SYLLABUS & COURSE INFORMATION

SCHOOL OF PUBLIC HEALTH
UNIVERSITY OF MINNESOTA

PUBH 8343, SECTION 001

Synthesis and Application of Methods in Epidemiologic Research
Fall 2019

COURSE & CONTACT INFORMATION

Credits: 4
Meeting Day(s): Tuesdays and Thursdays
Meeting Time: 12:20-2:15pm
Meeting Place: Mayo 1250

Instructor: Richard MacLehose
Email: macl0029@umn.edu
Office Phone: 612-624-1932
Fax: 612-624-0315
Office Hours: By appointment
Office Location: 441 West Bank Office Building (WBOB)

COURSE DESCRIPTION

This doctoral level course focuses on the extension, synthesis, and integration of research methods taught in the advanced epidemiology methods sequence (PubH 8341 and PubH 8342) and the application of these methods. We will discuss several novel methods such as causal inferences related to the g-formula and penalized regression. The purpose of the class is to foster a deeper understanding of current epidemiologic methods and how they are *actually* implemented in research. Lectures, in-class assignments, homework, and readings are aimed at both clinical/biologic and social/behavioral track students.

COURSE PREREQUISITES

PubH 8341 and PubH 8342, or permission of instructor

COURSE GOALS & OBJECTIVES

Upon completion of this course the student should be able to:

- Independently evaluate epidemiologic methods in regards to their utility, novelty and underlying assumptions
- Understand the foundation of causal inference theory and its relationship to regression and study design
- Implement new methodological techniques (marginal structural models, penalized regression, meta analysis)
- Synthesize and implement current epidemiologic methods for substantive research of the student's choosing

Appreciate and assess the assumptions underpinning methodologic choices and the trade-offs associated with different methodological approaches

METHODS OF INSTRUCTION AND WORK EXPECTATIONS

Course Workload Expectations

PubH 8343 is a 4 credit course. The University expects that for each credit, you will spend a minimum of three hours per week attending class or comparable online activity, reading, studying, completing assignments, etc. over the course of a 15-week term. Thus, this course requires approximately 16 hours of effort spread per week in order to earn an average grade.

The class will meet twice a week for 1.5 hours each. Class sessions will be based on a set of readings, with an instructor-led presentation and extension of the material. This course is highly interactive. Students are expected to actively participate in a detailed discussion of the assigned readings and how the readings relate to the research topics the students are working on. Each topic will have a reading that applies the method under discussion; these readings are denoted with an (A). All students endeavor to see the large ball of twine in Darwin, MN. In order to gain experience with each method/topic, a part of each class will be set aside so students can work on instructor assigned problems (e.g., analyses) that correspond to each week's topic. In-class assignments will be completed collaboratively during most weeks of the course. The in-class assignments will be conducted with the use of statistical software. Stata is required and students should bring a laptop to each class. Contact the instructor immediately if that poses a barrier. Students are required to attend each class having read the assigned material and prepared for doctoral-level group discussion and debate.

There will be 10 homework assignments corresponding to weekly topics (typically analyses). Homework will generally reinforce lecture material; however, sometimes they will be on a completely different topic in epidemiology to encourage students to learn new topics independently. The instructor will provide datasets that will be used for most homework analysis. Students may complete the homework in groups.

Class participation is based on student presentation of material as well as discussion of the material. Students are given the opportunity to introduce a methods topic before we begin, review a methods topic once we've ended, lead a debate on a topic and answer questions from other students. Each student is required to lead at least 2 of these. All students are required to actively participate in all discussion.

Grades will depend on homework (85%) and participation (15%).

Students who take the class S/N will achieve a satisfactory score if their class percent is 80 or higher

Learning Community
School of Public Health courses ask students to discuss frameworks, theory, policy, and more, often in the context of past and current events and policy debates. Many of our courses also ask students to work in teams or discussion groups. We do not come to our courses with identical backgrounds and experiences and building on what we already know about collaborating, listening, and engaging is critical to successful professional, academic, and scientific engagement with topics.

In this course, students are expected to engage with each other in respectful and thoughtful ways.

In group work, this can mean:

- Setting expectations with your groups about communication and response time during the first week of the semester (or as soon as groups are assigned) and contacting the TA or instructor if scheduling problems cannot be overcome.
- Setting clear deadlines and holding yourself and each other accountable.
- Determining the roles group members need to fulfill to successfully complete the project on time.
- Developing a rapport prior to beginning the project (what prior experience are you bringing to the project, what are your strengths as they apply to the project, what do you like to work on?)

In group discussion, this can mean:

- Respecting the identities and experiences of your classmates.
- Avoid broad statements and generalizations. Group discussions are another form of academic communication and responses to instructor questions in a group discussion are evaluated. Apply the same rigor to crafting discussion posts as you would for a paper.
- Consider your tone and language, especially when communicating in text format, as the lack of other cues can lead to misinterpretation.

