M19-610: Multilevel and Longitudinal Data Analyses for Clinical and Public Health Research
(3 credits)
Spring 2022
Tuesday, 9:00 to noon
Location: Zoom meeting if in-person not possible
Taylor Avenue Building 2nd floor, Richmond Room if in-person possible
Hybrid of virtual and in-person if appropriate

INSTRUCTOR: Yan Yan, MD, MA, MHS, Ph.D
   Professor of Surgery (Clinical epidemiology) and Biostatistics
OFFICE HOURS: By appointment

PREREQUISITES: (1) M19-512 or knowledge of generalized linear model and Cox PHM, (2) Introductory knowledge of SAS, and (3) SAS software ready for the class.

TARGET AUDIENCE: medical students, clinicians, epidemiologists and other population health researchers

COURSE DESCRIPTION & OBJECTIVES: This course is designed for medical students, clinicians, epidemiologists and other public health researchers. The topics include basic statistical concepts and methods for various types of biomedical and public health data (continuous, categorical, count, and time-to-event) in multilevel and longitudinal settings. Through lectures, SAS labs, homework assignments, and a small project, students will learn the concepts and methods for those types of data with application in clinical and public health research, and will further develop computing skills using SAS software.

COMPETENCIES: After completing the course, students should (1) understand the basic statistical concepts and methods for the various types of multilevel/longitudinal outcome data, (2) be able to address research questions using these concepts and methods, (3) be able to perform certain data analyses on these types of data with SAS software, and (4) be able to interpret the results in the context of clinical/public health research.

GRADING
Your grade will be based on:
- Class participation (10%)
- HW 1 – HW 3: (40% total, each assignment 1/3*40%)
- class project: (50%)

Grading Scale :
A+: 97-100; A: 93-96; A-: 90-92; B+: 87-89; B: 83-86; B-: 80-82; C+: 77-79; C: 73-76; C-: 70-72

ATTENDANCE AND PARTICIPATION
Class attendance is required. As a courtesy to other students, you are expected to arrive on time. More than two unexcused absences from class result in 0 point from class participation.

POLICY ON LATE ASSIGNMENTS

Late assignments will result in a deduction of 20% of the assignment for each day late (including weekends) unless prior approval is obtained from the instructor or a compelling situation prevents prior approval (i.e. documented health issues or family emergencies).

SCHEDULES:

Section	Date	Contents
1	1/18	Introduction: multilevel/longitudinal data analyses and the related SAS procedures
		Part I: Continuous outcomes
2	1/25	Two-level models
3	2/1	Longitudinal models – traditional ANOVA approach
4	2/8	Longitudinal models – Mixed effect regression
5	2/15	Three-level models
6	2/22	Crossed random effects models / diagnostics of linear mixed effect models
		Part II: Discrete (categorical/count) outcomes
7	3/1	Longitudinal models for binary outcomes
8	3/8	Multilevel models for binary outcomes
9	3/15	Multilevel /longitudinal models for ordinal outcomes
10	3/22	Multilevel/longitudinal models for nominal outcomes
11	3/29	Multilevel/longitudinal models for count outcomes
12	4/5	Multilevel/longitudinal models for counts with excessive zeros
		Part III: Time-to-event outcomes/missing data in longitudinal data
13	4/12	Multilevel models for continuous-time data
14	4/19	Multilevel models for discrete-time data
15	4/26	Models for recurrent-event data
16	5/3	Missing data in longitudinal studies with focus on MNAR

REFERENCE TEXTS:

The course materials are based on the class notes, which are largely selected from various books, papers, and SAS documents. Class notes will be handed out every Friday for the next week class. It is strongly recommended to study the class notes before the class. Two books are frequently used for this class and other reference (reading) materials are listed on the class notes.
1. Donald Hedeker, Robert D. Gibbons. Longitudinal data analysis. John Wiley & Sons, May 12, 2006. **(H&G)**
2. Sophia Rabe-Hesketh, Anders Skrondal. Multilevel and longitudinal modeling using Stata. Volume I: continuous responses, Volume II: categorical responses, counts, and survival. A Stata Press Publication, StataCorp LP, College Station, Texas 2012. **(RH&S)**

DROP DATES
You may drop for any reason during the course of the semester. However, you may only receive a partial or no tuition reimbursement depending upon how far into the semester you drop the course. See the MPHS Student Handbook. Late withdrawals will appear on your transcript as a withdrawal.

