School of Public Health
Syllabus and Course Information

UNIVERSITY OF MINNESOTA
Driven to Discover℠

PubH 8343
Synthesis and Application of Methods in Epidemiologic Research
Fall 2016

Credits:	**4**
Meeting Days:	**Tuesdays and Thursdays**
Meeting Time:	**12:20-2:15 pm**
Meeting Place:	**Mayo A110**

Instructor:	**Richard MacLehose, PhD**
Office Address:	**441 West Bank Office Building (WBOB)**
Office Phone:	**612-624-1932**
Fax:	**612-624-0315**
E-mail:	**macl0029@umn.edu**
Office Hours:	**By appointment**

I. 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.

II. Course Prerequisites

PubH 8341 and PubH 8342, or permission of instructor

III. Course Goals and 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
- Perform 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

IV. Methods of Instruction and Work Expectations

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. 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 (15% of grade) 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 4 homework assignments (15% each) corresponding to weekly topics (typically analyses). Homework will reinforce lecture material. The instructors will provide datasets that will be used for each homework analysis. Each student must complete the homework independently.

A final project (25%) will be distributed that last week of class. It will test student knowledge of topics that have been discussed throughout the semester. The project must be completed individually.

Grades will depend on: in-class assignments and participation (15%), homework (60%) and a final project (25%). There are no exams.

Grades based on percent of total points:	94-100 : A	90-93 : A-	87-89 : B+	83-86 : B
	80-82 : B-	77-79 : C+	73-76 : C	70-72 : C-

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

V. Course Text and 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

VI. Course Outline/Weekly Schedule

Week 1: 9/5; 9/7
Topic: Causal inference and probability
Readings:
- 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

In-class assignment : Permutation tests

Week 2: 9/12; 9/14
Topic: G-methods/Parametric g-formula
Readings:
- Hernan M, Robins JM. Ch 13: Standardization and the parametric g-formula. In Causal Inference, vol 2.
- Hernan M, Robins JM. Ch 12: IP weighting and marginal structural models 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.
- 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.

In-class assignment: Standardization
Homework 1: Marginal Structural Models

Week 3: 9/19; 9/21
Topic: Marginal Structural Models: cross sectional and developing weights
Readings:
- Robins, James M., Miguel Angel Hernan, and Babette Brumback. "Marginal structural models and causal inference in epidemiology." *Epidemiology* 11.5 (2000): 550-560.
- Cole, Stephen R., and Miguel A. Hernán. "Constructing inverse probability weights for marginal structural models." *American Journal of Epidemiology* 168.6 (2008): 656-664.
- 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.

In-class assignment: constructing weights

Week 4: 9/26; 9/28

Topic: Marginal Structural Models: longitudinal and selection bias
Readings:

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.

Robins, James M., Miguel Angel Hernan, and Babette Brumback. "Marginal structural models and causal inference in epidemiology." *Epidemiology* 11.5 (2000): 550-560.

Cole, Stephen R., and Miguel A. Hernán. "Constructing inverse probability weights for marginal structural models." *American Journal of Epidemiology* 168.6 (2008): 656-664.

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.

Week 5: 10/3; 10/5
Topic: Regression for binary outcomes & their relation to causal methods
Readings:

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

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.

In-class assignment: Estimate relative risks and risk difference using various approaches
Homework 2: Perform a regression analysis for common dichotomous outcomes

Week 6: 10/10; 10/12
Topic: Beyond the Cox Model
Readings:

Hernán, Miguel A. "The hazards of hazard ratios." *Epidemiology (Cambridge, Mass.)* 21.1 (2010): 13.

O'Brien, Katie M., et al. "Intrinsic breast tumor subtypes, race, and long-term survival in the Carolina Breast Cancer Study." *Clinical Cancer Research*16.24 (2010): 6100-6110.

Flanders, W. Dana, and Mitchel Klein. "Properties of 2 counterfactual effect definitions of a point exposure." *Epidemiology* 18.4 (2007): 453-460.

In-class assignment: Use regression life table approaches to estimate cumulative risks for survival data

Week 7: 10/17; 10/19
Guest Lecture on 10/19: Nick Roetker
Topic: Instrumental variables and Propensity Scores
Readings:

Greenland, Sander. "An introduction to instrumental variables for epidemiologists." *International journal of epidemiology* 29.4 (2000): 722-729.

Glymour, M. Maria. "Natural experiments and instrumental variable analyses in social epidemiology." *Methods in social epidemiology* (2006): 429-460.

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.

In-class assignment: Conduct instrumental variable and propensity score analysis

Week 8: 10/24; 10/26
Topic: Bias Analysis

Readings:

Modern Epidemiology. Chapter 19: Bias Analysis

Lash, Timothy L., et al. "Good practices for quantitative bias analysis." *International journal of epidemiology* (2014)

In-class assignment: Conduct Simple Bias Analysis

Week 9: 10/31; 11/2

Topic: Bias Analysis

Readings:

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 epidemiology*34.6 (2005): 1370-1376.

