

# DEPARTMENTAL REQUIREMENTS

The specific requirements with regard to courses, qualifying examinations, and admission to candidacy set by Public Health departments are described below.

## BIostatISTICS

Biostatistics involves the development and application of sound statistical and mathematical principles to research in the health sciences. Because original theoretical research in biostatistics flows from medical research, it is essential that the foundations of methodological development be firmly grounded in sound principles of statistical inference and a thorough knowledge of the substantive area that provides the source of the medical questions being addressed. Thus, the Department of Biostatistics encourages excellent methodological work that is motivated by sound science that includes but is not limited to active collaborations with other investigators.

Research collaborations for biostatisticians take place both within and across departments in the School of Public Health, as well as with other departments in the School of Medicine and the university at large. Areas of current research include development of general methods that have wide applicability across different areas of health research, as well as more specific techniques for dealing with the underlying processes that give rise to the data of interest. A broad range of health topics addressed by students in this department include chronic diseases such as cancer, genetic epidemiology, clinical research, and mathematical models for infectious diseases.

Graduates of the doctoral program in Biostatistics are employed in universities and research institutes such as the National Institute of Health, where they engage in biomedical and statistical research and education. In addition, graduates have pursued careers in the pharmaceutical industry, in which they make critical contributions to therapeutic developments. Graduates are also employed in fields such as technology and finance, where they are involved in data science developments and applications.

### *Required Coursework*

Ph.D. students in Biostatistics have the choice of two pathways: the Biostatistics Standard Pathway and the Biostatistics Implementation and Prevention Science Methods Pathway. Students in the Standard Pathway are required to take a minimum of sixteen courses, and students in the Implementation and Prevention Science Methods Pathway are required to take a minimum of fifteen courses (not including BIS 525, BIS 526, BIS 699, and EPH 600). Course substitutions must be identified and approved by the student's adviser and the DGS. Students funded by specific fellowships may be subject to additional requirements and should discuss this with their adviser.

Required courses (or their equivalents) for both pathways are:

BIS 525	Seminar in Biostatistics and Journal Club <sup>1</sup>	0
BIS 526	Seminar in Biostatistics and Journal Club <sup>1</sup>	0
BIS 610	Applied Area Readings for Qualifying Exams	1
BIS 623	Advanced Regression Models	1

or S&DS 612	Linear Models	
BIS 628	Longitudinal and Multilevel Data Analysis	1
BIS 643	Theory of Survival Analysis	1
BIS 691	Theory of Generalized Linear Models	1
BIS 699	Summer Internship in Biostatistical Research <sup>1</sup>	0
EPH 508	Foundations of Epidemiology and Public Health <sup>2</sup>	1
EPH 600	Research Ethics and Responsibility <sup>1</sup>	0
EPH 608	Frontiers of Public Health <sup>2</sup>	1
S&DS 610	Statistical Inference <sup>3</sup>	1

<sup>1</sup> Courses do not count toward the total number of courses required (fifteen for Implementation and Prevention Science Methods Pathway students and sixteen for Standard Pathway students)

<sup>2</sup> Students entering the program with an M.P.H. degree may be exempt. Students granted an exemption must take an alternate course to replace EPH 608.

<sup>3</sup> Course offered in the Graduate School of Arts and Sciences

In consultation with their academic adviser students in the Standard Pathway will choose a minimum of eight additional electives that will best prepare them for dissertation work.

Students in the Implementation and Prevention Science Methods Pathway will also be required to complete BIS 537, Statistical Methods for Causal Inference; BIS 629, Advanced Methods for Implementation and Prevention Science; BIS 631, Advanced Topics in Causal Inference Methods; and EMD 533, Implementation Science. In consultation with their adviser, students must also choose a minimum of three additional electives.

