THE GEORGE WASHINGTON UNIVERSITY MEDICAL CENTER
WASHINGTON DC

School of Public Health and Health Services
Department of Epidemiology and Biostatistics

Master of Science Public Health Microbiology And Emerging Infectious Diseases 2010-2011

Note: All curriculum revisions will be updated immediately on the website http://www.gwumc.edu/sphhs/

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Mission

The mission of the MS degree in Public Health Microbiology and Emerging Infectious Diseases is to provide training to a new generation of public health professionals to expand knowledge and expertise in the areas of disease mechanisms, with an emphasis on microbial pathogens, the use and application of modern biotechnologies and in epidemiologic skills relevant to the prevention and control of problems in the community arising from infectious diseases.

Graduates of the MS program will have an in-depth understanding of the major laboratory, clinical, and public health aspects of humankind's microbial pathogens, and acquire epidemiologic skills relevant to the prevention and control of problems arising from infectious diseases and modern biotechnologies. Areas of emphasis will include: the design and analysis of epidemiologic data; emerging infections; tropical diseases; Class A, B, C biological agents linked to bioterrorism; and applications of genomics, proteomics, and bioinformatics. MS graduates will be employed in academic and industrial research laboratories, international health agencies, NGOs, and private consulting groups. In addition, they may work in federal, state, and local public health agencies or state and local public health laboratories where their technical expertise and population-based perspective will be extremely useful. Students earning this degree will help meet a national demand that has reached critical proportions for a trained workforce in biodefense and emerging infections, and an international demand for training in diseases that affect the developing countries.

This MS program combines the strengths of two academic departments at the George Washington University Medical Center (GWUMC), one in the School of Public Health and Health Services (Department of Epidemiology and Biostatistics) and the other in the School of Medicine and Health Sciences (Department of Microbiology, Immunology, and Tropical Medicine).

Goals

The goals of the MS Program in Public Health Microbiology and Emerging Infectious Diseases are to ensure that graduates:

- Understand the biological complexities of microbial pathogens and the diseases they cause
- Recognize the major epidemiologic and clinical features of microbial diseases

- Understand how new biotechnololgies (including genomics, proteomics, and bioinformatics) can be applied to the study and control of microbial pathogens
- Develop an in-depth understanding of epidemiologic principles and practice
- Apply the principles of epidemiology, microbiology and public health practice toward the detection, surveillance, investigation, and control of microbial diseases

Course Requirements

The total 45 credit hours are distributed approximately evenly between the SPHHS (primarily the Department of Epidemiology and Biostatistics) and the SMHS (Department of Microbiology and Tropical Medicine). It is expected that most students will complete the degree in approximately two years. Because several courses in the Department of Microbiology and Tropical Medicine are offered during the daytime, it may not be practical in most cases for students to work full-time

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Course/Credit Distribution

Public Health Credits • Required Public Health Core Credits (8 credits) • Required Epidemiology and Biostatistics Program-Specific Credits (11)	19
Microbiology, Immunology, and Emerging Infectious Diseases Credits	17
Elective Credits (Either PubH or MICR)	4
Field/Laboratory Experience (PubH)	2
Final Project Credits (MICR)	3
Total	45

Admissions Requirements

The Admissions Committee requires students to have the following prerequisites to apply to this degree:

- Biological Sciences other than Botany $\geq$ 8 Credits
- Chemistry $\geq$ 3 Credits
- Physics $\geq$ 3 Credits
- Mathematics or Computer Science beyond introductory level $\geq$ 3 Credits

