

Module 223 Major A: Concepts, methods and design in Epidemiology

Module : 223	Concepts, methods and design in Epidemiology
UE coordinator	Dana March (TBC) Mailman School of Public Health, Columbia University
Dates	From December 5 th to 9 th 2016
Credits/ECTS	3 ECTS
Duration	30 hours
UE description	As a basic science of public health, epidemiology is responsible for the identification of causes of disease that can guide the development of rational public health policies. The accuracy of the information provided by epidemiologic studies is therefore of central concern. Epidemiologic methods are the tools we use to make valid causal arguments. The primary objective is to provide students with the basic tools necessary to design, carry out, and interpret the results from observational epidemiologic studies.
Prerequisites	Students entering this course are assumed to be able to: <ul style="list-style-type: none"> • Calculate basic measures of association between exposures and disease • Interpret data in 2 by 2 tables • Identify major epidemiologic study designs • Define confounding, selection bias and misclassification • Explain the concept of causality in epidemiology
Course learning objectives	Students who successfully complete this course will be able to: <ul style="list-style-type: none"> • Develop testable research hypotheses • Write a principled argument supporting research hypotheses • Operationalize hypotheses into statistically testable statements • Articulate the principles of basic observational study designs • Choose study designs that can test research hypotheses • Recognize and explain the effects of confounding and bias • Conduct basic sample size and power calculations
UE Structure (details of sessions title/speaker/date/duration)	
Course textbook	The textbook for the course is: Szklo , M and Nieto J. Epidemiology: beyond the basics, 3rd ed. Jones & Bartlett Learning 2013 OR Susser, Schwartz, Morabia and Bromet: Psychiatric Epidemiology: Searching for the Causes of Mental Disorders. Oxford: New York 2006.
Grading and assessment	Each session will be accompanied by a lab exercise to reinforce the concepts discussed during the lecture. The grade for the course is based on a homework assignment and a final exam which covers all the material covered in the course.
Location	George Sand EHESP Campus in Paris

Session Title	Causal inference in epidemiology and measures of effect
Speakers	Dana March Mailman School of Public Health, Columbia University
Learning Objectives	By the end of this section students should be able to: <ul style="list-style-type: none"> - Define a cause from a counterfactual perspective - Explain the sources of non-comparability in epidemiologic studies - Articulate the basic principles of the scientific method - Define and calculate a risk, odds and rate - Describe the relationship among these three measures of effect
Duration	3 hours
Training methods	Basic concepts in causal inference will be introduced as a framework for understanding the design and execution of epidemiologic studies. Confounding and bias will be discussed from this perspective. Since the scientific method requires the quantification of phenomena, we will review basic epidemiologic measures of disease frequency (risk, rates, and odds) and disease associations (risk ratios, rate ratios and odds ratios, risk differences) their interrelationships and relationships to causal inference. All design, analysis and measurement issues that form the bulk of this course will be discussed in the context of this conceptual framework;
Readings	Text chapters: Susser 4, 8 (to p. 84), Supplement 1

Session Title	Developing principled arguments
Speakers	Dana March Mailman School of Public Health, Columbia University
Learning Objectives	By the end of this section students should be able to: <ul style="list-style-type: none"> - Recognize the components of a grant proposal - Describe how each component is related to the process of causal inference - Develop research hypotheses - Write a principled argument
Duration	3 hours
Training methods	With the framework of causal inference in mind, we will review the components of a research proposal and how each component is related to the process of causal inference. Each session of the course will relate to sequential components of the grant proposal. After examining the framework, this session will focus on the Specific Aims, and Background and Significance Sections. We will discuss how to review the literature, develop hypotheses and operationalize them. The roles of confounding, bias and interaction in hypothesis development will be discussed.
Readings	Text Chapters Susser 5,6,7

Session Title	Designs: Experimental, cohort, case-control, cross-sectional, ecologic : Introduction to design
Speakers	Dana March Mailman School of Public Health, Columbia University
Learning Objectives	By the end of this section students should be able to: <ul style="list-style-type: none"> - Define the basic study designs used in epidemiologic research - Describe the relationships among the study designs - Select study designs appropriate to specific study hypotheses - Compare the roles of confounding and bias in each type of design - Critically assess the choice of study designs in research articles - Operationalize hypotheses to be tested in the context of these designs
Duration	3 hours
Training methods	The next three sessions introduce the issues involved in the choice of study design. The benefits and limitations of each design will be discussed in the context of causal inference. We will compare and contrast the problems of confounding and bias posed by each design and the methods for dealing with them.
Readings	Text Chapters Susser 9 – 12 Szklo and Nieto Chapter 1-3