Recommended electives for the Implementation and Prevention Science Methods pathway are:

BIS 536	Measurement Error and Missing Data	1
BIS 567	Bayesian Statistics	1
BIS 646	Nonparametric Statistical Methods and Their Applications	1
BIS 662	Computational Statistics	1
CDE 516	Principles of Epidemiology II	1
CDE 534	Applied Analytic Methods in Epidemiology	1
EMD 538	Quantitative Methods for Infectious Disease Epidemiology	1
HPM 570	Cost-Effectiveness Analysis and Decision-Making <sup>1</sup>	1
HPM 575	Evaluation of Global Health Policies and Programs	1
HPM 586	Microeconomics for Health Policy and Health Management	1
HPM 587	Advanced Health Economics	1
MGT 611	Policy Modeling <sup>1,2</sup>	4
SBS 541	Community Health Program Evaluation	1

SBS 574	Developing a Health Promotion and Disease Prevention Intervention <sup>1</sup>	1
SBS 580	Qualitative Research Methods in Public Health <sup>1</sup>	1
S&DS 541	Probability Theory <sup>1,3</sup>	1
S&DS 565 or S&DS 665	Introductory Machine Learning <sup>3</sup> Intermediate Machine Learning	1
S&DS 600	Advanced Probability <sup>3</sup>	1

<sup>1</sup> This course is strongly recommended.

<sup>2</sup> Course is offered by the School of Management

<sup>3</sup> Course offered in the Graduate School of Arts and Sciences

### *Qualifying Examination*

The qualifying examination has two parts. The first is a written, in-class examination that demonstrates competence with the use of statistical principles to develop methods of application; this exam is divided into two sections: a statistical theory examination and a biostatistics examination. The second involves the critical review of statistical literature, report writing, and oral defense of a specific biomedical topic agreed upon by the candidate and the BIS faculty adviser that will be evaluated by a committee approved by the BIS faculty.

### *Research Experience*

Through both required and elective courses, students gain actual experience with various aspects of research, including literature review, development of research questions, experimental design, data collection and management, data analysis and interpretation, and preparation of a manuscript and grant. In addition, doctoral students can gain research experience by working with faculty members on ongoing research studies prior to initiating dissertation research, which includes but is not limited to BIS 699. During the summer following the first year of coursework, candidates are required to take a research rotation (BIS 699) that is approved by the department and communicated to the DGS.

### *The Dissertation*

The department strives for doctoral dissertations that have a strong methodological component motivated by an important health question. Hence, the dissertation should include a methodological advance or a substantial modification of an existing method motivated by a set of data collected to address an important health question. The dissertation must also include the application of the proposed methodology to real data. A fairly routine application of widely available statistical methodology is not acceptable as a dissertation topic. Candidates are expected not only to show a thorough knowledge of the posed health question, but also to demonstrate quantitative skills necessary for the creation and application of novel statistical tools.

### **CHRONIC DISEASE EPIDEMIOLOGY**

Doctoral students in Chronic Disease Epidemiology use primarily quantitative research methods to identify risk factors for chronic diseases in populations. The department

is best known for research in the epidemiology of cancer, heart disease and stroke, aging, life course epidemiology (including perinatal and pediatric epidemiology), and genetics. Collaboration is key in epidemiology. Thus, students in the department often work on projects with other departments within YSPH, within the Schools of Medicine and Nursing, and across Yale University, resulting in numerous opportunities for creating an experientially rich doctoral experience. All candidates must become proficient in statistical analysis, research methods, and the application of epidemiology to the field in which they have special interest.

Graduates from the department's doctoral program are found on the faculties of universities throughout the world, at the highest levels of federal and international research programs, and in leadership positions in numerous private and public foundations and institutions.

### *Required Coursework*

Students in the CDE department are expected to complete a minimum of seventeen courses (not including EPH 600) from the following courses or their equivalents. Course substitutions must be identified and approved by the student's adviser and the DGS. Students supported by training grants may be subject to additional requirements and should discuss whether there are training-specific requirements with the principal investigator of the grant.

