

Syllabus Module 223 : Design & Concepts in Epidemiology

N°223	Design & Concepts in Epidemiology
Coordinator	Dr Judith Mueller Professor in Epidemiology, EHESP Judith.mueller@ehesp.fr
Other Faculty	Tarik Benmarhnia, EHESP Teaching assistant: Courtney Dow, Postdoctoral Fellow
Dates	4-8 November 2024 (5 days)
Credits/ECTS	3 ECTS
Duration or Course Format	30 hours
Location	To be announced
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. Epidemiologic methods are the tools we use to make valid causal arguments. The primary objective is to provide students with the fundamental knowledge to design and interpret observational epidemiologic studies and interventional research.
Prerequisites	Advanced core in Biostatistics and Advanced core in Epidemiology
Course learning objectives	Students who successfully complete this course will be able to: <ul style="list-style-type: none"> • Define and describe the study designs used in epidemiologic research • Identify sources of, and methods to avoid, threats to validity in epidemiologic research • Articulate distinction between confounding, mediation and use Directed Acyclic Graphs • Draw and use Directed Acyclic Graph to guide study design and analyses • Recognize and explain interaction and effect measure modification on absolute and relative scales • Develop multivariable analysis plan to answer a research question
Competences	<p>Competences:</p> <p>1.4 Knows how to retrieve, analyse and appraise evidence from all data sources to support decision-making</p> <p>1.5 Is aware of the health needs of the population based on considerations of the burden of disease, indicators, characterization of risks and demand for and access to health care</p> <p>1.6 Contributes to or leads community-based health needs assessments, ensuring that these assessments consider biological, social, economic, cultural, political and physical determinants of health and wider determinants of health such as deprivation</p> <p>1.7 Designs and conducts qualitative and/or quantitative research that builds on existing evidence and adds to the evidence base for public health practice, involving relevant stakeholders in this process</p> <p>2.4 Evaluates the effectiveness of activities to promote health geared toward producing changes at the community and individual levels and in public or social policy to benefit health and the quality of life</p>

Structure (see schedule and table below for details on sessions)	<p>Each session consists of lectures that introduce new topics and hands-on exercises (labs) that reinforce the concepts presented and discussed during that lecture.</p> <p>During a paper discussion session, students will critically appraise an epidemiological research paper, which they will have read before class. Individual students will be asked to present their analysis in front of the class.</p>
Resources	<p>Recommended text books (not required): K.J. Rothman: Modern Epidemiology. Szklo, M and Nieto J. Epidemiology: beyond the basics, 4th ed. Jones & Bartlett Learning 2018</p>
Course requirement	<p>Students must attend all sessions. Class attendance will be checked accordingly. Students are expected to actively participate in the lab work and discussion.</p> <p>They must prepare the following class day by reading assigned papers.</p>
Grading and assessment	<p>The grade for the course is based on a final written exam which covers the entire course (100%).</p>
Course policy	<p>Attendance & Punctuality Regular and punctual class attendance is a prerequisite for receiving credit in a course. Students are expected to attend each class. Attendance will be taken at each class. The obligations of attendance and punctuality cover every aspect of the course: lectures, conferences, group projects, assessments, examinations, as described in EHESP Academic Regulations http://mph.ehesp.fr EHESP Academic Regulation Article. 3).</p> <p>If students are not able to make it to class, they are required to send an email to the instructor and to the MPH program coordinating team explaining their absence prior to the scheduled class date. All supporting documents are provided to the end-of-year panel.</p> <p>Students who miss class are responsible for content. Any student who misses a class has the responsibility for obtaining copies of notes, handouts and assignments. If additional assistance is still necessary, an appointment should be scheduled with the instructor. Class time is not to be used to go over material with students who have missed class.</p> <p>Lateness: Students who are more than 10 minutes late may be denied access to a class. Repeated late arrivals may be counted as absences (See http://mph.ehesp.fr EHESP Academic Regulation Article. 3 Attendance & Punctuality)</p> <p>Maximum absences authorized & penalty otherwise Above 20% of absences will be designated a fail for a given class. The students will be entitled to be reassessed in any failed component(s). If they undertake a reassessment or they retake a module this means that they cannot normally obtain more than the minimum pass mark (i.e. 10 out of 20)</p> <p>Exceptional circumstances Absence from any examination or test, or late submission of assignments due to illness, psychological problems, or exceptional personal reasons must be justified; otherwise, students will be penalized, as above mentioned. Students must directly notify their professor or the MPH academic secretariat before the exam or before the assignment deadline. Before accepting the student's justification, the professor or the MPH academic secretariat has the right to request either a certificate from the attending physician or from a psychologist, or from any other relevant person (See http://mph.ehesp.fr EHESP Academic Regulation Article 4 Examinations).</p> <p>Courtesy: All cell phones/pagers MUST be turned off during class time. Students are required to conduct themselves according to professional standards, eating during class time is not permitted during class time, such as course or group work.</p>

Valuing diversity	Diversity enriches learning. It requires an atmosphere of inclusion and tolerance, which oftentimes challenges our own closely-held ideas, as well as our personal comfort zones. The results, however, create a sense of community and promote excellence in the learning environment. This class will follow principles of inclusion, respect, tolerance, and acceptance that support the values of diversity. Diversity includes consideration of: (1) life experiences, including type, variety, uniqueness, duration, personal values, political viewpoints, and intensity; and (2) factors related to “diversity of presence,” including, among others, age, economic circumstances, ethnic identification, family educational attainment, disability, gender, geographic origin, maturity, race, religion, sexual orientation and social position.
Course evaluation	EHESP requests that you complete a course evaluation at the end of the school year. Your responses will be anonymous, with feedback provided in the aggregate. Open-ended comments will be shared with instructors, but not identified with individual students. Your participation in course evaluation is an expectation, since providing constructive feedback is a professional obligation. Feedback is critical, moreover, to improving the quality of our courses, as well as for instructor assessment.