Homework 3: Conduct Probabilistic Bias Analysis

Week 10: 11/7; 11/9

Topic: The nonparametric bootstrap: did you really need to learn statistics?

Readings:

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.

Week 11&12: 11/14; 11/16; 11/21

Topic: Meta Analysis

Readings:

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 4: Analyze data for meta analysis

Week 13: 11/28; 11/30

Topic: Bayesian Analysis 1: prior beliefs as data

Readings:

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

In-class assignment: Fit approximate penalized models

Week 14: 12/5; 12/7

Guest lecture on 12/7: Fernando Alarid

Topic: Bayesian Analysis 2: hierarchical models and applications

Readings:

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.

In-class assignment: Fit Bayesian models using Stata

Week 15: 12/12

Topic: Review of the doctoral methods curriculum and wrap-up
Readings: None

VII. Evaluation and 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.

A 4.000 - Represents achievement that is outstanding relative to the level necessary to meet course requirements

A- 3.667

B+ 3.333

B 3.000 - Represents achievement that is significantly above the level necessary to meet course requirements

B- 2.667

C+ 2.333

C 2.000 - Represents achievement that meets the course requirements in every respect

C- 1.667

D+ 1.333

D 1.000 - Represents achievement that is worthy of credit even though it fails to meet fully the course requirements

S Represents achievement that is satisfactory, which is equivalent to a C- or better.

For additional information, please refer to:
http://policy.umn.edu/Policies/Education/Education/GRADINGTRANSCRIPTS.html.

Course Evaluation
The SPH will collect student course evaluations electronically using a software system called CoursEval: www.sph.umn.edu/courseval. The system will send email notifications to students when they can access and complete their course evaluations. Students who complete their course evaluations promptly will be able to access their final grades just as soon as the faculty member renders the grade in SPHGrades: www.sph.umn.edu/grades. All students will have access to their final grades through OneStop two weeks after the last day of the semester regardless of whether they completed their course evaluation or not. Student feedback on course content and faculty teaching skills are an important means for improving our work. Please take the time to complete a course evaluation for each of the courses for which you are registered.

Incomplete Contracts
A grade of incomplete "I" shall be assigned at the discretion of the instructor when, due to extraordinary circumstances (e.g., documented illness or hospitalization, death in family, etc.), the student was prevented from completing the work of the course on time. The assignment of an "I" requires that a contract be initiated and completed by the student before the last official day of class, and signed by both the student and instructor. If an incomplete is deemed appropriate by the instructor, the student in consultation with the instructor, will specify the time and manner in which the student will complete course requirements. Extension for completion of the work will not exceed one year (or earlier if designated by the student's college). For more information and to initiate an incomplete contract, students should go to SPHGrades at: www.sph.umn.edu/grades.

University of Minnesota Uniform Grading and Transcript Policy - A link to the policy can be found at onestop.umn.edu.

VIII. Other Course Information and Policies

Grade Option Change (if applicable)

For full-semester courses, students may change their grade option, if applicable, through the second week of the semester. Grade option change deadlines for other terms (i.e. summer and half-semester courses) can be found at onestop.umn.edu.

Course Withdrawal

Students should refer to the Refund and Drop/Add Deadlines for the particular term at onestop.umn.edu for information and deadlines for withdrawing from a course. As a courtesy, students should notify their instructor and, if applicable, advisor of their intent to withdraw.

Students wishing to withdraw from a course after the noted final deadline for a particular term must contact the School of Public Health Office of Admissions and Student Resources at sph-ssc@umn.edu for further information.

Student Conduct Code

The University seeks an environment that promotes academic achievement and integrity, that is protective of free inquiry, and that serves the educational mission of the University. Similarly, the University seeks a community that is free from violence, threats, and intimidation; that is respectful of the rights, opportunities, and welfare of students, faculty, staff, and guests of the University; and that does not threaten the physical or mental health or safety of members of the University community.

As a student at the University you are expected adhere to Board of Regents Policy: *Student Conduct Code*. To review the Student Conduct Code, please see: http://regents.umn.edu/sites/default/files/policies/Student_Conduct_Code.pdf.

Note that the conduct code specifically addresses disruptive classroom conduct, which means "engaging in behavior that substantially or repeatedly interrupts either the instructor's ability to teach or student learning. The classroom extends to any setting where a student is engaged in work toward academic credit or satisfaction of program-based requirements or related activities."

Use of Personal Electronic Devices in the Classroom

Using personal electronic devices in the classroom setting can hinder instruction and learning, not only for the student using the device but also for other students in the class. To this end, the University establishes the right of each faculty member to determine if and how personal electronic devices are allowed to be used in the classroom. For complete information, please reference: http://policy.umn.edu/Policies/Education/Education/STUDENTRESP.html.

