



Tufts
UNIVERSITY

Gerald J. and Dorothy R.
Friedman School of
Nutrition Science and Policy

**NUTR 204 – Principles of Epidemiology
Spring 2018**

Class Meetings: Mondays 9AM-12PM, Jaharis 155
Tuesday 20th Feb 6PM-9PM, Jaharis 155

Instructor(s): Fang Fang Zhang, M.D., Ph.D. (*Course Director*)
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Office hours: By appointment

Graduate Credits: 1 credit

Course Description:

This course covers basic epidemiologic methods and concepts, including study design, calculation and interpretation of basic measures of disease frequency and measures of associations, sources of inaccuracy in experimental and observational studies, causal inference, and an introduction to the statistical evaluation and interpretation of epidemiological data. Students will discuss past and recent publications in order to apply their understanding of abstract concepts and specific quantitative methods to the interpretation and critique of published work.

Course Objectives:

The overall purpose of this course is to introduce students to the principles of epidemiology and basic epidemiologic methods and concepts. The specific objectives are to:

1. Understand the principles of epidemiology and the major objectives, and explain the scope of epidemiology as a discipline.
2. Understand the basic concepts in infectious disease epidemiology and the importance and challenges of conducting epidemiologic investigation of chronic diseases.
3. Calculate, interpret, and compare measures of disease frequency and measures of association.
4. Differentiate among various epidemiologic study designs and steps to conduct each design, understand their strengths and limitations, and identify research questions that would be appropriate for each design.
5. Understand the concepts of measurement error, bias, and confounding, their consequences, and strategies to reduce sources of error and to prevent or control for confounding.
6. Discuss the principles of screening and evaluate screening in terms of sensitivity and specificity.

7. Explain causal inference in epidemiologic studies and the appropriate use of causal criteria to assess causality.

Texts or Materials:*Required Textbook:*

Gordis L. *Epidemiology*. 5th Edition. 2014. Elsevier Saunders. ISBN: 978-1-4557-3733-8.

Optional Textbook:

Aschengrau A and Seage GR III. *Essentials of Epidemiology in Public Health*. 3rd Edition. 2014. Jones and Bartlett Learning. ISBN: 978-1-284-02891-1.

Course Website:

Lecture slides and other materials are available on the class website at <https://trunk.tufts.edu>. There will generally be no handouts distributed in class (except exams, last-minute additions, and materials not easily posted to the website). If you have difficulty printing these materials, notify the instructor and/or TA.

Academic Conduct:

Each student is responsible for upholding the highest standards of academic integrity, as specified in the Friedman School's Policies and Procedures manual (<http://www.nutrition.tufts.edu/student/documents/policies-procedures>) and Tufts University policies (<http://students.tufts.edu/student-affairs/student-life-policies/academic-integrity-policy>). It is the responsibility of each student to understand and comply with these standards, as violations will be sanctioned by penalties ranging from failure on an assignment and the course to dismissal from the school.

Classroom Conduct:*Course Format*

The primary format of this course consists of weekly sessions that include a 2-hour lecture given by the instructor and a 1-hour lab. The lab section is designed to foster interactive discussion on important concepts and methods illustrated in the lecture. Lab handouts that contain examples and questions will be used to facilitate the discussion. At the same time, students are encouraged to bring questions that they would like to discuss in the lab section.

PowerPoint Presentations

PowerPoint presentations are intended to facilitate your notetaking, not to serve as an alternative textbook or as an alternative to coming to class. If you miss a lecture, it will be a good idea to obtain a copy of notes from someone who takes good ones. You are strongly encouraged to share your notes as you work through understanding the lecture objectives and form study groups to collaborate on homework assignments.

Lectures are designed to supplement, not supplant, the readings. Assigned readings for each lecture are expected to be completed before the lecture. The only exception to this is the first class. In general, for

class readings and exercises, you should expect to spend at least two hours out of class for each hour in class.

Class discussion is strongly encouraged. Please try not to feel intimidated by the size of the class or the nature of the material. The only bad question is the one not asked. If something puzzles you, the chance is excellent that the same thing puzzles several of your classmates. We cannot answer any questions you do not ask.

