

## Public Health Sciences 31001

### Epidemiologic Methods

Winter Quarter 2024

**Time:** Tuesday and Thursday, 12:30-1:50 PM, (BSLC 202)  
STATA lab: Wednesday, 9:00-9:50 AM (BSLC 018)

**Instructor:** Brian C.-H. Chiu, PhD  
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**TA:** Jason Cheung  
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Office hours: Thursday 2:00-3:00 PM (BSLC G/F)

**Guest Lecturer:**  
Gregory Calip, PharmD, MPH, PhD  
Director, Global Epidemiology (Oncology), AbbVie

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### Prerequisites

- PBHS 30910 (Epidemiology and Population Health) or equivalent
- Statistics coursework including multiple regression (such as PBHS/Stat 224).  
PBHS 32700 (Biostatistical Methods) may be taken concurrently, but this is not required.
- The course assumes some familiarity with Stata.

### Course Overview

This course provides students with an in-depth understanding of epidemiologic concepts and methods. It is the second course in the epidemiology series. The focus of this course will be in practical and theoretical considerations of observational research methods; statistical methods and applications in epidemiologic studies; in-depth evaluation of bias, confounding, and interaction; and communicating epidemiologic findings. Students will also learn how to perform data analysis using classic methods. It is not a theoretical statistics course.

### Format:

Lectures and discussions, homework, mid-term, and final term-paper and presentation. The lecture slides will be posted after each lecture, while reading materials are expected to be read before the lecture. This course also includes an optional lab session. The lab session will cover data management, data analyses, and model selection using STATA.

### Course Objectives:

1. Develop an in-depth methodologic framework for understanding, planning, and evaluating epidemiologic research
2. Develop skill in selecting and developing appropriate exposure and outcome measurement procedures
3. Define different types of bias; evaluate their likely directions and threat to causal inference; and identify strategies to minimize biases in epidemiologic studies
4. Define confounding, interactions, and effect modification and understand how they affect the design and analysis of studies

5. Be able to write STATA programs and select the appropriate analytic methods for epidemiologic studies
6. Recognize the essential connections between the planning of studies, evaluating measurement procedures for specific study design, as well as the collection, analysis, and interpretation of the data

### **For those in the MPH Program:**

The Council on Education for Public Health (CEPH) requires that the MPH curriculum include specific core competencies. The core competencies addressed in this course are listed below.

#### **(MPH) Public Health Knowledge (PHK) Competencies:**

1. Apply epidemiological methods to the breadth of settings and situations in public health practice
2. Select quantitative and qualitative data collection methods appropriate for a given public health context
3. Analyze quantitative and qualitative data using biostatistics, informatics, computer-based programming and software, as appropriate
4. Interpret results of data analysis for public health research, policy or practice
18. Select communication strategies for different audiences and sectors
19. Communicate audience-appropriate public health content, both in writing and through oral presentation

#### **MPH Concentration Competencies:**

- Epi/GH 1. Design and plan epidemiological studies to answer questions related to the determinants and distribution of diseases in human populations
- Epi/GH 2. Design and carry out the statistical analysis plan for different types of epidemiological studies, including cross-sectional, ecological, case-control and cohort studies
- Epi/GH 3. Develop multivariable statistical models to quantify the relationships between risk factors and disease, potentially in the presence of confounding and effect modification

### **Stata instruction sessions:**

TA will offer weekly STATA instruction sessions / office hours. These will be in the computer lab in the BSLC 018 on Wednesday, from 9:00-9:50 AM.

### **Required textbook:**

Epidemiology: Beyond the Basics, 4th ed. (Szklo M and Nieto FJ.), Jones & Bartlett Learning, 2019 (ISBN 978-1-284-11659-5)

### **Optional textbook:**

Modern Epidemiology, 4th ed. (Lash TL, VanderWeele TJ, Haneuse S, Rothman KJ), Lippincott-Raven, ISBN/ISSN: 9781451193282

Designing Clinical Research, 4<sup>th</sup> ed. (Stephen B. Hulley et al.), Lippincott Williams & Wilkins, ISBN-13: 9781608318049

### **Software:**

Stata version SE 17.0 (Intercooled or SE: Small Stata is too small): Helpful web page:

<http://www.stata.com/support/>

### **Grading/Student Evaluation**

- a) Class participation and discussion (2%) - Students are expected to come to class and take part in classroom discussion. If you will miss a class, you must notify the instructor in advance. Students are not expected to miss more than two classes.