Like other work in the course, all student to student communication is covered by the Student Conduct Code (https://z.umn.edu/studentconduct).

COURSE TEXT & READINGS

Hernán MA, Robins JM. Causal Inference Volume 1, Chapman & Hall/CRC, 2012. Available online at: http://www.hsph.harvard.edu/miguel-hernan/causal-inference-book/
Hernán MA, Robins JM. Causal Inference Volume 2, Chapman & Hall/CRC, 2012. Available online at: http://www.hsph.harvard.edu/miguel-hernan/causal-inference-book/
Rothman, Kenneth J., Sander Greenland, and Timothy L. Lash. 2008. Modern Epidemiology, 3rd edition. New York: Lippincott Williams & Wilkins. Available online through the UMN Library

COURSE OUTLINE/WEEKLY SCHEDULE

Week	Topic	Readings	Assignments
Week 1 9/3-9/5	• Causal inference	• Hernan & Robins, Chapter 1: A definition of causal effects • Hernan & Robins, Chapter 2: Randomized experiments • Hernan & Robins, Chapter 3: Observational studies • Greenland, Sander, and Hal Morgenstern. "Confounding in health research." *Annual review of public health* 22.1 (2001): 189-212. • Greenland, Sander, James M. Robins, and Judea Pearl. "Confounding and collapsibility in causal inference." *Statistical Science* (1999): 29-46	• Homework 1: causal inference
Week 2 9/10-9/12	• G-methods • Parametric g-formula	• Hernan M, Robins JM. Ch 13: Standardization and the parametric g-formula. In Causal Inference, vol 2. • Buckley, J. P., Keil, A. P., McGrath, L. J., & Edwards, J. K. (2015). Evolving methods for inference in the presence of healthy worker survivor bias. *Epidemiology*, *26*(2), 204-212. • (A) Cole, Stephen R., et al. "Analysis of occupational asbestos exposure and lung cancer mortality using the g formula." *American journal of epidemiology*177.9 (2013): 989-996.	• *Homework 2*: g-formula
Week 3 9/17-9/19	• Marginal Structural Models: cross sectional	• Hernan M, Robins JM. Ch 12: IP weighting and marginal structural models In Causal Inference, vol 2. • Sato, Tosiya, and Yutaka Matsuyama. "Marginal structural models as a tool for standardization." *Epidemiology* 14.6 (2003): 680-686. • Robins, James M., Miguel Angel Hernan, and Babette Brumback. "Marginal structural models and causal inference in epidemiology." *Epidemiology* 11.5 (2000): 550-560.	
Week 4 9/24-9/26	• Group Randomized Trials (Guest lecturer: Michael Oakes)	• TBD	•
Week 5 10/1-10/3	• Marginal Structural Models: longitudinal and weight construction	• Cole, Stephen R., and Miguel A. Hernán. "Constructing inverse probability weights for marginal structural models." *American Journal of Epidemiology* 168.6 (2008): 656-664. • Weuve, Jennifer, et al. "Accounting for bias due to selective attrition: the example of smoking and cognitive decline." Epidemiology (Cambridge, Mass.) 23.1 (2012): 119. • (A) Bodnar, Lisa M., et al. "Marginal structural models for analyzing causal effects of time-dependent treatments: an application in perinatal epidemiology." *American Journal of Epidemiology* 159.10 (2004): 926-934.	• Homework 3: Marginal structural models
Week 6 10/8-10/10	• Regression for binary outcomes & their relation to causal methods • Journal Club	• Greenland S. Model-based estimation of relative risks and other epidemiologic measures in studies of common outcomes and in case-control studies. Am J Epidemiol 2004; 160:301-5 • Localio AR, Margolis DJ, Berlin JA. Relative risks and confidence intervals were easily computed indirectly from multivariable logistic regression. J Clin Epidemiol 2007; 60(9): 874-82	Homework 4: Regression for common outcomes

