INFECTIOUS DISEASE DYNAMICS, ANALYTICS, AND MODELING, CERTIFICATE

Infectious Disease Dynamics, Analytics, and Modeling Certificate Program

This certificate program will provide students from diverse academic backgrounds with the skills to use mathematical and statistical modeling techniques to quantify and predict the spread of infectious diseases.

OVERVIEW

Students in the Certificate in Infectious Disease Dynamics, Analytics, and Modeling will take coursework covering i) the foundational epidemiological principles of infectious diseases, ii) advanced mathematical, statistical, and computational techniques relevant to analyzing infectious disease data, and iii) a specialized course on applied infectious disease modeling. They will be able to calculate metrics describing disease transmission, create mechanistic models of disease transmission, clinical progression, and control, use statistical methods to estimate model parameters and forecast disease dynamics, critically evaluate disease models in the scientific literature, and communicate model results to diverse stakeholders.

EDUCATIONAL OBJECTIVES

Upon completion of the program, students will be able to:

1. Describe the observed epidemiological patterns for important infectious diseases around the world and their biological, sociological, and environmental drivers;
2. Understand the predominant methods of infectious disease control and the pathogens to which they apply;
3. Be familiar with the metrics used to quantify disease transmissibility and the methods used to estimate;
4. Translate biological, epidemiological, and medical features of an infectious disease into mechanistic mathematical models;
5. Develop and apply statistical methods to estimate model parameters and predict disease spread or outcomes;
6. Understand the different types of infectious disease models (e.g. mathematical vs statistical, stochastic vs deterministic, well-mixed vs network) and the different uses of models (e.g. inference vs forecasting vs scenario projection);
7. Understand the common challenges of real-world infectious disease data and methods to deal with data limitations;
8. Critically evaluate infectious disease models in the scientific literature;
9. Communicate the results of models - including their critical assumptions and uncertainty - to both technical and non-technical audiences.

SPONSORING DEPARTMENT

Epidemiology (https://publichealth.jhu.edu/departments/epidemiology/)

ADMISSIONS

Contact information and complete certificate program admissions information are available on the certificate program page (https://publichealth.jhu.edu/academics/epidemiology-for-public-health-professionals-certificate-program/) on the Bloomberg School of Public Health website.

Requirements for Successful Completion

Students must take all required and elective courses for a letter grade and maintain an overall GPA of 2.75 or higher in all certificate coursework.

Students must successfully complete the core courses, demonstrated by full attendance and participation in all course activities and assignments. The student should review the section of the website that addresses completion (https://publichealth.jhu.edu/academics/certificate-programs/requirements-for-successful-completion-of-a-certificate-program/) before completing the certificate program requirements. The student's transcript will not indicate that the certificate was earned until the Notification of Completion has been submitted, verified by the certificate program and processed by the Registrar.

COURSE OF STUDY

Students are required to successfully complete 24 term credits, which are grouped into several categories of expertise. In addition, students must attend at least 4 research seminars in the “Infectious disease dynamics research seminar” series.

Code	Title	Credits
PH.550.860	Academic & Research Ethics at BSPH	
Basic Epidemiological Methods: Students must select 1 of the following courses		
PH.340.601	Principles of Epidemiology	5
PH.340.751	Epidemiologic Methods 1	5
PH.340.721	Epidemiologic Inference in Public Health I	5
PH.340.761	Epidemiologic Methods for EPI Doctoral Students I	5
Infectious Disease Epidemiology: Students must take 1 of the following courses		
PH.340.627	Epidemiology of Infectious Diseases	4
PH.340.668	Topics in Infectious Disease Epidemiology	3
Infectious Disease Modeling: Students must take 1 of the following courses		
PH.340.677	Infectious Disease Dynamics: Theoretical and Computational Approaches	4
EN.580.673	Dynamic Modeling of Infectious Diseases in Patients and Populations	2
Specialized Topics in Data Analytics and Modeling: Students must take at least 2 half semester courses (6 term credits) from this list		
PH.340.609	Concepts and Methods in Infectious Disease Epidemiology	4
PH.140.628	Data Science for Public Health in Python	4
PH.140.629	AI for Public Health in Python	4
EN.553.636	Introduction to Data Science	3
EN.601.675	Machine Learning	3
EN.601.682	Machine Learning: Deep Learning	4
EN.601.788	Machine Learning for Healthcare	3
EN.553.740	Machine Learning I	3

EN.553.741	Machine Learning II	3
EN.560.617	Deep Learning for Physical Systems	3
PH.140.644	Statistical Machine Learning: Methods, Theory, and Applications	4
AS.171.749	Machine Learning for Physicists	3
PH.221.660	Systems Science in Public Health: Basic Modeling and Simulation Methods	3
PH.380.603	Demographic Methods for Public Health	4
PH.380.755	Population Dynamics and Public Health	2
EN.560.653	An Introduction to Network Modeling	4
EN.553.692	Mathematical Biology	3
EN.580.680	Precision Care Medicine	4
EN.580.640	Systems Pharmacology and Personalized Medicine	4
EN.553.650	Computational Molecular Medicine	4
EN.540.633	Pharmacokinetics and Pharmacodynamics	3
AS.020.674	Quantitative Biology and Biophysics	4
EN.553.691	Dynamical Systems	4
EN.560.657	System Dynamics	3
EN.520.621	Introduction To Nonlinear Systems	3
EN.553.736	System Identification and Likelihood Methods	2
EN.553.633	Monte Carlo Methods	4
EN.553.626	Introduction to Stochastic Processes	4
EN.553.632	Bayesian Statistics	3
PH.140.762	Bayesian Methods I	3
PH.140.773	Foundations of Statistical Inference I	4
PH.140.777	Statistical Programming Paradigms and Workflows	3
PH.140.779	Advanced Statistical Computing	4
Specialized Topics in Infectious Disease Epidemiology: Students must take at least 2 half semester courses (or at least 6 term credits) from this list		
PH.260.623	Fundamental Virology	4
PH.340.654	Epidemiology and Natural History of Human Viral Infections	6
PH.340.646	Epidemiology and Public Health Impact of HIV and AIDS	4
PH.340.641	Healthcare Epidemiology	4
PH.340.612	Epidemiologic Basis for Tuberculosis Control	2
PH.182.640	Food- and Water- Borne Diseases	3
PH.260.656	Malariology	4
PH.223.682	Clinical and Epidemiologic Aspects of Tropical Diseases	4
PH.340.651	Emerging Infections	2
PH.380.761	Sexually Transmitted Infections in Public Health Practice	4
PH.260.650	Vector Biology and Vector-Borne Diseases	3
PH.260.631	Immunology, Infection and Disease	3
PH.223.680	Global Disease Control Programs and Policies	4
PH.223.662	Vaccine Development and Application	4
PH.180.623	Infectious Disease Threats to Global Health Security	3
PH.260.636	Evolution of Infectious Disease	3
PH.223.663	Infectious Diseases and Child Survival	3
PH.340.744	Advanced Topics on Control and Prevention of HIV/AIDS	4
PH.260.655	Pandemics of the 20Th Century	1
PH.260.635	Biology of Parasitism	5
PH.223.688	Clinical, Epidemiologic, and Climate Change factors of Enteric Infections in the Tropics	4
PH.340.653	Epidemiologic Inference in Outbreak Investigations	3
PH.340.693	Investigation of Outbreaks	2
ME.300.716	Pathology for Graduate Students: Immunology/ Infectious Disease	1
ME.250.633	Organ Systems Foundations of Medicine - Infectious Disease and Microbiology	2
ME.250.714	HIV Biology	1