PUBHEPI 7411 – Environmental Epidemiology
3 credit hours – Spring, 2020

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Class Time and Location: Mondays, 11:10am-1:45pm
Cunz Hall, Room 330

Instructor's Office Hours: By Appointment Only

TA Name, email, and office hours: Not applicable

TA responsibilities: Not applicable

Prerequisites: PUBHEPI6430 Epidemiology I or permission of the instructor.

Course description: The environment consists of where we live, work and play. Therefore, some critical questions about environmental and occupational exposures are: What are the sources of bias and confounding and how do these errors affect interpretation of environmental health studies? How can we minimize these errors through careful study design, statistical casual inference methods and emerging computational procedures, such as systems science methods? This course will examine these questions in depth and provide students an appreciation of epidemiological methods and causal thinking for improving rigor and relevance of scientific and policy research in environmental health and epidemiological research.

Class Format: Class sessions will consist of lectures and in-class discussions and readings. Group activities and problem-based learning techniques will be utilized on occasion in this course.

Course Learning Objectives (with *learning outcomes*)

1. Follow the basic building blocks in environmental epidemiological research and study design.
    - *Define study designs commonly used in environmental epidemiology and state their strengths and weaknesses.*
    - *List sources of bias in study design with a focus on exposure misclassification bias.*
    - *Write a scientific hypothesis, propose methods to test the hypothesis and communicate results in clear and practical language.*
    - *Critique peer-reviewed scientific articles in major epidemiology journals.*
2. Summarize principles of environmental exposure assessment methods and their application in epidemiological research.
    - *Describe impact of bias due to exposure assessment on health effect estimates.*
    - *Learn methods for dealing with exposure misclassification in retrospective studies.*
    - *Learn about novel exposure assessment methods for minimizing bias in prospective studies.*

3. Learn about your own strengths and weaknesses in designing studies, gathering data, and interpreting results in environmental epidemiology studies.
    - *Show evidence of continuous improvement in application of knowledge gained in this course.*
4. Learn to be faithful to your own shortcomings in understanding and applying knowledge gained in this course.
    - *Develop an individual learning plan that will help you achieve your goals for this course.*
5. Integrate concepts from epidemiology and exposure science.
    - *Develop a conceptual map of linkages between multiple risk factors for a health outcome.*
6. Appreciate the complementary role of environmental health sciences and epidemiology in the understanding of environmental burden of disease.
    - *List ongoing environmental health concerns from the global to local scale.*
    - *Articulate study designs that would robustly test the evidence for current environmental health issues and translate those findings into action.*
7. Become familiar with resources for continuously improving study design and measurement (of health outcome and environmental exposure).
    - *Inventory sources of information that students may use after the course as reference material.*

Core Competencies:

Upon completion of the MPH degree, all graduates will be prepared to (numbering based on online listing of 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. Communicate audience-appropriate public health content, both in writing and through oral presentation

22. Apply systems thinking tools to a public health issue

Specialization Competencies:

Upon completion of the MPH degree, all graduates with a specialization in environmental health sciences will be prepared to:

1. Explain the significance of the community and workplace environment to environmental health.
2. Outline the health threat that natural and anthropogenic contaminants in the environment and pose to population health.
3. Identify and explain individual (e.g., genetic, physiologic, and psychosocial) and community (social, built, economic, race) susceptibility factors that heighten the risk for populations for adverse health outcomes from environmental hazards.
4. Access state, federal, and local resources for assessing environmental and occupational health.
5. Work with other public health disciplines (e.g. nurses, physicians, veterinarians, epidemiologists, biostatisticians) to address environmental and occupational health concerns.
6. Compare the principle components and influencing factors in the exposure continuum from source to disease.
7. Determine the role of exposure assessment in environmental and occupational health.

Upon completion of the MPH degree, all graduates with a specialization in epidemiology will be prepared to:

1. Design a survey to examine a public health problem or for use in an epidemiologic investigation.
2. Assess confounding and effect modification in data from an epidemiologic investigation.
3. Demonstrate familiarity with the basic content and issues in at least two substantive areas of application in epidemiology (e.g., cardiovascular epidemiology, cancer epidemiology, chronic disease epidemiology, infectious disease epidemiology, injury epidemiology).
4. Identify the natural histories of major types of disease and their relevance to epidemiologic investigations.