	Cohort studies
Speakers	Judith Mueller
Learning Objectives	<ul style="list-style-type: none"> • Identify temporality of study design and unit of analysis • Describe the relationship among the study designs • Describe main features of cohort study design • Define prospective and retrospective cohort studies; Describe main differences between the two designs • Describe advantages and weaknesses of each design • Explain outcome assessment process and loss to follow-up in cohort studies • Calculate and interpret measures of association from cohort studies • Describe use of person-time to calculate incidence rate • Assess when loss-to-follow-up influences measures of associations
Readings	Required Reading: lecture slides

Day 1: Session 2 (afternoon)	Randomized trial designs, Evidence-based concepts
Learning Objectives	<ul style="list-style-type: none"> • Describe the relationship between experimental studies/randomized control trial (RCT) and cohort study designs • Describe the distinguishing design features of experimental studies • Explain reasons for randomization • Explain reasons for “blinding” • Describe “intent-to-treat analysis and reasons for using this type of analysis • Identify advantages and limitations of experimental study design
Readings	Required Reading: lecture slides

Day 2: Session 4 (afternoon)	Case-control Studies
Speakers	Judith Mueller
Learning Objectives	<ul style="list-style-type: none"> • Articulate the goals of case and control selection • Describe the relationship between cohort study design and case-control study design • Describe distinguishing design features of case-control studies • Describe the purpose of controls in case-control studies • Describe advantages and weaknesses of case-control studies • Discuss differences among variants of case-control design and their advantages and weaknesses • Understand the measures of associations that can be obtained with case-control studies
Readings	Required Reading: lecture slides

Day 3: Session 5 (morning)	Selection Bias
Speakers	Judith Mueller
Learning Objectives	<ul style="list-style-type: none"> • Define internal and external validity • Explain the concept of bias in epidemiologic studies • Explain and distinguish between selection and information bias • Define and assess selection bias • Identify common sources of selection bias in different study designs • Identify ways to minimize selection bias in the design of a study
Readings	Required Reading: lecture slides

Day 3: Session 6 (afternoon)	Information Bias and misclassification
Speakers	Judith Mueller
Learning Objectives	<ul style="list-style-type: none"> • Define and assess information bias • Understand the ways in which information bias can distort a measure of association • Identify common sources of information bias in different study designs • Identify ways to minimize information bias in the design of a study • Describe non-differential misclassification of disease and exposure • Describe differential misclassification of exposure
Readings	Required Reading: lecture slides

Day 4: Session 7 (morning)	Confounding, mediation
Speakers	Judith Mueller
Learning Objectives	<ul style="list-style-type: none"> • Define confounding • Apply confounding to counterfactual • Describe three criteria for identifying a confounder • Compare crude and adjusted measures of association to identify presence of confounding • Apply strategies for reducing confounding in the design, conduct and analysis of epidemiologic studies • Apply strategies for reducing confounding in the design, conduct and analysis of epidemiologic studies • Articulate distinction between confounding and mediation • Define mediation and mediators

Readings	Required Reading: lecture slides
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Day 4: Session 8 (afternoon)	Effect Modification
Speakers	Judith Mueller
Learning Objectives	<ul style="list-style-type: none"> Define and estimate effect measure modification and interaction Evaluate effect modification using stratified analyses Assess and articulate scale dependency of effect measure modification through risk ratios and risk differences
Readings	Required Reading: lecture slides

Day 5: Session 9 (morning)	Introduction to Directed acyclic graphs (DAGs) and causal inference frameworks
Speakers	Tarik Benmarhnia
Learning Objectives	<ul style="list-style-type: none"> Define Directed Acyclic Graph (DAG) Draw a causal DAG Deduce associations implied by the DAG Draw causal DAGs using DAGitty Describe selection of variables in analysis using DAG
Readings	<p>Required Reading: lecture slides</p> <p>Greenland, Pearl and Robins Causal Diagrams for Epidemiological Research, Epidemiology 1999; 10:37-38</p> <p>Shrier I, Platt R. Reducing bias through directed acyclic graphs. BMC Medical Research Methodology 2008; 8: 70.</p>

	Transferring concepts into statistical models
Speakers	Tarik Benmarhnia
Learning Objectives	<ul style="list-style-type: none"> Reflect on the strategies required to statistically evaluate epidemiological hypotheses Develop basic statistical models implying the key assumptions
Readings	Required Reading: lecture slides

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Speakers	Judith Mueller
Learning Objectives	<ul style="list-style-type: none"> Calculate cumulative incidence using Kaplan-Meier method Various topics
Readings	Required Reading: lecture slides