Syllabus Module : 210 Infectious disease epidemiology

N° 210	Infectious disease epidemiology
UE coordinator	Tiffany G. Harris, PhD, MS Associate Professor of Epidemiology at CUMC Mailman School of Public Health, Columbia University New York, NY, USA Email: th2604@cumc.columbia.edu
Dates	5th to 9th November 2018
ECTS	3 ECTS
Duration	5 days
Location	EHESP 20 Avenue George Sand 93210 LA PLAINE ST DENIS
Description	Infectious disease epidemiology studies the occurrence of infectious diseases; factors leading to infection by an organism; factors affecting transmission of an organism; and factors associated with clinically recognizable disease among those who are infected. It requires the use of traditional epidemiologic methods as well as methods unique to infectious disease epidemiology, such as mathematical modeling. In addition to knowing epidemiologic methods, infectious disease epidemiologists need to be familiar with the biological features and clinical manifestations of important pathogens as well as laboratory techniques for the identification and quantification of infectious organisms. This course is designed to provide an introduction to infectious disease epidemiology. It will focus on the tools and methods used in identifying, preventing, and controlling infectious diseases to improve public health. Case studies based on the literature and the work of faculty members will be used to illustrate the real-world application of these tools and methods to address public health problems.
Prerequisites	None
Course learning objectives	Students who successfully complete this course will be able to: ▪ Discuss the key concepts of infectious disease transmission and control, and the differences with non-infectious diseases ▪ Apply biological principles to development and implementation of disease prevention, control or management programs ▪ Specify the role of the immune system in population health ▪ Apply epidemiologic tools and methodologies to understand the transmission dynamics and control of infectious diseases ▪ Critically appraise and interpret the findings of infectious disease epidemiology papers
Structure (details of sequences: title/speaker/date/duration)	Specific leaning objectives are noted for each session. At the end of each session, students should know and be able to accomplish the session's learning objectives. • Session 1. Introduction to Infectious Disease Epidemiology • Session 2. Assessing the Epidemiological Burden of TB and the Impact of TB Control: Population-based TB Prevalence Surveys • Session 3. Mathematical Modeling: Introduction to Concepts in Transmission and Dynamics • Session 4: Epidemiologic Methods for Measuring Transmission and Control of Respiratory Infections: Influenza • Session 5. Causal Inference, Mathematical Modeling, and the Development of Public Health Policy: Voluntary Medical Male Circumcision to Prevent HIV Transmission • Session 6. Epidemiology and Control of Malaria • Session 7. Epidemiology and Control of Sexually Transmitted Infections • Session 8. Surveillance and control of healthcare-associated infections • Session 9. Epidemiologic Methods in Vaccinology • Session 10. Epidemiologic Methods for Measuring Transmission and Control of Viral Hepatitis

Resources	Textbook: Konrad E. Nelson and Carolyn Masters Williams (eds.) (2013). *Infectious Disease Epidemiology: Theory and Practice.* Third edition. Sudbury: Jones and Bartlett Publishers. Assigned journal articles
Course requirement	Read required readings before each session, attend each session, and participate in discussions
Grading and assesment	100% Final written examination
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.

# 1 Session Title	**Introduction to Infectious Disease Epidemiology**
Speaker	Tiffany G. Harris, PhD, MS Associate Professor of Epidemiology at CUMC Mailman School of Public Health, Columbia University New York, NY, USA Email: th2604@cumc.columbia.edu
Session Outline	• Overview of the biological basis of infectious disease epidemiology • Application of fundamental epidemiological study designs to infectious disease • Overview of surveillance approaches
Learning Objectives	• Describe the host-pathogen-environment interaction and identify factors influencing this interaction • Summarize the epidemiologic classification of infectious diseases • Explain the natural history of infectious diseases • Demonstrate the role of transmission mechanisms in disease control and prevention • Identify sources of data on infectious disease occurrence and pros and cons of various sources • Describe attributes of good surveillance systems and examples of infectious disease surveillance systems • Summarize and interpret surveillance data
Duration	3 hours
Training methods	Face to Face
Reading	Required Reading: • Hall HI, Correa A, Yoon PW, Braden CR; Centers for Disease Control and Prevention. Lexicon, definitions, and conceptual framework for public health surveillance. *MMWR Surveill Summ* 2012;61 Suppl:10-14. Optional Reading: • Textbook Chapter 2: Epidemiology of Infectious Disease: General Principles • Textbook Chapter 8: Microbiology Tools for the Epidemiologist • Textbook Chapter 10: The Immune System and Host Defense Against Infections
Validation	Not applicable