CDE 516	Principles of Epidemiology II	1
CDE 534	Applied Analytic Methods in Epidemiology	1
CDE 566	Causal Inference Methods in Public Health Research	1
CDE 610	Applied Area Readings for Qualifying Exams	1
CDE 617	Developing a Research Proposal <sup>1</sup>	1
or EMD 625	How to Develop, Write, and Evaluate an NIH Proposal	
CDE 650	Introduction to Evidence-Based Medicine and Health Care	1
EHS/CDE 502	Physiology for Public Health	1
EPH 508	Foundations of Epidemiology and Public Health <sup>3</sup>	1
EPH 600	Research Ethics and Responsibility <sup>2</sup>	0
EPH 608	Frontiers of Public Health <sup>3</sup>	1

<sup>1</sup> CDE 617 (or EMD 625) is not required of students funded by the Yale AIDS Prevention Training Program. Those students must take an additional elective in order to meet the seventeen-course requirement.

<sup>2</sup> This course does not count toward the minimum of seventeen courses.

<sup>3</sup> Students entering the program with an M.P.H. degree may be exempt. Students granted an exemption must take an alternate course to replace EPH 608.

In consultation with their academic adviser, students choose three 600-level course units in biostatistics (or equivalent substitutions approved by the student's adviser). For example, S&DS 563, Multivariate Statistical Methods for the Social Sciences, may serve as an option for these three courses.

Students also choose five additional electives that will best prepare them for their dissertation research.

### *Qualifying Examination*

The qualifying examinations in CDE entail a three-part system emphasizing biostatistics, epidemiological methods, and the student's chosen specialty area.

The examination covering epidemiological methods includes both an in-class and a take-home portion. Faculty members, chosen by the department chair, are responsible for coordinating this examination, and the examination content is developed by the overall faculty. Students are required to take a biostatistics exam but will receive an exemption from this exam if they receive grades of HP or Honors in the three required quantitative courses. The specialty area examination (CDE 610) is prepared in a tutorial with one or more faculty members. Students are required to prepare a short overview of their prospectus as a deliverable for this area (CDE 610) with their faculty mentor(s). Students are expected to submit this at the end of the spring term in the year they are taking qualifying examinations.

### *Research Experience*

In a number of courses, students gain actual experience with various aspects of research including preparation of a research grant, questionnaire design, preparation of a database for analysis, and analysis and interpretation of real data. In addition, doctoral students can gain research experience by working with faculty members on ongoing research studies prior to initiating dissertation research.

### *The Dissertation*

For the doctoral dissertation, some candidates will design and develop their own research protocol, collect the data, and conduct appropriate analyses. However, epidemiologic studies are often large, time-consuming, and expensive enterprises that often cannot be realistically completed within the time frame expected for a doctoral dissertation. Consequently, some dissertations often result from "piggy-backing" the dissertation research onto a larger study being conducted by a faculty member. If a student has previously documented experience with data collection, the doctoral dissertation may emphasize the statistical analysis of a data set in such a way as to address a new hypothesis. However the thesis is constructed, the department requires that the research makes a significant contribution to new knowledge in the field of epidemiology.

## **ENVIRONMENTAL HEALTH SCIENCES**

The Environmental Health Sciences (EHS) doctoral program focuses on how environmental agents – physical, chemical, and biological – affect human health, considered within the general framework of epidemiology and public health. Students are skilled in research, assessment, and evaluation of the impact of environmental stressors; they identify potentially adverse environmental agents, assess their exposures, determine their impact on health, and estimate the consequent risk. The Ph.D. emphasizes the preparation of students for scholarly careers in research and teaching.

Students must complete a minimum of thirteen courses (not including EHS 525, EHS 526, and EPH 600). Course substitutions must be identified and approved by the student's adviser and the DGS.