Competencies

- Knowledge of the biological, environmental, and socio-behavioral determinants of human diseases, and of the public health impacts of disease. Courses: PubH 203, PubH 204
- Knowledge of the laboratory characteristics of bacterial, viral, and parasitic pathogens, as well as biological Class A, B, C agents associated with bioterrorism. Courses: MICR 239, MICR 220, MICR 210, MICR 233, MICR 235, MICR 292
- Knowledge of the clinical manifestations of infectious agents. Courses: MICR 239, MICR 292,
- Knowledge of the principles of genomics, proteomics, and bioinformatics. Courses: MICR 236, MICR 237
- Knowledge of the principles of microbial disease surveillance and epidemiology. Courses: PubH 245,
- Skills to identify and analyze patterns of disease, to postulate hypotheses, to plan and implement studies (including outbreak investigations and analytic studies), to analyze, interpret and communicate results, and to evaluate the public health impact of such efforts. Courses: PubH 203, PubH 202, PubH 247, PubH 249, PubH 245, PubH 262, MICR 239, MICR 292
- Knowledge of public health roles and procedures of biomedical and public health laboratories, and skills relevant to working in such laboratories. Course: MICR 238

The curriculum sheet that follows describes the requirements for the MS Public Health Microbiology and Emerging Infectious Diseases program.

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Master of Science
Public Health Microbiology and
Emerging Infectious Diseases
2010-2011
Program-at-a-Glance

Prerequisites Preference Given to Applicants with Biological or Public Health Laboratory Experience	**Credits**
Biological Sciences other than Botany	≥ 8
Chemistry	≥ 3
Physics	≥ 3
Mathematics or Computer Science beyond introductory level	≥ 3

Required Public Health Core Courses - 8 Credits				
Course	Title	Credits	Semester Offered	Grade
PubH 202	Biostatistics Applications for Public Health	3	Fall, Spring, Summer	
PubH 203	Principles and Practice of Epidemiology	3	Fall, Spring, Summer	
PubH 204	Environmental and Occupational Health in a Sustainable World	2	Summer 2, Fall, Spring	

Required Epidemiology and Biostatistics Program Specific Courses - 11 Credits				
Course	Title	Credits	Semester Offered	Grade
PubH 245	Infectious Disease Epidemiology	2	Spring	
PubH 247	Design of Health Studies	3	Fall, Spring	
PubH 249	Use of Statistical Packages: Data Management and Data Analysis	3	Fall, Spring	
PubH 259	Epidemiologic Surveillance in Public Health	2	Spring	
PubH 262	Introduction to Geographic Information Systems	1	Spring	

Required Microbiology, Immunology, and Tropical Medicine Courses - 17 Credits				
Course	Title	Credits	Semester Offered	Grade
MICR 239	Interdisciplinary Medical Microbiology	3	Fall (Year 2)	
MICR 210	Infection and Immunity	3	Spring (Year 1)	
MICR 220	Biology of Parasitism	2	Spring	
MICR 233	Virology	3	Spring	
MICR 236	Fundamentals of Genomics	2	Fall	
MICR 238	Public Health Laboratory Workshop	2	Summer	
MICR 292	Tropical Infectious Diseases	2	Spring	

Elective Courses - 4 credits				
Course	Title	Credits	Semester Offered	Grade
PubH 227	Public Health Microbiology and Biodefense	2	Spring	
PubH 252	Advanced Epidemiology Methods	3	Spring	
PubH 250	Epidemiology of HIV/AIDS	2	Fall	
PubH 253	Issues in HIV/AIDS Care and Treatment	1	Fall	
PubH 274	Emerging Infectious Diseases for Public Health Professionals	2	Fall	
PubH 263	Advanced Geographic Information Systems (GIS)	1	Fall	
PubH 271	Disaster Epidemiology: Methods and Applications	1	Summer	
MICR 212	Pathogenic Bacteriology	3	Fall	
MICR 229	Immunobiology of Infection	2	Spring	
MICR 235	Human and Transforming Viruses	3	Fall	
MICR 237	Fundamentals of Proteomics	2	Spring	
MICR 277	Seminar Series in Microbiology I	1	Fall	
MICR 278	Seminar Series in Microbiology II	1	Spring	

MICR 293	Special Topics in Microbiology	Var.	Fall, Spring, Summer	
Electives	Approved by Advisor	2		
Field/Laboratory Experience and Final Project - 5 Credits				
Course	Title	Credits	Semester Offered	Grade
PubH 216	Field/Laboratory Experience	2	Summer, Fall, Spring	
MICR 294	Final Project	3	Fall, Spring Summer	