In addition, given the academic nature of the MS degree, upon graduation successful students in the MS degree program with a specialization in environmental health sciences or epidemiology are expected to be able to:

1. Read the scientific literature in the student's field and critique the methods and results.
2. With input from the student's advisor, identify an unanswered research questions, formulate a hypothesis, and design a research study.
3. Write a research proposal.
4. Evaluate research data and prepare a report summarizing the data, interpreting the statistical results, and presenting the findings, limitations, and conclusions.
5. Present and explain the study's purpose, methods, results, and conclusions to an informed audience.

In addition, given the advanced academic nature of the PhD degree, successful students in environmental health sciences or epidemiology are expected to be able to:

1. Formulate hypotheses and design a research study using the appropriate research methods and approaches.
2. Prepare a research proposal to address the research question, with particular attention to study design; subject selection; measurement of variables; methods for sample size determination, data collection, data management, and data analysis; and interpretation of results.
3. Apply relevant theories and conceptual models to inform and ground research and data analysis.
4. Communicate orally and in writing a research study's purpose, methods, results, and conclusions to an informed audience.

Text/Readings:

1. Savitz, David A. and Wellenius, George A. *Interpreting Epidemiologic Evidence: Connecting Research to Applications*. Oxford, UK: Oxford University Press, 2016. (Required text. PDF version of this book is available on Carmen.)
2. Additional peer-reviewed scientific articles as assigned in the course outline.

Grading: The weighting scheme for the course will be composed of the following items.

Item	Description	Weight (breakdown)
Self-assessment exercise	Students will complete a survey to assess their level of knowledge, interest and about epidemiological research and environmental exposure assessment. The survey will occur at start and end of the course.	5% (2.5% for each exercise)
Individual Development Plan exercise	Students will work one-on-one with instructor to describe their learning objectives in the course based on their research interests, status (student/ professional) and results of self-assessment.	5%
Proposal Assignment -Topic -Draft write-up -Final write-up	See details below.	50% overall (see details below for complete breakdown)

Concept Mapping exercise	Students will work in groups to develop a concept map for a current environmental health issue.	10%
Everybody's A Critic exercise	Students will prepare and present in front of the class a single slide that critiques the study design and/or approach to exposure assessment in the assigned scientific article.	10% (5% for each slide)
Group Assignment -Outline -Final write-up	See details below.	20% (see details below for complete breakdown)

Important due dates for Assignments/Exercises:

Initial self-assessment exercise (online submission) ..... January 6, 2020
Final self-assessment exercise (online submission) ..... April 20, 2020

Individual development plan exercise (online submission) ..... January 21, 2020

Concept mapping exercise (in-class submission) ..... January 27, 2020

Everybody's A Critic exercise #1 (online submission) ..... February 3, 2020
Everybody's A Critic exercise #2(online submission) ..... March 23, 2020

Individual Proposal Topic ..... January 27, 2020
Individual Proposal Outline write-up ..... February 17, 2020
Individual Proposal Draft write-up ..... March 16, 2020
Individual Proposal Final write-up ..... April 6, 2020

Group Proposal Outline ..... March 23, 2020
Group Proposal Final write-up ..... April 13, 2020
Group Proposal Presentation ..... April 13, 2020

Exams

There are no exams in this course.

Assignments

There are two assignments[1] in this course and each one is described below in detail with criteria and due dates.

Individual Proposal Assignment

Objective: Develop a research proposal that will answer a scientific hypothesis/questions about a current environmental health issue.

Details: The proposal will consist of multiple sections that collectively form a coherent and complete research proposal. The proposal sections will be: *Background, Rationale, Proposed Methods, Expected Outcomes, Challenges, and Conclusion*. Expectations for each section are provided below.

Proposal Section	Description

[1]Assignments differ from exercises in that they typically require handing in written material after several days of work outside of class whereas exercises are completed during in-class instruction time.

