Quantitative Methods in Health Systems Research I

HAD 5744
Fall 2024

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Class time and location: Fridays, 1pm-3pm. MS 4171 (1 King's College Circle)

Office hours: Book appointments at calendly.com/Hoagland-office-hours/

- Mondays: 1:00pm to 2:30pm
- Fridays: 3:00pm to 4:00pm
- By appointment.
- All appointments are by Zoom unless arranged otherwise in advance.
- Please note that I typically respond to emails and other class communication during normal "business hours," and not on evenings, weekends, or holidays.

Course Description: Introduces quantitative (econometric) methods frequently used in health systems research, as well as in applied health economics and health policy. In many applications, researchers want to understand a process by which data and outcomes are generated; however, many data generating processes (DGPs) are possible given observed data. This course deals with how to determine *which* DGPs, and hence which "story", has generated your data. The course uses applications of statistical tests and procedures in the context of distinguishing between models and explores the applications of a range of frameworks to the types of questions addressed by social scientists and health services researchers. It is assumed that students have basic (graduate) training in statistics.

Evaluation Criteria

- Assignments: 3 group assignments, each worth 20% of the final grade.
- Proposal or Referee Reports (see below): worth 40% of the final grade.

Assignments are to be completed using R or STATA.[1] Assignments and data sets will be posted on the course website. Due dates are listed on the schedule below. The assignments **must be submitted via email** before class on the due date. Assignments may be done in groups, but each person must submit their own code and output.

- Late assignments will be penalized at the rate of 10 percentage points per day.
- Any requested extension longer than 3 days must be made with a formal accommodation from Accessibility Services and must be made a week before the deadline.

[1] I strongly encourage you to use R unless you feel very comfortable with Stata. We will only discuss R coding principles and examples in class; in previous years, students have attempted to use Stata and then felt they could not engage in group assignments as easily, given the lack of Stata supports. Unfortunately, we can't cover all the coding languages we would like to in only 14 weeks!

In addition, each student must complete **a major evaluation or major paper**. **PhD students are expected to do a paper; MSc students have the option to either write 2 referee reports over the course of the semester, or to be a part of a paper.**

Major Paper**:** The paper provides students with an opportunity to undertake an investigation of a research question of their own choosing on a self-contained topic within the fields of health economics or health services research. Writing will also help with communication skills and familiarization with the structure of journal manuscripts. **Students are expected to pair up in groups of no more than four (and no less than two) to produce a paper.**

To find data for the project, I recommend using publicly available data: a primer on where to look can be found here. For example, there are public use files for the Canadian Community Health Survey (CCHS). Other health related surveys can be downloaded at CHASS (https://datacentre.chass.utoronto.ca/) We will discuss these options more in class.

Students will hand in an outline of their major paper due November 1. The major paper must include a brief introduction and literature review, description of data, variables, and methods employed. The final paper should include these as well as results, discussion and conclusion. The paper should be presented in the form of a journal manuscript (either health economics/policy or clinical). The final paper is due December 16.

Referee Reports: If you are an MSc student and are not doing a paper proposal, you must instead submit **2 referee reports** over the course of the semester. A referee report critically evaluates a recent HSR paper for its statistical (internal) validity and causal inference techniques, as well as providing suggestions for improvement and future work. For each course topic, there is a list of papers indicated on the reading list (there are approximately three choices per topic). **You must select papers from two different topics.** Your referee report should include: (1) a brief summary of the paper; (2) major concerns you have, including any potential flaws or drawbacks you see in the modeling choices; and (3) minor concerns you have, including ideas for extensions and future research. Your referee report should be no more than 3 pages long. **Reports are due one week after the topic has been covered in class.** Late reports will be discounted by 10 percentage points per day late.

Grading scale: Courses taken for graduate credit are assigned a letter grade according to the School of Graduate Studies usage as follows. While course grades may be collectively "curved," no individual grades will be rounded. Please do not ask me to round your grade, as this introduces inequity to other students, and does not come off well for a graduate student in a required methods course of a graduate degree.

Letter Grade	Grade Meaning	Numerical Marks (%)
A+	Excellent	90%-100%
A		85%-89.9%
A-		80%-84.9%
B+	Good	77%-79.9%
B		73%-76.9%

B-		70%-72.9%
FZ	Inadequate	0-69%

Course website: This course has a GitHub repository that contains all relevant materials; you can access the repo at https://github.com/alex-hoagland/HAD5744. Each lecture has a folder containing slides, code, and example papers. The assignments folder contains the relevant questions and data sets. Materials will be updated and/or added throughout the semester.

Software: We will make use of R and RStudio. You do not need a license for R or RStudio and it can be downloaded for free at https://www.r-project.org/ and https://rstudio.com/. Learning R or any program for the first time can be frustrating. Sometimes you can get really bogged down from not knowing a simple command or syntax. This is normal, and part of the learning process. The best way to learn is by relying on the built-in help functions, online short tutorials, class participation or by taking a short course. I am happy to respond to specific questions during office hours and class.

In addition to our Assignment 0, which was circulated before the beginning of the term, I recommend these additional resources for getting started with R:

- These slides: https://nickch-k.github.io/EconometricsSlides/Week_01/Week_01_Slides_2_Starting_R.html#1.
- An introductory 2-hour R session will be offered on September 13 and an introductory session on STATA will be offered on September 20 by the Canadian Centre for Health Economics (CCHE) as part of the CCHE Friday seminar series from 10:00 a.m. to 12:00 p.m.