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Graduation Requirements

- **Graduate Credit Requirement.** 45 credits required
- **Course Requirements.** Successful completion of the required courses
- **Grade Point Requirements.** An overall GPA of 3.0 (B average).
- **Time Limit Requirement.** The degree must be completed within 4 years
- **Transfer Credit Policy.** Up to 12 relevant credits that have not been applied to a previous graduate degree may to transferred to the MS program. (Exception: Up to 24 credits may transfer to this MS Program from the PHM&EID Graduate Certificate, or up to 18 credits from another SPHHS Graduate Certificate Program.) Credits must have been earned from an accredited institution in the last 3 years with a grade point of 3.0 or better.

Students will be expected to:

- Attend seminars in the Department of Epidemiology and Biostatistics and in the Department of Microbiology and Tropical Medicine.
- Participate in a poster presentation at GWUMC Research Day.

Public Health Core Courses
8 credits

PubH	202	Biostatistical Applications for Public Health	3	Application of biostatistical principles to critical analysis of retrospective studies, prospective studies, and controlled clinical trials, as well as studies in the health services literature. Selection, basic calculations, and interpretation of statistical methods for detection of significant associations and differences. Summer, Fall, Spring
PubH	203	Principles and Practice of Epidemiology	3	General principles, methods, and applications of epidemiology. Outbreak investigations, measures of disease frequency, standardization of disease rates, study design, measures of association, hypothesis testing, bias, effect modification, causal inference, disease screening, and surveillance. Case studies apply these concepts to a variety of infectious, acute, and chronic health conditions affecting the population. Summer, Fall, Spring
PubH	204	Environmental and Occupational Health in a Sustainable World	2	Examines the connection between population health and exposures to chemical, physical, and biological agents in the environment. Through the use of problem-solving frameworks, students will become familiar with data sources, methodologies and policy approaches being used to address the public health impacts of environmental and occupational health hazards, including the consequences of climate change, natural resource degradation, and industrial chemicals. The course will integrate key concepts of environmental health with principles of sustainability to illustrate how public policies and practices on the local, national and global level affect population health. Summer, Fall, Spring

Epidemiology and Biostatistics Required Program-Specific Courses 11 credits				
PubH	245	Infectious Disease Epidemiology	2	The role and conduct of laboratory and field investigations in the epidemiology of infectious diseases. Prerequisite: PubH 203. Spring
PubH	247	Design of Health Studies	3	Epidemiologic concepts and methods applied to specific research questions especially new types of public health problems. Recognition and development of the most appropriate study design for a specific health issue. Ecologic, cross-sectional, case-control, cohort studies and clinical trials. Sampling, measurement, questionnaire design, causality and causal criteria. Development of a research proposal. Prerequisite: PubH 203. Fall
PubH	249	Use of Statistical Packages: Data Management and Data Analysis	3	Familiarizes the student with one of the most widely used database management systems and statistical analysis software packages, the SAS System, operating in a Windows environment. Throughout the course, several database management system techniques and data analytical strategies for the appropriate analysis of datasets obtained from a variety of studies will be presented. Statistical techniques covered include linear regression, analysis of variance, logistic regression, and survival analysis. Prerequisite: PubH 202. Fall, Spring
PubH	259	Epidemiology Surveillance in Public Health	2	Foundations of public health surveillance systems for communicable as well as chronic diseases. Outbreak investigation methods will be included, as well as surveillance data sources, data management, data analysis, ethical issues, surveillance system evaluation, and use of information for prevention. Surveillance systems for reportable diseases, nosocomial infections, bioterrorism events, cancer, environmental disease, vaccine-related adverse events, bovine spongiform encephalophy, and military personnel will be discussed. Prerequisites: PubH 203. Spring
PubH	262	Introduction to Geographic Information Systems	1	Geographic information systems (GIS) for mapping and display of health data. The course makes use of ArcGIS 8.3. The use of spatial statistics for the detection of clusters and patterns in the spread of diseases. Working with geodatabases, shape files, layers, query information from attribute tables, geocode addresses and customizing GIS applications. Summer, Fall, Spring
Microbiology and Tropical Medicine Required Courses 20 Credits				
MICR	239	Interdisciplinary Medical Microbiology	3	Integrates topics in basic microbiology and clinical infectious diseases. Provides students with an understanding of the basic principles of medical microbiology including microbial pathogenesis, and clinical infectious diseases. This will also build on material from the first year Tropical Infectious Disease course as it relates to the pathogenesis of infectious diseases. The course will consist of classroom lectures. Prerequisites Micr 292, or permission of the Microbiology Program Director. Fall Year 2
MICR	210	Infection and Immunity	3	Provides an introduction to basic concepts in the fields of immunology and microbiology. The immunology component will cover basic aspects of innate immunity, antigen processing and presentation, T and B lymphocyte effector function, autoimmunity and tumor immunology. The microbiology component will cover different aspects of viral and bacterial pathogenesis, virulence, parasite infections and vaccine design. Spring

