

**University of Florida**  
**College of Public Health & Health Professions Syllabus**  
**PHC 6937: Causal Inference (3 credit hours)**

Spring: 2023

E-Learning: [lss.at.ufl.edu](http://lss.at.ufl.edu)

---

Instructor Name: Feifei Xiao, Ph.D.

Office Number: CTRB 5227, Phone Number: 352-294-5917

Email Address: [feifeixiao@ufl.edu](mailto:feifeixiao@ufl.edu)

Course Hours: Tuesday 8:30am-9:20am and Thursdays 8:30am-10:25am

Course Location: HPNP G-316

Office Hours: Thursday 1:00pm-2:00pm and by appointment

---

Prerequisites: Courses in introductory statistics, regression, and computer programming. Some knowledge of R. Students must own a computer that can run the statistical package R, which is freely available at <http://cran.r-project.org/>.

---

## **PURPOSE AND OUTCOME**

### **Course Overview**

Concepts and methods for causal inference from randomized trials and observational studies.

### **Relation to Program Outcomes**

This course serves the knowledge and skills student learning objectives by preparing students to communicate the underpinning of biostatistics concepts and methods and to apply biostatistical concepts and methods on one's own, including interpretation and communication of results.

### **Course Objectives and/or Goals**

Upon successful completion of the course, students should be able to:

- Formulate and explain assumptions required for causal inference from randomized trials or observational studies.
- Target appropriate causal effect measures, understanding the implications for effect-measure modification.
- Adjust for confounding using statistical methods such as standardization with an exposure or outcome model, difference-in-differences estimation, instrumental variables estimation, front-door adjustment, and propensity-score adjustment.
- Use causal directed acyclic graphs to formulate and assess statistical methods for causal inference.
- Incorporate precision variables in analyses of randomized trials.
- Conduct mediation analyses.
- Adjust for time-dependent confounding.

### **Instructional Methods**

Lectures with slides, data analysis demonstrations in R, and discussions. Homework assignments for each chapter and two take-home exams

---

## DESCRIPTION OF COURSE CONTENT

### Topical Outline/Course Schedule

1. Introduction: A Brief History, Data Examples (Jan 10, 12)
2. Conditional Probability and Expectation (Jan 17, 19)
3. Potential Outcomes and the Fundamental Problem of Causal Inference (Jan 24, Jan 26)
4. Effect-measure Modification and Causal Interaction (Jan 31, Feb 2)
5. Causal Directed Acyclic Graphs (Feb 7, 9)
6. Adjusting for Confounding: Backdoor Method via Standardization (Feb 14, 16, 21, 23)
7. TAKEHOME EXAM 1: Handed out Feb 23, Return Mar 2
8. Adjusting for Confounding: Difference-in-Differences Estimators (Feb 28, Mar 2)
9. Adjusting for Confounding: Front-Door Method (Mar 7, 9)
10. Adjusting for Confounding: Instrumental Variables (Mar 21, 23)
11. Adjusting for Confounding: Propensity-Score Methods (Mar 28, 30)
12. Gaining Efficiency with Precision Variables (Apr 4, Apr 6)
13. TAKEHOME EXAM 2: Handed out Apr 6, Return Apr 13
14. Mediation (Apr 11, 13)
15. Adjusting for Time-Dependent Confounding (Apr 18, 20)
16. Review of Course, Discussion, and Farewell (Apr 26)

### Course Materials and Technology

Required text: *Fundamentals of Causal Inference (2021)*, by Babette A. Brumback, Boca Raton: Chapman & Hall, forthcoming. A pdf is posted on e-Learning for your use, provided you do not share with anyone outside of the class.

Recommended texts:

- *Causal Inference: What If* (2020), by Miguel A. Hernan and James M. Robins, Boca Raton: Chapman & Hall/CRC, forthcoming. Available for free download at <https://www.hsph.harvard.edu/miguel-hernan/causal-inference-book>, but please use the version posted on e-Learning so that everyone has the same one.
- *The Book of Why: The New Science of Cause and Effect* (2018), by Judea Pearl and Dana Mackenzie, Basic Books, New York, NY.
- Additional Course Materials Available via E-Learning at [lss.at.ufl.edu](https://lss.at.ufl.edu)

For technical support for this class, please contact the UF Help Desk at:

- [Learning-support@ufl.edu](mailto:Learning-support@ufl.edu)
- (352) 392-HELP - select option 2
- <https://lss.at.ufl.edu/help.shtml>

---

## ACADEMIC REQUIREMENTS AND GRADING

### Assignments

Students are expected to be actively involved in each class, including sharing comments of required reading, discussing answers and questions to homework assignments, and participating in class discussion.

The overall grade will include quizzes, class participation and two in-class exams. Class participation will include weekly attendance, sharing reading comments, and leading and participating in discussion. Students are encouraged to discuss either in groups or with the instructor on homework assignments.