Background	Describe the context of the environmental health issue in terms of history and geography but also general information on social, economic and political characteristics of the study population. This is where you tell the reader why your proposal topic is important and relevant.
Rationale	This is a short section (5-8 lines) where you provide the purpose of your proposed study and indicate what new knowledge/method/product it will contribute as a result of achieving the study purpose and the objectives.
Objectives	Write two to three objectives of the proposed study using complete sentences.
Proposed Methods	This section is the longest part of the proposal because here you will provide details on the following methodology components (as applicable): study subjects, inclusion/exclusion criteria, study design, exposure assessment, data collection and analysis strategy. Under study design, you should justify your selected design and discuss why other designs may not be appropriate, impractical and/or too costly to implement. Also, you should discuss any assumptions regarding exposure assessment you are making, mention sources of uncertainty related to exposure assessment approach, choice of study design and statistical analysis. Discussion of uncertainty/bias should be in the context of both the exposure estimate and the health effect estimate.
Expected Outcomes	Provide a brief overview of what you expect to find if you undertook the study. What level of evidence do you expect to find based on existing literature? Do you expect your estimates to be biased? If so, then in what direction?
Challenges	Discuss potential barriers and challenges to conducting the study according to the proposed methods. Also, discuss how you may overcome those barriers and address potential challenges using alternative or modified study designs and exposure assessment approaches. Discuss these challenges in the context of data collection, appropriateness of study measures, such as instruments (quantitative or qualitative), and, biological plausibility.
Conclusion	This last section will be short (5-8 lines) and should summarize your rationale (1 sentence), methods (3-5 sentences) and expected outcomes section (1-2 sentences).

Proposal Outline refers to a bullet-point version of your proposal that includes 3-5 bullet points for each section of the proposal. At the outline stage, I am mainly looking for evidence that you have started to think about the various sections of the paper. I will provide brief comments on bullet points. For the methods section, please provide additional bullet points for each sub-section. The headings for sub-sections will depend on your selected study design but at a minimum should consist of the following sub-sections: *Data collection, Exposure, Health Outcomes, and Statistical Analysis.*

Proposal Draft refers to first draft of the final paper that includes text for each section of the proposal. At the draft stage, I am mainly looking for evidence that you have started to write for each section and sub-section (as applicable) and that you are on track to complete and submit a final paper on time. I will provide some comments on the draft document as well. One way to do this is to expand further on each bullet point in your Proposal Outline document.

Proposal Final refers to the final paper that meets all of the above-mentioned requirements for the proposal.

Due date and other policies: Hand in your assignment online. Late assignment will not be accepted except under extenuating circumstance and with prior approval of instructor. Late assignments will be deducted 10% from the original grade (e.g., if original grade is 82%, then late submission will result in a final assignment grade of 72%).

Formatting guidelines: Written report with the following specifications: 10 pages maximum, double spaced, 1-inch margins, 11pt Arial font

Evaluation criteria:

Criteria	***Description***	***Weight***
Format	Does the document follow all formatting guidelines?	10%
Content	Does the content of the document appropriately address the objective of the assignment? Did the student follow expectations for each assignment section? Is there content that is extra or not related to the assignment?	20%
Originality	Is the proposed methodology appropriate for answering the research question? Did the students stretch themselves by going outside of their specialization/program/interest in their proposal topic? If not, then did the student address a topic within their specialization/program/interest that demonstrates a novel approach in terms of exposure assessment approach and/or study design?	40%
Critical Thinking	Does the overall assignment show evidence of critical assessment and problem solving? Is there evidence of incorporating ideas and concepts that have been discussed in class? From outside the class?	30%

For this assignment, students will hand in three separate documents with the following breakdown (adds up to 50% of final mark):
Proposal topic.....1%
Proposal outline.....4%
Proposal draft.....10%
Proposal final write-up 35%

Group Proposal Assignment
Objective: Demonstrate ability to work across disciplines and research interests to address an environmental health issue.

Details: Ideally, students from Environmental Health Sciences and Epidemiology specialization programs will be grouped together to develop a short research proposal similar to the Proposal Assignment (see above). Alternatively, students may select a health outcome and environmental exposure outside of their primary research interests for the purpose of the group assignment. The objective of this assignment is to expose students to areas of research that they would not typically consider as part of their graduate training. At the end of the semester, each group will present their proposal in front of the class. Each presentation should be 30 minutes in length (15-20 minutes presentation and 10 minutes for Q&A).

