Syllabus Module: 210 Infectious disease epidemiology

N° 210	Infectious disease epidemiology
UE coordinator	Tiffany G. Harris, PhD, MS Adjunct Associate Professor of Epidemiology Mailman School of Public Health, Columbia University New York, NY, USA Email: th2604@cumc.columbia.edu
Dates	6 to 10 November 2023
ECTS	3 ECTS
Duration	5 days
Location	CNAM, 292 rue saint-Martin 75003 Paris
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. ▪ Describe development and implementation of disease prevention, control, or management programs. ▪ 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. Infectious Disease Modeling

	• Session 3. Vaccinology • Session 4: Outbreak Investigation and Foodborne and Waterborne Diseases • Session 5. HIV • Session 6. Sexually Transmitted Infections and Hep B and C • Session 7. Respiratory Viruses • Session 8. Vectorborne and Neglected Tropical Diseases • Session 9. Tuberculosis • Session 10. Group presentations
Resources	Journal articles, podcasts, websites
Course requirement	Read/listen to/watch required material before each session, attend each session, participate in discussions, and complete assignments
Grading and assessment	25%: Individual exercises 25%: Group project 50%: Final written examination on Tuesday, November 28th 2023
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**: Cell phones MUST be turned off during class time and students are required to conduct themselves according to professional standards.
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
Session Outline	• Infectious disease modes of transmission, model, and natural history • Public health surveillance approaches • Application of molecular techniques to infectious disease epidemiology
Learning Objectives	• Identify the different modes of infectious disease transmission • Describe the host-pathogen-environment interaction (infectious disease model) and identify factors influencing this interaction • Describe the natural history of infectious diseases • Describe attributes of different surveillance approaches • Summarize and interpret surveillance data
Duration	3 hours
Training methods	Lecture, group discussion, surveillance exercise
Reading	**Required material** Explore: https://www.history.com/topics/middle-ages/pandemics-timeline Listen: https://www.wnycstudios.org/podcasts/otm/segments/five-micron-mistake **Supplementary/optional material** Merck Manual Laboratory Diagnosis of Infectious Disease (overview of various types of laboratory tests – suggest reviewing if do not have this background) https://www.merckmanuals.com/professional/infectious-diseases/laboratory-diagnosis-of-infectious-disease Videos about the immune system (suggest if do not have this background) https://www.youtube.com/watch?v=fSEFXI2XQpc https://www.youtube.com/watch?v=GIJK3dwCWCw Genomic/molecular epidemiology with a focus on COVID-19 https://www.cdc.gov/amd/training/covid-19-gen-epi-toolkit.html Megan Molteni. The 60-Year-Old Scientific Screwup That Helped Covid Kill. *Wired* 05.13.2021.
Validation	Surveillance exercise

# 2 Session Title	**Mathematical Modeling: Introduction to Concepts in Transmission and Dynamics**
Speaker	Pascal Crépey, PhD Department Epidemiology and Biostatistics, EHESP Pascal.crepey@ehesp.fr
Session Outline	Introduction to concepts in transmission and dynamics based upon mathematical modeling
Learning Objectives	• Describe a basic compartmental model • Identify the parameters to calculate R0 • Explain the concept of and calculate an « epidemic threshold » • Describe the effect of vaccination on the spreading of a disease in a population • Discuss the roles, outcomes, and limits of mathematical modeling in public health and characteristics of infectious disease transmission that may limit their use
Duration	3 hours
Training methods	Lecture, group discussion
Reading	**Required material** Read: Houdroge, F., Palmer, A., Delport, D. *et al.* Frequent and unpredictable changes in COVID-19 policies and restrictions reduce the accuracy of model forecasts. *Sci Rep* 2023;13:1398. https://doi.org/10.1038/s41598-023-27711-3 Holmadhl I and Buckee C. Wrong but Useful — What Covid-19 Epidemiologic Models Can and Cannot Tell Us. *N Engl J Med* 2020;383:303-305. DOI: 10.1056/NEJMp2016822. https://www.nejm.org/doi/full/10.1056/NEJMp2016822 **Supplementary/optional material** Interview with Dr. Buckee that goes with above article. https://www.nejm.org/doi/full/10.1056/NEJMp2016822 Heesterbeek H, Anderson RM, Andreasen V, et al. Modeling infectious disease dynamics in the complex landscape of global health. *Science* 2015;347(6227):aaa4339.
Validation	NA for this session