		• Norton EC. Log odds and ends. National Bureau of Economic Research Working Paper Series. 2012. http://www.nber.org/papers/w18252.pdf?new_window=1 • Muller, Clemma J., and Richard F. MacLehose. "Estimating predicted probabilities from logistic regression: different methods correspond to different target populations." *International journal of epidemiology* 43.3 (2014): 962-970. • (A) Kurella Tamura M, et al. Dialysis Initiation and Mortality Among Older Veterans with Kidney Failure Treated in Medicare vs the Department of Veterans Affairs. *JAMA Intern Med.* Published online April 09, 2018; 178(5):657–664.	
Week 7 10/15-10/17	• Power Calculations and Propensity Scores	• Oakes, J. Michael, and Pamela Jo Johnson. "Propensity score matching for social epidemiology." *Methods in social epidemiology* 1 (2006): 370-393. • d'Agostino, Ralph B. "Tutorial in biostatistics: propensity score methods for bias reduction in the comparison of a treatment to a non-randomized control group." *Stat Med* 17.19 (1998): 2265-2281. • (A) Zaoutis, Theoklis E., et al. "The epidemiology and attributable outcomes of candidemia in adults and children hospitalized in the United States: a propensity analysis." *Clinical infectious diseases* 41.9 (2005): 1232-1239.	• Homework 5: Power Calculations (1)
Week 8 10/22-10/24	• Bias Analysis - simple	• Modern Epidemiology. Chapter 19: Bias Analysis • Lash, Timothy L., et al. "Good practices for quantitative bias analysis." *International journal of epidemiology* (2014) • (A) Ogilvie, Rachel P., et al. "Diagnosed sleep apnea and cardiovascular disease in atrial fibrillation patients: The role of measurement error from administrative data." *Epidemiology (Cambridge, Mass.)* (2019)	• *Homework 6*: Conduct Bias Analysis
Week 9 10/29-10/31	• Bias Analysis – probabilistic	• Steenland, Kyle, and Sander Greenland. "Monte Carlo sensitivity analysis and Bayesian analysis of smoking as an unmeasured confounder in a study of silica and lung cancer." American Journal of Epidemiology 160.4 (2004): 384-392. • Fox, Matthew P., Timothy L. Lash, and Sander Greenland. "A method to automate probabilistic sensitivity analyses of misclassified binary variables." International journal of epidemiology34.6 (2005): 1370-1376. • (A) Goto, Atsushi, et al. "Severe hypoglycaemia and cardiovascular disease: systematic review and meta-analysis with bias analysis." *Bmj* 347 (2013)	• Homework 7: Power Calculations (2)
Week 10 11/5-11/7	• The nonparametric bootstrap & Splines	• Wasserman L. CH4: Bootstrapping. *All of nonparametric statistics*. Springer 2006 • Devore JL, Berk KN. Ch: 8. Statistical intervals based on a single sample. *Modern mathematical statistics with applications*. Springer 2012. • Additional reference: Efron B, Tibshirani R. An introduction to the bootstrap. CRC Press 1993. • (A) Morrison, Alanna C., et al. "Prediction of coronary heart disease risk using a genetic risk score: the Atherosclerosis Risk in Communities Study." *American journal of epidemiology*166.1 (2007): 28-35. • (A) Bell, Michelle L., et al. "Seasonal and regional short-term effects of fine particles on hospital admissions in 202 US counties, 1999–2005." *American journal of epidemiology*168.11 (2008): 1301-1310.	• Homework 8: Bootstrap

Week 11 11/12-11/14	• Meta Analysis	• Greenland S, O'Rouke K. Ch 33 Meta-Analysis in Rothman, Greenland and Lash. Modern Epidemiology. • (A) Grøntved, Anders, and Frank B. Hu. "Television viewing and risk of type 2 diabetes, cardiovascular disease, and all-cause mortality: a meta-analysis."*Jama* 305.23 (2011): 2448-2455.	•
Week 12 11/19-11/21	• Meta Analysis & Journal club	• Greenland S, O'Rouke K. Ch 33 Meta-Analysis in Rothman, Greenland and Lash. Modern Epidemiology. • Grøntved, Anders, and Frank B. Hu. "Television viewing and risk of type 2 diabetes, cardiovascular disease, and all-cause mortality: a meta-analysis." *Jama* 305.23 (2011): 2448-2455.	• *Homework 9: Meta analysis*
Week 13 11/26-11/28	• Bayesian Analysis 1: prior beliefs as data	• Greenland S. Bayesian perspectives for epidemiologic research 1. IJE. 2007 • Greenland S. Bayesian perspectives for epidemiologic research 2. IJE. 2008 • Greenland S. Bayesian perspectives for epidemiologic research 3. IJE. 2009	•
Week 14 12/3-12/5	• Bayesian Analysis 2: hierarchical models and applications	• MacLehose, Richard F., and Ghassan B. Hamra. "Applications of Bayesian Methods to Epidemiologic Research." *Current Epidemiology Reports* 1.3 (2014): 103-109. • Hamra, Ghassan B., Richard F. MacLehose, and Stephen R. Cole. "Sensitivity analyses for sparse-data problems—using weakly informative Bayesian priors." *Epidemiology (Cambridge, Mass.)* 24.2 (2013): 233. • (A) Buckley, Jessie P., et al. "Prenatal phthalate exposures and body mass index among 4 to 7 year old children: a pooled analysis." *Epidemiology (Cambridge, Mass.)* 27.3 (2016): 449.	• *Homework 10*: Bayesian analysis
Week 15 12/10	• Review of the doctoral methods curriculum and wrap-up	• None	•

SPH AND UNIVERSITY POLICIES & RESOURCES

The School of Public Health maintains up-to-date information about resources available to students, as well as formal course policies, on our website at www.sph.umn.edu/student-policies/. Students are expected to read and understand all policy information available at this link and are encouraged to make use of the resources available.