# 2 Session Title	**Mathematical Modeling: Introduction to Concepts in Transmission and Dynamics**
Speaker	Pascal Crépey, PhD, Lecturer Departement EPI & Biostats EHESP Pascal.crepey@ehesp.fr
Session Outline	Introduction to concepts in transmission & dynamics based upon mathematical modeling
Learning Objectives	▪ Describe in words, by diagram, and by differential equations a basic compartmental model (like the susceptible-infectious-recovered [SIR] model) ▪ Identify the parameters to calculate the basic reproductive number (R_0) ▪ Explain the concept of and calculate the epidemic threshold ▪ Describe in words and mathematically the effect of vaccination on the spreading of a disease in a population ▪ Provide examples of control strategies for the transmission of infectious diseases, and what transmission parameters are targeted by these strategies

	▪ Identify how and why epidemics behave differently in closed versus open populations ▪ Identify the limitations of deterministic models, and characteristics of infectious disease transmission that may limit their use.
Duration	3 hours
Training methods	Lecture
Reading	Optional Reading: Textbook Chapter 6: Infectious Disease Dynamics
Validation	NA for this session

# 3 Session Title	**Assessing the Epidemiological Burden of TB and the Impact of TB Control: Population-based TB Prevalence Surveys**
Speaker	Tiffany G. Harris, PhD, MS Associate Professor of Epidemiology at CUMC Mailman School of Public Health, Columbia University New York, NY, USA Email: th2604@cumc.columbia.edu
Session Outline	• Overview of the epidemiology of tuberculosis (TB) and how diagnostic tests are applied
Learning Objectives	• Describe the natural history and epidemiology of TB • Describe the role of inventory studies, capture-recapture methods, and population-based TB prevalence surveys in estimating TB incidence • Discuss the benefits and challenges of utilizing various screening strategies to identify individuals at high risk for TB • Discuss the impact of incorporating various laboratory techniques into the case definition on estimates of TB prevalence • Interpret findings from population-based TB prevalence surveys, to inform the development of strategies that could increase the proportion of TB cases that are diagnosed, and improve the proportion of cases being captured by routine surveillance data
Duration	3 hours
Training methods	Face to Face, Group Work and Student Presentations
Reading	Required Reading: • Kebede AH, Alebachew Z, Tsegaye F, et al. The first population-based national tuberculosis prevalence survey in Ethiopia, 2010-2011. *Int J Tuberc Lung Dis* 2014;18(6):635-9. • Senkoro M, Mfinanga S, Egwaga S, et al. Prevalence of pulmonary tuberculosis in adult population of Tanzania: a national survey, 2012. *Int Tuberc Lung Dis* 2016;20(8):1014-21 Optional Reading: • Pai M, Behr MA, Dowdy D, et al. Tuberculosis. *Nat Rev Dis Primers* 2016; 2:16076. doi:10.1038/nrdp.2016.76.
Validation	NA for this session

# 4 Session Title	**Epidemiologic Methods for Measuring Transmission and Control of Respiratory Infections: Influenza**
Speaker	Tiffany G. Harris, PhD, MS