Other policies: Hand in your assignment via online submission on Carmen. Late assignment will not be accepted except under extenuating circumstance and prior approval of instructor. Late assignments will be deducted 10% from the original grade (e.g., if original grade is 82%, then late submission will result in a final assignment grade of 72%).

Formatting guidelines: Written report with the following specifications: 4 pages maximum, double spaced, 1inch margins, 11pt Arial font.

Evaluation criteria: See evaluation criteria for Proposal Assignment (above).
For this assignment, students (in groups) will hand in two separate documents with the following breakdown and give an in-class presentation (sums to 20% of final mark):

Group Proposal outline 5%
Group Proposal Final write-up 10%
Group Proposal Presentation 5%

Carmen

We will use the Carmen website for the course for all announcements, class materials, and quizzes.

Class Policies

Respect for individual differences and alternative viewpoints will be maintained at all times in this class. One's words and use of language should be temperate and within acceptable bounds of civility and decency. Since every student is entitled to full participation in class without interruption, all students are expected to come to class prepared and on time and to remain for the full class period. All pagers, wireless phones, games, players, or other electronic devices that generate sound and/or pictures must be turned off during class.

Office of Student Life: Disability Services

Any student who feels s/he may need an accommodation based on the impact of a disability should contact me privately to discuss your specific needs. Please contact the Office of Student Life: Disability Services at 614-292-3307 in Room 098 Baker Hall 113 W. 12th Ave. to coordinate reasonable accommodations for students with documented disabilities (http://slds.osu.edu/).

Mental Health Services

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 or reduce a student's ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing. If you or someone you know are suffering from any of the aforementioned conditions, you can learn more about the broad range of confidential mental health services available on campus via the Office of Student Life's Counseling and Consultation Service (CCS) by visiting https://ccs.osu.edu/ or calling 614-292-5766. CCS is located on the 4th Floor of the Younkin Success Center and 10th Floor of Lincoln Tower. You can reach an on call counselor when CCS is closed at 614-292-5766 and 24 hour emergency help is also available through the 24/7 National Suicide Prevention Hotline at 1-800-273-TALK or at suicidepreventionlifeline.org.

Academic integrity

Academic integrity is essential to maintaining an environment that fosters excellence in teaching, research, and other educational and scholarly activities. Thus, The Ohio State University, the College of Public Health, and the Committee on Academic Misconduct (COAM) expect that all students have read and understood the University's *Code of Student Conduct* and the School's *Student Handbook*, and that all students will complete all academic and scholarly assignments with fairness and honesty. The *Code of Student Conduct* and other information on academic integrity and academic misconduct can be found at the COAM web pages (https://oaa.osu.edu/academic-integrity-and-misconduct). Students must recognize that failure to follow the rules and guidelines established in the University's *Code of Student Conduct*, the *Student Handbook*, and in the syllabi for their courses may constitute "Academic Misconduct."

The Ohio State University's *Code of Student Conduct* (Section 3335-23-04) defines academic misconduct as: "Any activity that tends to compromise the academic integrity of the University, or subvert the educational process." Examples of academic misconduct include (but are not limited to)

plagiarism, collusion (unauthorized collaboration), copying the work of another student, and possession of unauthorized materials during an examination. Please note that the use of material from the Internet without appropriate acknowledgement and complete citation is plagiarism just as it would be if the source were printed material. Further examples are found in the *Student Handbook*. Ignorance of the *Code of Student Conduct* and the *Student Handbook* is never considered an "excuse" for academic misconduct.

If I suspect a student of academic misconduct in a course, I am obligated by University Rules to report these suspicions to the University's Committee on Academic Misconduct. If COAM determines that the student has violated the University's *Code of Student Conduct* (i.e., committed academic misconduct), the sanctions for the misconduct could include a failing grade in the course and suspension or dismissal from the University. If you have any questions about the above policy or what constitutes academic misconduct in this course, please contact me.

