Environmental Epidemiology

Course Syllabus

Course number: EPID 7110
Course level: Graduate
Course semester: Spring 2024
Course credit unit: 1.0
Course time: Tuesday 1:45pm to 4:44pm (3 hours a week)
Course location: Blockley 235

Course director: Dr. Aimin Chen
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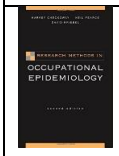
Course textbook: None is required. Recommended readings are:

Book	Title	Authors	Edition	Year	Publisher	ISBN
	Environmental Epidemiology: Study Methods and Application	Dean Baker, Mark Nieuwenhuijsen	First	2008	Oxford University Press	978-0-19-852792-3
	Research Methods in Occupational Epidemiology	Harvey Checkoway, Neil Pearce, David Kriebel	Second	2004	Oxford University Press	978-0-19-509242-4

Course description: Environmental Epidemiology is an advanced epidemiology course that addresses epidemiological research methods used to study environmental exposures from air pollution to heavy metals, and from industrial pollutants to consumer product chemicals. The course will provide an overview of major study designs in environmental epidemiology, including cohort studies, panel studies, natural experiments, randomized controlled trials, time-series, and case-crossover studies. The course will discuss disease outcomes related to environmental exposures, including cancer and diseases of cardiovascular, respiratory, urinary, reproductive, and nervous systems. Case studies in environmental epidemiology will be discussed to provide details of research methods and findings.

Course prerequisite: It is recommended, although not required, that students had an introductory epidemiology course and an introductory biostatistics course. The course is open to

all BGS students, MSCE and MPH students, with a particular emphasis on epidemiology students, environmental health students, and students in the Certificate Program in Environmental Health Sciences.

Course learning objectives: The course is structured to enhance students' abilities in reviewing, designing, conducting, and interpreting environmental epidemiologic studies. Specific learning objectives are:

1. To review and criticize environmental epidemiology literature and identify research gaps;
2. To apply environmental epidemiologic designs and methods in designing studies of environmental exposures and health outcomes;
3. To implement cohort study, time-series study, case-crossover study and other study designs in the real-world setting of environmental exposures;
4. To demonstrate the abilities of exposure assessment, health outcome ascertainment, and association investigation while controlling confounding factors and reducing selection and information biases;
5. To interpret environmental epidemiologic study findings in the context of strengths and weaknesses of the study designs and research methods

Course competencies: The course will emphasize the following core competencies: knowledge in environmental epidemiology (designs and methods, research topics); research skills (literature review, study design, implementation, and interpretation); and communication skills (writing, discussion, and presentation).

Scientific rigor and reproducibility: The course will use peer-reviewed high-quality environmental epidemiologic studies, provide instructions on rigorous study design and implementation, and highlight reproducibility of data analysis and interpretation.

Course outcomes: After the completion of the course, the students will be able to independently evaluate a research area in environmental epidemiology through literature review and use of library and internet resources. The students will have abilities to design an environmental epidemiologic study to examine a new association between an exposure and a health outcome in a human population. The students will also acquire and implement knowledge in exposure quantification using history of exposure, biomarkers, and spatiotemporal modeling, in pathways of disease occurrence using biomarkers of pathogenesis, and in outcome assessment using record linkage and direct measurements. Finally, the students will have enhanced skills in communication of environmental epidemiologic studies to peers, public, and policy makers.

Course format: The course format is a combination of lectures of study designs and methods, lectures of case studies, student journal clubs, and student presentations of a new research design.

- Course lectures of study designs and methods: The study designs and methods will be lectured with a focus on environmental epidemiologic studies. These lectures are intended to provide students principles of exposure assessment and study designs and methods for the investigation of environmental chemical exposures.

