Syllabus

HPM 883: Advanced Quantitative Methods
for Health Policy and Management
Spring 2026
3 Credits

UNC
GILLINGS SCHOOL
OF GLOBAL
PUBLIC HEALTH

Course Description

This course provides a practical introduction to experimental methods and machine learning techniques with direct applications in health services research.

Course Overview

HPM 883 is an advanced graduate-level course designed to equip PhD students in Health Policy and Management with sophisticated quantitative research skills. This course is the third installment in the quantitative methods sequence, building on foundations from HPM 881 and HPM 882.

The course integrates experimental design principles with modern causal machine learning methods, following a three-layer framework: **Identification → Estimation → Decision**. Students will learn to design rigorous experiments, estimate treatment effects using cutting-edge methods, and translate findings into actionable policy decisions.

Focus Areas:

- Experimental design and randomization inference
- Double/Debiased Machine Learning (DML)
- Heterogeneous treatment effects and causal forests
- Policy learning and optimal treatment rules
- Modern causal inference methods

Prerequisites

HPM 881, HPM 882, or permission of instructor

Instructor

- Sean Sylvia, PhD
- Associate Professor
- Department of Health Policy and Management

- McGavran-Greenberg 1101-D
- Email: sysylvia@email.unc.edu

Teaching Assistant

- Bryan Nice, MPH
- bnice@email.unc.edu

Office Hours

Instructor: Available by Appointment

TA: TBD

Course Website

Find all course content on the main site.

Class Days, Times, Location

Meeting Time: Monday & Wednesday, 11:15am - 12:30pm

Location: Rosenau 228 for lectures and Zoom for labs

Course Format

This is a hybrid course combining ~weekly in-person lectures (theory and discussion) with remote Zoom sessions (coding labs and implementation). This format provides face-to-face interaction for conceptual material while offering flexibility for hands-on coding work. Students are expected to complete the readings before class and come to each class prepared for discussion.

Required Materials

Textbooks

Chernozhukov, V., Hansen, C., Kallus, N., Spindler, M., & Syrgkanis, V. (2025). Applied Causal Inference Powered by ML and AI. Available free at: https://causalml-book.org/

Wager, S. (2024). Causal Inference: A Statistical Learning Approach. Available free at: http://web.stanford.edu/~swager/causal_inf_book.pdf

Software Requirements

All course assignments should be completed using R. RStudio or Positron may be used for IDE.

In addition, we will use GitHub (free for students) for version control and assignment submission as well as Posit Cloud ($5/month) as a backup computing environment.

Course-at-a-Glance

The instructor reserves the right to make changes to the syllabus, including topics, readings, assignments, and due dates. Any changes will be announced as early as possible.

See the course website for the class schedule.

Unit	Topic	Weeks	Content Focus
0	Foundations: Potential Outcomes & DAGs	1	Framework foundations
1	Experimental Design & Randomization	2–3	Design-based inference
2	Double/Debiased Machine Learning	4–6	Semiparametric estimation
3	HTE & Causal Forests	7–8	Treatment heterogeneity
4	Policy Learning	9	Optimal decisions
5	Observational Causal ML	10	Weighting and balance
6	DiD & Synthetic Controls	11	Panel methods
7	Advanced Topics	12	Student choice
8	Integration & Capstone	13–14	Synthesis and presentations

Course Assignments and Assessments

This course will include the following graded assignments that contribute to your final grade in the course. See full descriptions on course website.

Graded Assignments	Points/Percentages of Final Course Grade
1. Problem Sets	30
2. Design Memos	20
3. Capstone Project	40
4. Peer Review	10
Total	**100**

Table 1: List of Graded Assignments

Problem Sets (30%): Take-home assignments where students independently apply course methods to data analysis problems. Approximately 7 problem sets throughout the semester (roughly one every two weeks). The 3 lowest problem set grades will be dropped, allowing flexibility for challenging weeks or unexpected circumstances.

Design Memos (20%): Two written memos (3-5 pages each):

- Memo 1: Experimental design plan with power analysis
- Memo 2: DML analysis plan with estimator specification

Capstone Project (40%): A substantial independent project demonstrating mastery of course methods. Options include:

1. Pre-Analysis Plan (PAP) for proposed research

2. Replication + Extension of published study

3. Methods comparison using simulation or real data

Deliverables: 15-20 page paper, full replication code, 20-minute presentation

Peer Review (10%): Written review of one classmate's capstone project, providing constructive methodological feedback.

Course Grading Scale(s)

Final course grades will be determined using the following UNC Graduate School grading scale. The relative weight of each course component is shown in the Graded Assignments section.

- **H**—High Pass (93-100): Clear excellence
- **P**—Pass (80-92): Entirely satisfactory graduate work

- **L**—Low Pass (70-79): Inadequate graduate work
- **F**—Fail (0-69)

Map of Competencies to Learning Objectives and Assessments Assignments

Below you will see the program competency(ies) you will develop in this course, the learning objectives that comprise the competency(ies), and the assessment assignment(s) in which you will practice demonstrating this competency.

