

Syllabus Module Minor A: 210	
Module #210	Infectious disease epidemiology
UE coordinator	Andrea A. Howard, MD, MS Associate Professor of Epidemiology Mailman School of Public Health, Columbia University New York, NY, USA Email: aah2138@columbia.edu
Dates	17th to 21st October 2016
Credits/ECTS	3 ECTS
Duration	5 days
Module 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	.
Course learning objectives	Students who successfully complete this course will be able to: <ul style="list-style-type: none"> ▪ 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
UE structure (details of sequences : title/speaker/date/duration)	Specific learning 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. <ul style="list-style-type: none"> • Session 1. Introduction to Infectious Disease Epidemiology • Session 2. & Evaluation of Diagnostic Tests and Treating Latent Infection as a Control Strategy: Tuberculosis • Session 3. Causal Inference, Mathematical Modeling, and the Development of Public Health Policy: Voluntary Medical Male Circumcision to Prevent HIV Transmission • Session 4. Epidemiology and Control of Malaria • Session 5. Epidemiologic Methods for Measuring Transmission and Control of

	<p>Respiratory Infections: Influenza</p> <ul style="list-style-type: none"> • Session 6. Epidemiologic Methods in Vaccinology • Session 7. Choosing Biologic Outcomes and Developing Immunization Policy: The Human Papillomavirus Vaccine to Prevent Cervical Cancer • Session 8. Mathematical Modeling: Introduction to Concepts in Transmission and Dynamics • Session 9. Epidemiologic Methods for Measuring Transmission and Control of Viral Hepatitis • Session 10. Surveillance and control of healthcare-associated infections
Course requirement	
Grading and assesment	100% Final written examination
Location	Columbia Global Centers\Europe, Reid Hall 4 rue de Chevreuse 75006 Paris
Readings	assigned journal articles

# 1 Session Title	Introduction to Infectious Disease Epidemiology
Speaker	Andrea A. Howard, MD, MS Associate Professor of Epidemiology Mailman School of Public Health, Columbia University New York, NY, USA Email: aah2138@columbia.edu
Session Outline	Overview of the Biological Basis of Infectious Disease Epidemiology, Immune Response, and Methods for Detection of Infectious Diseases Application of Fundamental Epidemiological Study Designs to Infectious Disease
Learning Objectives	<ul style="list-style-type: none"> • Describe the host-pathogen-environment interaction and identify biologic factors influencing this interaction <ul style="list-style-type: none"> ▪ 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 ▪ Describe the branches of the immune system ▪ Explain the different immune responses to specific infectious diseases ▪ Describe laboratory testing methodologies used to monitor or detect infectious diseases and determine susceptibility to pathogens ▪ Apply traditional epidemiological study designs including cross-sectional, case-control, and cohort, for the purpose of investigating infectious disease transmission ▪ Compare the respective strengths and limitations of these traditional epidemiological study designs ▪ Explain the assumptions of traditional epidemiological study designs that limit their use in studying infectious disease transmission
Duration	3 hours
Dates	Monday October 17th, 9h-12h
Training methods	Face to Face
Reading	
Validation	Not applicable

# 2 Session Title	Evaluation of Diagnostic Tests and Treating Latent Infection as a Control Strategy: Tuberculosis
Speaker	Andrea A. Howard, MD, MS Associate Professor of Epidemiology Mailman School of Public Health, Columbia University New York, NY, USA Email: aah2138@columbia.edu
Session Outline	
Learning Objectives	<ul style="list-style-type: none"> ▪ Describe how knowledge of the epidemiology of an infectious disease can be used to choose a cut-point for a diagnostic test ▪ Calculate the sensitivity and specificity of a diagnostic test