MPHS ACADEMIC POLICY GUIDELINES:

Guidelines regarding MPHS course registration and enrollment, grades, tuition obligation, and academic leave are consolidated in the **MPHS Student Handbook**. Please review this document.

MPHS GUIDELINES FOR ACADEMIC AND NON-ACADEMIC TRANSGRESSIONS:

By registering for this course you have agreed to the terms of the **MPHS Academic Integrity Policy, outlined below and in more detail in the [MPHS Student Handbook](#)**. Please review this policy before submitting your first graded assignment.

Academic Integrity/Plagiarism Policy:
- Academic dishonesty is a serious offense that may lead to probation, suspension, or dismissal from the University. Academic dishonesty includes plagiarism (the use of someone else's ideas, statements, or approaches without proper citation). Academic dishonesty also includes copying information from another student, submitting work from a previous class for a new grade without prior approval from your instructor, cheating on exams, etc. You are responsible for reviewing [WashU's academic integrity resources](#) to become aware of all the actions that constitute academic dishonesty.
- All instances of academic dishonesty will be reported to the Office of the Registrar for investigation and potential disciplinary action. In addition, the instructor will make an independent decision about the student's grade on any assignment in question. The MPHS process regarding academic dishonesty is described in the [MPHS Student Handbook](#)

DISABILITY RESOURCES

It is the goal of Washington University to assist students with disabilities in removing the barriers their disabilities may pose and provide support in facing the challenge of pursuing an education at Washington University.

Washington University recognizes and accepts its professional, legal and moral responsibility to avoid discrimination in the acceptance and education of qualified students with disabilities and to provide reasonable accommodations to such students consistent with the principles embodied in the law. These guidelines apply to students seeking admittance as well as to those who become disabled while they are enrolled.

Washington University makes every effort to insure that all qualified applicants and students can participate in and take full advantage of all programs and opportunities offered within the university. Washington University encourages and gives full consideration to all applicants for admission. Washington University does not discriminate in access to its programs and activities on the basis of age, sex, sexual orientation, race, disability, religion, color or national origin.

To learn more about services provided to students with disabilities, initiate the process of formal documentation and/or to arrange for accommodations, please review the [Disability Resources](#) for the Med School at the start of the course.

MENTAL HEALTH RESOURCES

Mental Health Services' professional staff members work with students to resolve personal and interpersonal difficulties, many of which can affect the academic experience. These include conflicts with or worry about friends or family, concerns about eating or drinking patterns, and feelings of anxiety and depression. See: [shs.wustl.edu/MentalHealth](#).

SEXUAL ASSAULT RESOURCES

You can also speak confidentially and learn about available resources by contacting [Dr. Gladys Smith, PhD](#), Sexual Violence Prevention Therapist and Licensed Psychologist at the Medical Campus, (314) 362-2404.

Additionally, you can report incidents to the Office of Student Affairs or by contacting WUSM Protective Services 314-362-4357 or your local law enforcement agency.

BIAS RESOURCES
The University has a process through which students and staff who have experienced or witnessed bias, prejudice or discrimination against a student can report their experiences to the University's Bias Report and Support System (BRSS) team. For details see: diversityinclusion.wustl.edu/brss/.

Office of the Associate Vice Chancellor for Diversity, Equity and Inclusion (DEI)
The DEI Training Team designs, facilitates and leads diversity education programming for faculty, staff and students on a wide range of topics including: creating a climate of respect, the value of diversity and the role of biases in our day-to-day lives.
diversity.med.wustl.edu/training/

The Office of Diversity Programs promotes diversity among and prepares medical students to lead in a global society. A priority for the Office of Diversity Programs is to cultivate and foster a supportive campus climate for students of all backgrounds, cultures and identities.
mddiversity.wustl.edu/

The Diversity and Inclusion Student Council promotes an inclusive campus environment for all School of Medicine students.
sites.wustl.edu/disc/

The Office for International Students and Scholars embraces the university's mission of welcoming promising students from around the world.
wumma.wustl.edu/