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**University of Florida • College of Medicine
Department of Health Outcomes and Biomedical Informatics**

GMS 6844: Time Series and Quasi-Experimental Design for Health Outcomes Research

Time: tbd
Location: tbd
Credits: 2 credits
Instructor: tbd

Course Description

This course provides instruction in controlled quasi-experimental trials—longitudinal and time-series experiments (including “natural” experiments) where random assignment is not possible, but high levels of internal validity remain attainable. Critical thinking, reading relevant literature, and data analysis will play an important role in the class.

Audience

This course is designed for advanced masters-level and doctoral-level students in medicine, public health, and other health professions, as well as advanced students in public policy, sociology, psychology or other social sciences with plans for a career in research. Prerequisites are a minimum of a graduate course in epidemiology and a graduate course in statistics, and permission of instructor.

Objectives

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

1. Explain key concepts that underlie the design of research trials.
2. Define the four major types of validity used as the basis for evaluating the strength of a research trial: statistical conclusion validity, internal validity, construct validity, and external validity.
3. Distinguish stronger and weaker research designs in terms of levels of validity.
4. Visualize general research designs and apply “design sketch” techniques to current literature and media reports that suggest causal connections.
5. Understand the strengths and limitations of non-equivalent comparison group designs and interrupted time-series designs.
6. Identify several alternative research designs for particular scientific questions; evaluate pros and cons of design choices made by published investigators.
7. Demonstrate awareness of special statistical considerations in analyzing data from controlled time-series trials.
8. Perform analysis of a time series of a health-related outcome, visualize the data, interpret the results, and provide discussion of implications.

After this course, students will be better able to plan, implement or critically evaluate quasi-experimental research trials, as well as evaluating effects of natural experiments (e.g., policy changes).

Methods of Instruction

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The course will operate as an advanced graduate seminar, with students taking an active role in initiating and leading discussions and debates. Attendance and active participation in all class discussions is required, and will be evaluated as part of the student's grade for the course. Students *must* read the required readings *prior* to each class session. Guest speakers will periodically be invited.

Tests

No exams will be given in this graduate-level seminar course.

Term Paper

There is no term paper in this course.

Assignments

There are three requirements:

1. **Written comments on readings and class discussions.** You *must* read the assigned readings *prior* to each class session, and submit one (minimum) to two (maximum) single-spaced pages of your reactions, thoughts, analysis, comments and questions on the main research design issues raised in the readings. **Comments are due via email by 8:30 am on the day of each class session.** Do *not* summarize each reading; instead, tell me what you are *thinking* about what you have read. Your comments should focus on the important conceptual and research design, or analysis implications of the readings. Share what strikes you as new, unexpected, confusing, or particularly important. Discuss implications the authors' ideas, theories, and research findings for *your* work. Organize your comments by each chapter/paper assigned, identifying each with author last name and shortened title. (Student comments will be used to shape class discussions, but time constraints will likely prevent discussion of all issues raised.) All students are expected to participate in each class discussion.
2. **Study Diagramming/Data Visualization.** At times, you will work to quickly outline, diagram, and/or visualize an appropriate study design using optimal design elements. Be prepared to actively participate in the discussion and decisions regarding design elements, threats to validity, and strength of causal inference. To the extent possible, these exercises will extend to actual data sets.
3. **Advancing Student Research.** One of the following options will be considered depending on the instructor's assessment of students' readiness/interest.

I. Specific Aims page of a grant proposal

II. Letter to the Editor

III. Brief Literature Review

IV. Group project based on instructor's data

4. **Presentation guidelines:**

When presenting, you should prepare a well-designed set of slides in a PowerPoint file, which you will use during your presentation and will email to the entire class by 10am the day of your presentation (so people can print a copy prior to the class, if they wish). Design each visual carefully, to illustrate the main points. Remember the rules for clear, easy to understand, and interesting visuals, such as no more than 12 words per slide (ok, maybe you can break that rule, but only by a couple more words), and prevalent use of diagrams, charts, etc. to illustrate points (avoid too many word-only slides).