The University of Minnesota has official policies, including but not limited to the following:

- Grade definitions
- Scholastic dishonesty
- Makeup work for legitimate absences
- Student conduct code
- Sexual harassment, sexual assault, stalking and relationship violence
- Equity, diversity, equal employment opportunity, and affirmative action
- Disability services
- Academic freedom and responsibility

Resources available for students include:

- Confidential mental health services
- Disability accommodations
- Housing and financial instability resources
- Technology help
- Academic support

EVALUATION & GRADING

Grading is either A/F or pass/fail on the S/N grading scale. The “S” grade does not carry points but credit will count toward completion of student’s degree if permitted by college or program. An “N” is given for student’s exercising the S/N grading option but who fail to meet minimum course requirements. The grade will be based on homework and participation. Active participation during paper discussion is required. Please refer to the University’s Uniform Grading Policy and Grading Rubric Resource at https://z.umn.edu/gradingpolicy

Grading Scale
The University uses plus and minus grading on a 4.000 cumulative grade point scale in accordance with the following, and you can expect the grade lines to be drawn as follows:

% In Class	Grade	GPA
93 - 100%	A	4.000
90 - 92%	A-	3.667
87 - 89%	B+	3.333
83 - 86%	B	3.000
80 - 82%	B-	2.667
77 - 79%	C+	2.333
73 - 76%	C	2.000
70 - 72%	C-	1.667
67 - 69%	D+	1.333
63 - 66%	D	1.000
< 62%	F	

- A = achievement that is outstanding relative to the level necessary to meet course requirements.
- B = achievement that is significantly above the level necessary to meet course requirements.
- C = achievement that meets the course requirements in every respect.
- D = achievement that is worthy of credit even though it fails to meet fully the course requirements.
- F = failure because work was either (1) completed but at a level of achievement that is not worthy of credit or (2) was not completed and there was no agreement between the instructor and the student that the student would be awarded an I (Incomplete).
- S = achievement that is satisfactory, which is equivalent to a C- or better
- N = achievement that is not satisfactory and signifies that the work was either 1) completed but at a level that is not worthy of credit, or 2) not completed and there was no agreement between the instructor and student that the student would receive an I (Incomplete).

Evaluation/Grading Policy	Evaluation/Grading Policy Description
Scholastic Dishonesty, Plagiarism, Cheating, etc.	You are expected to do your own academic work and cite sources as necessary. Failing to do so is scholastic dishonesty. Scholastic dishonesty means plagiarizing; cheating on assignments or examinations; engaging in unauthorized collaboration on academic work; taking, acquiring, or using test materials without faculty permission; submitting false or incomplete records of academic achievement; acting alone or in cooperation with another to falsify records or to obtain dishonestly grades, honors, awards, or professional endorsement; altering, forging, or misusing a University academic record; or fabricating or falsifying data, research procedures, or data analysis (As defined in the Student Conduct Code). For additional information, please see https://z.umn.edu/dishonesty The Office for Student Conduct and Academic Integrity has compiled a useful list of Frequently Asked Questions pertaining to scholastic dishonesty: https://z.umn.edu/integrity. If you have additional questions, please clarify with your instructor. Your instructor can respond to your specific questions regarding what would constitute scholastic dishonesty in the context of a particular class-e.g., whether collaboration on assignments is permitted, requirements and methods for citing sources, if electronic aids are permitted or prohibited during an exam. Indiana University offers a clear description of plagiarism and an online quiz to check your understanding (http://z.umn.edu/iuplagiarism).
Late Assignments	Late assignments will be docked 10% for each day they are late.
Attendance Requirements	Class attendance is required. Absences must be approved by the instructor.
Extra Credit	None

CEPH COMPETENCIES

Competency	Learning Objectives	Assessment Strategies
1. Apply epidemiological methods to the breadth of settings and situations in public health practice	Apply a wide range of epidemiologic methods	Homework assignments will be assigned for most of the methods discussed in the course
3. Analyze quantitative and qualitative data using biostatistics, informatics, computer-based programming and software as appropriate	Epidemiological methods will be implemented in Stata	Homework assignments will require students to analyze data provided by the instructor, using Stata.
4. Interpret results of data analysis for public health research, policy or practice	Interpret results of all models presented in the class	Each homework will require students to interpret the results of models they have implemented
19. Communicate audience-appropriate public health content, both in writing and through oral presentation	Students should be able to present the results of their analyses in a manner sufficient to convey their work to a technical audience.	Homework will assess the ability to convey this information in a clear and concise fashion.