MICR	220	Biology of Parasitism	2	Exposes students to the strategies that parasites use to infect their hosts, how they survive and thrive within their host, and the developmental adaptations they use to ensure transmission of their offspring to the next host. Examines specific parasite life histories and mechanisms that represent the common themes of infection, survival and transmission. Specific parasite systems will focus primarily on, but not be limited to, multicellular parasites, and those with some understanding at the molecular and/or biochemical level. Topics will include modulation of host immunity, physiology and behavior, and developmental adaptations that increase transmission. Augments and builds upon traditional phylogeny-driven introductory parasitology course to provide the student with detailed, in-depth information about the host-parasite relationship. Open to graduate students in biomedical and biological science, public health, and students with an interest in the study of parasitism. Upper class undergraduates should have completed the course BiSc 139 or its equivalent, or have permission of the instructor. Spring
MICR	233	Virology	3	For graduate and advanced undergraduate biomedical science majors. An overview of the history of animal virology is presented to provide a foundation for understanding the current state of the field. Course content focuses of the structural and molecular makeup, replication and pathogenesis of the major animal virus groups. Key landmark features of each group are highlighted. Emphasis is placed on sharing information available using Internet sites, and supplemented with journal and text readings. Students are encouraged to participate in class discussions and short presentations on a specific element of viral development or virulence. Spring
MICR	236	Fundamentals of Genomics	2	Provides a broad overview of the goals, methods, and applications for genomics and proteomics in the life sciences. The students will become familiar with the terminology, underlying principles and strategies, and the technical methodology involved in genomics and proteomics. Areas covered include genome structure, genome sequencing, microarray application/analysis and proteomic concepts. Fall
MICR	238	Public Health Laboratory Workshop	2	Instructs students in the MS and Graduate Certificate in Public Health Microbiology and Emerging Infectious Diseases Program on laboratory test methods commonly performed at public heath laboratories both in the USA and in developing countries. Focuses on the latest developments in quality assurance, laboratory management, health and bio-safety. Reinforces theoretical knowledge pathogens in important subject areas, and provide ample opportunity to enhance practical skill related laboratory knowledge. Advisor's Permission. Summer – Intensive two week course.
MICR	292	Tropical Infectious Diseases	2	Provides students with both comprehensive and selected detailed information on the natural history and epidemiology of the major infectious and parasitic diseases that occur in developing countries. Information presented will highlight the potential introduction of these infections, through global travel, into developed countries. Health-related issues of containment, treatment, and eradication through chemotherapy or vaccination will be discussed. Economic impact issues of trade and social development will be discussed. Students will acquire an understanding of the medical and social impact of tropical disease impact on the quality of life. No prior medical knowledge is required. Open to Graduate and Undergraduate students in any major, but with interest in the global health issues affecting developing countries. Spring

