MTR 6000: Introduction to Biostatistics

Fall 2025

Course Dates:

Tuesdays and Thursdays, 8:30-10:00am
September 4th – December 4th
Online via Zoom

Zoom Information:

Coming Soon

Instructor Information:

Course Director:

Roger Vaughan, MS, DrPH | Email: rdvdks@gmail.com

Course Coordinator:

Jessica German, MSEd | Email: jbgerman@upenn.edu

General Course Information

Course Description:

This Introduction to Biostatistics course will use elements of statistics as a vehicle through which to: better understand, absorb, and adjudicate information from the peer review literature; assess the best analytic approach to interrogate scientific hypotheses; develop the necessary vocabulary needed to engage with professional statisticians, and create your own independent critical thinking lens.

Course Plan/Schedule/Assignments:

The course will proceed through a regular cadence as we motivate the case for the need and utility for a particular analytic tool, derive and the method to understand how and why it works, do an in-class example, review and interpret computer output, then dive into a peer reviewed article that implemented the method to ensure we understand its application, appropriateness, interpretation, and limitations. We will begin each class with a brief review of the prior week, followed by a structured presentation of the assigned article. We will use the lab time on Tuesdays for teams to review and prep for the presentation. Teams will log into the Zoom link we use for Thursday class and move into breakout rooms based on their assigned group number.

We will use the *'Essentials of Biostatistics in Public Health (Essential Public Health) 4th Edition'* by Lisa M. Sullivan throughout the course. The associated reading assignments from this textbook are available on Canvas.

Assessment:

The mechanism to determine success in the course will be through three channels: your attendance in the class, your contributions and participation during class discussions, and your presentation of cases across the semester.

Evaluation Methods:

Students will be graded based on class attendance, active engagement and participation, and team presentations.

- Attendance: 20%
- Participation: 40%
- Presentation: 40%

Program and Course Policies

Attendance:

The course will be held virtually. Students are expected to attend *and participate* in all labs and classes.

If for any reason a student will not be in class or lab, they should contact the Course Director and Coordinator prior to the date to alert them. Attendance will be taken at the beginning of each session, please make sure to be on time to be counted as present. Part of attendance consists of using your camera. If you experience technical issues, please let the course director know.

Students are allowed two excused absences. Additional absences will impact the course attendance grade by 1 point for each absence. Students who are absent from any class are at a minimum always responsible for reviewing materials covered during a class. This may include recording, slides, assigned readings, and prepping for presentations.

ITMAT Online Learning Standards and Expectations:

All students taking ITMAT Education online and hybrid courses must ensure that their learning environment for synchronous course meetings is appropriate and free from distractions to themselves, other students, and instructors. Specifically, participate in the session in a physical space and surrounding environment that allows you to devote your full attention to the course meeting. Remain stationary in that location for the duration of class. You are expected to log on using a computer, with working microphone and video capabilities. During each class, your video must be operational and be on at all times, with your background blurred and your microphone muted to minimize unexpected distractions to you and your fellow students. If you identify issues that compromise your ability to meet these expectations, contact the course director to seek ways to resolve the situation in a timely manner.

Two general rules of thumb are (i) if you wouldn't expect your instructor to facilitate a class under any condition or set of conditions, it is equally unacceptable for a student to attend class under those same conditions; (ii) if you would not do something in an in-person classroom environment, it should not be done in a synchronous online class. Some examples of unacceptable conduct during synchronous sessions include attending class while driving; attending class while walking; attending class while also working; attending class while being physically located in a busy environment or an environment likely to be disrupted by other people or significant background noise; attending class using your cell phone.

ITMAT Ed is committed to creating a supportive, respectful, and productive learning environment for all students. Students will remain professional and respectful of their peers, course instructors, and guest lecturers. We expect students to approach debates and disagreements in a thoughtful and respectful manner.

Academic Policies:

As a student at the University of Pennsylvania, you are required to uphold the Code of Academic Integrity. Specifically, this means materials you submit either online or in person should be independent works created by you that uphold all tenets of academic integrity (i.e. do not cheat, fabricate, or plagiarize, amongst others). We encourage you to reach out to the course director or coordinator if you are not clear on what potential violations are.

Course Management System - Canvas:

All course materials and assignments will be posted on Canvas. Log in with your PennKey. Contact the Course Coordinator with questions.

Course Evaluations:

Course evaluations are an opportunity to share feedback on the strengths of the course and opportunities for improvement. We welcome constructive feedback in the BLUE system. Completing evaluations is a required part of course

participation. An email from the BLUE system is sent to students with a link and directions on how to complete the evaluation(s).

