Intermediate Statistics for Health Service Researchers

HAD 5772
Winter 2025

Instructor: Alex Hoagland, Ph.D.
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Class time and location: Thursdays, 12:00pm to 2:00pm. MS 4171 (1 King's College Circle)

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

- Thursdays 10:00am to 11:30am or 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: This course is designed to provide introductory background in statistical thinking, and to prepare students in the following areas: data handling, cleaning, and visualization in R; correlation; confidence intervals and hypothesis testing; regression; and applications to health systems research. This course is preparatory for students planning to do quantitative research and pursue the quantitative methods courses offered at IHPME (5744 and 5746).

Course Objectives:
At the end of this course, students should be able to:

- Use the computer program R for data management, statistical exploration, and analysis.
- Demonstrate an understanding (both conceptual and practical) of analytical approaches.
- Identify and execute appropriate analytical approaches to address specific research questions and collected data.
- Understand, explain, and present analytical results.
- Interpret and critique analytical methods used in the cutting edge of quantitative health systems research.

Evaluation Criteria

- Assignments: 5 group assignments, collectively worth 60% of the final grade.
- Final Project: One group project, worth 40% of the final grade.

Assignment: There are 5 assignments, which can be completed in groups of 2-5, although each individual must make their own submission. The purpose of each assignment is for you to demonstrate that you can perform the analyses covered in this course and interpret the results. Late assignments will be **discounted by 10 percentage points per day late.** No assignments will be dropped from the grade barring exceptional circumstances.

Final project: The project 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 policy briefs. **Students are expected to pair up in groups of no more than five (and no less than two) for their projects.**

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. Assignment details and a rubric are provided on the GitHub repository. **Final projects are due April 10.**

Course website: This course has a GitHub repository that contains all relevant materials; you can access the repo at https://github.com/alex-hoagland/HAD5772.

Suggested textbooks: Our lectures are self-contained, but I recommend readings from (and frequently incorporate lecture material from) the following textbooks:

- *Intuitive Biostatistics: A Nonmathematical Guide to Statistical Thinking* (Harvey Motulsky).
- *The Effect,* Nick Huntington-Klein. (This one is free online!)
- Statistical Inference, 2002 (Casella and Berger)
- Regression and Other Stories: https://avehtari.github.io/ROS-Examples/

Selected Course Policies

Attendance Policy: This course is a fully in-person course and students are expected to attend all sessions that they are able to. While you do not need to excuse your absences with me in general, I reserve the right to reduce marks for students who are consistently absent from or do not participate in class.

Lectures are recorded conditional on classroom resources and feasibility; however, these recordings are not made publicly available or posted online, including on Quercus. Recordings may be shared upon request to make up for class absences or as an additional course resource; however, recordings may not be used as a replacement for in-person attendance. Please email me if you have any questions or are concerned about being recorded; otherwise, I will assume all students are okay being recorded.

Grading scale: Courses taken for graduate credit are assigned a letter grade according to the School of Graduate Studies usage as follows:

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%

Note that 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.

Statement on Generative AI in Course Content and Materials: Students may use artificial intelligence tools, including generative AI, in this course as learning aids or inputs into assignments. We will cover ways to utilize AI in quantitative research, including as a support for programming; however, we will also highlight the ways that these tools fail at discussing and evaluating statistical concepts. Any work that is clearly generated completely by generative AI will be deemed plagiarism, which will result in a grade of 0 for any assignment and a referral to the Academic Integrity office. **Students are ultimately accountable for the work they submit.**

Course Schedule

Session	Date	**Lecture / Readings**	**Due Dates**
1	Jan. 9	Introduction • HK, Introduction + Chapters 1-2 • Motulsky, Chapters 1-3	
2	Jan. 16	Programming in R + Descriptive Statistics • HK, Chapters 3-4 (through p. 46)	
3	Jan. 23	Visualizing data + Research Designs • HK, Chapters 4-5 (resuming on p.47) • https://experimentology.io/015-viz.html • Motulsky, Chapters 7-9; 32	Assignment 1 due
4	Jan. 30	Measuring uncertainty I: standard errors + confidence intervals • Motulsky, Chapters 4-6 (emphasis on 4)	
5	Feb. 6	Measuring uncertainty II: standard errors + confidence intervals • Motulsky, Chapters 10-11	Assignment 2 due
6	Feb. 13	Hypothesis Testing I: Statistical Significance • Motulsky, Chapters 12-14	
	Feb. 17-21	**No class – Winter Reading Week**	
7	Feb. 27	Hypothesis Testing II: *p*-values and Practical Applications Motulsky, Chapter 16-17	
	Feb. 28	**Deadline to drop without academic penalty**	
8	Mar. 6	Linear Regression I: Bivariate Regression Models • HK, Chapters 12-13 • Motulsky, Chapters 33-35	Assignment 3 due
9	Mar. 13	Linear Regression II: Multivariate Regression + Applications • HK, Chapter 6-8 • Motulsky, Chapters 37-38	
10	Mar. 20	Linear Regression III: Causality and Model-based Inference • HK, Chapter 14 • **Paper**: Dayan, N., et al. (2019). "Infertility treatment and risk of severe maternal morbidity: a propensity score–matched cohort study." *CMAJ, 191*(5), E118-E127.	Assignment 4 due
11	Mar. 27	Applications II: Survival Analysis and Mixed Methods • **Paper**: Bohm, E., Loucks, L., Wittmeier, K., Lix, L. M., & Oppenheimer, L. (2015). "Reduced time to surgery improves mortality and length of stay following hip fracture: results from an intervention study in a Canadian health authority." *Canadian Journal of Surgery, 58*(4), 257. • **Paper**: Hansen, N., Jensen, K., MacNiven, I., Pollock, N., D'Hont, T., & Chatwood, S. (2021). "Exploring the impact of rural health system factors on physician burnout: a mixed-methods study in Northern Canada." *BMC health services research, 21*(1), 1-10.	
	Apr. 3	**No Class**	Assignment 5 due
12	Apr. 10	Final project presentations	Final project due