## *Required Coursework*

### CORE REQUIREMENTS

CDE 617	Developing a Research Proposal	1
or EMD 625	How to Develop, Write, and Evaluate an NIH Proposal	
EHS 503	Public Health Toxicology	1
EHS 508	Environmental and Occupational Exposure Science	1
EHS 525	Seminar and Journal Club in Environmental Health <sup>1</sup>	0
EHS 526	Seminar and Journal Club in Environmental Health <sup>1</sup>	0
EHS 560	Methods in Climate Epidemiology	1
or EHS 566	Causal Inference Methods in Public Health Research	
EHS 619	Research Rotation	1
EHS 620	Research Rotation	1
EPH 505	Biostatistics in Public Health	1
EPH 508	Foundations of Epidemiology and Public Health <sup>2</sup>	1
EPH 600	Research Ethics and Responsibility <sup>1</sup>	0
EPH 608	Frontiers of Public Health <sup>2</sup>	1

<sup>1</sup> These courses do not count toward the minimum of thirteen courses.

<sup>2</sup> Students entering the doctoral program with an M.P.H. degree may be exempt. Students granted an exemption must take an alternate course to replace EPH 608.

Suggested electives (minimum of four required)

BIS 505	Biostatistics in Public Health II	1
BIS 623	Advanced Regression Models	1
BIS 628	Longitudinal and Multilevel Data Analysis	1
CDE 516	Principles of Epidemiology II	1
CDE/EHS 520	Case-Based Learning for Genetic and Environmental Diseases	1
CDE 534	Applied Analytic Methods in Epidemiology	1
EHS/CDE 502	Physiology for Public Health	1
EHS 511	Principles of Risk Assessment	1
EHS 530	Our Air, Our Health	1
EHS/EMD 537	Water, Sanitation, and Global Health	1
EHS 547	Climate Change and Public Health	1
EHS/CDE 563	Biomarkers of Exposure, Effect, and Susceptibility in the Epidemiology of Noncommunicable Disease	1
EHS 567	Fundamentals of Green Chemistry and Green Engineering	1
EHS 568	Introduction to GIS for Public Health	1
EHS 569	Advanced GIS Workshop	1

EHS 581	Public Health Emergencies: Disaster Planning and Response	1
ENV 755	Modeling Geographic Space <sup>1</sup>	3
ENV 756	Modeling Geographic Objects <sup>1</sup>	3

<sup>1</sup> These courses are offered in the School of the Environment.

### *Qualifying Examination*

A qualifying examination that will serve as the formal test prior to admission to candidacy for the Ph.D. program will be administered after completion of thirteen course units and generally before the end of the second year. The student's DAC will administer this qualifying examination. The exam consists of an evaluation of a written prospectus and an oral presentation and defense of the research proposal. The proposal will be on the student's thesis project, written in NRSA format. Within two weeks of completing the written segment, the student will present the thesis proposal to the dissertation advisory committee and EHS faculty. The possible outcomes are (a) pass unconditionally, (b) pass conditionally, with further study suggested (or required) in one or more areas, or (c) fail, with or without the option to retake the examination after the areas of concern have been identified and the student has had time to prepare. If a student receives an unconditional pass, the committee should note whether it is an unconditional pass with distinction.

### *Research Requirements*

Two research rotations during the first academic year in EHS laboratories able to accommodate students are required of each student, one in the fall term and one in the spring term. In consultation with the student's academic adviser, an additional rotation may be offered during the summer between the first and second year. Research rotations will be available for both "dry" (i.e., statistical analysis) and "wet" (i.e., bench) laboratory research. The student will meet with the EHS graduate faculty member at the beginning of the rotation for an explanation of the goals and expectations of a student in the laboratory. The student will become familiar with the research models, approaches, and methods utilized by the research group through interactions with other laboratory/research personnel and from laboratory manuscripts. The student is expected to spend at least fifteen hours per week working in the laboratory or research group and to present a rotation seminar at the end of the rotation period.

In years three and beyond, students are required to present at least twice a year to their DAC and annually to the rest of the Ph.D. students and faculty in a departmental retreat or during an EHS Doctoral Research-in-Progress seminar.