Required texts: Both books have a free e-book version or are relatively cheap buys on Amazon. I *highly* recommend owning print copies if you plan to pursue applied research – they are both very handy. **Course readings are expected to be completed prior to class.**

- "The Effect," Nick Huntington-Klein (NHK).
- "Causal Inference: The Mixtape," Scott Cunningham (SC).

Additional (non-required) reading:

- "Principles of Econometrics, 5th edition", R. Carter Hill, William E. Griffiths and Guay C. Lim (HGL).
- A useful online resource: https://tinyurl.com/bdzxbxce
- Example papers for each method are included in the GitHub repo.

Statement on Generative AI in Course Content and Materials: Students may use artificial intelligence tools, including generative AI and GitHub Copilot, in this course as learning aids or to help produce assignments. However, students are ultimately accountable for the work they submit and should document for each assignment in an appendix how these tools were used. The documentation should include what tool(s) were used, how they were used, and how the results from the AI were incorporated into the submitted work.

- *Note*: GitHub Copilot is free for students and easy to integrate into R Studio – I highly recommend you take advantage of it! Our Assignment "0" goes over details on installation of Copilot into RStudio.

Course Schedule

Session #	Date	Lecture / Readings *All case studies should be read before class*	Assignments Due
1	Sep. 13	**Econometric Philosophies: DAGs and Potential Outcomes** • SC Introduction, Chapters 2-3 (p. 96-148)	
2	Sep. 20	**Coding/Probability Review, Univariate OLS** • SC, Chapter 1 (p. 16-58) • HK, Chapter 4	
3	Sep. 27	**Regression I: Setup & Inference** • SC, Chapter 1 (pg. 63-95) • HK, Chapter 12-13 (pg. 175-200)	
4	Oct. 4	**Regression II: Additional Topics** • HK, Chapter 13 (pg. 201-266; can omit pages 226-232) *Case Study:* Michaelsen, M. M., & Tolan, S. (2012). Children at Risk: The Effect of Crop Loss on Child Health in Rural Mexico. *Ruhr Economic Paper*, (376).	
5	Oct. 11	**Data Cleaning and Research Designs** • "Everything is a Remix" (YouTube video, ~30 minutes)	• **Assignment 1 due**
N/A	Oct. 18	**No class, Fall Reading Week**	
6	Oct. 25	**Matching Methods** • SC, Chapter 4 (p.175-240) • HK, Chapter 14 *Case Study:* Shahidi, F. V., Muntaner, C., Shankardass, K., Quiñonez, C., & Siddiqi, A. (2019). The effect of unemployment benefits on health: a propensity score analysis. *Social Science & Medicine*, *226*, 198-206.	• **Research Question + Teams due**
N/A	Oct. 28	**Add/drop deadline**	
7	Nov. 1	**Instrumental Variables Regression** • HK, Chapter 19 (also chapter 9 if you're interested in front-door approaches) • SC, Chapter 7 (p. 315-385) *Case Study:* Eliason, P., Heebsh, B., League, R., McDevitt, R., & Roberts, J. (2022). The effect of bundled payments on provider behavior and patient outcomes: evidence from the dialysis industry. *R&R, American Economic Revie*	
8	Nov. 8	**Limited Dependent Variables I: Binary and Count Data** • HK, pages 226-232 *Case Study:* Bruhin, A., Goette, L., Haenni, S., & Jiang, L. (2020). Spillovers of prosocial motivation: Evidence from an intervention study on blood donors. *Journal of health economics*, *70*, 102244.	**Paper Outline due**
9	Nov. 15	**Limited Dependent Variables II, and Identification** *Case Studies (2!):* - Buchmueller, T. C., Jacobson, M., & Wold, C. (2006). How far to the	

		hospital?: The effect of hospital closures on access to care. *Journal of health economics*, *25*(4), 740-761. - Kreider, B., Manski, R. J., Moeller, J., & Pepper, J. (2015). The effect of dental insurance on the use of dental care for older adults: a partial identification analysis. *Health economics*, *24*(7), 840-858. - **Optional reading:** Hoagland (2024). "Innovations and Inequities in Access to Medical Services" Working paper.	
10	Nov. 22	**Differences-in-Differences** ***Guest Lecture*:** Renzo Calderon Anyosa, IHPME Postdoc • HK, Chapter 18 • SC, Chapter 8-9 (p. 406-510) *Case Study:* Kessler, J. B., & Roth, A. E. (2014). *Don't take 'no' for an answer: An experiment with actual organ donor registrations* (No. w20378). National Bureau of Economic Research.	**Assignment 2 due**
11	Nov. 29	**Synthetic Controls & Quantile Regression** • SC, Chapter 10 (p. 511-539) • HK, Section 21.2.1 (pages 555-559) *Case Studies (2!):* - Geloso, V., & Pavlik, J. B. (2021). The Cuban revolution and infant mortality: A synthetic control approach. *Explorations in Economic History*, *80*, 101376. - Carrieri, V., & Jones, A. M. (2017). The income–health relationship 'beyond the mean': New evidence from biomarkers. *Health economics*, *26*(7), 937-956.	
12	Dec. 6	**Class Presentations** • Please review each other's slides prior to class	**Assignment 3 due, Class Presentations**
N/A	Dec. 16	--	**Final Paper Due**