Course Outline (Subject to change)

Alignment of Course Topics, Course Learning Objectives, Foundational Knowledge, Foundational Competencies and Specialization Competencies

Week No.	Session Dates	Topics (Chapter(s) to read from course textbook)	Aligned Course Learning Objective(s)	Aligned Foundational Knowledge Areas	Aligned Foundational Competencies	Aligned Specialization Competencies	Readings/ Other Assignments	Student Evaluation Activity for Assessment
1	1/6/20	Introduction and Overview of Environmental Epidemiology (1, 2)	1	3	1,2	EHS:1,2 EPI:2,3,4	**Reading:** Frumkin, H. (2015). Work that matters: toward consequential environmental epidemiology. *Epidemiology*, 26(2), 137-140. **Assignment:** Initial self-assessment	Initial self-assessment
2	1/13/20	Causal Inference (3)	1	3, 4	1,2,3,4	EHS:2,4,9 EPI:2,3,4	**Reading:** 1. Susser, M. (1991). What is a cause and how do we know one? A grammar for pragmatic epidemiology. *American Journal of Epidemiology*, *133*(7), 635-648. 2. Glass, T. A., Goodman, S. N., Hernán, M. A., & Samet, J. M. (2013). Causal inference in public health. *Annual review of public health*, *34*, 61-75. 3. Zigler, C. M., & Dominici, F. (2014). Point: clarifying policy evidence with potential-outcomes thinking—beyond exposure-response estimation in air pollution epidemiology. *American journal of epidemiology*, *180*(12), 1133-1140. **Assignment:** Individual development plan	Individual development plan
3	1/27/20	Confounding and Bias (5)	1	3,7,8,9,10	1,2,3,4, 22	EHS:2,4,9 EPI:3,4	**Reading:** Liu, C. Y., Maity, A., Lin, X., Wright, R. O., & Christiani, D. C. (2012). Design and analysis issues in gene and environment studies. *Environmental Health*, *11*(1), 93. **Assignment:** Concept mapping,	Concept mapping, Proposal topic

Week No.	Session Dates	Topics (Chapter(s) to read from course textbook)	Aligned Course Learning Objective(s)	Aligned Foundational Knowledge Areas	Aligned Foundational Competencies	Aligned Specialization Competencies	Readings/ Other Assignments	Student Evaluation Activity for Assessment
							Proposal topic	
4	2/3/20	Confounding and Bias (5)	1	3,7,8,9,10	1,2,3,4	EHS:2,4,9 EPI:3,4	**Reading:** **Assignment:** Everybody's A Critic #1	Everybody's A Critic #1
5	2/10/20	Methodological Approaches for Confounding and Bias in Environmental Epidemiology (7)	1, 2,3	3,7,8,9,10	2,3	EHS:4 EPI:2,3,4,7	**Reading:** Janes, H., Dominici, F., & Zeger, S. L. (2007). Trends in air pollution and mortality: an approach to the assessment of unmeasured confounding. *Epidemiology*, *18*(4), 416-423. **Assignment:**	
6	2/17/20	Methodological Approaches for Confounding and Bias in Environmental Epidemiology (7)	1, 2,3	3,7,8,9,10	2,3	EHS:4 EPI:2,3,4,7	**Reading:** see above **Assignment:** Proposal outline	Proposal outline
7	2/24/20	Cohort Studies: Applications in Environmental Health (7)	1,2,3	3	1,2,3	EHS:4 EPI:2,4	**Reading:** Attfield, M. D., Schleiff, P. L., Lubin, J. H., Blair, A., Stewart, P. A., Vermeulen, R., Coble, J. B., & Silverman, D. T. (2012). The diesel exhaust in miners study: a cohort mortality study with emphasis on lung cancer. *Journal of the National Cancer Institute*, *104*(11), 869-883. **Assignment:**	
8	3/2/20	Case-control Studies: Advances and Applications in Environmental Health (8)	1,2,3	3	1,2,3	EHS:4 EPI:2,4	**Reading:** Silverman, D. T., Samanic, C. M., Lubin, J. H., Blair, A. E., Stewart, P. A., Vermeulen, R., Coble, J.B., Rothman, N., Schleiff, P.L., Travis, W.D., & Ziegler, R. G. (2012). The Diesel Exhaust in Miners Study: A Nested Case–Control Study of Lung Cancer and Diesel Exhaust. *J Natl Cancer Inst*, *104*, 1-14. **Assignment:**	