Participation and Active Participation:

Participation in class is crucial to students' success. Students will attend and actively engage with the content and participate in discussions in all courses.

Examples of active participation in a synchronous session include:

- asking or answering questions during class
- posting comments in the chat
- collaborating with other students during group work
- sharing relevant expertise with other students and the instructor

ITMAT Education is committed to creating a supportive, respectful, and productive learning environment for all students. Students will remain professional and respectful of their peers, course instructors, and guest lecturers. An important principle of code of conduct is to behave in the virtual space in the same way you would in a work meeting. If you wouldn't do it in a work meeting and/or in-person class, don't do it in the virtual space.

Student Disabilities Services:

The University of Pennsylvania provides reasonable accommodations to students with disabilities who have self-identified and been approved by the office of Student Disabilities Services (SDS). Please make an appointment to meet with your instructor and the course coordinator as soon as possible to discuss your accommodations and your needs. To request accommodations or ask questions, you can make an appointment by calling SDS at 215-573-9235 or accessing the MyWeingartenCenter portal. The office is in the Weingarten Learning Resources Center at Stouffer Commons, 3702 Spruce St., Suite 300. All services are confidential. Learn more about the types of services and accommodations offered by Weingarten.

Late Work, Extensions:

Students must request an extension prior to assignment deadline. Acceptance of late assignments and extensions will be approved at the discretion of the instructor.

Student Conduct:

ITMAT Ed students must comply with the University's Code of Student Conduct and other University policies related to student conduct that appear in The PennBook: Resources, Policies and Procedures Handbook. These include, but are not limited to, policies on sexual harassment, acquaintance rape and sexual violence, appropriate use of electronic resources, open expression, and drug and alcohol usage.

Additional codes of conduct and expectations students should be familiar with are the equal opportunity and nondiscrimination statement, the sexual misconduct policy and resource offices, and student grievance procedures.

Academic Integrity:

The fundamental value of our academic community is intellectual honesty; accordingly, our academic community relies upon the integrity of every member. Students are responsible not only for adhering to the highest standards of truth and honesty but also for upholding the principles and spirit of the Academic Code. Violations of the Code include but are not limited to plagiarism, cheating, and fabrication, among others.

If you have questions regarding what is considered a violation of academic integrity, please review The Code of Academic Integrity in the PennBook.

Alleged violations of the Code of Academic Integrity are reviewed by the Program Director and as necessary referred to the Penn Office of Student Conduct. If a student is unsure whether their action(s) constitute a violation of the Code of Academic Integrity, it is that student's responsibility to consult with the instructor to clarify any ambiguities.

Use of Generative AI:

It is plagiarism to submit work produced by a generative artificial intelligence (AI) service as your own without citing the source. Any use of generative AI services must be in alignment with course requirements and restrictions. Course Directors have full discretion to allow or deny use of ChatGPT or similar AI tools in their courses. Ask the course director for permission before using these tools for course assignments.

Religious and Cultural Holidays:

Religious and cultural holidays are listed on the University of Pennsylvania's Chaplain website. If a student observes any of the listed holidays and they conflict with a class date, please contact the course coordinator with the class date with which the holiday coincides.

If an assignment is due during a holiday, the course director and coordinator will work with the student to determine an alternative due date.

Course Schedule and Content:

Date	Week	Topic
Thurs, Sept 4	**1**	**Introduction to the Course – Framework and Approach** Asking Questions – rigorously defining and interrogating a hypothesis General Form: "I think that X is the cause of / or is related to change in Y among entities in population P"; Operationalizing X, Y and P – defining elements of the hypothesis (what exactly is the purposed causative agent X, how exactly is outcome measure Y coded, how were the number and elements (sample) from population P selected / acquired? Data types – Discrete vs. Continuous **Readings:** Hernan: Causation A.Bradford Hill: Cause Criteria Sullivan Chapter 1 (attention to 1.2), and Chapter 2 (2.1 definitions, 2.2 study designs).
Tues, Sept 9	**2**	**Group Work:** Review of Causation Criteria, Sullivan readings, Review of Article presentation template
Thurs, Sept 11		**The Inferential Method** How do we determine if the evidence supports our hypothesis about the relationship between X and Y? Terms of Art and Definitions: Type I and Type II Errors, Power, Sample size calculations, p-values, Null hypotheses **Readings:** Sullivan Chapter 7 and 8.
Tues, Sept 16	**3**	**Group Work:** Inferential method, Power, Sullivan readings, Review of Article presentation template
Thurs, Sept 18		**How do statistical tests help us adjudicate the hypothesis?**