# 3 Session Title	**Epidemiologic Methods in Vaccinology**
Speakers	Judith Mueller, MD, MPH, PhD Department Epidemiology & Biostatistics, EHESP Judith.Mueller@ehesp.fr
Session Outline	Overview of epidemiologic principles of vaccines for disease prevention
Learning Objectives	• Describe study designs for evaluation of vaccines and vaccination strategies including for COVID-19 vaccines • Describe pre-and post-licensure surveillance approaches
Duration	3 hours
Training methods	Lecture and group discussion
Reading	**Required material** None **Supplementary/optional material** Great site covering vaccine history (check out the blog) https://historyofvaccines.org/ Pouwels KB, Pritchard E, Matthews PC, et al. Effect of Delta variant on viral burden and vaccine effectiveness against new SARS-CoV-2 infections in the UK. *Nat Med* 2021. https://doi.org/10.1038/s41591-021-01548-7. Halloran ME, Struchiner CJ, Longini IM Jr. Study designs for evaluating different efficacy and effectiveness aspects of vaccines. *Am J Epidemiol* 1997;146(10):789-803. Henao-Restrepo AM, Camacho A, Longini IM, et al. Efficacy and effectiveness of an rVSV-vectored vaccine in preventing Ebola virus disease: final results from the Guinea ring vaccination, open-label, cluster-randomised trial (Ebola Ça Suffit!). *Lancet* 2017:505-518. doi: 10.1016/S0140-6736(16)32621-6. Epub 2016 Dec 23. Erratum in: *Lancet* 2017;389(10068):504. *Lancet* 2017;389(10068):504. PubMed PMID: 28017403; PubMed Central PMCID: PMC5364328. Miranda S, Chaignot C, Collin C, et al. Human papillomavirus vaccination and risk of autoimmune diseases: A large cohort study of over 2 million young girls in France. *Vaccine* 2017;35(36):4761-4768. doi: 10.1016/j.vaccine.2017.06.030. Epub 2017 Jul 24. PubMed PMID: 28750853. Simondon F, Preziosi MP, Yam A, et al. A randomized double-blind trial comparing a two-component acellular to a whole-cell pertussis vaccine in Senegal. *Vaccine* 1997;15(15):1606-12. PubMed PMID: 9364690.
Validation	NA for this session

# 4 Session Title	**Outbreak Investigations and Foodborne and Waterborne Diseases**
Speakers	Tiffany G. Harris, PhD, MS
Session Outline	• Steps in an outbreak investigation • Causes, surveillance, epidemiology, and prevention of foodborne and waterborne diseases • Outbreak exercise
Learning Objectives	• Explain the steps involved in detecting and investigating an outbreak • Discuss different surveillance approaches for foodborne diseases • Summarize and interpret surveillance and outbreak investigation data
Duration	3 hours
Training methods	Lecture, group discussion, outbreak exercise
Reading	**Required material** Read before class: Crowe SJ, Bottichio L, Shade LN, et al. Shiga Toxin-Producing E. coli Infections Associated with Flour. *N Engl J Med* 2017;377(21):2036-2043. doi: 10.1056/NEJMoa1615910. PMID: 29166238; PMCID: PMC5792826. **Supplementary/optional material** Publisher's Platform: A history of flour outbreaks in recent years https://www.foodsafetynews.com/2023/04/publishers-platform-a-history-of-flour-outbreaks-in-recent-years/ America's Food Safety System Failed to Stop a Salmonella Epidemic. It's Still Making People Sick. https://www.propublica.org/article/salmonella-chicken-usda-food-safety (ProPublica did a whole series on food safety in US – can be found at https://www.propublica.org/series/unchecked)
Validation	Foodborne outbreak exercise