Assessment and Grading:

The overall grade for the course will be based on the following:

1. Class Attendance and Lab Participation (10%)
2. Participation in Online Discussion Forums (10%)
3. Homework (15%)
4. Mid-term Exam (20%)
5. Final Exam (25%)
5. Final Paper (20%)

Assignments and Submission Instructions:

Class Attendance and Lab Participation

Please note that class and lab participation will be noted and used to make a final determination of your grade (10%). Lab sessions are designed for students to practice the concepts and methods introduced in lectures. In each one-hour lab session, students will be asked to work on lab exercises either individually or in groups and actively participate in discussions. The instructor or TA will lead the lab sessions and engage students in practices and discussion.

Participation in Online Discussion Forums

You will be expected to participate in an online course forum by submitting a post of 100-150 words each week for 10 weeks. Your post may consist of 1) a short but thoughtful discussion of a particular concept or aspect of the current week lecture or reading assignments that you found interesting or surprising; 2) a question in relation to a concept or aspect of the lecture that you found confusing, providing some framework for discussion; or 3) a thoughtful response to other student's question. Posts must demonstrate your familiarity and understanding of lecture and reading materials, and will be due Thursday by midnight following Monday's lecture. Each participation accounts for 1 point. Forum participation accounts for 10% of your grade.

Homework

There will be three homework assignments to be completed during the course (15%), which will include computational exercises (e.g., calculations of measures of disease frequency and association), multiple-choice questions, or short answer questions. These assignments are designed to provide practical application of the concepts presented in lectures and labs.

Mid-term and Final Exams

Competency in meeting the objectives of the course will be assessed by a mid-term (20%) and final (25%) examination. Review sessions will precede both the mid-term and final exam. Calculators are permitted during the examination, but books, notes, and other memory aids are not.

Final Paper

At the end of the semester you will hand in your final paper (20%). This involves a critique of one journal article and will be an independent project (no collaboration allowed). The article will be posted on the course website along with guidelines for the critique. A maximum of 5 pages (typed, font 12 and double spaced) will be allowed.

Assignments received after their deadline will not be accepted or graded unless an extension is approved in advance. Students who are unable to complete an assignment on time for any reason should notify the instructor by email or phone call prior to the deadline, with a brief explanation for why the extension is needed.

Accommodation of Disabilities:

Tufts University is committed to providing equal access and support to all students through the provision of reasonable accommodations so that each student may access their curricula and achieve their personal and academic potential. If you have a disability that requires reasonable accommodations please contact the Friedman School Assistant Dean of Student Affairs at 617-636-6719 to make arrangements for determination of appropriate accommodations. Please be aware that accommodations cannot be enacted retroactively, making timeliness a critical aspect for their provision.

Course Topics, Learning Objectives and Assignments

(This schedule is subject to modification at the instructors' discretion. Additional readings may be assigned.)

Week 1: Introduction to Epidemiology

Learning Objectives

Upon completion of this week, you will be able to:

- Identify the principles and main objectives of epidemiology.
- Define basic terms related to the occurrence of disease in a population.
- Discriminate between descriptive epidemiology and analytic epidemiology.
- Explain the meanings of disease frequency, disease distribution, and determinants in epidemiology.

Readings

- Gordis, Ch. 1

Lab Exercise:

No lab

Homework assignment:

None

Graded forum participation:

Forum 1 (Due on Thursday, see information on Canvas)

Week 2: Concepts in Infectious Disease Epidemiology

Learning Objectives

Upon completion of this week, you will be able to:

- Describe the main concepts in infectious disease epidemiology (mode of transmission, iceberg phenomenon, carrier status, incubation period, epidemic curve, herd immunity).
- Explain how to conduct outbreak investigations (steps in an outbreak investigation).
- Identify possible contributors and challenges to the changing pattern of disease occurrence over the last century, from primarily infectious to chronic diseases.

Readings:

- Gordis, Ch. 2
- Dworkin MS. How an outbreak is investigated (Ch. 1). In: *Outbreak Investigations around the World*. Dworkin MS (Editor). Sudbury, MA: Jones and Bartlett Publishers. 2010.
- Popkin, B.M. What can public health nutritionists do to curb the epidemic of nutrition-related noncommunicable disease? *Nutrition Reviews* 2009; 67 (suppl 1): S79-S82.