		The case of two discrete variables (e.g. What if X=Drug vs Placebo, and Y=Improve vs Not Improve): *The Chi-squared Test* – Derivation, Computer output review, Article review **Readings:** Sullivan Chapter 7: section 7.9
Tues, Sept 23	**4**	**Group Work:** Review of Article for presentation
Thurs, Sept 25		**How do statistical tests help us adjudicate the hypothesis?** The Case of a two-level discrete variable vs a continuous variable (e.g. X=Drug vs Placebo, Y=Blood Pressure in mm/Hg): The Two sample t-test – Derivation, Computer output review, Article review **Readings:** Sullivan Chapter 7: Section 7.5
Tues, Sept 30	**5**	**Group Work:** Review of Article for presentation
Thurs, Oct 2		**How do statistical tests help us adjudicate the hypothesis?** The Case of a K-level discrete variable vs a continuous variable (e.g. X=Drug 1, Drug 2, Sham therapy and Placebo groups, Y=Blood Pressure in mm/Hg): *ANOVA:* Derivation, Computer output review, Article review **Readings:** Sullivan Chapter 7: Section 7.8
Tues, Oct 7	**6**	**Group Work:** Review of Article for presentation
Thurs, Oct 9		**How do statistical tests help us adjudicate the hypothesis?** The Case of a continuous variable vs another continuous variable (e.g. X=Weekly Exercise Minutes, Y=Blood Pressure in mm/Hg): *Correlation:* Derivation, Computer output review, Article review **Readings:** Sullivan Chapter 9.3.
Tues, Oct 14	**7**	**Group Work:** Review of Article for presentation
Thurs, Oct 16		**How do statistical tests help us adjudicate the hypothesis? Embracing complexity:** The Case of a Continuous outcome variable and other variables (e.g. Y=Blood Pressure in mm/Hg, X1=Age, or X2=Sex, ….. or Xk=Dose): *Introduction to Linear Regression:* Derivation, Computer output review, Article review **Readings:** Sullivan Chapter 9.3
Tues, Oct 21	**8**	**Group Work:** Review of Article for presentation
Thurs, Oct 23		**How do statistical tests help us adjudicate the hypothesis? Embracing complexity:** The Case of a Continuous outcome variable and other variables at the same time (e.g. Y=Blood Pressure in mm/Hg, X1=Age, and X2=Sex, and ….. Xk=Dose): *Introduction to Multivariable Linear Regression:* Derivation, Computer output review, Article review **Readings**: Sullivan Chapter 9.4.

Tues, Oct 28	**9**	**Group Work:** Review of Article for presentation
Thurs, Oct 30		**How do statistical tests help us adjudicate the null hypothesis? Embracing complexity:** The Case of a Binary outcome variable and other variables (e.g. Y=Improve vs Not Improve, X1=Age, or X2=Sex, or ….. Xk=Dose): *Introduction to the Odds Ratio and Logistic Regression:* Derivation, Computer output review, Article review **Readings:** Sullivan Chapter 9.5
Tues, Nov 4	**10**	**Group Work:** Review of Article for presentation
Thurs, Nov 6		**How do statistical tests help us adjudicate the null hypothesis? Embracing complexity:** The Case of a Binary outcome variable and other variables at the same time (e.g. Y=Improve vs Not Improve, X1=Age, and X2=Sex, and ….. Xk=Dose): *Introduction to Multivariable Logistic Regression:* Derivation, Computer output review, Article review **Readings:** Sullivan Chapter 9.5.
Tues, Nov 11	**11**	**Group Work:** Review of Article for presentation
Thurs, Nov 13		**How do statistical tests help us adjudicate the null hypothesis?** Special topics: the case when the outcome describes time to some event (Y= Time to Discharge or Time to Relapse, or Time to Death): *Introduction to the Kaplan-Meier (KM) method:* Derivation, Computer output review, Article review **Readings:** Sullivan Chapter 11.1-11.3
Tues, Nov 18	**12**	**Group Work:** Review of Article for presentation
Thurs, Nov 20		**How do statistical tests help us adjudicate the null hypothesis? Embracing complexity:** Special topics: the case when the outcome describes time to some event (Y= Time to Discharge or Time to Relapse, or Time to Death, and X1=Age, X2=Sex, …and Xk=Dose): *Introduction to Cox / Proportional Hazards (PH) regression:* Derivation, Computer output review, Article review **Readings:** Sullivan Chapter 11.4-11.5
Tues, Nov 25	**13**	**No scheduled group work**
Thurs, Nov 27		**No Class – Thanksgiving**
Tues, Dec 2	**14**	**Group Work:** Review of Article for presentation
Thurs, Dec 4		**Wrap up**