## Syllabus Module : 210 Infectious disease epidemiology

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<thead>
<tr>
<th>N° 210</th>
<th>Infectious disease epidemiology</th>
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</table>
| **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** | 18 to 22 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 3. Measuring the Effectiveness of HIV Prevention Interventions in Generalized and Concentrated Epidemics  
- Session 4. Epidemiologic Methods for Measuring Transmission and Control of Respiratory Infections: Influenza  
- Session 6. Epidemiology and Control of Sexually Transmitted Infections and Viral Hepatitis  
- Session 7. Surveillance and control of healthcare-associated infections  
- Session 8. Epidemiology and Control of Vectorborne Diseases  
- Session 9. Epidemiologic Methods in Vaccinology  
- Session 10. Epidemiologic Methods for Foodborne and Waterborne Diseases |
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<tr>
<th>Resources</th>
<th>Assigned journal articles</th>
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<tr>
<td>Course requirement</td>
<td>Read required readings before each session, attend each session, and participate in discussions</td>
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<tr>
<td>Grading and assessment</td>
<td>100%: Final written examination on 28 November 2019</td>
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<tr>
<td>Course policy</td>
<td><strong>Attendance &amp; punctuality</strong>&lt;br&gt;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 [<a href="http://mph.ehesp.fr">http://mph.ehesp.fr</a> EHESP Academic Regulation Article. 3].&lt;br&gt;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.&lt;br&gt;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.&lt;br&gt;<strong>Lateness:</strong> Students who are more than 10 minutes late may be denied access to a class. Repeated late arrivals may be counted as absences (See <a href="http://mph.ehesp.fr">http://mph.ehesp.fr</a> EHESP Academic Regulation Article. 3 Attendance &amp; Punctuality)&lt;br&gt;<strong>Maximum absences authorized &amp; penalty otherwise</strong>&lt;br&gt;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)&lt;br&gt;<strong>Exceptional circumstances</strong>&lt;br&gt;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 <a href="http://mph.ehesp.fr">http://mph.ehesp.fr</a> EHESP Academic Regulation Article 4 Examinations).&lt;br&gt;<strong>Courtesy:</strong> All cell phones/pages MUST be turned off during class time.&lt;br&gt;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.</td>
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<td>Valuing diversity</td>
<td>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.</td>
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<tr>
<td>Course evaluation</td>
<td>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.</td>
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<tr>
<td># 1 Session Title</td>
<td>Introduction to Infectious Disease Epidemiology</td>
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<tr>
<td>Speaker</td>
<td>Tiffany G. Harris, PhD, MS Associate Professor of Epidemiology at CUMC Mailman School of Public Health, Columbia University New York, NY, USA Email: <a href="mailto:th2604@cumc.columbia.edu">th2604@cumc.columbia.edu</a></td>
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<tr>
<td>Session Outline</td>
<td>• Overview of the biological basis of infectious disease epidemiology • Application of fundamental epidemiological study designs to infectious disease • Overview of the immune system, laboratory tests, molecular methods, and surveillance approaches</td>
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<tr>
<td>Learning Objectives</td>
<td>• 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 • Describe components of the immune system that are important in responding to pathogens • Describe laboratory tests used in diagnosing infectious diseases • Describe molecular methods used in infectious disease epidemiology • Identify sources of data on infectious disease occurrence and pros and cons of various sources • Summarize and interpret surveillance data</td>
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<tr>
<td>Duration</td>
<td>3 hours</td>
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<tr>
<td>Training methods</td>
<td>Lecture, group exercise</td>
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<tr>
<td>Validation</td>
<td>Not applicable</td>
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<tr>
<th># 2 Session Title</th>
<th>Mathematical Modeling: Introduction to Concepts in Transmission and Dynamics</th>
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<tbody>
<tr>
<td>Speaker</td>
<td>Pascal Crépey, PhD, Lecturer Departement EPI &amp; Biostats EHESP <a href="mailto:Pascal.crepey@ehesp.fr">Pascal.crepey@ehesp.fr</a></td>
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<tr>
<td>Session Outline</td>
<td>Introduction to concepts in transmission and dynamics based upon mathematical modeling</td>
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<tr>
<td>Learning Objectives</td>
<td>• 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</td>
</tr>
<tr>
<td>Duration</td>
<td>3 hours</td>
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## # 3 Session Title
**Measuring the Effectiveness of HIV Prevention Interventions in Generalized and Concentrated Epidemics**