Lab Exercise:

Lab 1: Outbreak Investigation

Homework assignment:

None

Graded forum participation:

Forum 2 (Due on Thursday, see information on Canvas)

Week 3: Measures of Disease Frequency

Learning Objectives

Upon completion of this week, you will be able to:

- Describe the important role of epidemiology in disease surveillance.
- Compare different measures of disease frequency, including incidence rate, incidence proportion, prevalence, attack rate, and mortality measures (e.g., case-fatality rate).
- Illustrate why incidence data are necessary for measuring risk.
- Discuss the interrelationship between incidence and prevalence.

Readings:

- Gordis, Ch. 3 and Ch. 4
- Davies AR, Smeeth L, Grundy EM. Contribution of changes in incidence and mortality to trends in the prevalence of coronary heart disease in the UK: 1996-2005. *European Heart Journal* 2007; 28:2142-7.

Lab Exercise:

Lab 2: Measures of Disease Frequency

Homework assignment:

None

Graded forum participation:

Forum 3 (Due on Thursday, see information on Canvas)

Week 4: Measures of Association

Learning Objectives

Upon completion of this week, you will be able to:

- Explain how to investigate the relationship between a potential exposure and a disease.
- Describe the concepts of rate/risk ratio (i.e., relative risk) and odds ratio and be able to calculate and interpret them.
- Describe the concept of risk/rate difference and attributable risk/rate difference and be able to calculate and interpret them.
- Compare the different measures of association and explain the difference between absolute and relative measures.
- Conduct direct and indirect age adjustment.

Readings:

- Gordis, Ch. 11 and Ch. 12
- Kuhle S, Allen AC, Veugelers PJ. Prevention Potential of Risk Factors for Childhood Overweight. *Can J Public Health* 2010; 101(5):365-68.
- Singh GM; Micha R; Khatibzadeh S; Lim S; Ezzati M; Mozaffarian D. Estimated Global, Regional, and National Disease Burdens Related to Sugar-Sweetened Beverage Consumption in 2010. *Circulation*, 2015; 132(8):639-66.

Lab Exercise for this week:

Lab 3: Measures of Association

Homework assignment:

Homework assignment 1 (due next week): measures of disease frequency and association

Graded forum participation:

Forum 4 (Due on Thursday, see information on Canvas)

Week 5: Cohort Studies

Learning Objectives

Upon completion of this week, you will be able to:

- Describe the design and timing of a cohort study, and the different types of cohort studies.
- Explain the steps in conducting a cohort study.
- Estimate and interpret risk (or rate) differences/ risk (or rate) ratios in cohort studies.
- Identify strengths and weaknesses of cohort studies and discuss potential issues in their design.

Readings

- Gordis, Ch. 9
- Doll R & Hill AB. Lung cancer and other causes of death in relation to smoking. A second report on the mortality of British doctors. *British Medical Journal*. 1956; Nov.10, 1071-1081
- Yang G, Zheng W, Xiang Y-B, Gao J, Li H-L, Zhang X, Gao Y-T, Shu X-O. Green tea consumption and colorectal cancer risk: a report from the Shanghai Men's Health Study. *Carcinogenesis* 2011; 32:1684-88.

Lab Exercise:

Lab 4: Design and Interpretation of Cohort Study

Homework:

Homework 1 (Due on Monday, see Canvas site for additional information)

Graded forum participation:

Forum 5 (Due on Thursday, see information on Canvas)

Week 6: Case-control Studies

Learning Objectives

Upon completion of this week, you will be able to:

- Describe the design features of case-control and nested case-control studies.
- Explain the appropriate way to select cases and controls in a case-control study.
- Calculate and interpret an odds ratio in a case-control study, and consider when the odds ratio is a good estimate of the relative risk.
- Identify strengths and weaknesses of case-control studies.
- Discuss potential selection biases, information biases, and the use of matching in case-control studies.