## **EPIDEMIOLOGY OF MICROBIAL DISEASES**

The goals for doctoral students in the Department of Epidemiology of Microbial Diseases (EMD) are to obtain a current theoretical and practical base of epidemiological and microbiological principles, to master research methods, and to apply these skills to investigations of the biology of infectious organisms of public health importance, their transmission, and the epidemiology of the diseases they cause. The approach is multidisciplinary and includes in-depth ecological, pathogenic, clinical, cellular,

immunological, and molecular aspects of infectious diseases, their causative agents, vertebrate hosts, and vectors.

### *Required Coursework*

Courses in biostatistics, epidemiology, and microbiology are strongly recommended. The specific courses taken depend on the background of individual students and their stated research interests. An individual program that includes courses, seminars, and research rotations is developed by the student and the student's academic adviser. All students are required to complete three distinct research rotations. These are done in the fall and spring terms and in the summer between the first and second years. These research rotations (EMD 670, EMD 671, and EMD 672) are graded and account for three of the required ten courses. In addition, students are required to complete coursework in epidemiology (EPH 508 or CDE 516), in the breadth of public health (EPH 608) and in research proposal development (EMD 625 or CDE 617). EPH 608 may be waived if the student enters the program with an M.P.H. degree. Students with prior graduate-level epidemiology courses may be exempt from coursework in epidemiology.

Students are required to take a minimum of ten courses (not including EPH 600). Course substitutions must be identified and approved by the student's adviser and the DGS.

#### CORE REQUIREMENTS

EMD 625	How to Develop, Write, and Evaluate an NIH Proposal	1
or CDE 617	Developing a Research Proposal	
EMD 670	Advanced Research Laboratories	1
EMD 671	Advanced Research Laboratories	1
EMD 672	Advanced Research Laboratories	1
EPH 508	Foundations of Epidemiology and Public Health <sup>1</sup>	1
or CDE 516	Principles of Epidemiology II	
EPH 600	Research Ethics and Responsibility <sup>2</sup>	0
EPH 608	Frontiers of Public Health <sup>1</sup>	1

<sup>1</sup> Students entering the program with an M.P.H. or relevant graduate degree may be exempt. Students granted an exemption must take an alternate course to replace EPH 608.

<sup>2</sup> This course does not count toward the minimum of ten courses.

#### SUGGESTED COURSES

The following courses are suggested as appropriate for Ph.D. students in EMD. However, in consultation with the student's adviser, other courses in YSPH or in other departments may also be appropriate.

BIS 537	Statistical Methods for Causal Inference	1
BIS 567	Bayesian Statistics	1
CDE/EHS 566	Causal Inference Methods in Public Health Research	1
EHS 568	Introduction to GIS for Public Health	1

EMD 531	Genomic Epidemiology of Infectious Diseases	1
EMD 533	Implementation Science	1
EMD 538	Quantitative Methods for Infectious Disease Epidemiology	1
EMD 539	Introduction to the Analysis and Interpretation of Public Health Surveillance Data	1
EMD 546	Vaccines and Vaccine-Preventable Diseases	1
EMD 550	Epidemiology and Control of Vector Borne Diseases	1
EMD 553	Transmission Dynamic Models for Understanding Infectious Diseases	1
EMD 567	Tackling the Big Three: Malaria, TB, and HIV in Resource-Limited Settings	1
EMD 582	Political Epidemiology	1
HPM 570	Cost-Effectiveness Analysis and Decision-Making	1
S&DS 530	Data Exploration and Analysis <sup>1</sup>	1
S&DS 538	Probability and Statistics <sup>1</sup>	1
S&DS 563	Multivariate Statistical Methods for the Social Sciences <sup>1</sup>	1

<sup>1</sup> These courses are offered in the Graduate School of Arts and Sciences.

