Causal Inference

Cornell STSCI / INFO / ILRST 3900 Fall 2024 causal3900.github.io

27 Aug 2024

Welcome to Causal Inference!



Mayleen Cortez-Rodriguez



Sam Wang



Filippo Fiocchi



Shira Mingelgrin

Why causal inference?

What motivated you to take this course?

Why causal inference?

Why are we teaching this course?

Why causal inference?

Why are we teaching this course?

Causal inference provides tools to

- Understand the world
- Speak to policy interventions

Examples of causal questions

Card and Krueger (2000) ask if increasing the minimum wage results in a causes the employment rate to increase

Examples of causal questions

- Card and Krueger (2000) ask if increasing the minimum wage results in a causes the employment rate to increase
- ► Kearney and Levine (2015) ask if the reality TV show "16 and Pregnant" caused a decrease in US teen pregnancy rates

Examples of causal questions

- Card and Krueger (2000) ask if increasing the minimum wage results in a causes the employment rate to increase
- ► Kearney and Levine (2015) ask if the reality TV show "16 and Pregnant" caused a decrease in US teen pregnancy rates
- Yam and Lopez (2019) ask if NFL teams would win more games if they tried to convert 4th downs more often

Observing



Image source: Wikimedia

Observation:

People who eat a Mediterranean diet have lower rates of cardiovascular disease

Circulation Volume 99, Issue 6, 16 February 1999; Pages 779-785 https://doi.org/10.1161/01.CIR.99.6.779



CLINICAL INVESTIGATION AND REPORTS

Mediterranean Diet, Traditional Risk Factors, and the Rate of Cardiovascular Complications After Myocardial Infarction

Final Report of the Lyon Diet Heart Study

Michel de Lorgeril, Patricia Salen, Jean-Louis Martin, Isabelle Monjaud, Jacques Delaye, and Nicole Mamelle

Circulation Volume 99, Issue 6, 16 February 1999; Pages 779-785 https://doi.org/10.1161/01.CIR.99.6.779



CLINICAL INVESTIGATION AND REPORTS

Mediterranean Diet, Traditional Risk Factors, and the Rate of Cardiovascular Complications After Myocardial Infarction

Final Report of the Lyon Diet Heart Study

Michel de Lorgeril, Patricia Salen, Jean-Louis Martin, Isabelle Monjaud, Jacques Delaye, and Nicole Mamelle

Heart attack survivors randomized to

- ► advice to follow a Mediterranean diet
- advice to follow a prudent diet

(treatment) (control)

Circulation Volume 99, Issue 6, 16 February 1999; Pages 779-785 https://doi.org/10.1161/01.CIR.99.6.779



CLINICAL INVESTIGATION AND REPORTS

Mediterranean Diet, Traditional Risk Factors, and the Rate of Cardiovascular Complications After Myocardial Infarction

Final Report of the Lyon Diet Heart Study

Michel de Lorgeril, Patricia Salen, Jean-Louis Martin, Isabelle Monjaud, Jacques Delaye, and Nicole Mamelle

Heart attack survivors randomized to

- ► advice to follow a Mediterranean diet
- advice to follow a prudent diet

(treatment) (control)

Outcome: Recurrent heart attack or death



As a result of participating in this course, students will be able to

- define counterfactuals as the outcomes of hypothetical interventions
- identify counterfactuals by causal assumptions presented in graphs
- estimate causal quantities by pairing those assumptions with statistical evidence

COURSE LOGISTICS

Who should take this course?

The course is designed for upper-division undergraduate students.

Prerequisites.

An introductory statistics course at the level of STSCI 2110, PAM 2100, PSYCH 2500, SOC 3010, ECON 3110, or similar courses.

All materials will be posted here:

causal3900.github.io

- Post questions on Ed Discussion
- Office hours—listed at who we are page

Course readings



Typesetting

R Markdown

As soon as possible, you should

- ► Install R
- Install RStudio

- (statistical software)
 - (user interface)

Bookmark the RMarkdown cheat sheet

(documentation)

Note: 20% penalty for reported results that are not reproducible

Method of assessing student achievement

Problem sets 55% Class project 35% In-class assignments 5% Peer grading 5% Each student in this course is expected to abide by the Cornell University Code of Academic Integrity. Any work submitted by a student in this course for academic credit must be the student's own work.

Generative AI tools should not be used for generating text/code on assignments unless explicitly allowed.

Collaboration

- Encouraged to work together
- Consulting help is great
- Should never involve one student having possession of a copy of all or part of work done by someone else, in the form of an email, an email attachment file, or a hard copy

Late work

- ▶ 5 flex days to be used on problem sets with no questions
- Each day beyond your 5 deducts 10% of the assignment's total points
 - max score after 1 day late is 90%
 - max score after 2 days late is 80%
- Exceptions to this policy in exceptional circumstances; come talk to us.
- ► Minimum grade value of 50%

Attendance

Public health matters-stay home if sick! Let us know.

Otherwise, we hope to see you in class and discussion.

Students with disabilities

You belong in this course. We are happy to work with you on appropriate accomodations—see the syllabus for details about working with Student Disability Services.

Mental health and wellbeing

Your health and wellbeing are important to us!

See syllabus for links to mental health resources. We hope our course helps you thrive a Cornell, and your thriving at Cornell is far more important than anything in this course.

Course environment discussion

- ▶ What does a successful learning experience look like to you?
- What conditions are needed in order for you to feel welcome participating in class?

Poll everywhere

Questions

We look forward to exploring causal inference together!

- Card, D. and Krueger, A. B. (2000). Minimum wages and employment: a case study of the fast-food industry in new jersey and pennsylvania: reply. *American Economic Review*, 90(5):1397–1420.
- Kearney, M. S. and Levine, P. B. (2015). Media influences on social outcomes: The impact of mtv's 16 and pregnant on teen childbearing. *American Economic Review*, 105(12):3597–3632.
- Yam, D. R. and Lopez, M. J. (2019). What was lost? a causal estimate of fourth down behavior in the national football league. *Journal of Sports Analytics*, 5(3):153–167.