Readings:

- Gordis, Ch. 10 and 13
- MacMahon B, Yen S, Trichopoulos D, Warren K, Nardi G. Coffee and cancer of the pancreas. *NEJM*. 1981; 304(11):630-3
- Newcomb PA, Storer BE, Longnecker MP, Mittendorf R, Greenberg ER, Willett WC. Pregnancy termination in relation to risk of breast cancer. *JAMA*. 1996: 283-287
- Lu MS, Fang YJ, Chen YM, Luo WP, Pan ZZ, Zhong X, Zhang CX. Higher intake of carotenoid is associated with a lower risk of colorectal cancer in Chinese adults: a case-control study. *European Journal of Nutrition* 2015; 54(4):619-28.

Lab Exercise:

Lab 5: Design and Interpretation of Case-Control Study

Homework assignment:

None

Graded forum participation:

Forum 6 (Due on Thursday, see information on Canvas)

Week 7: Experimental Studies

Learning Objectives

- Explain the fundamental difference between randomized trials and observational studies.
- Describe the concepts of randomization, placebo effect, and blinding.
- Estimate measures of association from randomized trials.
- Describe the concept of intention-to-treat analysis in randomized trials.
- Consider important issues in conducting experimental studies such as ethics and non-compliance.

Readings:

- Gordis, Ch. 7 and 8
- de Ruyter JC, Olthof MR, Seidell JC, Katan MB. A Trial of Sugar-free or Sugar-Sweetened Beverages and Body Weight in Children. *New England Journal of Medicine* 2012; 367(15):1397-406.
- de Ruyter JC, Olthof MR, Jan Kuijper LD, Katan MB. Effect of sugar-sweetened beverages on body weight in children: design and baseline characteristics of the Double-blind, Randomized Intervention study in Kids. *Contemporary Clinical Trials* 2012; 33: 247–257.

Lab Exercise:

Lab 6: Design and Interpretation of Randomized Controlled Trial

Homework assignment:

Homework assignment 2 (due next week): study designs.

Graded forum participation:

Forum 7 (Due on Thursday, see information on Canvas)

Week 8: Cross-sectional and Ecologic Studies & Mid-term Review

Learning Objectives:

- Describe the design features of cross-sectional and ecologic studies.
- Estimate and interpret the measures of association in cross-sectional and ecologic studies.
- Explain the concept of ecologic fallacy.
- Describe the advantages and disadvantages of cross-sectional and ecologic study designs.

Readings:

- Gordis, Ch. 10
- Ma J, Sloan M, Fox CS, Hoffmann U, Smith CE, Saltzman E, Rogers GT, Jacques PF, NM Sugar-Sweetened Beverage Consumption Is Associated with Abdominal Fat Partitioning in Healthy Adults. *J Nutr.* 2014 August; 144(8): 1283–1290
- Besson H; Paccaud F; Marques-Vidal P. Ecologic correlations of selected food groups with disease incidence and mortality in Switzerland. *Journal of Epidemiology* 2013; 23(6):466-73.

Lab Exercise:

No lab

Homework assignment:

None

Graded forum participation:

No forum

Week 9: In-Class Midterm

Week 10: Bias

Learning Objectives

Upon completion of this week, you will be able to:

- Explain and give examples of possible biases in epidemiologic studies, including selection bias and the various types of observation (i.e., information) bias.
- Describe ways to minimize bias in epidemiologic studies.
- Classify random error and be able to differentiate it from systematic error.

Readings:

- Gordis, Ch. 15
- Morabia A. Case-control studies in clinical research: mechanism and prevention of selection bias. *Preventive Medicine*; 1997; 26: 674-677
- Tang MT. Case-control differences in the reliability of reporting a history of induced abortion. *American Journal of Epidemiology*. 2000; 151: 1139-1143
- Smith AF; Baxter SD; Hardin JW; Guinn CH; Royer JA. Relation of Children's Dietary reporting accuracy to cognitive ability. *American Journal of Epidemiology* 2011; 173(1):103-9.

Lab Exercise:

Lab 7: Types and Consequences of Bias

Homework assignment:

None

Graded forum participation:

Forum 8 (Due on Thursday next week, see information on Canvas)

Week 11: Confounding

Learning Objectives

Upon completion of this week, you will be able to:

- Define confounding and be able to explain the conditions a variable must fulfill to be a confounder in an epidemiologic study.
- Discuss possible ways to control for confounding in the design and/or analysis of a study.
- Explain how these methods for controlling for confounding may be used through an example.