### *Qualifying Examination*

EMD has adopted an oral and written qualifying examination format. The qualifying examination serves as an opportunity for the faculty to evaluate students before their admission to candidacy for the Ph.D. degree. It also serves as a valuable learning experience, where a student has a chance to read critically and in-depth with various faculty members on both the thesis topic and two other topics of interest to the student. The other two topics should ideally be in areas that will expand the dissertation topic to subject matters not covered in courses. The second component includes writing a research proposal on the proposed dissertation topic. The oral examination takes the form of questions from members of the committee based on the readings and an oral defense of the research proposal.

Detailed information regarding the EMD qualifying examination is available from the EMD representative to the GSEC.

### *Research Requirements*

Three research training modules are required of all students, and each term involves a different investigator. These are offered as formal courses (EMD 670, EMD 671, EMD 672). Each term is graded and recorded on the student's transcript. Investigators act as tutors and monitor the progress of the work, although students are given a certain amount of independence in their work. Rotations are defined broadly, including experiments in the more traditional wet laboratory setting, as well as work in the field and on the computer.

### **HEALTH POLICY AND MANAGEMENT**

The doctoral program in the Health Policy and Management (HPM) Department emphasizes application of theory and methods to important policy and management

topics. It is designed to educate students to apply knowledge derived from public health, social sciences (political science, organizational behavior, and microeconomics), and other areas to crucial public health topics. The program educates students to conduct research on the forefront of health services research; management of health care organizations; policy analysis; and health economic issues. Students are prepared for academic, research, and policy careers in both the public and the private sectors in public health.

### *Specializations*

Disciplinary background and methods are important to meaningful application of theory and methods to key public health topics. Students in HPM will be required to develop expertise in one of the following specializations: Economics; Organizational Theory and Management; or Political and Policy Analysis.

### *Mentoring and Advising*

A hallmark of our program is the low student-to-faculty ratio and the high student and faculty interaction. Students work closely with their adviser and with a number of faculty with common interests, either a specific topic or a policy area. The adviser or set of advisers conducts independent readings with the student in preparation for the dissertation. In addition, students will typically work on research with faculty from both inside the department and from around the university throughout the student's time in the program; these faculty provide an informal network for supplementary mentoring. The student's DAC works closely with the student and has informal as well as formal meetings.

### *Coursework*

Students are required to complete the following coursework (or the equivalent in the topic areas covered in these courses). This course listing represents a suggested general program of study, but the specifics of course requirements are adapted to the particular interests and professional aspirations of each student. The standard number of courses taken is sixteen (excluding EPH 600, HPM 617, and HPM 618), with the option of obtaining credits for previous courses. With the approval of the academic adviser and the DGS, alternative courses that better suit the needs of the student may satisfy the coursework requirement. The departmental representative to the GSEC, in conjunction with the student's adviser, is responsible for determining if core course requirements have been satisfied by previous coursework or alternative courses. If so, the student should apply for a course waiver through the graduate school. HPM students can only waive up to three of the sixteen courses.

#### CORE REQUIREMENTS <sup>1</sup> (ALL STUDENTS)

EPH 508	Foundations of Epidemiology and Public Health <sup>2</sup>	1
EPH 600	Research Ethics and Responsibility <sup>3</sup>	0
EPH 608	Frontiers of Public Health <sup>2</sup>	1
HPM 600	Independent Study or Directed Readings <sup>1</sup>	2
HPM 610	Applied Area Readings	1

HPM 617	Colloquium in Health Services Research <sup>3</sup>	0
HPM 618	Colloquium in Health Services Research <sup>3</sup>	0

<sup>1</sup> Students must enroll in two distinct Independent Study courses (HPM 600).

<sup>2</sup> Students entering the program with an M.P.H. degree may be exempt. Students granted an exemption must take an alternate course to replace EPH 608.

<sup>3</sup> These courses do not count toward the standard number of sixteen courses.