	<ul style="list-style-type: none"> ▪ Determine the predictive value of a diagnostic test given the prevalence of disease in the population ▪ Outline limitations of the use of various tests for the diagnosis of latent tuberculosis infection and identify settings in which use of specific tests or cutpoints would be useful ▪ Evaluate strategies for TB control that target people with latent TB infection
Duration	3 hours
Dates	Monday October 17th, 14h-17h
Training methods	Face to Face, Group Work and Student Presentations
Reading	<ul style="list-style-type: none"> - Cailleaux-Cezar M, de A. Melo D, Xavier Gm, et al. Tuberculosis incidence among contacts of active pulmonary tuberculosis. Int J Tuberc Lung Dis 2009;13:190-5. - Golub JE, Pronyk P, Mohapi L, et al. Isoniazid preventive therapy, HAART and tuberculosis risk in HIV-infected adults in South Africa: a prospective cohort. AIDS 2009;23:631-6.
Assignment	<p>Come to class prepared to discuss the following:</p> <ol style="list-style-type: none"> 1) Based on the data presented by Cailleaux-Cezar et al., do you think the Brazilian government should change its criteria for LTBI treatment? If so, how? What data support your answer? If not, what additional evidence would you require? 2) If clinical trials have shown that treatment of LTBI reduces TB incidence among HIV-infected individuals, why did Golub et al. conduct this study? Why did they use the chosen study design? How might the effect size change if TST-testing was not performed?

# 3 Session Title	Causal Inference, Mathematical Modeling, and the Development of Public Health Policy: Male Circumcision to Prevent HIV Transmission
Speaker	Andrea A. Howard, MD, MS Associate Professor of Epidemiology Mailman School of Public Health, Columbia University New York, NY, USA Email: aah2138@columbia.edu
Session Outline	
Learning Objectives	<ul style="list-style-type: none"> • 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 • 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

Dates	Tuesday October 18th, 9h-12h
	<p>Bailey RC et al. Male circumcision for HIV prevention in young men in Kisumu, Kenya: a randomised controlled trial. <i>Lancet</i> 2007;369:643-56.</p> <p>Hallett TB et al. Understanding the impact of male circumcision interventions on the spread of HIV in southern Africa. <i>PLoS One</i> 2008;3:e2212.</p> <p>Londish GL, Murray JM. Significant reduction in HIV prevalence according to male circumcision intervention in sub-Saharan Africa. <i>Int J Epidemiol</i> 2008;37:1246-53.</p>
Assignment	<p>Come to class prepared to discuss the following:</p> <p>1) Applying Hill's criteria for causality, what is the evidence that male circumcision prevents acquisition of HIV?</p> <p>2) In deciding whether and how best to include voluntary medical male circumcision as part of a HIV prevention program, what are the key questions to be addressed? Which of these can be answered using the clinical trial data and which are best answered by mathematical modeling?</p>

# 4 Session Title	Epidemiology & Control of Malaria
Speaker	Dr. Jacques LeBras Institut de Médecine et d'Epidémiologie Appliquée/Institut de recherche pour le développement (UMR 216 IRD) Paris
Session Outline	Epidemiologic Methods for Measuring Transmission and Control of Vector-borne Infections: Malaria
Learning Objectives	<ul style="list-style-type: none"> • 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
Dates	Tuesday October 18th, 14h-17h
Training methods	Lecture
Reading	
Validation	NA for this session, final written exam on November 27 2014

# 5 Session Title	Epidemiologic Methods for Measuring Transmission and Control of Respiratory Infections: Influenza
Speaker	Andrea A. Howard, MD, MS Associate Professor of Epidemiology Mailman School of Public Health, Columbia University New York, NY, USA

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Session Outline	
Learning Objectives	<ul style="list-style-type: none"> • 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
Dates	Wednesday October 19th, 9h-12h
Readings	<p>Khazeni N, Hutton DW, Collins CIF et al. Health and economic benefits of early vaccination and nonpharmaceutical interventions for a human influenza A (H7N9) pandemic. <i>Ann Intern Med</i> 2014;160:684-94.</p> <p>Loeb M, Russell ML, Fonseca et al. Effect of influenza vaccination of children on infection rates in Hutterite communities: a randomized trial. <i>JAMA</i> 2010;303:943-50.</p>
Assignment	<p>Come to class prepared to discuss the following:</p> <ol style="list-style-type: none"> 1) What kind of influenza mitigation strategies are available, and how might these interventions affect transmission (think of this in terms of the equation for R_0)? 2) In the paper by Khazeni et al, what assumptions did the authors make? Do you think they were reasonable? 3) What are some of the strengths and limitations of the study design chosen by Loeb et al?

