

STSCI 3900 / INFO 3900 / IRST 3900: Causal Inference.

Fall 2024

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Instructors

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Office Hours

Thur 10:15-11:15
Tues 4:00-5:00

TAs

Shira Mingelgrin, sm2267@cornell.edu,
Filippo Fiocchi, ff257@cornell.edu,

Wed 3:00-4:00
Mon 11:00-12:00

Where to send questions. Please post questions on Ed Discussion (accessible through Canvas). This includes substantive questions about the material as well as administrative questions about the course. You will get a faster answer because all of the course staff and your peers are on Ed. When possible, use Ed rather than email.

Credits

3.0 Credits, Student Option Grading (Letter, S/U)

Time and Location

Lecture TTh 9:05–9:55, 28 total meetings
Phillips Hall 101

Discussion section, 14 total meetings

W 9:05–9:55	W 10:10–11:00	W 11:15–12:05	W 12:20–1:10	W 1:25–2:15
Hollister Hall 314	Hollister Hall 368	Hollister Hall 312	Snee Hall 2154	Hollister Hall 368
Filippo	Filippo	Filippo	Shira	Shira

Course description. Causal claims are essential in both science and policy. Would a new experimental drug improve disease survival? Would a new advertisement cause higher sales? Would a person's income be higher if they finished college? These questions involve counterfactuals: outcomes that would be realized if a treatment were assigned differently. This course will define counterfactuals mathematically, formalize conceptual assumptions that link empirical evidence to causal conclusions, and engage with statistical methods for estimation. Students will enter the course with knowledge of statistical inference: how to assess if a variable is associated with an outcome. Students will emerge from the course with knowledge of causal inference: how to assess whether an intervention to change that input would lead to a change in the outcome.

Course objectives. 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 counterfactual outcomes by pairing those assumptions with statistical evidence

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.

Instructional format. Lecture and discussion section.

Course readings. Readings will be available online for free. Lecture slides will also be posted on the course website. Readings may come from:

Hernán, M.A., and J.M. Robins. 2020. *Causal Inference: What If?* Boca Raton: Chapman & Hall / CRC. PDF available at hsph.harvard.edu/miguel-hernan/causal-inference-book/.

Typesetting. Problem sets will be typeset using RMarkdown, which is a language that easily embeds code and results in a single reproducible document. RMarkdown will be taught.

Method of assessing student achievement. Grades will be determined by:

Problem sets	55%
Course project	35%
In-class assignments	5%
Peer grading	5%

For details, see [Assignments](#).

Grading scale. Course grades will be assigned on the following scale:

		$87\% \leq x < 90\%$	B+	$77\% \leq x < 80\%$	C+	$67\% \leq x < 70\%$	D+
$93\% \leq x \leq 100\%$	A	$83\% \leq x < 87\%$	B	$73\% \leq x < 77\%$	C	$63\% \leq x < 67\%$	D
$90\% \leq x < 93\%$	A-	$80\% \leq x < 83\%$	B-	$70\% \leq x < 73\%$	C-	$60\% \leq x < 63\%$	D-
						$0\% \leq x < 60\%$	F

Assignments

Problem sets. Students will complete problem sets on their own which will involve a combination of conceptual questions, data analysis, visualization of results, and written summaries.

Course project. There will be a group research project which will involve defining a causal question, outlining key assumptions, analyzing a data set, and presenting the findings. Various pieces of the project will be completed throughout the semester and a short write-up will be due by the end of the semester.

In-class assignments. This class is interactive and participatory, and we expect you to be engaged in class and section. While there will not be a formal grade for participation, we will have periodic in-class assignments which will be graded for completion.

Peer grading. A principle on which this course is built is that you will offer feedback to one another. Following this principle, after each problem set is submitted you will be assigned to anonymously grade the problem sets of three peers in Canvas. You will assign points using a rubric and offer constructive comments.

Course Management

Academic integrity. 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. The explicit use of generative AI (e.g., ChatGPT, Llama, Claude, etc) is not allowed for generating text/code for assignments unless the question explicitly mentions that it is allowed.

Reproducibility. A key principle of science is that we be transparent about the procedures that produced any reported result. In this course, all statistical results will be accompanied by the code that produces them (e.g., via RMarkdown). If a reported result should be generated by code and is clearly not generated by the accompanying code, we will impose a reproducibility penalty by subtracting off 20% of the total possible points on the assignment.

Collaboration. You are encouraged to work together and to discuss information and concepts covered in lecture and the sections with other students. You can give "consulting" help to or receive "consulting" help from such students. However, this permissible cooperation 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, so that the max score after 1 days late is 90% and the max score after 2 days late is 80%. We will make exceptions to this policy in exceptional circumstances; come talk to us. Minimum grade value of 50%.

Attendance. Attendance in class is expected. However, public health is also important. If you are feeling unwell, please stay home from class and send us an email to let us know.

Students with disabilities.¹ Your access in this course is important to us. Please request your accommodation letter early in the semester, or as soon as you become registered with Student Disability Services (SDS), so that we have adequate time to arrange your approved academic accommodations.

- Once SDS approves your accommodation letter, it will be emailed to both you and me. Please follow up with us to discuss the necessary logistics of your accommodations.
- If you experience any access barriers in this course, such as with printed content, graphics, online materials, or any communication barriers; reach out to us or SDS right away.
- If you need an immediate accommodation, please speak with us after class or send an email message to us and to SDS at sds_cu@cornell.edu.
- If you have, or think you may have a disability, please contact Student Disability Services for a confidential discussion: sds_cu@cornell.edu, 607-254-4545, sds.cornell.edu.

Mental health and wellbeing. Your health and wellbeing are important to us. There are services and resources at Cornell designed specifically to bolster undergraduate, graduate, and professional student mental health and well-being. Remember, your mental health and emotional well-being are just as important as your physical health. If you or a friend are struggling emotionally or feeling stressed, fatigued, or burned out, there is a continuum of campus resources available to you: mentalhealth.cornell.edu/get-support/support-students. Help is also available any time day or night through Cornell's 24/7 phone consultation (607-255-5155). You can also reach out to me, your college student services office, your resident advisor, or Cornell Health for support.

¹This statement is based on [guidelines](#) from Student Disability Services.