# 5 Session Title	**Epidemiology and Control of HIV**
Speaker	Tiffany G. Harris, PhD, MS
Session Outline	• Biology and natural history of HIV • Epidemiology of HIV • HIV prevention and control approaches • HIV surveillance approaches
Learning Objectives	• Describe HIV prevention • Discuss the different interventions currently available to achieve HIV epidemic control • Describe different HIV surveillance approaches
Duration	3 hours
Training methods	Lecture, group discussion
Reading	**Required material** Read before class: Harris TG, Wu Y, Parmley LE, et al. HIV care cascade and associated factors among men who have sex with men, transgender women, and genderqueer individuals in Zimbabwe: findings from a biobehavioural survey using respondent-driven sampling. *Lancet HIV* 2022;9(3):e182-e201. doi: 10.1016/S2352-3018(21)00297-6. Explore: AVERT HIV Timeline. In this interactive timeline, you can explore how different people have been affected by HIV over the past four decades and read, see, and hear how things have changed around the world. https://timeline.avert.org/ **Supplementary/optional material** More information on the HIV epidemic and HIV prevention and treatment programs: https://www.beintheknow.org/
Validation	NA for this session

# 6 Session Title	**Epidemiology and Control of Sexually Transmitted Infections and Hepatitis B and C**
Speakers	Tiffany G. Harris, PhD, MS
Session Outline	Overview of the epidemiology and control of sexually transmitted infections (STIs) and hepatitis B and C
Learning Objectives	• Describe the epidemiology and natural history of select STIs and hepatitis B and C • Describe STI and hepatitis B and C prevention and control approaches
Duration	3 hours
Training methods	Lecture, group discussion
Reading	**Required material** Hazra A, Cherabie JN, Is Mpox a Sexually Transmitted Infection? Why Narrowing the Scope of This Disease May Be Harmful, *Clinical Infectious Diseases* 2023;76(8):1504–1507. https://doi.org/10.1093/cid/ciac962 Allan-Blitz LT et al. A Position Statement on Mpox as a Sexually Transmitted Disease, *Clinical Infectious Diseases* 2023;76(8):1508–1512. https://doi.org/10.1093/cid/ciac960 **Supplementary/optional material** Marshall BD, Milloy MJ, Wood E, et al. Reduction in overdose mortality after the opening of North America's first medically supervised safer injecting facility: a retrospective population-based study. *Lancet* 2011;377:1429–37. https://doi.org/10.1016/s0140-6736(10)62353-7 Colledge-Frisby, Samantha et al. Global coverage of interventions to prevent and manage drug-related harms among people who inject drugs: a systematic review. *The Lancet Global Health* 2023;11(5):e673 - e683. https://doi.org/10.1016/S2214-109X(23)00058-X Platt L, Monozzi S, Reed J, et al. Needle and syringe programmes and opioid substitution therapy for preventing HCV transmission among people who inject drugs: findings from a Cochrane Review and meta-analysis. *Addiction* 2018;113 :545–563. https://doi.org/10.1002/14651858.CD012021.pub2
Validation	NA for this session