- b) Examination (28%) – There will be a closed-book midterm exam. The examination may consist of multiple choice, and short answer, and will be administered at the scheduled times. Students are expected to do their own work on exams. **Cheating on exams will not be tolerated and can result in a failing grade.** You will need a basic calculator for the exam. You may not use your phone or computer as a calculator during the exam. Make up examination will only be given under extenuating circumstances and should be arranged in advance.  
Competencies assessed: PHK 1, 2, 4; Epi/GH 1, 2.
- c) Homework assignments (30%) – There will be 6 homework assignments; all will involve data analysis. Students may discuss homework assignments but **each student must create their Stata do-file, log file, and write-up the assignment individually.** Assignments will be posted in advance on the course's Canvas site. Assignments should be uploaded to Canvas by the beginning of the scheduled class time on their due dates. Late assignments will not be read unless a valid reason is given to the instructor *in advance*. If you have any planned absences during the quarter, be sure to arrange alternative due dates in advance as necessary. Each assignment will count 5% of the course grade.  
Competencies assessed: PHK 3, 4; Epi/GH 2, 3.
- d) Final term-paper (35%) and presentation (5%) – The final project will be done in two-person teams (unless there are an odd number of students, in which case there will be a three-person team). Dr. Chiu will pair students with different backgrounds, reflecting the interdisciplinary nature of epidemiology research. The purpose of the final project will be to **design an observational study**. Thus, experimental designs such as randomized clinical trials are not allowed. Attached are possible topics for final projects. Each group should select three topics and rank them in order of priority (1=highest priority, 3=lowest priority) on the form below. These forms should be turned in by **Thursday, January 25 at noon**. One topic will be assigned to each group with every attempt to assign the preferred topic. No two groups will receive the same topic, however.

The topics have been selected to purposely reflect areas of research that have not been explored (or explored very little). For this reason, students will **not** be expected to conduct a literature search on the particular etiologic hypothesis. However, students are encouraged to consult available literature regarding classification and measurement of exposures and outcomes involved. For example, methods for ascertaining pesticide exposure in food might be researched. Likewise, diagnostic criteria for dementia as well as epidemiologic literature on the natural history of the disease would be researched for a study of that outcome.

You may need to refine the question, often by narrowing the exposure or outcome variable. For example, you might want to restrict a study of cerebrovascular disease to hemorrhagic stroke, select subtype of leukemia, and type of wound infection, etc.

The final product will be a double-spaced, typewritten paper of 10 pages of text using font size 12 with one inch margins, due on **Tuesday, February 27th at noon**, when copies should be uploaded to the course's Canvas site. Late submission will not be graded. The paper should demonstrate comprehensive understanding of epidemiologic concepts and methods. The three final classes will consist of brief presentations and discussions of these assignments. The following outline describes what should be included in the paper.

1. Specific Objectives (<1/3 page, 1 pt)  
State the research question and the study design to follow. Students will **not** be expected to conduct a literature search on the particular etiologic hypothesis. (1 pt)
2. Methods (64 pts)

- 2.1 Overview of chosen study design - Provide rationale for chosen design, including considerations of practicality and scientific validity. (10 pts)
  - 2.2 Study subjects – Sampling frame, inclusion and exclusion criteria, and plans for recruiting subjects if applicable. (3 pts)
  - 2.3 Measures and data collection methods – students should describe and justify measurement methods. Reliability and validity in previous studies and required adaptations for the proposed study are relevant. (10 pts)
  - 2.4 Main independent variables – be specific about measures and classification schemes chosen. Should critically evaluate various options, with citations, and justify the chosen options as compared with others given the proposed study design, with citations. Creation of a new measurement instrument is not required, but may be needed for some projects. In this case, consideration will be given for creative effort (i.e., created items/scales/indexes don't have to be perfect, but evidence should exist for a good effort). (20 pts)
  - 2.5 Potential confounding variables – provide rationale for potential variables to be measured. Give measures and classification schemes to be used, with citations, but in-depth presentation is not necessary. (6 pts)
  - 2.6 Outcome variables – be specific, critically evaluate available options with citations, and justify options chosen for measures given the study design, diagnostic criteria, and classification schemes. (15 pts)
3. Statistical issues (15 pts)  
Outline of statistical analyses to be employed (1 pt). Discuss how independent variables and outcome variables to be analyzed (2 pts) and why (6 pts). Also, discuss in detail how potential confounding and interaction/effect modification will be examined and why. (6 pts)
  4. Potential limitations (20 pts)  
Concerns regarding proposed study design and conduct. (10 pts) Discuss methods that will be used to evaluate whether any potential biases actually occur. (10 pts)

Competencies assessed by final term-paper: PHK 1, 2; Epi/GH 1, 2, 3.