# 6 Session Title	Epidemiologic Methods in Vaccinology
Speakers	Judith Mueller Lecturer Departement EPI & Biostats EHESP Judith.Mueller@ehesp.fr
Session Outline	
Learning Objectives	<ul style="list-style-type: none"> ▪ 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 (polio, pneumococci)
Duration	3 hours
Dates	Wednesday October 19th, 14h-17h

Training methods	Lecture
Reading	
Validation	NA for this session, final written exam on November 27 2014

# 7 Session Title	Choosing Biologic Outcomes and Developing Immunization Policy: The Human Papillomavirus Vaccine to Prevent Cervical Cancer
Speakers	Andrea A. Howard, MD, MS Associate Professor of Epidemiology Mailman School of Public Health, Columbia University New York, NY, USA Email: aah2138@columbia.edu
Session Outline	
Learning Objectives	<ul style="list-style-type: none"> • Explain human papillomavirus (HPV) natural history and its link to cervical cancer • Discuss how the diversity of HPV types necessitates development of broad spectrum immunologic vaccines • Discuss the strengths and weaknesses of various biologic outcomes used to evaluate efficacy and effectiveness of HPV vaccination • Design studies to assess the impact of HPV vaccination programs
Duration	3 hours
Dates	Thursday October 20th, 9h-12h
Reading	<p>Joura EA, Giuliano AR, Iversen OE, et al. for the Broad Spectrum HPV Vaccine Study. A 9-valent HPV vaccine against infection and intraepithelial neoplasia in women. N Engl J Med 2015;372:711-23.</p> <p>Markowitz LE, Hariri S, Lin C, et al. Reduction in human papillomavirus (HPV) prevalence among young women following HPV vaccine introduction in the United States, National Health and Nutrition Examination Surveys, 2003-2010. JID 2013;208:385-93.</p>
Assignment	<p>Come to class prepared to discuss the following:</p> <ol style="list-style-type: none"> 1) In the papers by Joura and Markowitz, what were the endpoints? What was the rationale for choosing each endpoint, and what are the limitations? 2) Why weren't Markowitz et al. able to assert that there was evidence of herd immunity in their study? 3) What are some of the other studies that could be conducted to assess the impact of HPV vaccine on HPV infection and disease outcomes?

# 8 Session Title	Mathematical Modeling: Introduction to Concepts in Transmission and Dynamics
Speaker	Pascal Crépey, PhD, Lecturer Département EPI & Biostats EHESP Pascal.crepey@ehesp.fr
Session Outline	Introduction to concepts in transmission & dynamics based upon mathematical modeling

Learning Objectives	<ul style="list-style-type: none"> ▪ 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
Dates	Thursday October 20th, 14h-17h
Training methods	Lecture
Reading	
Validation	NA for this session, final written exam on November 26 or 27, 2015

# 9 Session Title	Epidemiologic Methods for Measuring Transmission and Control of Viral Hepatitis
Speakers	<p>Andrea A. Howard, MD, MS Associate Professor of Epidemiology Mailman School of Public Health, Columbia University New York, NY, USA Email: aah2138@columbia.edu</p>
Session Outline	
Learning Objectives	<ul style="list-style-type: none"> ▪ Identify appropriate prevention strategies for viral hepatitis based upon the epidemiology of the disease in the targeted population ▪ Evaluate the impact of Hepatitis B vaccination strategies in the US and globally ▪ Assess the impact of risk behaviors and preventive measures on HBV and HCV prevalence
Duration	2 hours
Dates	Friday October 21st, 9h-11h
Reading	<p>Burt RD, Hagan H, Garfein RS, Sabin K, Weinbaum C, Thiede H. Trends in hepatitis B virus, hepatitis C virus, and human immunodeficiency virus prevalence, risk behaviors, and preventive measures among Seattle injection drug users aged 18-30 years, 1994-2004. J Urban Health 2007;84:436-54.</p> <p>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.</p>
Assignment	<p>Come to class prepared to discuss the following:</p> <ol style="list-style-type: none"> 1) What were the outcomes used to determine the effectiveness of Hepatitis B vaccination programs in the paper by Liang et al? What are the pros and cons of each approach? 2) What risk behaviors and preventive measures were assessed in the paper by Burt et al? How could differences in study design among the included studies have influenced the findings?

#10 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	<ul style="list-style-type: none"> ▪ 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	4 hours
Dates	Friday October 21st, 13h-17h
Training methods	Lecture
Reading	
Assignment	NA for this session, final written exam on November 27 2014