Competency	**Learning Objectives** that comprise the competency	**Assessment Assignment** for evidence of student attainment of competency
Apply appropriate analytical strategies used in health services/health policy research (PhD)	Design randomized experiments with appropriate power analysis, randomization strategies, and variance reduction techniques	Design Memo 1, PS 1, Capstone Project
	Implement Double/Debiased Machine Learning and doubly-robust estimators for causal inference	PS 2, Design Memo 2, Capstone Project
	Estimate heterogeneous treatment effects using causal forests and meta-learners	PS 3, Capstone Project
	Evaluate Conditional Average Treatment Effect (CATE) estimates using calibration diagnostics	PS 3, Capstone Project
	Learn optimal treatment policies from observational data using policy trees	PS 4, Capstone Project
	Apply modern difference-in-differences and synthetic control methods	PS 5, Capstone Project
	Diagnose common problems including overlap violations,	PS 2-5, Design Memos, Capstone Project

	confounding, and model misspecification	
	Produce reproducible research using modern workflow tools	PS 0, All Problem Sets, Capstone Project

Table 2: Competencies mapped to learning objectives and assignments

Expectations, Policies, and Resources

Attendance Policy

Please read the University Attendance Policy.

Regular attendance is expected for both in-person and Zoom sessions. The hybrid format requires active engagement:

- In-person sessions: Theory, discussion, and collaborative problem-solving
- Zoom sessions: Coding labs, implementation, and troubleshooting

Code of Conduct

All students are expected to adhere to University policy and follow the guidelines of the UNC Code of Conduct. Additional information can be found at the UNC Student Code of Conduct website.

Students are bound by the Honor Pledge and University policy in completing academic coursework. Such policies are effective at all times, and the submission of work signifies understanding and acceptance of those requirements. Plagiarism will not be tolerated. Please consult with me if you have any questions about course requirements, academic misconduct, or the Student Code of Conduct. You can also find additional information at the UNC Student Code of Conduct website.

Artificial Intelligence (AI) Use Policy

Carolina students are expected to follow these AI guidelines:

1. AI should help you think, not think for you. You may be able to use these tools to brainstorm ideas, research topics, and analyze problems, but you must decide what's appropriate and accurate.
2. Engage responsibly with AI. You must evaluate AI-generated outputs for potential biases, limitations, inaccuracies, false output, and ethical implications. Do not put personal or confidential data into these tools.

3. The use of AI must be open and documented. You should declare, explain, and cite any use of AI in the creation of your work using applicable standards (e.g., APA, MLA, course guidelines). Understand that you are ultimately 100% responsible for your final product.

In addition to the guidelines above, follow these specific AI guidelines in this syllabus as stated below. If you are unsure, check with me. Guidance offered in this syllabus would be referenced should an issue be referred to Student Conduct for alleged academic misconduct.

In this course, the use of AI tools (such as Claude Code, Codex, GitHub Copilot) is permitted and encouraged for:

- Debugging code
- Understanding error messages
- Learning syntax and package functions
- Generating code snippets for adaptation

However:

- You are responsible for all code you submit—AI-generated code must be understood, tested, and verified
- Conceptual understanding cannot be outsourced; you must be able to explain your methods
- AI use should be acknowledged in your work (e.g., "Code structure suggested by ChatGPT and modified")
- On written components (memos, capstone paper), AI may assist with editing but substantive content must be your own

The goal is to prepare you for a world where AI tools are standard practice while ensuring you develop genuine methodological understanding.

Gillings Community

Shared values such as mutual respect, intellectual humility, interdisciplinary collaboration, and commitment to public health ethics form the foundation of our teaching and learning, research, public health practice, professional networks, and community engagement. In this spirit, we strive to foster an environment across the school that welcomes and values all individuals while supporting their development and success. A new Gillings Community Plan designed to help us uphold and advance these values – core to the Gillings mission - is in development; we anticipate its adoption in Fall 2025.

Additional campus resources include: UNC Student Affairs, including the LGBTQ Center; Non-Discrimination Policies at UNC Chapel Hill; Ombuds; and Prohibited Discrimination, Harassment, and Related Misconduct at UNC Chapel Hill.

Technical Support

The best way to help prevent technical issues from causing problems for assignments and quizzes is to submit them at least 36 hours before the due date and time. Your instructor cannot resolve technical issues, but it's important to notify them if you are experiencing issues. If you have problems submitting an assignment or taking a quiz in Canvas, immediately do the following:

1. Contact the UNC Information Technology Services (ITS) department with the time you attempted to do your course action and what the course action was.
2. Email your instructor with the information you sent to ITS and what time you sent the information.

The ITS department provides technical support 24-hours per day, seven days per week. If you need computer help, please contact the ITS Help Desk by phone at +1-919-962-HELP (4357), or by online help request, or by UNC Live Chat.

Course Communication

- **Course Slack** workspace for questions, discussion, and announcements. Do NOT post anything private or personal in Slack.
- **Email**: For private matters (grades, accommodations, personal circumstances)
- **Canvas**: Grade posting and official announcements

Response times: Slack/email within 24-48 hours on weekdays; longer on weekends.

Appropriate Use of Course Resources

Please read the Appropriate Use of Course Resources.

Equal Opportunity and Compliance – Accommodations

Please read the Equal Opportunity and Compliance – Accommodations.

Policy on Non-Discrimination

Please read the Policy on Non-Discrimination.

Title IX and Related Resources

Please read the Title IX and Related Resources.

Counseling and Psychological Services (CAPS) at UNC Chapel Hill

Please read the Counseling and Psychological Services (CAPS) at UNC Chapel Hill.

Student Feedback and Concerns

Please read the Student Feedback and Concerns.

Safety and Emergency Information at Gillings

Please read the Safety and Emergency Information at Gillings.

Syllabus Changes

The instructor reserves the right to make changes to the syllabus including project due dates and test dates. These changes will be announced as early as possible.