**Presentation:** Each team needs to prepare a presentation on the final project. The presentation should focus on the **methods section** (i.e., **items 2.1-2.6**) listed above. The presentation should be 15 minutes, plus 1-2 minutes for questions/discussion. Everyone will be expected to ask questions and participate in discussion. The presentation will be graded on organization, content, clarity, as well as communication, coordination, and collaboration between team members. Dr. Chiu will randomly order the presentation, and then you can trade among yourselves.

Competencies assessed by final presentation: PHK 18, 19.

- e) All **final grades** are rounded to the nearest decimal (e.g., 91.39% = 91.4%). The following grading scheme is used to determine final grade: A (93-100), A- (90-92), B+ (88-89), B (83-87), B- (80-82), C+ (78-79), C (73-77), C- (70-72), D+ (68-69), D (63-67), D- (60-62), F (0-59). A letter grade (10%) will be deducted per day any assignment is late.

### The Use of AI Tools

In this course, we will be developing skills and knowledge that are important to discover and practice on your own. Because use of AI tools inhibits development of these skills and knowledge, students are **not allowed to use any AI tools**, such as ChatGPT or Dall-E 2 etc., in this course. Students are expected to present work that is their own without assistance from others, including automated tools. If you are unclear if something is an AI tool, please check with your instructor. Using AI tools for any

purposes in this course will violate the University's [academic integrity policy](#). **Potential academic integrity violations will not be tolerated and can result in a failing grade.**

NOTE: If you are graduating this quarter, you must let the instructor know by the end of 4<sup>th</sup> week so that appropriate arrangements can be made to submit your course grade early.

	Date	Topics & Competencies	Reading	Instructor	Homework
1	Th 1/4	Course introduction, Causal inference and scientific reasoning  PHK 1	<ul style="list-style-type: none"> <li>• Szklo, p. 439-456</li> <li>• Lash, ch 2</li> </ul> <a href="https://www.youtube.com/watch?v=8B271L3NtAw">https://www.youtube.com/watch?v=8B271L3NtAw</a>	Chiu	
2	T 1/9	Overview of study designs  PHK 2; Epi/GH 1	<ul style="list-style-type: none"> <li>• Szklo, ch 1</li> <li>• Ness R. AJE 2012;175:733-8</li> </ul>	Chiu	
	W 1/10 Lab 1	Intro to Stata - Variable creation, reshaping of data  PHK 2	Stata session 1		HW1 HANDOUT
3	Th 1/11	Measure of occurrence  PHK 1	<ul style="list-style-type: none"> <li>• Szklo, ch 2</li> </ul>	Chiu	
4	T 1/16	Measure of disease association  PHK 1, 2; Epi/GH 1	<ul style="list-style-type: none"> <li>• Szklo, ch 3</li> <li>• Pearce N. Int J Epidemiol 1993;22:1189-92</li> </ul>	Chiu	HW1 DUE
	W 1/17 Lab 2	Hypothesis testing, table 1  PHK 3, 4; Epi/GH 2, 3	Stata session 2		HW2 HANDOUT
5	Th 1/18	Bias I  PHK 1, 2; Epi/GH 1	<ul style="list-style-type: none"> <li>• Szklo, ch 4</li> <li>• Sackett DL et al., J Chronic Dis 1979;32:51-63</li> <li>• Morimoto LM, AJE 2003;158:259-63</li> </ul>	Chiu	
6	T 1/23	Bias II  PHK 1, 2; Epi/GH 1	<ul style="list-style-type: none"> <li>• Suissa S. AJE 2008;167:492-9</li> <li>• Suissa &amp; Azoulay, Diabetes Care 2012;35:2665-2673</li> </ul>	Calip	HW2 DUE
	W 1/24 Lab 3	Epidemiologic module in Stata  PHK 3, 4; Epi/GH 2	Stata session 3		HW3 HANDOUT
7	Th 1/25	Confounding  PHK 1, 2; Epi/GH 1	<ul style="list-style-type: none"> <li>• Szklo, ch 5</li> <li>• Blakely T et al. J Epidemiol Community Health 2004;58:1030-1</li> </ul>	Chiu	topic for final project due (1/25 by noon)
8	T 1/30	Interaction  PHK 1, 2; Epi/GH 1	<ul style="list-style-type: none"> <li>• Szklo, ch 6 and Appendix C</li> <li>• Knol MJ et al., Epidemiol 2009;20:161-6</li> <li>• Rothman et al., AJE 1980;112:467-70</li> </ul>	Chiu	HW3 DUE
	W 1/31 Lab 4	Identifying confounding and interaction  PHK 3, 4; Epi/GH 2, 3	Stata session 4		HW4 HANDOUT
9	Th 2/1	<b>Midterm exam</b>		Chiu	
10	T 2/6	Cohort studies  PHK 1, 2; Epi/GH 1	<ul style="list-style-type: none"> <li>• Lash, ch 7</li> <li>• Hunt JR. Epi Review 1998;20:57-70</li> <li>• Szklo M. Epi Review 1998;20:81-90</li> <li>• Willett WC. Epi Review 1998;20:91-99</li> </ul>	Chiu	HW4 DUE
	W 2/7 Lab 5	Poisson regression  PHK 3, 4; Epi/GH 2, 3	Stata session 5		HW5 HANDOUT
11	Th 2/8	Cohort/case-control studies	<ul style="list-style-type: none"> <li>• Lash, ch 7, ch 8</li> <li>• Hunt JR. Epi Review 1998;20:57-70</li> <li>• Szklo M. Epi Review 1998;20:81-90</li> <li>• Willett WC. Epi Review 1998;20:91-99</li> <li>• Knol MJ, et al., AJE 2008;168:1073-81</li> </ul>	Chiu	

