

Epidemiology for Environmental Scientists and Engineers

ENVR 601-001 Spring 2019 (3 credits)

Tues, Th from 11-12:15, Rosenau Rm 230

Course Description

Epidemiology is the study of patterns of diseases and their risk factors in the population. As a cornerstone of public health research, epidemiologic concepts and methods are used to understand and protect the population's health. Epidemiologic concepts are used to plan, implement and evaluate population based interventions. Moreover, epidemiologic research helps inform evidence-based medicine by identifying risk factors for disease, and determining optimal treatment approaches to clinical practice and for preventive medicine. Environmental epidemiology is a sub-field which focuses on the health effects of environmental exposures in the population. Epidemiologic research studies generally include the following steps: 1) design the study, 2) collect data, 3) statistically analyze data, 4) interpret results in the context of existing literature, and 5) submit results for peer review and publication. These results often contribute to scientific knowledge and also can be used to help federal and state agencies set regulations and health policy agendas.

Public health problems are multi-disciplinary and epidemiologists collaborate with a number of other scientific disciplines such as environmental sciences and engineering (to more accurately assess environmental exposures), biology and toxicology (to better understand disease processes), biostatistics (for sophisticated statistical techniques to analyze data), geographic information systems (to map disease and exposure patterns) and social science disciplines (to better understand proximate and distal risk factors such as the effect of socioeconomic factors.) We will use real life research examples from environmental epidemiology to illustrate basic epidemiologic principles.

Course Objectives

This course is intended to provide an introduction to basic epidemiologic concepts within a framework of environmental health. Students will learn and practice key concepts of epidemiology while applying these to environmental issues in soil, air, and water. We will link these concepts with environmental science research and illustrate how they are used to address public health problems.

We will focus on the following learning objectives:

1. Explain the population perspective, key sources of public health data; describe the magnitude, population distribution, and time trends of public health problems locally, nationally, and globally.
2. Describe and evaluate disease variation by person, place, and time.
3. Discuss, apply, and interpret basic epidemiologic concepts and measures of disease occurrence and association in populations: incidence, prevalence, risk ratios, rate ratios, odds ratios, risk and rate differences;
4. Understand the relative strengths and limitations of different epidemiologic study designs (e.g., cohort, case-control, cross-sectional, ecologic and experimental studies) for studying associations between risk factors and/or exposures in populations and rates of disease occurrence or death;
5. Identify the major sources of potential error in epidemiologic studies;
6. Comprehend basic ethical and legal principles in human subjects research pertaining to the collection, maintenance, use and dissemination of epidemiologic data and results in different cultures.
7. Evaluate epidemiologic evidence by applying criteria for causal inference to information about an association between a population exposure and health outcome;

Throughout the course, we will use the field of aflatoxin research (aflatoxin exposures in human populations and epidemiologic strategies used to identify biomarkers of exposure to understand exposure-disease links, and establish molecular mechanisms of disease) to demonstrate basic epidemiologic concepts.

Students will work in small group settings to practice applying and integrating epidemiologic concepts.

Course Instructors

Dr. Rebecca Fry

Office: Ros 160

Email: rfry@unc.edu

Phone: (919) 843-6864

Dr. Karin Yeatts

Office: MHRC 3002

Email: Karin_Yeatts@unc.edu

Phone: (919) 966-9899

Course Resources

Essentials of Epidemiology in Public Health, 3rd Edition. Ann Aschengrau and George R. Seage III

Kensler et al. 2010: Aflatoxin: a 50 Year Odyssey of Mechanistic and Translational Toxicology.

Assignments and Grading

Your grade in the module will be determined as a weighted average of your scores (after each is converted to a 0-100% scale) for the following assignments:

Assignments and Grading		Point Value
Quizzes	Individual	15%
Individual Data Set Analysis	Individual	15%
Environmental Topic & Study Design Presentations	Team Presentation/ Individual grade	20%
Epidemiologic Critique Presentations	Team Presentation/ Individual grade	20%
Final Exam, Monday April 30, noon-3pm	Individual	20%
Class Attendance, all semester	Individual	10%
Total		100%

Due Dates in Course Schedule.

The grading scale is as follows:

Undergraduate students: A (94-100%); A- (90-93.9%); B+ (87-89%); B 83-86%); B (80-82%); C+ (77-80%); C (73-76%); C (70-72%); D+ (67-70%); D (63-66%); D- (50-62%); and F (<50%)

Graduate students: H (94-100%); P (75-93.9); L (50-74.9) and F (<50%)

Assignment Descriptions

Quizzes. Students will be given ~4 to 5 quizzes. The due dates will be listed in the course schedule.

Data Set Analysis. Students will be given a data set and asked to perform epidemiologic analysis using free software.