	Associate Professor of Epidemiology at CUMC Mailman School of Public Health, Columbia University New York, NY, USA Email: th2604@cumc.columbia.edu
Session Outline	Overview of influenza surveillance and control strategies
Learning Objectives	• Identify sources of surveillance data used to monitor influenza activity, and the ways in which these sources can be biased • Describe available influenza mitigation strategies, and how they affect transmission • Describe how complexity can be added to basic SIR models for evaluating pandemic policy strategies • Describe how model assumptions can alter the interpretation of model output • Discuss strengths and limitations of study designs used to assess the effect of herd immunity from influenza vaccination
Duration	3 hours
Training methods	Lecture, Group discussions
Readings	Required Readings: • Fung ICH, Gambhir M, Glasser JW, Gao H, Washington ML, Uzicanin A, Meltzer MI. Modeling the effect of school closures in a pandemic scenario: exploring two different contact matrices. *Clin Infect Dis* 2015;60(S1)S58-63. • Loeb M, Russell ML, Fonseca et al. Effect of influenza vaccination of children on infection rates in Hutterite communities: a randomized trial. *JAMA* 2010;303:943-50. • Wang B, Russell ML, Moss L, Fonseca K, Earn DJD, Aoki F, et al. Effect of Influenza Vaccination of Children on Infection Rate in Hutterite Communities: Follow-Up Study of a Randomized Trial. PLoS ONE 2016;11: e0167281. Optional Reading: • Krammer F, Smith GJD, Fouchier RAM, Peiris M, Kedzierska K, Doherty PC, Palese P, Shaw ML, Treanor J, Webster RG, García-Sastre A. *Nat Rev Dis Primers* 2018;4(1):3. doi: 10.1038/s41572-018-0002-y. • Textbook Chapter 15: Epidemiology and Prevention of Influenza
Validation	NA for this session

# 5 Session Title	**Causal Inference, Mathematical Modeling, and the Development of Public Health Policy: Male Circumcision to Prevent HIV Transmission**
Speaker	Tiffany G. Harris, PhD, MS Associate Professor of Epidemiology at CUMC Mailman School of Public Health, Columbia University New York, NY, USA Email: th2604@cumc.columbia.edu
Session Outline	• Overview of the natural history and epidemiology of HIV • Overview of the role of voluntary male medical circumcision (VMMC) and other HIV prevention approaches
Learning Objectives	• Describe the biological properties that appear to promote HIV acquisition in uncircumcised men compared to circumcised men • Apply criteria for causality to determine whether a biomedical intervention prevents acquisition of an infectious disease • Define risk compensation and explain how it can impact the effectiveness of a prevention intervention

	• Critically analyze journal articles evaluating the effectiveness of public health interventions • Interpret the results of mathematical modeling papers to determine whether a public health intervention will lead to reductions in infectious disease transmission and prevalence
Duration	3 hours
Training methods	Lecture, Group discussions
Reading	Required Readings: • Auvert B, Taljaard D, Rech D, et al. Association of the ANRS-12126 male circumcision project with HIV levels among men in a South African township: evaluation of effectivenss using cross-sectional surveys. *PLOS Med* 10(9):e1001509. Doi:10.1371/journal.pmed.1001509. • Blaizot S, Maman D, Riche B, et al. Potential impact of multiple interventions on HIV incidence in a hyperdemic region in western Kenya: a modelling study. *BMC Infect Dis* 2016;16:189. Doi: 10.1186/s128799-016-1520-4. Optional Reading: • Textbook Chapter 22: Human Immunodeficiency Virus Infections and the Acquired Immunodeficiency Syndrome • Deeks SG, Overbaugh J, Phillips A, et al. HIV infection. *Nat Rev Dis Primers* 2015;1(15035).
Validation	NA for this session

# 6 Session Title	**Epidemiology and Control of Malaria**
Speaker	Dr. Jacques LeBras Institut de Médecine et d'Epidémiologie Appliquée/Institut de rechercher pour le developpement (UMR 216 IRD) Paris
Session Outline	Epidemiologic Methods for Measuring Transmission and Control of Vector-borne Infections: Malaria
Learning Objectives	• Discuss the limitations of epidemiologic methods used to measure the burden of malaria in the population • Describe the control strategies used for malaria
Duration	3 hours
Training methods	Lecture
Reading	Required Reading: • Phillips MA, Burrows JN, Manyando C, van Huijsduijnen RH, Van Voorhis WC, Wells TNC. Malaria. *Nat Rev Dis Primers* 2017;3:17050. Optional Reading: • Textbook Chapter 27: The Epidemiology and Control of Malaria
Validation	NA

# 7 Session Title	**Epidemiology and Control of Sexually Transmitted Infections**
Speakers	Tiffany G. Harris, PhD, MS Associate Professor of Epidemiology at CUMC Mailman School of Public Health, Columbia University New York, NY, USA Email: th2604@cumc.columbia.edu

