Syllabus Modules – Analysis in Epidemiology (I) & (II)

N°224 & 225	**Analysis in Epidemiology (I) & (II)**
Coordinator	Mary-Beth TERRY
Dates	From December 9th to 13th 2024 (week 50) & from January 06th to 10th 2025 (week 2)
Credits/ECTS	3 ECTS for each module
Duration or Course Format	Two times 5 days of 6 hours = 30 hours
Location	EHESP 20 Avenue George Sand 93210 LA PLAINE ST DENIS
Description	The course focuses on integrating study design methods with advanced statistical analyses. The lectures focus on methodological issues of study designs covering causal modeling and hypothesis development, variable construct and measurement issues, tabular and multivariable analyses. The purpose of this course is to provide both theoretical and practical experience in analyzing epidemiological data. The main textbooks used are Rothman's Modern Epidemiology and Hosmer and Lemeshow's Logistic and Survival Models. Lectures cover theoretical concepts from confounding, interaction, pseudo risks and rates, and generalized linear models. Computer laboratories use multiple data sets covering topics in linear, logistic (binary and polytomous), Cox Proportional Hazard, Poisson, and Quantile regression methods. Multivariable methods for testing for confounding, interaction, and mediation are taught both in lecture and laboratories.
Prerequisites	Concepts in Methods and Design in Epidemiology
Course learning Objectives	Students who successfully complete this course will be able to: 1) Critique the major study epidemiological study designs for use based on a research question 2) Apply study design methodology and analytic methods to make inferences about causation 3) Conduct statistical regression analyses including logistic, COX, and Poisson
Structure (details of sessions title/speaker/date /duration)	Details of the sessions: *Session 1:* Introduction The Multivariable Model Absolute versus Relative Measures of Effect Observational Epidemiology and Counterfactuals *Lab 1: Mantel-Haenszel using Stata or R software* Session 2: Measurement and Bias Overview of Precision versus Bias, Selection Bias, Information Bias, Confounding Session 3: Statistical Interaction, Biological Interaction, Public Health Interaction *Lab 2: Confounding & Interaction* Session 4: Case-control Analysis I Design Categorical Analyses, Logistic Regression Modeling Session 5: Case-control Analysis II Model building Interaction in case-control studies Polytomous modeling *Lab 3: Polytomous Logistic Regression* Session 6: Cohort/Follow-up Analysis I Description, Tabular analysis, Basic survival analysis *Lab 4: Kaplan Meier*

	Session 7: Cohort/Follow-up Analysis II Cohort/Follow-up Analysis II Non-parametric versus Parametric Approaches, PH Cox Models *Lab 5: Cox PH Modeling* Session 8: Advanced topics Conceptual, Tabular Analyses, Regression Models, Time Varying Covariates *Lab 6: Poisson & Relative Risk Regression* *Lab 7: Time Varying Covariates* Session 9: Matching and Weighting *Lab 8: Conditional Logistic Regression* Session 10: Meta-Analysis
Resources	Books The required text for this course is: Rothman K, Greenland S, Lash T. (2008) Modern Epidemiology (3^rd edition). Philadelphia: Lippincott-Raven. Referred to as R&G. For theoretical aspects of epidemiological research and data analytic methods the following books are also recommended for reading and have been placed on reserve at the Health Sciences library: 1. Hosmer DW (2004), Lemeshow S. Applied Logistic Regression (2^nd edition). New York: John Wiley & Sons. Hosmer DW (2008), Lemeshow S. Applied Survival Analysis. New York: John Wiley & Sons.
Course requirement	Students are expected to attend all lectures and seminars. Class attendance will be checked accordingly. Students are expected to read and analyse selected papers for the group work before the courses.
Grading and assessment	Class assessment: Daily laboratory and presentations (40%) Homeworks (40%) Final: (20%)
Course policy	**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). 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. . 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. **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) **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) **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). **Courtesy**: All cell phones/pages 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.
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.