# 7 Session Title	**Epidemiology, Prevention, and Control of Respiratory Viruses**
Speaker	Tiffany G. Harris, PhD, MS
Session Outline	Overview of respiratory virus surveillance, epidemiology, prevention, and control strategies
Learning Objectives	• Identify sources of surveillance data used to monitor respiratory virus activity, and the ways in which these sources can be biased • Describe available prevention, mitigation, and containment strategies, and how they affect transmission • Discuss strengths and limitations of study designs used to assess control measures
Duration	3 hours
Training methods	Lecture, Group discussion
Readings	**Required material** Read before class: Gettings J, Czarnik M, Morris E, et al. Mask Use and Ventilation Improvements to Reduce COVID-19 Incidence in Elementary Schools — Georgia, November 16–December 11, 2020. *MMWR Morb Mortal Wkly Rep* 2021;70:779–784. DOI: http://dx.doi.org/10.15585/mmwr.mm7021e1 **Supplemental/optional material** Morawska L, Bahnfleth W, Bluyssen PM, et al. Coronavirus Disease 2019 and Airborne Transmission: Science Rejected, Lives Lost. Can Society Do Better? *Clin Infect Dis* 2023;76(10):1854-1859. https://doi.org/10.1093/cid/ciad068. PMID: 36763042; PMCID: PMC10209435. Lewis D. Indoor air is full of flu and COVID viruses. Will countries clean it up? Nature. 2023 Mar;615(7951):206-208. doi: https://doi.org/10.1038/d41586-023-00642-9. PMID: 36882616. Oxford JS and Gill D. Unanswered questions about the 1918 influenza pandemic: origin, pathology, and the virus itself. *Lancet Infect Dis* 2018;18(11): e348-e354. https://doi.org/10.1016/S1473-3099(18)30359-1. Pandemic influenza: 100 years https://www.thelancet.com/journals/laninf/article/PIIS1473-3099(18)30359-1/fulltext#relAudio What We Know About Covid, the Flu and the Air We Breathe https://www.nytimes.com/2021/10/19/opinion/covid-flu-air-transmission.html
Validation	NA for this session

# 8 Session Title	**Epidemiology and Control of Vectorborne and Neglected Tropical Diseases**
Speaker	Tiffany G. Harris, PhD, MS
Session Outline	Epidemiology and control of malaria
Learning Objectives	• Describe the epidemiology of malaria and select other vectorborne and neglected tropical diseases • Discuss the public health interventions for malaria and select other vectorborne and neglected tropical diseases • Discuss strengths and limitations of various study designs used to assess the effectiveness of bed net distribution campaigns at the community level • Explain why an individual can benefit from an infectious disease intervention received by someone else in the community
Duration	3 hours
Training methods	Lecture, group discussion
Reading	**Required material** Read before class: Levitz L, Janko M, Mwandagalirwa K et al. Effect of individual and community-level bed net usage on malaria prevalence among under-fives in the Democratic Republic of Congo. *Malar J* 2018 ;17. https://doi.org/10.1186/s12936-018-2183-y **Supplementary/optional material** Plague at the Golden Gate – Prejudice Spread Faster than the Pandemic https://www.pbs.org/wgbh/americanexperience/films/plague-golden-gate/
Validation	NA

# 9 Session Title	**Application of Molecular Epidemiology to Tuberculosis Prevention and Control**
Speaker	Tiffany G. Harris, PhD, MS
Session Outline	• Overview of the natural history and epidemiology of tuberculosis (TB) • TB genotyping
Learning Objectives	• Describe the natural history and epidemiology of TB • Describe approaches to TB prevention and control including the use of genotyping • Explain how genotyping is used in TB cluster investigations
Duration	3 hours
Training methods	Lecture, group discussion
Reading	**Required material** Read before class: Perri BR, Proops D, Moonan PK, et al. Mycobacterium tuberculosis cluster with developing drug resistance, New York, New York, USA, 2003-2009. *Emerg Infect Dis* 2011;17(3):372-378. doi: 10.3201/eid1703.101002. PMID: 21392426; PMCID: PMC3166009. **Supplementary/optional material** https://ed.ted.com/lessons/what-makes-tb-the-world-s-most-infectious-killer-melvin-sanicas PBS. *The Forgotten Plague – Tuberculosis in America* (2015). https://www.pbs.org/wgbh/americanexperience/films/plague/ (this also has articles related to TB history)
Validation	NA for this session

# 10 Session Title	**Group presentations**