

## Biostatistics Methods for Longitudinal Studies (TSCI 6070) Fall of 2019

**CLASS DAYS and TIME:** Wednesdays 1.30pm-4.00pm

**CLASSROOM:** MED 2.211C

**COURSE FACULTY:** Chen-Pin Wang

**OFFICE LOCATION and HOURS:** VAH F308.4 Wednesdays 12:30-1:30

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**READ THIS DOCUMENT CAREFULLY - YOU ARE RESPONSIBLE FOR ITS CONTENTS.**

### COURSE DESCRIPTION AND OBJECTIVES

Apply and implement appropriate biostatistics methods to design and analyze longitudinal studies, which will enhance the quality of medical research.

**Pre-requisites** – MEDI 5072 and MEDI 6061.

**Semester credit hours** – 2.5

By the end of this course, each student should be able to:

- Plan a well thought-through longitudinal study design to derive the inference of interest.
- Use graphs or summary tables to present longitudinal data that effectively describes the data pattern and communicates the scientific problem of interest.
- Identify appropriate statistical models (with mixed/random effects) to assess the relationship between response and predictors while accounting for within-subject correlation.
- Understand the statistical and substantive roles of random effects in mixed effect models in the context of the scientific research question.
- Conduct longitudinal data analyses to assess the relationship between response and predictors.
- Describe the relationship between response and predictors for linear and non-linear statistical models for longitudinal studies
- Interpret and present the statistical analysis results derived from longitudinal studies.
- Identify techniques of conducting rigorous causal analyses of longitudinal studies, and the implication of the underlying model assumptions to medical research.
- Critique literature on longitudinal studies in terms of the design and analysis used for the inference.

### COURSE ORGANIZATION

**The main teaching modalities used in this course include:**

**Lectures** – Presentations are given in the common lecture format and are accompanied by PowerPoint slide files. The files are provided to you. You are responsible for all information included in the lecture materials. However, you should not assume that all testable lecture material is found only in the posted materials. That is, lectures may be expanded and enhanced during in-class presentations. So, take good notes because any information discussed in class is considered testable.

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**Computer Access** – Materials and assignments will require access to a computer with internet capabilities, access to the UTHSCSA network.

**Computer Requirements:** Students are required to have a laptop computer that can connect to and operate over a wireless network, and has the following softwares installed:

- Microsoft Office Suite (A personal copy of the latest version can be purchased at The UTHSCSA bookstore at student pricing with a student ID)
- Stata/IC or R (a version that has the capacity to conduct analyses learn from this course) is required.

<http://www.stata.com/order/new/edu/gradplans/gp-campus.html>

<https://www.r-project.org/>

Laptops with an Apple based Operating System must be able to also operate using a Windows based Operating System. It may be necessary to purchase Windows (student pricing available at The UTHSCSA bookstore with a student ID) and virtualization software.

All laptops will connect to The UTHSCSA network via the HSCwave broadcast wireless connection. Authentication for wireless use is based on The UTHSCSA domain username and password.

Verification of proper operation prior to the start of class is highly recommended.

Assistance is available thru the IMS Service Desk

- Telephone: 567-7777
- E-mail: [ims-servicedesk@uthscsa.edu](mailto:ims-servicedesk@uthscsa.edu)

Assistance is also available at the IMS Student Support Center (ALTC 106).

**Reading Assignments** – Chapters in the recommended books that will be covered in the class.

### TEXTBOOKS

**Required:** Class notes and references discussed in the class.

**Recommended:**

- Analysis of Longitudinal Data, Peter J. Diggle, Kung-Yee Liang and Scott L. Zeger, 2nd ed. Oxford (2002).
- Linear Mixed Models for Longitudinal Data. G. Verbeke and G. Molenberghs. Springer (2000).
- Handbook of Statistical Analyses using Stata , Sophia Rabe-Hesketh and Brian Everitt, Chapman & Hall/CRC (2004).
- Causal Inference for Statistics, Social, and Biomedical Sciences: An Introduction by Guido W. Imbens and Donald B. Rubin (2015).
- Explanation in Causal Inference: Methods for Mediation and Interaction. Tyler VanderWeele (2015). Oxford.

### ATTENDANCE

Attendance at scheduled classes and examinations is crucial to meeting course objectives. Therefore, regular attendance in class is expected of each student.

- Attendance is defined as being present within 15 minutes after the scheduled beginning of the class and until 15 minutes before the scheduled ending of the class.

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- Excused absences may be granted by the Course Director in cases such as formal presentations at scientific meetings, illness, or personal emergency.
- Excused absences are considered on an individual basis and require electronic communication with the Course Director to request an excused absence. The e-mail request to the Course Director for consideration of an excused absence must provide details regarding the circumstances and specific dates.
- It is expected that students will provide *advanced notice* of absence for scheduled events.
- If a student has excessive unexcused absences in a given course, they will automatically receive a grade of *unsatisfactory* unless *makeup* has been approved by the Course Director.
- Makeup of absences (both excused and unexcused) is allowed at the discretion of the Course Director.
- Allowable unexcused absences will be determined by the credit hours of the course as follows:

Course Semester Credit Hours	Allowable Unexcused Absences
3.0	3
2.0	2
1.0	1

### GRADING POLICIES AND EXAMINATION PROCEDURES

Two projects and 2 exams will be derived from the Lectures. Each is worth 25% of your grade. Projects and exams should be turned in electronically via emails or the CANVAS system.