Scholastic Dishonesty

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. (Student Conduct Code: http://regents.umn.edu/sites/default/files/policies/Student_Conduct_Code.pdf) If it is determined that a student has cheated, he or she may be given an "F" or an "N" for the course, and may face additional sanctions from the University. For additional information, please see: http://policy.umn.edu/Policies/Education/Education/INSTRUCTORRESP.html.

The Office for Student Conduct and Academic Integrity has compiled a useful list of Frequently Asked Questions pertaining to scholastic dishonesty: http://www1.umn.edu/oscai/integrity/student/index.html. If you have additional questions, please clarify with your instructor for the course. 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.

Makeup Work for Legitimate Absences
Students will not be penalized for absence during the semester due to unavoidable or legitimate circumstances. Such circumstances include verified illness, participation in intercollegiate athletic events, subpoenas, jury duty, military service, bereavement, and religious observances. Such circumstances do not include voting in local, state, or national elections. For complete information, please see: http://policy.umn.edu/Policies/Education/Education/MAKEUPWORK.html.

Appropriate Student Use of Class Notes and Course Materials
Taking notes is a means of recording information but more importantly of personally absorbing and integrating the educational experience. However, broadly disseminating class notes beyond the classroom community or accepting compensation for taking and distributing classroom notes undermines instructor interests in their intellectual work product while not substantially furthering instructor and student interests in effective learning. Such actions violate shared norms and standards of the academic community. For additional information, please see: http://policy.umn.edu/Policies/Education/Education/STUDENTRESP.html.

Sexual Harassment
"Sexual harassment" means unwelcome sexual advances, requests for sexual favors, and/or other verbal or physical conduct of a sexual nature. Such conduct has the purpose or effect of unreasonably interfering with an individual's work or academic performance or creating an intimidating, hostile, or offensive working or academic environment in any University activity or program. Such behavior is not acceptable in the University setting. For additional information, please consult Board of Regents Policy: http://regents.umn.edu/sites/default/files/policies/SexHarassment.pdf

Equity, Diversity, Equal Opportunity, and Affirmative Action
The University will provide equal access to and opportunity in its programs and facilities, without regard to race, color, creed, religion, national origin, gender, age, marital status, disability, public assistance status, veteran status, sexual orientation, gender identity, or gender expression. For more information, please consult Board of Regents Policy: http://regents.umn.edu/sites/default/files/policies/Equity_Diversity_EO_AA.pdf.

Disability Accommodations
The University of Minnesota is committed to providing equitable access to learning opportunities for all students. Disability Services (DS) is the campus office that collaborates with students who have disabilities to provide and/or arrange reasonable accommodations.

If you have, or think you may have, a disability (e.g., mental health, attentional, learning, chronic health, sensory, or physical), please contact DS at 612-626-1333 to arrange a confidential discussion regarding equitable access and reasonable accommodations.

If you are registered with DS and have a current letter requesting reasonable accommodations, please contact your instructor as early in the semester as possible to discuss how the accommodations will be applied in the course.

For more information, please see the DS website, https://diversity.umn.edu/disability/.

Mental Health and Stress Management
As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance and may reduce your ability to participate in daily activities. University of Minnesota services are available to

assist you. You can learn more about the broad range of confidential mental health services available on campus via the Student Mental Health Website: http://www.mentalhealth.umn.edu.

The Office of Student Affairs at the University of Minnesota

The Office for Student Affairs provides services, programs, and facilities that advance student success, inspire students to make life-long positive contributions to society, promote an inclusive environment, and enrich the University of Minnesota community.

Units within the Office for Student Affairs include, the Aurora Center for Advocacy & Education, Boynton Health Service, Central Career Initiatives (CCE, CDes, CFANS), Leadership Education and Development –Undergraduate Programs (LEAD-UP), the Office for Fraternity and Sorority Life, the Office for Student Conduct and Academic Integrity, the Office for Student Engagement, the Parent Program, Recreational Sports, Student and Community Relations, the Student Conflict Resolution Center, the Student Parent HELP Center, Student Unions & Activities, University Counseling & Consulting Services, and University Student Legal Service.

For more information, please see the Office of Student Affairs at http://www.osa.umn.edu/index.html.

Academic Freedom and Responsibility: for courses that do not involve students in research

Academic freedom is a cornerstone of the University. Within the scope and content of the course as defined by the instructor, it includes the freedom to discuss relevant matters in the classroom. Along with this freedom comes responsibility. Students are encouraged to develop the capacity for critical judgment and to engage in a sustained and independent search for truth. Students are free to take reasoned exception to the views offered in any course of study and to reserve judgment about matters of opinion, but they are responsible for learning the content of any course of study for which they are enrolled.*

Reports of concerns about academic freedom are taken seriously, and there are individuals and offices available for help. Contact the instructor, the Department Chair, your adviser, the associate dean of the college, or the Vice Provost for Faculty and Academic Affairs in the Office of the Provost.

* Language adapted from the American Association of University Professors "Joint Statement on Rights and Freedoms of Students".

Template update 9/2014