Evaluation and Grading

Grades will be based on the written comments on readings (25%), attendance and participation in discussions and group activities (15%); study design and analytic group activities (30%); advancing student research and presentation (30%). All deadlines must be met. Any assignment turned in after the deadline will receive one grade below what it would have earned had it been submitted on time. Grades will be assigned as follows:

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Letter Grade	Grade Points	Grade Percentage
A	4.0	95-100
A-	3.67	90-94
B+	3.33	87-89
B	3.0	83-86
B-	2.67	80-82
C+	2.33	77-79
C	2.0	73-76
C-	1.67	70-72
D+	1.33	67-69
D	1.0	63-66
D-	.67	60-62
E	0	59 and below

For additional grading policy information, you may visit the web page at:
<http://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>.

Class Attendance

Class attendance is required. Excused absences follow the criteria of the UF Graduate Catalogue (e.g., illness, serious family emergency, military obligations, religious holidays), and should be communicated to the instructor prior to the missed class day when possible. UF rules require attendance during the first two course sessions, and students also must attend all course sessions of student presentations. Missing more than three scheduled sessions will result in a failure. Regardless of attendance, students are responsible for all material presented in class and meeting the scheduled due dates for class assignments. Finally, students must read the assigned readings *prior to* the class meetings, and be prepared to discuss the material.

E-Learning

Course information, readings, and grades are available on e-learning at <http://elearning.ufl.edu/>. You must have a Gatorlink account to log on. For more information on using e-learning see the help files <https://kb.helpdesk.ufl.edu/FAQs/E-Learning>.

Accommodations for Students with Disabilities

Students requiring accommodations must first register with the Dean of Students' Office. The Dean of Students' Office will provide documentation to the student who must then provide this documentation to the faculty member when requesting accommodation. The College is committed to providing reasonable accommodations to assist students in their coursework.

University of Florida Academic Honesty Statements

“I understand that the University of Florida expects its students to be honest in all their academic work. I agree and adhere to this commitment to academic honesty and understand that my failure to comply with this commitment may result in disciplinary action up to and including expulsion from the University.”

“All faculty, staff and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate.”

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

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Citations and Plagiarism

The two key purposes of citation are to: 1) give appropriate credit to the authors of information, research findings, and/or ideas (and avoid plagiarism), and 2) facilitate access by your readers to the sources you use in your research.

Quotations: When directly quoting an outside source, the borrowed text, regardless of the amount, must be surrounded by quotation marks or block quoted. Quoted text over two lines in length should be single-spaced and indented beyond the normal margins. Every quote must include a source—the author, title, volume, page numbers, etc.—whether an internal reference, footnote, or endnote is used in conjunction with a bibliography page.

Paraphrasing or Citing an Idea: When summarizing an outside source in your own words or citing another person's ideas, quotation marks are not necessary, but the source must be included. This includes, but is not confined to, personal communications from other students, faculty members, experts in the field, summarized ideas from published or unpublished resource, and primary methods derived from published or unpublished sources. Use the general concept of “when in doubt – cite.”

Plagiarism is a serious violation of the academic honesty policy of the College. If a student plagiarizes others' material or ideas, he or she may receive an “E” in the course. The faculty member may also recommend further sanctions to the Dean, per College disciplinary action policy. Generally speaking, the three keys of acceptable citation practice are: 1) thoroughness, 2) accuracy, and 3) consistency. In other words, be sure to fully cite all sources used (thoroughness), be accurate in the citation information provided, and be consistent in the citation style you adopt. All references should include the following elements: 1) last names along with first and middle initials; 2) full title of reference; 3) name of journal or book; 4) publication city, publisher, volume, and date; and 5) page numbers referenced. When citing information from the Internet, include the WWW address at the end, with the “access date” (i.e., when you obtained the information), just as you would list the document number and date for all public documents. When citing ideas or words from an individual that are not published, you can write “personal communication” along with the person's name and date of communication.

Textbook (not required)

McCleary, R, McDowall, D, and Bartos, BJ (2017). *Design and Analysis of Time Series Experiments*.