#### Grading System

Grading is based on the following scale: Satisfactory= 80%-100%, Unsatisfactory = < 80%.

**Examination Protocol** – Exams may be composed of multiple choice, interpretation of analysis results, and some answers could require demonstration of statistical procedures. References, class notes, and computers are allowed at the exam. You are allowed to ask questions of the proctor during the examination. But the proctor will only address questions regarding potential typographical errors or clarify the exam questions.

**Late Arrival to Exams** - Exams will be timed. If you arrive late to an exam, and are given permission to take the exam, you will not be given additional time to complete your test. If you arrive after another student has finished the exam and has departed the exam room, you will not be allowed to take the exam. If you miss an exam, you may be eligible for taking a make-up exam (see below).

**Late Turn-In of Projects** - Projects are expected to be turned in on time. If you must turn in projects beyond the due date without a serious reason, 10 points will be deducted from the score each day of delay.

**Grading Procedures** – Exam results will be provided to students as quickly as possible. No “challenges” are allowed. However, a time will be scheduled outside of class so that students may review concepts of concern to them.

**Make-up Examinations** – A student who must miss a scheduled exam for a serious reason must request an excused absence from the Course Director. Acceptable “serious reasons” usually involve serious illness or injury to the student (doctor’s excuse may be required) or the student’s family member. Examples of unacceptable reasons include: Not prepared or incomplete studying, over-sleeping, hangover, heavy traffic or any travel delays, other appointments or scheduled professional or personal commitments. If it is determined that missing an exam is justified, a make-up examination will be scheduled. The make-up exam will be given as soon as possible at a time designated by the Course

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Director. Any student who misses an exam and does not receive an excused absence will receive a grade of zero for that exam.

### REQUESTS FOR ACCOMMODATIONS FOR DISABILITIES

In accordance with policy 4.2.3, **Request for Accommodation Under the ADA and the ADA Amendments Act of 2008 (ADAAA)**, any student requesting accommodation must submit the appropriate request for accommodation under the American with Disabilities Act (ADA, form 100) to his/her appropriate Associate Dean of their School and a copy to the ADA Coordinator. Additional information may be obtained at <http://uthscsa.edu/eeo/request.asp>.

### ACADEMIC INTEGRITY AND PROFESSIONALISM

Any student who commits an act of academic dishonesty is subject to discipline as prescribed by the UT System Rules and Regulations of the Board of Regents. Academic dishonesty includes, but is not limited to, cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an exam for another person, signing attendance sheets for another student, and any act designed to give unfair advantage to a student or the attempt to commit such an act. Additional information may be obtained at <http://catalog.uthscsa.edu/generalinformation/generalacademicpolicies/academicdishonestypolicy/>

### TITLE IX AT UTHSA

#### **Title IX Defined:**

Title of the Education Amendments of 1972 is a federal law that prohibits sex discrimination in education. It reads “no person in the United States shall, on the basis of sex, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any education program or activity receiving Federal financial assistance.”

#### **University of Texas Health Science Center San Antonio’s Commitment:**

University of Texas Health San Antonio (UTHSA) is committed to maintaining a learning environment that is free from discriminatory conduct based on gender. As required by Title IX, UTHSA does not discriminate on the basis of sex in its education programs and activities, and it encourages any student, faculty, or staff member who thinks that he or she has been subjected to sex discrimination, sexual harassment (including sexual violence) or sexual misconduct to immediately report the incident to the Title IX Director.

In an emergency, victims of sexual abuse should call 911. For non-emergencies, they may contact UPD at 210-567-2800. Additional information may be obtained at <http://students.uthscsa.edu/titleix/>

### EMAIL POLICY

Every student is issued a University e-mail address and account at the time of enrollment. As a matter of University Policy, communications between students and faculty that occur using the student’s University e-mail address is considered official business. Therefore, students are expected to check their university email inboxes on a regular basis so that any announcements, instructions, or information regarding this course will be received in a timely way. Missed communications due to inadequate monitoring of incoming emails on the University’s email server will never be a valid excuse for unsatisfactory academic progress.

### USE OF RECORDING DEVICES

Recording of lectures and other learning activities in this course by any means (*e.g.*, video, audio, etc.) is only permitted if approved by the instructor or required for compliance with Americans with Disabilities Act (ADA).

### ELECTRONIC DEVICES

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Cell phones must be turned off during all class meetings and exams. Computers and electronic tablets are allowed only for participating in classroom activities (*e.g.*, viewing slides presented in lecture or conference materials). No texting, tweeting, emailing, web-surfing, gaming, or any use of electronic devices that is not directly connected with classroom activities is permitted.

**TENTATIVE CLASS SCHEDULE**

<b>Week</b>	<b>Title</b>
1	Overview
2	Longitudinal Study Designs
3	Generalized Linear Models for Continuous Outcomes
4	Generalized Linear Mixed Effect Models for Correlated Continuous Outcomes
5	Generalized Linear Models for Discrete Outcomes
6	Generalized Linear Mixed Effect Models for Correlated Discrete Outcomes
7	Alternative Approaches for Analyzing Longitudinal Study
8	Review (week1-week 7)
9	Midterm Examination/Project
10	Survival Analysis I (Lifetable, Kaplan-Meier Curve)
11	Survival analysis II (Cox regression)
12	Confounding, Mediation and Moderation
13	Missing Data
14	Causal Inference
15	Heterogeneity in Causal Inference
16	Review (week10-week 15)
17	Final Examination/Project