Field/Laboratory Experience and Final Project				
PubH	216	Field/Laboratory Experience	2	The overall purpose of the field/laboratory experience requirement is to introduce students in the MS-PHMEID degree program to a supervised practical experience in a Public Health Laboratory or other qualifying public health entity from the perspective of the actual wet laboratory operations. Students that already have this laboratory experience will be introduced to epidemiologic research, particularly surveillance, and its tie-in with laboratories either in the United States or in an international setting. Summer, Fall, Spring
MICR	294	Final Project	3	This is the final project for MSPHM-EID students. It is taken in the final semester of their degree programs during which the Field/Laboratory Experience is presented for graduation. Advisor's permission. Summer, Fall, Spring
Sample Electives 2 credits				
PubH	227	Public Health Microbiology and Biodefense	2	Provides students with a basic understanding of microbes and the environment with a particular emphasis on bioterrorism. Students will be able to: describe microbiological agents in the environment; describe the public health triad; outline public health measures addressing the threats of these environmental microbes; and, evaluate policy and regulations available to address these threats. Prerequisites: PubH 204. Spring
PubH	250	Epidemiology of HIV/AIDS	2	Methodological issues central to HIV/AIDS research. Biases peculiar to HIV/AIDS epidemiologic studies (both observational and experimental designs). The natural history of HIV, diagnosis, surveillance, vulnerable subpopulations, behavioral facets, and evaluation of epidemiologic studies with an emphasis on methodological considerations. Prerequisite, PubH 203, Recommended 202 Fall
PubH	252	Advanced Epidemiology Methods	3	Advanced quantitative epidemiologic methods, with a focus on basic data analytic techniques, identifying and evaluating bias and adjusting for confounding. Dose-response, trend analysis, and multiple linear and logistic regression models. Prerequisites: PubH 202, 203,247; Pre or co-requisite: PubH 249. Fall, Spring
PubH	253	Issues in HIV Care and Treatment	1	This course will provide an overview and in depth consideration of some of the major issues in treatment of HIV disease, including assessing efficacy and effectiveness, drug resistance, monitoring of toxicity, special populations, treatment and prevention, and quality of care. The course has been designed with an interdisciplinary audience in mind. In discussions and assignments, students will be able to emphasize their own area of interest and/or expertise (e.g. epidemiology, policy, etc). Fall
PubH	263	Advanced Geographic Information Systems (GIS)	1	Structured to provide mid to advanced level training in GIS for display and analysis of health data. Use software ArcGIS 9.3 and additional extensions such as Spatial Analyst and Geostatistical Analyst. Also uses GeoDa software. Emphasizes benefits of using GIS to do more than simply manage and map data. GIS supports a range of spatial analysis functions that enable researchers to extract additonal meaning from manipulating geographic data. Learn to work with raster datasets and geodatabases to build spatial models for analyzing health data and evaluating spatial patterns of health events based on notion of distance. Prerequisite: PubH262. Fall, Spring