### Methods and Statistics

Minimum of four courses. Suggested courses are:

BIS 623	Advanced Regression Models	1
BIS 628	Longitudinal and Multilevel Data Analysis	1
ECON 556	Topics in Empirical Economics and Public Policy <sup>1</sup>	1
ECON 558	Econometrics <sup>1</sup>	1
HPM 583	Methods in Health Services Research	1
MGMT 737	Applied Empirical Methods <sup>1</sup>	1
PLSC 500	Foundations of Statistical Inference <sup>1</sup>	1
PLSC 503	Theory and Practice of Quantitative Methods <sup>1</sup>	1
S&DS 563	Multivariate Statistical Methods for the Social Sciences <sup>1</sup>	1
S&DS 565	Introductory Machine Learning <sup>1</sup>	1
SBS 580	Qualitative Research Methods in Public Health	1
SOCY 580	Introduction to Methods in Quantitative Sociology <sup>1</sup>	1
SOCY 581	Intermediate Methods in Quantitative Sociology <sup>1</sup>	1
SOCY 582	Statistics III: Advanced Quantitative Analysis for Social Scientists <sup>1</sup>	1

<sup>1</sup> Course offered in the Graduate School of Arts and Sciences.

### Health Policy and Management

Minimum of two courses, all with Ph.D. readings. Suggested courses are:

EPH 510	Health Policy and Health Care Systems	1
HPM 514	Health Politics, Governance, and Policy	1
HPM 570	Cost-Effectiveness Analysis and Decision-Making	1
HPM 573	Advanced Topics in Modeling Health Care Decisions	1
HPM 587	Advanced Health Economics	1

### AREA OF SPECIALIZATION COURSE REQUIREMENTS

A minimum of four courses, all with Ph.D. readings, are required in the student's area of specialization.

#### Economics

Four courses are required. These must include the following:

ECON 545	Microeconomics <sup>1</sup>	1
ECON 558	Econometrics <sup>1,2</sup>	1

<sup>1</sup> Course offered in the Graduate School of Arts and Sciences.

<sup>2</sup> ECON 558 may count as a methods/statistics course or as a specialization course, but not both.

Students are required to take courses (or their equivalents) in graduate level microeconomics (i.e., ECON 545, Microeconomics and ECON 558, Econometrics, listed above) and a year-long sequence in econometrics, selected in consultation with the student's adviser (this will count towards the required Methods and Statistics courses). In addition, students take *two* field courses in a concentration area in which they plan to develop expertise. Sets of courses across topics can be selected to meet research interests. Concentration areas and courses (other courses may be substituted in consultation with the student's adviser) are:

#### **Behavioral Economics**

MGMT 758	Foundations of Behavioral Economics <sup>1</sup>	1
PSYC 553	Behavioral Decision-Making I: Choice <sup>1</sup>	1

#### **Industrial Organization**

ECON 600	Industrial Organization I <sup>1</sup>	1
ECON 601	Industrial Organization II <sup>1</sup>	1

#### **Labor Economics**

ECON 630	Labor Economics <sup>1</sup>	1
ECON 631	Labor Economics <sup>1</sup>	1

#### **Public Finance**

ECON 556	Topics in Empirical Economics and Public Policy <sup>1</sup>	1
ECON 680	Public Finance I <sup>1</sup>	1
ECON 681	Public Finance II <sup>1</sup>	1

<sup>1</sup> Course offered in the Graduate School of Arts and Sciences.

#### **Organizational Theory and Management**

Four courses are required, selected in consultation with the student's adviser.

#### **Political and Policy Analysis**

Four courses are required, selected in consultation with the student's adviser. Suggested courses are:

PLSC 800	Introduction to American Politics <sup>1</sup>	1
PLSC 801	Political Preferences and American Political Behavior <sup>1</sup>	1
PLSC 803	American Politics III: Institutions <sup>1</sup>	1

<sup>1</sup> Course offered in the Graduate School of Arts and Sciences.

Students will also choose one additional elective that will best prepare them for their dissertation research.

## Qualifying Exams

Students take qualifying exams in each of these three areas: (1) health policy and management, (2) empirical analysis and/or statistics, and (3) the student's area of specialization. Typically these are taken in the summer after two years of coursework.