Shadish, WR, Cook, TD, & Campbell, DT (2002). *Experimental and Quasi-Experimental Designs for Generalized Causal Inference*. Houghton Mifflin, 2002 (or 2001, 2nd edition). Available at Amazon.com (<http://www.amazon.com/Experimental-Quasi-Experimental-Designs-Generalized-Inference/dp/0395615569>) and elsewhere; cost about \$92.

Freakonomics: A Rogue Economist Explores the Hidden Side of Everything Paperback – August 25, 2009 by Steven D. Levitt (Author), Stephen J. Dubner (Author). Many website resources available including an award-winning podcast series; cost about \$12.

Schedule of Topics and Readings

	Lecture	Text Readings	Design work	Data work HW (TB=Textbook, A=assigned, D=due)
1. Class 1	Introductions, review of syllabus	TB pp.1-18		
2. Class 2	White noise, seasonality, AR1, MA1, stationarity, ACF/PCF interpretation	TB pp.88-103	Intro to study diagrams, ARIMA models syntax	A1: Receive FL raw data (Rx and/or drug mortality)
3. Class 3	Tests of independence and normality on residuals		Concepts of validity	A2: Receive ACF/PCF graphs from Dr. Delcher D1: Rx data visualized with descriptive statistics, seasonality
4. Class 4		TB pp.186-208	Quasi-experimental designs	A3: Receive residual data D2: ACF/PCF interpretation/comparison with statistical results
5. Class 5	Intervention design			A4: Repeat A1-A4 using CA data D3: Results of residual tests
6. Class 6	Controls			A5: Receive intervention results
7. Class 7				A6: Class identification of control series D4: Methods and univariate/intervention results write up to-date for Florida and California
8. Class 8				A7: Obtain raw data for controls D5: Identification of potential control series including raw data (share results with co-authors)
9. Class 9				D6: Repeat A1-A4 for control series with write up
10. Class 10				
11. Class 11				
12. Class 12				
13. Class 13				
14. Class 14				Submit paper

Class 1:

Part I: Welcome & overview of course. Student introductions and presentation of your research interests. Prepare a brief summary of your 1) publication history, 2) proposal writing history, 3) data analysis skills 4)

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data visualization example that you have created for past projects (if available), 5) access to software such as Excel/SAS/R/Tableau, 6) access to/knowledge of time series data, 6) list of top 3 journals in your field.

In addition, please identify your preferred, reputable news outlet to listen/read daily for the “language of quasi or natural experiments” in the media. (I suggest the local news radio station 89.1 FM). By the end of the semester, you will gain experience of quickly visualizing media reports, data diagramming, and applying the design and validity concepts that you will learn in this class. One of the class presentation will involve one such stories. I will demonstrate the concept with the “Huntington Beach Prop 47 example”.

Introduction to class project: Evaluation of CDC prescribing guidelines on high-risk opioid prescribing behaviors using interrupted time series analysis.

- *Additional times series data set resources from multiple domains:*
<https://datamarket.com/data/list/?q=provider%3Atsdl>
- The McCleary book has many publicly available examples included.

Class 2

Part I: Introduction to time series analysis: design notation and three types of analyses descriptive, correlational, and interrupted time series.

Readings: Preface, Ch. 1

Assignment #1 (due for Class 3): Identify an “interrupted time series” paper from one of the top 3 journals in your field. You will read the paper, provide general design notation, identify the type of time series analysis, report the features provided in the methods and identify one major threat to validity.

To complete this assignment, please email me the pdf versions of the paper and your response.

Class 3

Part II: Statistical validity; Internal validity, Construct validity; External validity

Readings: Ch. 2

Assignment #1 due.

Validity Handout (bring to class)

Assignment #2 (due for Class 4). Read the letters to the editor given below. In a written response, answer the following questions:

- 1) What is the study design of the original study?
- 2) Identify the threats to validity that the responding authors are addressing. Align your written language in the response letter to the “threat vocabulary” on the handout and/or chapter provided in class.
- 3) Do you believe that a response was warranted? Please justify either way.
- 4) What threats to validity did the authors potentially miss or exclude?

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Delcher C, Wang Y. Re: “Longitudinal Health Study of US 1991 Gulf War Veterans: Changes in Health Status at 10-Year Follow-Up.” *Am J Epidemiol* 2012;175:473.