		PHK 1, 2; Epi/GH 1	• Wacholder S et al., AJE 1992;135:1019-50		
12	T 2/13	Case-control studies PHK 1, 2; Epi/GH 1	• Lash, ch 8 • Knol MJ, et al., AJE 2008;168:1073-81 • Wacholder S et al., AJE 1992;135:1019-50	Chiu	HW5 DUE
	W 2/14 Lab 6	Logistic regression PHK 3, 4; Epi/GH 2, 3	Stata Session 6		HW6 HANDOUT
13	Th 2/15	Data collection instruments and field methods PHK 2; Epi/GH 1	• Lash ch. 10 • Hulley Ch 4, 15, 17	Chiu	
14	T 2/20	Administrative databases PHK 1, 2; Epi/GH 1	• Warren JL et al., Med Care 2002;40(8 suppl):IV-3-18 • Klabunde CN et al., Med Care 2002;40(8 suppl):IV-26-35	Calip	HW6 DUE
	W 2/21 Lab 7	STATA Help	Stata session 7		
15	Th 2/22	Meta-analysis PHK 1, 2; Epi/GH 1	• Szklo, pp 461-465 • Hulley pp 200-202, 205-206	Cheung	Final project due (2/27 at noon)
16	T 2/27	Student presentation PHK 18, 19		Chiu	
17	Th 2/29	Student presentation PHK 18, 19		Chiu	
18	T 3/5	Student presentation PHK 18, 19		Chiu	
19	Th 3/7	No final exam. Optional individual meetings to discuss final projects.		Chiu	

Topics for Final Paper – PHS31001  
Winter Quarter 2024

Your Group:

Circle three topics below. By each, indicate first, second, or third choice.

Choice number	Topic
	1. Air pollution as a risk factor for epilepsy
	2. Radon exposure as a risk factor for chronic obstructive pulmonary disease (COPD)
	3. Stress as a risk factor for acquired immune deficiency syndrome (AIDS)
	4. Insomnia as a risk factor for brain cancer
	5. High blood pressure as a risk factor for Alzheimer's disease
	6. TSA full body scanning as a risk factor for Parkinson's disease
	7. Non-occupational physical activity as a protective factor for glaucoma
	8. High cholesterol level as a risk factor for dementia
	9. Maternal caffeine intake during pregnancy and risk of bipolar disorder in children
	10. Ionizing radiation as a risk factor for depression
	11. Antioxidant intake as a protective factor for type 2 diabetes mellitus
	12. Chlorine in water supplies as a risk factor for ovarian cancer
	13. BCG vaccination as a risk factor for bladder cancer
	14. Blood transfusion as a risk factor for asthma
	15. Low social support as a risk factor for posttraumatic stress disorder
	16. Multivitamin intake as a protective factor for shingles
	17. Low dietary fiber as a risk factor for anorexia
	18. Smoking and risk of multiple sclerosis
	19. Employment as a nuclear medical technician and risk of lymphoma
	20. Pesticide exposure as a risk factor for cirrhosis
	21. High intake of red meat as a risk factor for arthritis



	22. Social use of cannabis as a risk factor for multiple myeloma
	23. Depression as a risk factor for lung cancer
	24. Alcohol intake as a risk factor for coronavirus disease (COVID-19)
	25. Exposure to a general anesthetic as a risk factor for memory decline
	26. Obesity as a risk factor for hepatitis C infection
	27. COVID-19 infection as a risk factor for the development of gout