Week No.	Session Dates	Topics (Chapter(s) to read from course textbook)	Aligned Course Learning Objective(s)	Aligned Foundational Knowledge Areas	Aligned Foundational Competencies	Aligned Specialization Competencies	Readings/ Other Assignments	Student Evaluation Activity for Assessment
9	3/16/20	General Considerations for Exposure Measurement and Misclassification in Environmental and Occupational Health Studies (6)	1,2,3,5,6	3,7,8,9,10	2,3	EHS:1,8,9,10 EPI:2,3,4,7	**Reading:** Zeger, S. L., Thomas, D., Dominici, F., Samet, J. M., Schwartz, J., Dockery, D., & Cohen, A. (2000). Exposure measurement error in time-series studies of air pollution: concepts and consequences. *Environmental health perspectives*, *108*(5), 419. **Assignment:** Proposal draft write-up	Proposal draft write-up
10	3/23/20	General Considerations for Exposure Measurement and Misclassification in Environmental and Occupational Health Studies (6)	1,2,3,5,6	3,7,8,9,10	2,3	EHS:1,8,9,10 EPI:2,3,4,7	**Reading:** 1. Pereira, G., Bracken, M. B., & Bell, M. L. (2016). Particulate air pollution, fetal growth and gestational length: The influence of residential mobility in pregnancy. *Environmental research*, *147*, 269-274. **2.** Hyder, A., Lee, H. J., Ebisu, K., Koutrakis, P., Belanger, K., & Bell, M. L. (2014). PM2. 5 exposure and birth outcomes: use of satellite- and monitor-based data. Epidemiology (Cambridge, Mass.), 25(1), 58. **Assignment:** Everybody's A Critic #2	Everybody's A Critic #2
11	3/30/20	Exposure Measurement and Misclassification in Special Populations (e.g., Children, Women, Older Adults) (6)	1,2,6	3,7,8,9,10	2,3	EHS:1,8,9,10 EPI:2,3,4,7	**Reading:** **Assignment:**	
12	4/6/20	Integrating, interpreting and communicating evidence (13,14)	5,7	6	2,3	EHS:1,2,10 EPI:3	**Reading:** 1. Bracken, M. B. (2009). Why are so many epidemiology associations inflated or wrong? Does poorly conducted animal	Proposal final write-up

Week No.	Session Dates	Topics (Chapter(s) to read from course textbook)	Aligned Course Learning Objective(s)	Aligned Foundational Knowledge Areas	Aligned Foundational Competencies	Aligned Specialization Competencies	Readings/ Other Assignments	Student Evaluation Activity for Assessment
							research suggest implausible hypotheses?. *Annals of epidemiology*, *19*(3), 220-224. **2.** Montori, V. M., Jaeschke, R., Schunemann, H. J., Bhandari, M., Brozek, J. L., Devereaux, P. J., & Guyatt, G. H. (2004). Users' guide to detecting misleading claims in clinical research reports. *BMJ: British Medical Journal*, *329*(7474), 1093. **Assignment:** Proposal final write-up	
13	4/13/20	Group projects presentation[2]	4,5		19	EHS:1,2,4,8,9,10 EPI:2,3	**Reading:** - **Assignment:** -	Group Proposal Final write-up, Group Proposal Presentation
14	4/20/20	Advanced Topics in Environmental Epidemiology[3]	4,5		1,2,3,4,22	EHS: EPI:	**Reading:** To be assigned **Assignment:** Final self-assessment	Final self-assessment

[2] These classes will consist of problem-based learning where each group will be interact with other students and the instructor to work towards completion of the Group Assignment.

[3] Potential topics for Spring 2020 session include Computational exposure science and environmental health "big data" analytics, Environmental Health Economics, Integrated/cumulative risk assessment, agriculture-related exposures such as studies on pesticides and health outcomes