

**M19-511 Introduction to Propensity Score Methods (1 credit)**

Spring 1 2023 (1/18/2023 – 2/22/2023)

Wednesdays: 9 am to Noon

Location: Doll & Hill, the Taylor Avenue Building

**INSTRUCTORS**

**Fei Wan, Ph.D.**

wan.fe@wustl.edu

314-362-9647

**OFFICE HOURS**

Via zoom, by appointment (send email to schedule)

**PREREQUISITES**

The students need to have a good prior knowledge on introductory statistics and regression analysis by taking the following courses (or equivalent courses from the other programs)

M19-520 Introduction to R for Clinical Research

M19-511 Introductory Biostatistics for Clinical Research

M19-512 Intermediate Biostatistics for Clinical Research

M19-501 Introductory Clinical Epidemiology

**COURSE DESCRIPTION & OBJECTIVES**

This introductory course on Propensity Score Methods is designed for medical students, clinicians and health researchers to understand propensity score methods and to foster the skills needed to plan and conduct their own research projects. This course will introduce the students to the techniques of using propensity score methods to control for confounding biases in non-randomized observational studies. Through lectures, labs, and homework assignments, students will learn the concept of propensity score methods and how to apply learnt statistical methods in a medical context.

**COMPETENCIES**

1. Understand how the treatment effect is defined under the potential outcome framework.
2. Understand that randomized controlled trials are the gold standard for establishing the efficacy but they have limitations.
3. Understand the advantages of observational studies over randomized controlled trials and the confounding bias problems in observational studies.
4. Understand the potential issues with classic confounding adjustment methods such as regression adjustment and covariate matching.
5. Perform propensity score modeling and variable selection, matching and weighting on propensity scores, balance diagnosis, and estimation of treatment effects.

6. Interpret results of statistical analyses found in biomedical and public health studies.

**COURSE TEXTBOOKS:**

Walter Leite, Practical Propensity Score Methods Using R (Recommended). Lecture notes and handouts will be available.

**STATISTICAL SOFTWARE**

The course provides a further introduction to R, a statistical software package. Several homework assignments require you to use R.

**GRADING**

Your grade will consist of four components: Homework, class project, and class participation.

<b>Components</b>	<b>Percentage</b>
Homework Assignments	50%
Class Participation	10%
Final Project/Presentation	40%
<b>Total</b>	<b>100%</b>

Grading scale:

A	A-	B+	B	B-	C+	C	C-	F
94-100	90-93	88-89	84-87	80-83	78-79	74-77	70-73	<70

Homework: Four homework assignments can be found on the course website under course documents in the homework folder. Each homework assignment will be graded on a 100-point scale. In order to receive credit for a homework assignment, students must complete every question. Problems should be submitted in the order in which they were assigned. Homework should include summaries of results illustrated by relevant R output. Students can use their own research data for the final project. Students will make a short presentation of their study results.

Class project: Students are welcome to use their own research data for the final course project. Students are required to write a short summary for the final project and do a short presentation (no more than 10 minutes).

Classroom environment: The more you participate in class discussions, the more you will gain from the course. It is understood that students bring varying kinds and levels of expertise to the class. In order for everyone to feel comfortable presenting work and voicing opinions or suggestions, a climate of tolerance and respect is essential.

**ATTENDANCE AND PARTICIPATION**

Class attendance is required. Statistics is a hands-on, collaborative practice, so much of the learning comes from input received from peers and course instructors. Homework does not replace labs, in-class exercises and

discussion. Absences from single classes for professional reasons (conferences, residency interviews) are acceptable. Extended absences will severely limit the return on your effort in this class.

**POLICY ON LATE ASSIGNMENTS**

Late assignments will result in a deduction of one grade point (A+ down to A) 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).

**LECTURE SCHEDULE**

<b>Date</b>	<b>Topic</b>	<b>HW Due</b>
Week 1	The potential outcomes and causal inference	
	- The potential outcome framework	
	- Definition of the treatment effect in a randomized controlled trial	
	- Marginal and conditional treatment effect	
	- Observational studies and confounding bias	
Week 2	Classic methods and propensity score	1
	- Regression adjustment and matching on covariates	
	- Problems with classic methods	
	- Concept and properties of propensity score	
	Lab 1	
Week 3	Propensity score analysis: Matching method	2
	- Estimating propensity score using logistic regression	
	- Matching algorithms and balance diagnosis	
	- Post-matching analysis	
	Lab 2 R/matchit package	
Week 4	Propensity score weighting: Weighting method	3
	- Weighting approach	
	- Balance diagnosis and Weights trimming	
	- Weighted analysis	
	Lab 3 R/stat, psweight, and twang packages	
Week 5	Advanced topic: Sensitivity analysis	4
	- Sensitivity analysis of propensity score analysis results in presence of unmeasured confounding	
	Lab 4 (Sensitivity analysis, not required for the final project)	
	Final project presentation.	

**COURSE SYLLABUS SUBJECT TO CHANGE**

Every effort will be made to follow the syllabus content and schedule. If circumstances dictate, there may be modifications made during the semester and every effort will be made to notify students in a timely manner.

## **CANVAS**

We will use Canvas to manage our class, access assignment instructions and post course-related questions. Canvas can be accessed at <https://hellocanvas.wustl.edu/>. Login with your WUSTLKey and Introductory biostatistics for clinical research should appear on the homepage. All updates and reminders will be posted on Canvas. Lecture notes and additional readings and assignment instructions will be posted on Canvas throughout the semester.

## **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](https://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/](https://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/](https://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/](https://mddiversity.wustl.edu/)

**The Diversity and Inclusion Student Council** promotes an inclusive campus environment for all School of Medicine students.

[sites.wustl.edu/disc/](https://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/](http://wumma.wustl.edu/)