Session 1	**Causal Inference, Measures of Effect and Association, Multivariable Model**
Speakers	
Session Outline	
Learning Objectives	Lecture 1 Learning Objectives: • Discuss causal inference and the concept of the counterfactual • Distinguish between absolute vs. relative measures of effect and association • Explain the relationships among various measures of association • Discuss the multivariable model and its advantages over tabular analyses for analysis of epidemiologic data
Duration	
Training methods	
Readings	Ch 2 (p. 5-13) Ch 3 (p. 32-48) Ch 4 (p. 51-61)

Session 2	Precision and Bias
Speakers	

Session Outline	
Learning Objectives	Lecture 2 Learning Objectives: • Discuss and compare precision and bias • Explain how selection bias, information bias, and confounding can influence observed measures of association • Discriminate between selection bias, information bias, and confounding • Distinguish between confounding and mediation
Duration	
Training methods	
Reading	Ch 9 Ch 10 (p. 148-151, 156-158)

Session 3	**Interaction**
Speakers	
Session Outline	
Learning Objectives	Lecture 3 Learning Objectives: • Describe and distinguish between statistical and biological interaction • Assess interaction on the additive and multiplicative scales • Explore interaction in stratified and regression analyses
Duration	
Training methods	
Readings	Ch 5

Session 4	Case-control 1
Speakers	
Session Outline	
Learning Objectives	Lecture 4 Learning Objectives: • Summarize the design elements of a case-control study • Describe the measure of association used for a case-control study • Discuss the fundamental concepts underlying the logistic regression model and when it is useful for the analysis of epidemiologic data
Duration	
Training methods	

Reading	Ch 8 Ch 14 (p. 238-253) Ch 15 (p. 274-276)

Session 5	**Case Control 2**
Speakers	
Session Outline	
Learning Objectives	Lecture 5 Learning Objectives: • Demonstrate approaches to evaluate linearity • Evaluate confounding and interaction using a multivariable model • Describe model evaluation • Discuss and apply an extension of the logistic model – Polytomous Regression
Duration	
Training methods	
Readings	Ch 17 (p. 303-305, 321-323) Ch 20 (p. 394-395, 413-415)

Session 6	Cohort 1
Speakers	
Session Outline	
Learning Objectives	Lecture 6 Learning Objectives: • Summarize the design elements of a cohort study • Describe and discuss utility of analysis of age, period, and cohort effects • Describe and demonstrate basic survival analysis: Life Table and Kaplan-Meier methods
Duration	
Training methods	
Reading	Ch 14 (p. 253-257) Ch 15 (p. 273-274) Ch 20 (p. 393-394)

Cohort 7	**Cohort 2**
Speakers	
Session Outline	
Learning Objectives	Learning Objectives: • Describe and discuss the choices for multivariable models of survival data once we move beyond Kaplan-Meier and Life Table methods • Discuss the Cox Proportional Hazards Model and describe its assumptions

	• Decide when the Cox model is a good choice for the analysis of epidemiologic data • Demonstrate approaches for evaluating whether the assumptions of this model have been met • Review an application of the Cox model from the literature • Explain the concept of time-varying covariates • Demonstrate the utility of time-varying covariates in the analysis of data from cohort studies
Duration	
Training methods	
Readings	

Session 8	Advanced Topics
Session Outline	
Learning Objectives	Lecture 9 Learning Objectives: • Describe and give examples of types of correlated data • Examine commonly used regression models for correlated data • Discuss poisson regression model and describe its assumptions • Decide when the poisson model is a good choice for the analysis of epidemiologic data • Demonstrate approaches for evaluating whether the assumptions of the Poisson model have been met • Describe relative risk regression
Duration	
Training methods	
Reading	Ch. 14 (p. 240-245)

Session 9	**Matching**
Speakers	
Session Outline	
Learning Objectives	Learning Objectives: • Describe the purpose and benefits of matching in case-control • Summarize tabular analyses for matched data • Discuss regression models suitable for matched data; apply these methods • Discuss different options for handling correlated data • Compare and contrast GEE and MLMs
Duration	
Training methods	

Readings	Ch 11 (p. 171-182) Ch 16 (p. 283-288) Ch 21 (p. 434-435)

Session 10	Meta-Analysis, Synthesis and Review
Speakers	
Session Outline	
Learning Objectives	Learning Objectives: • Discuss and distinguish between narrative reviews, meta-analysis, and pooled analysis • Explain statistical methods used in meta- and pooled analyses
Duration	
Training methods	
Reading	