

# School of Public Health

## Syllabus and Course Information



UNIVERSITY OF MINNESOTA  
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### PubH 8300

### Synthesis and Application of Methods in Epidemiologic Research

### Fall 2015

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Credits:	3	
Meeting Days:	Tuesdays and Thursdays	
Meeting Time:	12:30-2:00 pm	
Meeting Place:	Moos Health Science Tower 5-125	
Instructor:	Richard MacLehose, PhD	Michael Oakes, PhD
Office Address:	441 West Bank Office Building (WBOB)	431 WBOB
Office Phone:	612-624-1932	612-624-6855
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Office Hours:	By appointment	By appointment

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#### 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 survey analysis and parametric g-formula. 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.

Note: This syllabus is subject to change.

#### II. Course Prerequisites

PubH 8341 and PubH 8342, or permission of instructors

### 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 and conduct new methodologies (g-formula, complex survey analysis) on example data sets
- 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
- Write the methods and results section of a research paper

### 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. Students and instructor will engage in a detailed discussion of the assigned readings and how the readings relate to the research topics the students are working on for class. 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 by collaborative groups during most weeks of the course. 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 homeworks 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: 9/8; 9/10**

Lecturer: Richard MacLehose

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: 9/15; 9/17**

Lecturer: Richard MacLehose

Topic: G-methods/Marginal Structural Models

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.

*In-class assignment*: Standardization

*Homework 1*: Marginal Structural Models

### **Week 3: 9/22; 9/24**

Lecturer: Richard MacLehose

Topic: Marginal Structural Models

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: 10/1 (NO CLASS ON 9/29)**

Lecturer: Richard MacLehose

Topic: Regression for binary outcomes

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](http://www.nber.org/papers/w18252.pdf?new_window=1)

*In-class assignment:* Estimate relative risks and risk difference using various approaches

**Week 5: 10/6; 10/8**

Lecturer: Michael Oakes

Topic: Subject recruitment, retention and survey design

Readings: Oakes et al. Recruiting subjects for neighborhood effects research. *Health & Place*. 2006.

Swanson, G. Marie, and Amy J. Ward. "Recruiting minorities into clinical trials toward a participant-friendly system." *Journal of the National Cancer Institute* 87.23 (1995): 1747-1759.

Zook, Patricia M., et al. "Retention strategies and predictors of attrition in an urban pediatric asthma study." *Clinical Trials* 7.4 (2010): 400-410.

*In-class assignment:* Design or modify a survey for use in a designated study; develop a subject recruitment and retention plan

**Week 6: 10/13; 10/15**

Lecturer: Michael Oakes

Topic: Sampling, complex survey designs and analysis

Readings:

Rothman, Kenneth J., John EJ Gallacher, and Elizabeth E. Hatch. "Why representativeness should be avoided." *International Journal of Epidemiology* 42.4 (2013): 1012-1014. (with discussion)

Valient et al., Ch 2: Design a single stage personal survey. In *Practical Tools for Designing and Weighting Survey Samples*. Springer, 2013

Valient et al., Ch 3: Sample design and sample size. In *Practical Tools for Designing and Weighting Survey Samples*. Springer, 2013

Extra Awesomeness:

Lumley T. *Complex Surveys: a guide to analysis using R*. Wiley, 2011

*In-class assignment:* Assess complex survey data

*Homework 3:* Analyze complex survey data using Stata

**Week 7: 10/20; 10/22**

Lecturer: Michael Oakes

Topic: Multiple causes: Factorial experiments and factorial surveys

Readings: Wallander, Lisa. "25 years of factorial surveys in sociology: A review." *Social Science Research* 38.3 (2009): 505-520.

Jasso, G. (2006). Factorial survey methods for studying beliefs and judgments. *Sociological Methods & Research*, 34(3), 334-423.

Review <http://methodology.psu.edu/ra/most/factorial>

*In-class assignment:* Design factorial experiment and fit appropriate model

**Week 8: 10/27; 10/29**

Lecturer: Richard MacLehose

Topic: Meta Analysis

Readings: Greenland S, O'Rourke K. Ch 33 Meta-Analysis in Rothman, Greenland and Lash. *Modern Epidemiology*.

*Homework 4:* Analyze data for meta analysis

**Week 9: 11/3; 11/5**

Lecturer: Michael Oakes

Topic: Multilevel models

Readings:

In-class assignment:

Oakes, J. Michael, et al. "Twenty years of neighborhood effect research: an assessment." *Current epidemiology reports* 2.1 (2015): 80-87.

Singer, Judith D. "Using SAS PROC MIXED to fit multilevel models, hierarchical models, and individual growth models." *Journal of educational and behavioral statistics* 23.4 (1998): 323-355.

Greenland, Sander. "A review of multilevel theory for ecologic analyses." *Statistics in medicine* 21.3 (2002): 389-395.

**Week 10: 11/10; 11/12**

Lecturer: Michael Oakes

Topic: Power and Statistical Inference

Readings:

Balding, David J. "A tutorial on statistical methods for population association studies." *Nature Reviews Genetics* 7.10 (2006): 781-791.

Pocock, Stuart J., Nancy L. Geller, and Anastasios A. Tsiatis. "The analysis of multiple endpoints in clinical trials." *Biometrics* (1987): 487-498.

Hoening, John M., and Dennis M. Heisey. "The abuse of power." *The American Statistician* 55.1 (2001).

*Homework 2:* Write statistical power sections for two grant applications, one observational and one experimental design.

**Week 11&12: 11/17; 11/19; 11/24**

Lecturer: Richard MacLehose

Topic: Penalized regression

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 13: 12/1; 12/3**

Lecturer: Michael Oakes

Topic: Psychological bias in statistical and scientific reasoning

Readings:

Burton RA. *On Being Certain: Believing you are Right even when you're Not*. New York: St. Martin's Press 2008.

Cope MB, Allison DB. White hat bias: a threat to the integrity of scientific reporting. *Acta Paediatr*;99:1615-7.

MacCoun RJ. Biases in the interpretation and use of research results. *Annu Rev Psychol* 1998;49:259-87.

**Week 14: 12/8; 12/10;**

Lecturer: Richard MacLehose

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.

Homework: Bootstrap effect estimates from

**Week 15: 12/15**

Lecturer: Oakes/MacLehose

Topic: Wrap-up  
Readings: None  
*Final*

## **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](http://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](http://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](http://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](http://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](http://onestop.umn.edu).

### **Course Withdrawal**

Students should refer to the Refund and Drop/Add Deadlines for the particular term at [onestop.umn.edu](http://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](mailto: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](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](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](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".

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