Class participation: 10%; Homework: 30%

Exam 1 (mid-semester): 30%; Exam 2 (final week of classes): 30%

The grading scale for this course consists of the standard scale, including minus grades, below. Percentages will be rounded to the nearest grade.

93% - 100% = A

90% - 92% = A-

87% - 89% = B+

83% - 86% = B

80% - 82% = B-

77% - 79% = C+

73% - 76% = C

70% - 72% = C-

67% - 69% = D+

63% - 66% = D

60% - 62% = D-

Below 60% = E

Please be aware that a C- is not an acceptable grade for graduate students. A grade of C counts toward a graduate degree only if an equal number of credits in courses numbered 5000 or higher have been earned with an A.

Letter grade to grade point conversions fixed by UF:

Letter Grade	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E	WF	I	NG	S-U
Grade Points	4.0	3.67	3.33	3.0	2.67	2.33	2.0	1.67	1.33	1.0	0.67	0.0	0.0	0.0	0.0	0.0

For greater detail on the meaning of letter grades and university policies related to them, see the Registrar's Grade Policy regulations at:

<http://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

### Exam Policy

The two exams and the homework assignments are takehome. Students are bound by the UF honor code (see below) and may neither give nor receive aid on the exams. Students may not share exams or homeworks or solutions with anyone outside the course at any time, even after the course is finished.

### Policy Related to Make up Exams or Other Work

In the event of unusual circumstances, a student could receive an extension of the due-date to a take-home exam or an incomplete grade in the course.

### Policy Related to Required Class Attendance

Attendance of all online sessions is expected. Exceptions will be granted with the expectation of watching the video recordings of the online classes missed. We will follow the UF Attendance Policy. For information regarding the UF Attendance Policy see the Registrar website for additional details: <https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>

---

## STUDENT EXPECTATIONS, ROLES, AND OPPORTUNITIES FOR INPUT

### **Expectations Regarding Course Behavior**

Students are expected to show up for each online class prepared and on time. Students should mute their microphones in the event of external noise.

### **Communication Guidelines**

Students are expected to participate in class discussions. Assignments must be clearly written in reasonably good English.

### **Academic Integrity**

Students are expected to act in accordance with the University of Florida policy on academic integrity. As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes the following pledge:

**“We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity.”**

You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit at the University of Florida, the following pledge is either required or implied:

**“On my honor, I have neither given nor received unauthorized aid in doing this assignment.”**

It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not be tolerated. Violations will be reported to the Dean of Students Office for consideration of disciplinary action. For additional information regarding Academic Integrity, please see Student Conduct and Honor Code or the Graduate Student Website for additional details: <https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>  
<http://gradschool.ufl.edu/students/introduction.html>

Please remember cheating, lying, misrepresentation, or plagiarism in any form is unacceptable and inexcusable behavior.

### **Online Faculty Course Evaluation Process**

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results/>.

---

## SUPPORT SERVICES

### **Accommodations for Students with Disabilities**

If you require classroom accommodation because of a disability, you must register with the Dean of Students Office <https://www.dso.ufl.edu> within the first week of class. The Dean of Students Office

will provide documentation of accommodations to you, which you then give to me as the instructor of the course to receive accommodations. Please make sure you provide this letter to me by the end of the second week of the course. The College is committed to providing reasonable accommodations to assist students in their coursework.

### **Counseling and Student Health**

Students sometimes experience stress from academic expectations and/or personal and interpersonal issues that may interfere with their academic performance. If you find yourself facing issues that have the potential to or are already negatively affecting your coursework, you are encouraged to talk with an instructor and/or seek help through University resources available to you.

- The Counseling and Wellness Center 352-392-1575 offers a variety of support services such as psychological assessment and intervention and assistance for math and test anxiety. Visit their web site for more information: <http://www.counseling.ufl.edu>. On line and in person assistance is available.
- You Matter We Care website: <http://www.umatter.ufl.edu/>. If you are feeling overwhelmed or stressed, you can reach out for help through the You Matter We Care website, which is staffed by Dean of Students and Counseling Center personnel.
- The Student Health Care Center at Shands is a satellite clinic of the main Student Health Care Center located on Fletcher Drive on campus. Student Health at Shands offers a variety of clinical services. The clinic is located on the second floor of the Dental Tower in the Health Science Center. For more information, contact the clinic at 392-0627 or check out the web site at: <https://shcc.ufl.edu/>
- Crisis intervention is always available 24/7 from:  
Alachua County Crisis Center  
(352) 264-6789  
<http://www.alachuacounty.us/DEPTS/CSS/CRISISCENTER/Pages/CrisisCenter.aspx>

---

Do not wait until you reach a crisis to come in and talk with us. We have helped many students through stressful situations impacting their academic performance. You are not alone so do not be afraid to ask for assistance.