Alene Kennedy-Hendricks, Matthew Richey, Emma E. McGinty, Elizabeth A. Stuart, Colleen L. Barry, Daniel W. Webster. (2016) Kennedy-Hendricks et al. Respond. *American Journal of Public Health* 106:6, e11-e12.

Chris Delcher, Yanning Wang, Alexander C. Wagenaar, Bruce A. Goldberger, Robert L. Cook, Mildred M. Maldonado-Molina. (2016) Prescription and Illicit Opioid Deaths and the Prescription Drug Monitoring Program in Florida. *American Journal of Public Health* 106:6, e10-e11.

Class 4

Quasi-experimental designs, Qualities of design for strong causal inference; Review of weak to stronger design features

Assignment #2 due.

Assignment #3 (due for Class 5). Using one of the papers identified in Assignment #1, prepare a one-page narrative response (not including the accompanying figure) to the following questions:

- 1) What is the study design of the original study? Create a study design diagram using the visualization approach provided in the class lecture.
- 2) Identify major threats to validity. Align the language in the response letter to the “threat vocabulary” on the handout and/or chapter provided in class.
- 3) Read the corresponding letter to the editor. Compare the similarities/difference in your response and theirs.

Class 5,

Design elements continued from above.

Assignment #3 due.

Assignment #4 (due for Class 6)

Please provide a copy of the news story that you will be presenting in Class 6. This may be an audio or transcript version.

Class 6

Time-series quasi-experimental designs; Applications of time-series designs; Regression discontinuity designs

Assignment #5 (due for Class 7)

Finalize the time series data set that will be used for the Time Series Analysis section of the class. Prior to this point, I will work with you to help you find an appropriate data set (ideally, you might consider a data set that is related to your research.)

Wagenaar, A.C. & Komro, K.A. (2013). Natural Experiments: Research Design Elements for Optimal Causal Inference Without Randomization. In: *Public Health Law Research*. San Francisco: John Wiley & Sons, Inc., pp. 307-324.

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View webinar: Wagenaar, A.C. & Komro, K.A. Analyzing Natural Experiments: A Public Health Methods Webinar. Invited Webinar, sponsored by Academy Health, December 14, 2011.

<http://www.academyhealth.org/professional-resources/training/prof-dev/analyzing-natural-experiments-public-health-methods>

Class 7

Time-series quasi-experimental designs; studies using ARIMA model.

Delcher, C., Wagenaar, A. C., Goldberger, B. A., Cook, R. L. & Maldonado-Molina, M. M. Abrupt decline in oxycodone-caused mortality after implementation of Florida's Prescription Drug Monitoring Program. *Drug Alcohol Depend* (2015). doi:10.1016/j.drugalcdep.2015.02.010

Delcher, C., Maldonado-Molina, M. M. & Wagenaar, A. C. Effects of alcohol taxes on alcohol-related disease mortality in New York State from 1969 to 2006. *Addictive Behaviors* **37**, 783–789 (2012).

Class 8

Analysis methods for time-series designs; Interactive lab

****NOTE: Bring your laptop with appropriate software ready to use to this class.****

Hartmann, D. P., J. M. Gottman, et al. (1980). "Interrupted Time-Series Analysis and its Application to Behavioral Data." *Journal of Applied Behavior Analysis* **13**(4): 543-559.

Wagenaar, A.C., Livingston, M.D., & Staras, S.S. (2015). Effects of a 2009 Illinois Alcohol Tax Increase on Fatal Motor Vehicle Crashes. *American Journal of Public Health*, 105 (5).

Class 9

Analysis methods for time-series designs; Interactive lab continued

Class 10

Break *No Class*****

Class 11

Analysis methods for time-series designs; Interactive lab continued. Bring your own data!

Class 12/13

Advancing Student Research

Class 14

Advancing Student Research

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Class wrap-up

Other Recommended Resources

Zotero – a citation manager

Tableau student version – a powerful data visualization resource

Strengths and Weaknesses of Experimental and Quasi-Experimental Designs

<http://prevention.nih.gov/mindthegap/shadish.aspx>