PubH	271	Disaster Epidemiology: Methods and Applications	1	Introduction to disaster epidemiology that elucidates the important role epidemiologists play in assessing the health and psychological effects of natural and man-made disasters and in identifying factors that contribute to these effects. Focus will be on applications of epidemiologic methods to the study of public health consequences of disasters, case studies from actual disasters used to illustrate various roles of epidemiologist in responding to these events and lessons learned. Highlight key skills that epidemiologists need to be part of a response and recovery . Identify methodological issues for future work. Prerequisites: PubH 202, 203. Summer
PubH	274	Emerging Infectious Diseases for Public Health Professionals	2	Focus on epidemiology of emerging infectious diseases of public health importance, including factors leading to their development, management of emerging infectious diseases from a public health and laboratory standpoint, including biosafety, and strategies for emergency preparedness from a national and international perspective. Course emphasizes the context of emerging infectious diseases and strategic approaches to their containment. Prerequisites: PubH 203 or Micr 292 or Instructor permission. Fall
MICR	212	Pathogenic Bacteriology	3	Pathogenic Bacteriology will integrate topics in basic microbiology and clinical infectious diseases. Specific pathogens will be discussed at both the cellular and the molecular level with special emphasize on virulent factors that promote disease. Current issues in the field will also be discussed, including antibiotic resistance and vaccine development.
MICR	229	Immunobiology of Infection	2	The course provides an in depth exploration of immune responses induced during viral, bacterial and parasitic infections. Topics to be covered include the epidemiology of infections, host/pathogen interactions, immune evasion mechanisms developed by infectious organisms and vaccination strategies of the future. Prerequisite 210. Spring
MICR	235	Human and Transforming Viruses	3	This course focuses on human viruses that have the ability to affect cell transformation. Emphasis is placed of the interpretation of the molecular mechanisms of cell signaling and regulatory processes and the influence of different viral factors. This course is designed for graduate and advanced undergraduate biomedical science majors. Spring
MICR	237	Fundamentals of Proteomics	2	This course is a continuation and expansion of the concepts presented in MICR 236 (BIOCHEM 236). Major goals will be to cover both the strengths and limitations of this new technology, and to emphasize the use of these methods for experimental problem-solving, and hypothesis testing. More emphasis will be placed on experimental approaches, advanced proteomics, literature mining and bioinformatics software applications. Spring
MICR	277	Seminar Series in Microbiology I	1	The department presents regular-scheduled and special seminar presentations throughout the semester. Students in this course are required to satisfy the requirements outlined by the course instructor at the beginning of the semester.
MICR	278	Seminar Series in Microbiology II	1	The department presents regular-scheduled and special seminar presentations throughout the semester. Students in this course are required to satisfy the requirements outlined by the course instructor at the beginning of the semester.
MICR	293	Special Topics in Microbiology	Var	This course enables students to work directly with a faculty member on an independent project for the semester. The setting can be either theoretical, laboratory or field-based. Students taking this course must receive permission of program director.

Career Options with the MSPH-MEID Degree (SOME BASIC QUESTIONS AND ANSWERS)

1. What is the real-world demand for people with this type of degree?

A new generation of researchers and public health practitioners is needed who have an in depth understanding of the major laboratory, clinical and public health aspects of humankind's microbial pathogens. These individuals must possess skills relevant to the prevention and control of problems arising from natural infectious diseases, modern biotechnologies and issues of national security.

2. Who are some of the employers likely to seek MSPH-MEID graduates?

Employment areas will include, in part, positions within:
• Public Health Departments (state and federal)
• Community health
• Homeland Security Preparedness
• Immigrant and migrant health service organizations
• Health issues in minority communities
• International relief organizations (e.g. WHO, AID….)
• Private relief organizations (World Vision….)
• Private industry (pharmaceuticals, health care….)
• Non-governmental Organizations

3. With what professional organizations would the MS PHM-EID graduate affiliate?

• American Public Health Association; http://apha.org/
• American Society for Microbiology; http://www.asm.org/

4. What are the possible job titles and how much salary would one expect to make in an entry-level position?

There are many job titles which holders of the MSPH-MEID will qualify. The following short list, extracted from the APHA WEB site (April, 2004), are but a few examples. All require the Master's degree. Salaries are dependent on the hiring organization and experience prerequisites:
• Assistant Epidemiologist (Henry M. Jackson Foundation, Washington, DC)
• Director of Community Services (Clark County (Nevada) Health District)
• Medical Officer of Health (City of Toronto)
• International HIV/AIDS Programs (Columbia University, international site locations)
• Study Managers (WESTAT, Rockville, MD)
• Project Manager (ORC Macro, Atlanta GA)
• Research Associate (The Center for Science in the Public Interest, Washington DC)
• Senior Health Advisor (USAID/Afghanistan The Center for Development & Population Activities, Kabal, Afghanistan)
• Resources and Planning Specialist (OHA, The Center for Development & Population Activities, Washington, DC)
• Clinical Program Director (Carl Vogel Center, Washington DC, $50-60K)