependent Variables
- Missing Data in Longitudinal Studies
- Other topics such as joint modeling of longitudinal and survival data

Homework

There will be four homework assignments during the semester. All assignments will involve computing, including data analysis and possibly simulations. I encourage you to work together in computing and discussing the problems. However, each student is expected to independently write up the assignment using her/his own computing and own words.

Presentation

There will be a 15-minute presentation on an "advanced" topic by each student during the last instruction week. The emphasis of the presentation will be on methodology with applications. Ideally the papers selected should involve method development as well as data analysis. Review papers will not be allowed. The presentations will be evaluated primarily based on the clarity of the talk, rather than the technical difficulty of the paper.

Final Project

There will be a final project at the end of the semester instead of a final exam. You will be given one week to work on the project and submit a written report. You may consult any books, class notes, or resources on the internet, but you may not collaborate with any person in the class or not, nor may you consult with any person online.

SPH AND UNIVERSITY POLICIES & RESOURCES

The School of Public Health maintains up-to-date information about resources available to students, as well as formal course policies, on our website at www.sph.umn.edu/student-policies/. Students are expected to read and understand all policy information available at this link and are encouraged to make use of the resources available.

The University of Minnesota has official policies, including but not limited to the following:

- Grade definitions
- Scholastic dishonesty
- Makeup work for legitimate absences
- Student conduct code
- Sexual harassment, sexual assault, stalking and relationship violence
- Equity, diversity, equal employment opportunity, and affirmative action
- Disability services
- Academic freedom and responsibility

Resources available for students include:

- Confidential mental health services
- Disability accommodations
- Housing and financial instability resources
- Technology help
- Academic support

EVALUATION & GRADING

Homework (40%), presentation (20%), final project (40%).

Grading Scale
The University uses plus and minus grading on a 4.000 cumulative grade point scale in accordance with the following, and you can expect the grade lines to be drawn as follows:

% In Class	Grade	GPA
93 - 100%	A	4.000
90 - 92%	A-	3.667
87 - 89%	B+	3.333
83 - 86%	B	3.000
80 - 82%	B-	2.667
77 - 79%	C+	2.333
73 - 76%	C	2.000
70 - 72%	C-	1.667
67 - 69%	D+	1.333
63 - 66%	D	1.000
< 62%	F	

- A = achievement that is outstanding relative to the level necessary to meet course requirements.
- B = achievement that is significantly above the level necessary to meet course requirements.

- C = achievement that meets the course requirements in every respect.
- D = achievement that is worthy of credit even though it fails to meet fully the course requirements.
- F = failure because work was either (1) completed but at a level of achievement that is not worthy of credit or (2) was not completed and there was no agreement between the instructor and the student that the student would be awarded an I (Incomplete).
- S = achievement that is satisfactory, which is equivalent to a C- or better
- N = achievement that is not satisfactory and signifies that the work was either 1) completed but at a level that is not worthy of credit, or 2) not completed and there was no agreement between the instructor and student that the student would receive an I (Incomplete).

Evaluation/Grading Policy	Evaluation/Grading Policy Description
Scholastic Dishonesty, Plagiarism, Cheating, etc.	You are expected to do your own academic work and cite sources as necessary. Failing to do so is scholastic dishonesty. Scholastic dishonesty means plagiarizing; cheating on assignments or examinations; engaging in unauthorized collaboration on academic work; taking, acquiring, or using test materials without faculty permission; submitting false or incomplete records of academic achievement; acting alone or in cooperation with another to falsify records or to obtain dishonestly grades, honors, awards, or professional endorsement; altering, forging, or misusing a University academic record; or fabricating or falsifying data, research procedures, or data analysis (As defined in the Student Conduct Code). For additional information, please see https://z.umn.edu/dishonesty The Office for Student Conduct and Academic Integrity has compiled a useful list of Frequently Asked Questions pertaining to scholastic dishonesty: https://z.umn.edu/integrity. If you have additional questions, please clarify with your instructor. Your instructor can respond to your specific questions regarding what would constitute scholastic dishonesty in the context of a particular class-e.g., whether collaboration on assignments is permitted, requirements and methods for citing sources, if electronic aids are permitted or prohibited during an exam. Indiana University offers a clear description of plagiarism and an online quiz to check your understanding (http://z.umn.edu/iuplagiarism).