Team Project Overview. Student teams will select an environmental health topic of interest. The two team projects are designed for you to practice apply epidemiologic concepts and critical thinking to a topic of your choice. The projects include sequential steps you would use when writing a grant proposal.

Part 1, Environmental Topic & Study Design Presentations. Student teams will choose a current environmental exposure/health outcome (such as the health effects of fracking, Gulf Oil Spill, or Fukushima nuclear reactor spill etc.). Teams will research in the peer review literature, and use measures of occurrence (prevalence, incidence) to describe the exposure and of the health outcome in the population.

As a team, we ask you to select an environmental exposure in real geographic location in the world. Define your location. Define the exposure. Define the disease or health outcomes you will be studying. The outcome doesn't necessarily have to be a disease-you can also choose other outcomes such as subclinical markers of inflammation etc.

Use the peer reviewed literature to justify and support (provide at least 2 sources for the each of the following):

- 1) Measure(s) of exposure
- 2) Measure(s) of health outcome(s)
- 3) the suspected exposure-health outcome relationship

Study design. Student teams will propose a study design for the exposure/event and potential health effect you selected. Teams will also provide the measure of association and measures of uncertainty that would be used (such as prevalence odds ratios and 95% confidence intervals).

We would like you to design an epidemiologic study based in a real geographic location in the world. Study design options include ecologic, cross-sectional, cohort, and case control. Justify your choice. For example, if you chose childhood cancer related to the Fukushima nuclear disaster, you might recommend a case control study. Your justification would mention childhood cancers are rare in the population, and you would provide the rate of disease from the peer review literature. Topics will need instructor approval.

Each team should put together a power point slide presentation with every student selecting which slides they will present. Individual students names should be noted on the slides they present and an accompanying 1 page document provided after the presentation from each student on the content of the slides they present.

Part 2, Team Epidemiologic Publication Critique. With your team you will select an epidemiologic publication on the topic you selected in team project part 1. You will prepare a presentation critiquing this research publication. Please use these guidelines to guide you in critiquing the publication.

1. What is the research question?
2. What is the epidemiologic study design?

3. How do the authors measure the exposure (s) of interest? What measure of disease occurrence do they use?
4. How do the authors measure health outcome(s)? What measure of disease occurrence do they use?
5. What measure of association and measures of uncertainty do the authors use? Are they interpreted correctly? Are they appropriate for the study design?
6. Do the authors address confounding and/or effect modification? How?
7. What are potential sources of random and non-random error? How might they affect the study? How do the authors address them?
8. Do the researchers comply with ethical standards for human subjects research?
9. Does this study meet any of the criteria used to establish causality and if so, how?

Each team should put together a powerpoint slide presentation with every student selecting which slides they will present. Individual student names should be noted on the slides they present and an accompanying 1 page document provided after the presentation from each student on the content of the slides they present.

Final Exam. Students will be given a final exam covering the material described in the learning objectives. Topics may include measures of disease occurrence, study design, measures of association, sources of systematic error, and Bradford Hill criteria for causality.

Class Attendance, Participation. Attendance and participation in class discussions and assignments will be worth 10% of your grade. Classes where you will need to prepare beforehand for discussion of specific material have been asterisked. We are looking for student engagement with the topics and concepts.

Extra Credit (1%). Students may have opportunities to earn extra credit during the semester.

Honor System. As part of the UNC Honor Code, Carolina students pledge to maintain ideals of academic honesty, personal integrity, and responsible citizenship. These ideals are embodied in the Honor Code set forth in the Instrument of Student Judicial government, with the support of students, faculty, and staff. When a student applies to Carolina, he/she undertakes a commitment to the principles embodied in the Honor Code. The University endeavors to instill in each student a love of learning, a commitment to fair and honorable conduct, and respect for the safety and welfare of others. It also strives to protect the community from those who, for whatever reason, do not embody these values in their conduct, and to protect the integrity of the University and its property for the benefit of all. It is our expectation that all students in the class will uphold the UNC Honor System.

Course Evaluations. The School uses an on-line evaluation system to assess the quality of instruction and learning of the courses offered. The system is open for a two week period before the end of classes. An email will notify you that the system is open and a link to access the form. This evaluation system is anonymous. The instructors will only see the aggregate data with any comments at the end of the course after grades are turned in. It is your responsibility as a student to complete the evaluations. You will be sent multiple emails from the School until it is completed.

We value your feedback on the course. We may also conduct in-class evaluations. We will ask you for your (anonymous) feedback about specific class sessions, assignments, and instructors.

Class Etiquette. Please put cell phone on vibrate (acceptable if you are expecting important call) or turn it OFF (preferable). In case of an emergency call, leave class and return. We ask you not to text in class. When possible, please try to utilize designated course time (such as office hours and class time) for questions and concerns rather than last minute email questions.