Session Title	Designs : Experimental and Cohort
Speakers	Dana March Mailman School of Public Health, Columbia University
Learning Objectives	See session 3
Duration	3 hours
Readings	Text Chapters Susser 9 – 12 Szklo and Nieto Chapter 1-3

Session Title	Designs : Case-control and cohort
Speakers	Dana March Mailman School of Public Health, Columbia University
Learning Objectives	<u>Learning Objectives:</u> <ul style="list-style-type: none"> • Age, birth cohort and period effects • Describe the relationship between cohort and case control designs • Relate valid selection of controls in a case control design to the impact of attrition in a cohort study • Compare the sources of bias in the two designs
Duration	3 hours
Readings	Text Chapters Susser 15 – 17, 18 (p. 217-222) Szklo and Nieto Chapter 1-3

Session Title	Confounding
Speakers	Dana March Mailman School of Public Health, Columbia University
Learning Objectives	<ul style="list-style-type: none"> - Assess the presence of confounding - Use graphical aids to understand confounding - Understand adjustment and stratification methods to disentangle confounding - Define residual confounding
Duration	3 hours
Readings	Text Chapters Susser 15 – 17, 18 (p. 217-222) Szklo and Nieto Chapter 5

Session Title	Graphical Representation of Causal Effects- DAGs
Speakers	Dana March Mailman School of Public Health, Columbia University
Learning Objectives	<p>By the end of this section students should be able to:</p> <ul style="list-style-type: none"> - Draw DAGs to represent causal ideas - Define a DAG - Understand colliders - Draw a causal DAG - Deduce associations implied by the DAG
Duration	3 hours
Readings	Supplement: Greenland, Pearl and Robins Causal Diagrams Epidemiological Research, Epidemiology 1999; 10:37-38

Session Title	Effect modification and Mediation
Speakers	Dana March Mailman School of Public Health, Columbia University
Learning Objectives	<ul style="list-style-type: none"> - Define and estimate effect measure modification - Evaluate effect measure modification using stratified analyses - Interpret the results of stratified analyses - Additive vs Multiplicative Interaction - Define mediation and mediators - Articulate distinction between confounding and mediators - Estimate the effects of mediation
Duration	3 hours
Readings	Text Chapters Susser 27 (to p. 326), 25 (to p. 297)

Session Title	Testing our causal hypotheses : causal identification through stratification
Speakers	Dana March Mailman School of Public Health, Columbia University
Learning Objectives	By the end of this section students should be able to: <ul style="list-style-type: none"> - Describe the relationship between stratified analysis and mathematical modeling - Select analytic approaches appropriate for the study design - Interpret results of output from stratified analyses, linear regression, logistic regression and survival analyses
Duration	3 hours
Training methods	These four sessions provide an introduction to the basic analytic approaches to examining data from cohort, case control and cross-sectional studies. The goal is to translate causal ideas into statements that can be tested with data. We will examine simple bivariate methods for analyzing unmatched and matched data and multivariate extensions of these methods. We will cover stratified analyses, linear regression, logistic regression and survival analytic techniques. The goal will be to understand the basic concepts and the situations in which each technique is appropriate, to be able to read and interpret computer printouts and to understand how to evaluate confounding, mediation and effect modification.
Readings	Text Chapters Susser 12, 18 (p. 212-217), 25 (to p. 297)

Session Title	Consequences of measurement error
Speakers	Dana March Mailman School of Public Health, Columbia University
Learning Objectives	By the end of this section students should be able to: <ul style="list-style-type: none"> - Calculate and interpret sensitivity, specificity, predictive power and Kappa - Describe the consequences of different types of measurement error - Identify sources of potential bias in the way information is obtained - Implement strategies to avoid bias in obtaining information
Duration	3 hours
Training methods	This session provides an introduction to the problem of measurement error and its implications for causal inference. We will examine the effects of measurement error in independent and dependent variables of interest as well as confounders and covariates. Sensitivity and specificity will be covered. We will also describe the sources of measurement error and various techniques to avoid it and tame its consequences.
Readings	Text Chapter Susser 14, Supplement 11 Szklo and Nieto Chapter 4

Session Title	Sampling and power
Speakers	Dana March Mailman School of Public Health, Columbia University
Learning Objectives	<p>By the end of this section students should be able to:</p> <ul style="list-style-type: none"> - Describe the basic rights of study participants - Delineate the ethical responsibilities of researchers regarding study results - Identify strategies to avoid unethical conduct in epidemiologic studies - Explain the role of IRB's
Duration	3 hours
Training methods	This session provides an overview of issues in sampling including an introduction to considerations and biases in different sampling procedures - random sampling, systematic, stratified, cluster, etc. This session also includes a conceptual and applied discussion of power analysis.
Readings	Text Chapter Susser 24 Supplements 12a, 12b