### 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 HIV prevention approaches

### Learning Objectives
- Describe the biological mechanisms of HIV treatment as prevention
- 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 at the population level

### Duration
3 hours

### Training methods
Lecture, Group discussions

### Reading
**Required Readings:**

### 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
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<tr>
<th>Session Outline</th>
<th>Overview of influenza surveillance and control strategies</th>
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| 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:**  
**Optional Reading:**  
| Validation | NA for this session |

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<thead>
<tr>
<th># 5 Session Title</th>
<th>Assessing the Epidemiological Burden of TB and the Impact of TB Control: Population-based TB Prevalence Surveys</th>
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</table>
| 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 tuberculosis (TB)  
- Testing for TB |
| 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**

Lecture, Group discussions

**Reading**

Required Reading:

Optional Reading:

**Validation**

NA for this session

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**# 6 Session Title**

**Epidemiology and Control of Sexually Transmitted Infections and 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 epidemiology and control of sexually transmitted infections (STIs) and Hepatitis B and C

**Learning Objectives**

- Describe the epidemiology and natural history of STIs and Hepatitis B and C
- Describe STI and hepatitis 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:

Optional Reading:

**Validation**

NA for this session

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**# 7 Session Title**

**Surveillance and control of healthcare-associated infections**

**Speaker**

Pascal Astagneau, Departement EPI & Biostats EHESP
# Session Title

**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
- Describe the epidemiology of healthcare-associated infections (HCAI)
- Compare different surveillance methods for HCAI

## Duration
3 hours

## Training methods
Lecture, Group discussion

## Reading
**Required Reading:**

**Optional Reading:**

## Validation
NA for this session

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# Session Title

**Epidemiology and Control of Vectorborne Diseases**

## 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
Epidemiology and control of malaria and other vectorborne diseases

## Learning Objectives
- Discuss the implications of limitations of methods to measure infection acquired through vectorborne transmission for epidemiological research
- Describe the lifecycle of select vectorborne infections
- Discuss strengths and limitations of various study designs used to assess the effectiveness of bednet distribution campaigns at the community level
- Discuss strengths and limitations of various outcome and process measures used to evaluate community-level interventions to lower malaria morbidity and mortality
- 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 discussions

## Reading
**Required Reading:**

**Optional Reading:**
# 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 |  
|---------------------|-----------------  
| Describe study designs for evaluation of vaccines and vaccination strategies  
| Describe pre- and post-licensure surveillance approaches  

| Duration | 3 hours  

| Training methods | Lecture  

| Reading | Optional Reading:  
|----------------|-----------------  

| Validation | NA for this session  

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# 10 Session Title: Epidemiologic Methods for Foodborne and Waterborne Diseases

| 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 prevention of foodborne and waterborne diseases  

| Learning Objectives |  
|---------------------|-----------------  
| Describe the epidemiology of foodborne and waterborne disease  
| Describe the steps involved in detecting and investigating foodborne and waterborne outbreaks  
| Describe the advantages and disadvantages of using measures of infection based on laboratory tests, clinical criteria, and participant recall  
| Summarize and interpret surveillance data  
| Recognize difficulties in balancing public health concerns with consumer and industry considerations in emerging infectious disease issues  
| Describe ways to reduce foodborne and waterborne illness  

| Duration | 3 hours  

| Training methods | Lecture, Group discussion, Outbreak exercise  

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<table>
<thead>
<tr>
<th>Reading</th>
<th>Required Readings:</th>
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<tbody>
<tr>
<td>Optional Readings :</td>
<td></td>
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<td>Validation</td>
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