Session Outline	Overview of the epidemiology and control of sexually transmitted infections (STIs)
Learning Objectives	• Describe the epidemiology of STIs • Explain the strengths and limitations of surveillance systems for STIs • Describe STI control approaches • Critically assess the epidemiological methods used to evaluate the efficacy of partner treatment and notification strategies for gonorrhea and chlamydial infection
Duration	3 hours
Training methods	Lecture, Group discussions
Reading	Required Reading: • García PJ, Holmes KK, Cárcamo CP, et al. Prevention of sexually transmitted infections in urban communities (Peru PREVEN): a multicomponent community-randomised controlled trial. *Lancet* 2012;379:1120-8. Erratum in: *Lancet* 2012;379:1102 • Kerani RP, Fleming M, DeYoung B, Golden MR. A randomized, controlled trial of inSPOT and patient-delivered partner therapy for gonorrhea and chlamydial infection among men who have sex with men. *Sex Transm Dis.* 2011 Oct;38(10):941-6. Erratum in: *Sex Transm Dis.* 2013 May;40(5):432. Optional Reading: • Textbook Chapter 24: Sexually Transmitted Diseases
Validation	NA for this session

# 8 Session Title	**Surveillance and control of healthcare-associated infections**
Speaker	Pascal Astagneau, Departement EPI & Biostats EHESP
Session Outline	Method of health care associated infection control programs and surveillance will be presented. Comparative analysis of interventions regarding human and economic resources required for data collection and patient follow up will be discussed in terms of cost effectiveness.
Learning Objectives	• Identify different programs for controlling health care associated infections worldwide • Compare different surveillance systems in terms of cost effectiveness • Describe the limitations of surveillance systems that rely on routine data collection, for instance in hospital settings
Duration	3 hours
Training methods	Lecture, Group discussion
Reading	Required Reading: • Allegranzi B, Bagheri Nejad S, Combescure C, et al. Burden of endemic health-care-associated infection in developing countries: systematic review and meta-analysis. *The Lancet* 2011; 377:228-241. Optional Reading: • Center for Disease Dynamics, Economics & Policy. 2015. State of the World's Antibiotics, 2015. CDDEP: Washington, D.C.
Validation	NA for this session

# 9 Session Title	**Epidemiologic Methods in Vaccinology**
Speakers	Judith Mueller Lecturer Departement EPI & Biostats EHESP Judith.Mueller@ehesp.fr
Session Outline	Overview of epidemiologic principles of vaccines for disease prevention
Learning Objectives	• Explain the principle epidemiological concepts around vaccine prevention • Describe study designs for evaluation of vaccines and vaccination strategies • Explain the role that vaccination can play in the occurrence and prevention of epidemics • Describe a selection of immunization programs
Duration	3 hours
Training methods	Lecture
Training methods	Lecture
Reading	Optional Reading: • Textbook Chapter 11: Vaccines: Past, Present, and Future • WHO Global Vaccine Action Plan, 2011-2020
Validation	NA for this session

# 10 Session Title	**Epidemiologic Methods for Measuring Transmission and Control of Viral Hepatitis**
Speakers	Tiffany G. Harris, PhD, MS Associate Professor of Epidemiology at CUMC Mailman School of Public Health, Columbia University New York, NY, USA Email: th2604@cumc.columbia.edu
Session Outline	Overview of the natural history, epidemiology, and control of Hepatitis B (HBV) and Hepatitis C (HCV)
Learning Objectives	• Describe the natural history and epidemiology of HBV and HCV • Evaluate the impact of Hepatitis B vaccination strategies • Assess the impact of risk behaviors and preventive measures on HBV and HCV prevalence
Duration	3 hours
Training methods	Lecture, Group discussion
Reading	Required Readings: • Liang X, Bi S, Yang W et al. Evaluation of the impact of hepatitis B vaccination among children born during 1992-2005 in China. J Infect Dis 2009;200:39-47. • Chang MH, You SL, Chen CJ, et al. Decreased incidence of hepatocellular carcinoma in hepatitis B vaccinees: a 20-year follow-up study. *J Natl Cancer Inst* 2009;101:1348-55. Optional Readings : • Textbook Chapter 23: Viral Hepatitis • Mann MP, Buti M, Gane E, Pawlotsky JM, Razavi H, Terrault N, and Younossi Z. Hepatitis C virus infection.*Nature Reviews Disease Primers* 2017;3:17006.
Validation	NA for this session