- Course lectures of case studies: The research topic areas of environmental epidemiology are diverse. These lectures are intended to provide students a wide array of case studies in environmental epidemiology, including air pollution, heavy metals, persistent organic pollutants, and endocrine disrupting chemicals.
- Student journal clubs: In student journal club, students will lead a discussion of a case study, typically an environmental epidemiology research paper published in the past 5 years in a peer-reviewed journal. Journal examples include *Environmental Health Perspectives, Environmental International, Environmental research, International Journal of Hygiene and Environmental Health, American Journal of Epidemiology, Epidemiology, International Journal of Epidemiology, and Environmental Epidemiology*. Students will be grouped and work together to identify the paper and lead the discussion.
- Student presentations of a new research design: Each student will be asked to identify a research topic and design a new environmental epidemiologic study. Any environmental epidemiology topics are allowed; however, it is recommended to select a cutting edge research topic or an unsolved research question. Do not propose a meta-analysis or systematic review. Students will review the literature of the topic area and **write a term paper on the new research design**. The term paper should be 10-12 pages (double space, font size 12, 1-inch margin, not including bibliography) and include background, new research study design, exposure assessment, outcome assessment, confounding control, statistical analysis, potential pitfalls and alternative strategies. Students will **present the new research design** to the class for feedbacks and comments. The presentation will be 30 min plus 15 min Q&As.

Course Schedule

Week	Date Tuesday	Contents		Reading
1	1/23	Introduction of environmental epidemiology	Case study: asbestos and mesothelioma	Berger RE et al. NEJM 2017; 376:2591-2592
2	1/30	Exposure assessment I: general guidelines and air pollution	Case study: Radon and lung cancer	Konen T et al. Environ Res 2019;175:449-456
3	2/6	Exposure assessment II: metals and organic chemicals	Case study: Arsenic and cadmium exposure and health outcomes	Field RW et al. Am J Epidemiol 2002; 151(11):1091-1102
4	2/13	Cohort study & Birth cohort	Case study: Lead and child neurodevelopment	Argos M et al. Lancet 2010;376(9737):252-258
5	2/20	Case-control study and nested case-control study	Case study: Pesticides and Parkinson's disease	Lanphear BP et al. Environ Health Perspect 2005;113(7):894-899

6	2/27	Time series study (Guest Lecture by Dr. Jagadeesh Puvvula)		Tanner CM et al. Environ Health Perspect 2011;119(6):866-872
7	3/5	Spring Break (no class)		
8	3/12	Case-crossover study	Case study: Air pollution and cardiac disease	Bravo MA et al. Environ Health Perspect 2017;125(4):594-601
9	3/19	Randomized trial, natural experiment, and panel study	Case study: Air pollution and respiratory disease	Garcia E et al. JAMA 2019;321(19):1906-1915
10	3/26	Spatial environmental epidemiology (Guest Lecture by Dr. Jagadeesh Puvvula)		
11	4/2	Student journal club	Student journal club	Journal club paper
12	4/9	Methods considerations in environmental epidemiology (Guest lecture by Dr. Enrique Schisterman)		
13	4/16	Interpreting environmental epidemiologic findings: policy implications	Case study: C8 (PFOA) Health Study	
14	4/23	Methods in studying mixture of exposure	Case study: Fluoride and flame retardants: beneficial or harmful?	
15	4/30	Challenges in environmental epidemiology	Case study: Global setting for environmental epidemiology	
16	5/7	Student presentation	Student presentation	

Course grading

- Student journal club (30%): Students will actively participate in student journal club, including searching for environmental epidemiology literature, reading the journal club article, presenting the article to the class, and discussing the strengths and limitations of the article.
  Each student or each student group (if more students are available) will lead a 45-min session of journal club discussion of one paper. Two papers will be discussed in a journal club session (90 min total), for a total of four papers in the semester. The lead

student or group will select, distribute, present, and discuss the paper. The papers need to be distributed to all students two weeks before the session; other students will submit at least one question per paper to the lead student or student group two days before the journal club. The presentation of each paper is about 25 min, leaving 20 min for discussing the paper. The grading will be based on understanding of the papers (15 points) and the quality of questions and discussion (15 points).

- Term paper of new research design (50%): Students will independently complete the term paper of a new research design in environmental epidemiology. The grading will be based on:
    - Literature review and knowledge gap (10 points);
    - Significance and implication of the new study (10 points);
    - Methodological rigor of the new study design, exposure assessment, outcome assessment, confounding control, and statistical analysis (25 points);
    - Feasibility, potential pitfalls, and alternative strategies (5 points).
- Final presentation of new research design (20%): Students will present the new study design to the class, including background, new design, and scientific impact. The grading will be based on:
    - Clarity of presentation (5 points);
    - Depth of knowledge in the topic area (5 points);
    - Scientific impact of the new study design (10 points).