Readings:

- Gordis, Ch. 15
- Imamura F; Lichtenstein AH; Dallal GE; Meigs JB; Jacques PF. Confounding by dietary patterns of the inverse association between alcohol consumption and type 2 diabetes risk. American Journal of Epidemiology 2009; 170(1):37-45.

Lab Exercise:

Lab 8: Evaluation of Confounding in Epidemiologic Studies

Homework assignment:

Homework assignment 3 (due next week): bias and confounding
Final paper will be assigned

Graded forum participation:

Forum 8 (Due on Thursday, see information on Canvas)

Week 12: Screening

Learning Objectives:

Upon completion of this week, you will be able to:

- Describe the purpose and benefits of screening in populations, and identify conditions that are appropriate for screening.
- Describe different types of screening (sequential/simultaneous).
- Assess the validity and reliability of screening (sensitivity, specificity, positive predictive value), and diagnostic tests.
- Explain the concepts of lead time bias, volunteer bias and length-based sampling and know how they affect the evaluation of screening.

Readings:

- Gordis, Ch. 5 and Ch. 18
- Ferguson M et al. Development of a valid and reliable malnutrition screening tool for adult acute hospital patients. *Nutrition* 1999; 15:458-64.
- Morabia A, Zhang FF. History of medical screening: from concepts to action. *Postgrad Med J.* 2004; 80: 463-9

Lab Exercise:

Lab 9: Screening

Homework assignment:

None

Graded forum participation:

Forum 9 (Due on Thursday, see information on Canvas)

Week 13: Causal Inference/Final Review and Student Presentations on Study Design

Learning Objectives:

Upon completion of this week, you will be able to:

- Define the concept of a cause in epidemiologic studies and describe characteristics of a cause.
- Define necessary, sufficient, and component causes in the context of a causal relationship.
- Explain how causal inference is central to the role of epidemiology and discuss guidelines for judging whether an association is causal.
- Describe and critique Bradford Hill's causal criteria.
- Review epidemiologic methods and concepts introduced in this course.

Readings:

- Gordis, Ch. 14
- Karmon A, Sheiner E. The relationship between urinary tract infection during pregnancy and preeclampsia: causal, confounded or spurious? *Arch Gynecol Obstet* 2008; 277:479-81.
- Munger KL et al. Vitamin D and incidence of multiple sclerosis. *Neurol* 2004; 62:60-5.

Lab Exercise:

None

Homework assignment:

None

Graded forum participation:

Forum 10 (Due on Thursday, see information on Canvas)

Week 14: In-Class Final Exam and Final Paper Due

Course Schedule (Lectures and Labs)*:

Week # Jaharis 155	Lecture	Lab	Assignments Due
Wk1 (Jan 22)	Introduction to Epidemiology	No lab	Due: Forum 1
Wk2 (Jan 29)	Concepts in Infectious Disease Epidemiology	Outbreak Investigation	Due: Forum 2
Wk3 (Feb 5)	Measures of Disease Frequency	Measures of Disease Frequency	Due: Forum 3
Wk4 (Feb 12)	Measures of Association	Measures of Association	Homework 1 assigned Due: Forum 4
Wk5 (Feb 20)	Cohort Studies	Cohort Study	Due: Homework 1 Due: Forum 5
Wk6 (Feb 26)	Case-control Studies	Case-control Study	Due: Forum 6
Wk7 (Mar 5)	Experimental Studies	Randomized Controlled Trial	Homework 2 assigned Due: Forum 7
Wk8 (Mar 12)	Cross-sectional and Ecologic Studies & Mid-term Review	No lab (Q & A)	Due: Homework 2
Mar 19	Spring Break		
Wk9 (Mar 26)	In-class Mid-term Exam		
Wk10 (Apr 2)	Bias	Bias	
Wk11 (Apr 9)	Confounding	Confounding	Homework 3 assigned Paper assigned Due: Forum 8
Apr 16	No classes (Patriots' Day)		
Wk12 (Apr 23)	Screening	Screening	Due: Homework 3 Due: Forum 9
Wk13 (Apr 30)	Causal Inference	No lab (Q &A)	Due: Forum 10
Wk14 (May 7)	In-Class Final Exam		Due: Final Paper

* This schedule is subject to modification at the instructors' discretion.