## Research Requirements

All students are expected to develop their research skills through working with HPM faculty on research. Typically, students will work on a variety of projects with multiple faculty members, beginning during their initial year in the program. Students are expected to attend the departmental research seminar for faculty and are also expected to attend the doctoral research seminar.

## Dissertation

Students' doctoral dissertations should have a strong disciplinary base, often with an interdisciplinary approach, applying theory and rigorous methods to a significant public health policy or management topic.

## SOCIAL AND BEHAVIORAL SCIENCES

The Social and Behavioral Sciences (SBS) department aims to understand and improve health equity, both domestically and globally. Students will have the opportunity to follow the Maternal Child Health Promotion Pathway within SBS (or follow the traditional SBS curriculum). SBS provides instruction in the theory and methods of the social and behavioral sciences that emphasize individual, interpersonal, community, and structural influences on health, illness, and recovery. The primary emphases are focused on (1) understanding the psychosocial, behavioral, community, and societal influences on health in the general population, with a focus on those who are disadvantaged; and (2) creating multilevel interventions that eliminate barriers to health, from infancy to old age. The SBS curriculum takes an interdisciplinary approach and focuses on integrating methods from epidemiology and the social sciences, training scientists with a broad skill set that allows them to answer a host of complex research questions. The department has numerous research strengths, including in HIV/AIDS, aging health, community-engaged health research, maternal child health, mental health, health equity and disparities, and stigma prevention and health.

## Required Coursework

Students in SBS or the Maternal Child Health Promotion Pathway are expected to complete a minimum of fifteen courses (not including EPH 600) from the following courses or their equivalents. Course substitutions must be identified and approved by the student's adviser and the DGS. Students supported by training grants may be subject to additional requirements and should discuss whether there are training-specific requirements with the principal investigator of the grant.

### CORE REQUIREMENTS (ALL STUDENTS)

CDE 617	Developing a Research Proposal <sup>1</sup>	1
or EMD 625	How to Develop, Write, and Evaluate an NIH Proposal	
EPH 508	Foundations of Epidemiology and Public Health <sup>3</sup>	1

EPH 600	Research Ethics and Responsibility <sup>2</sup>	0
EPH 608	Frontiers of Public Health <sup>3</sup>	1
SBS 574	Developing a Health Promotion and Disease Prevention Intervention	1
or SBS 541	Community Health Program Evaluation	
or SBS 593	Community-Based Participatory Research in Public Health	
SBS 580	Qualitative Research Methods in Public Health	1
SBS 610	Applied Area Readings for Qualifying Exams	1
SBS 699	Advanced Topics in Social and Behavioral Sciences	1

<sup>1</sup> CDE 617 or EMD 625 is not required of students funded by the Yale AIDS Prevention Training Program. Those students must take an additional elective in order to meet the fifteen-course requirement.

<sup>2</sup> This course does not count toward the minimum of fifteen courses.

<sup>3</sup> Students entering the program with an M.P.H. degree may be exempt. Students granted an exemption must take an alternate course to replace EPH 608.

In consultation with their dissertation adviser, SBS students (not in the Maternal and Child Health Promotion Pathway) will choose three advanced-level (600 or above) statistics or methods courses from Biostatistics, Psychology, Political Science, Sociology, Anthropology, or Statistics and Data Science (S&DS 563, Multivariate Statistical Methods for the Social Sciences, and CDE 516, Principles of Epidemiology II, also qualify as statistics or methods courses), as well as five additional electives that will best prepare them for their dissertation research.

### **Maternal and Child Health (MCH) Promotion Pathway**

Students that choose this pathway will be required to take the following three courses in addition to the core requirements listed for all SBS students.

EMD 533	Implementation Science	1
HPM 542	Health of Women and Children	1
SBS 594	Maternal-Child Public Health Nutrition	1

MCH Promotion Pathway students are required to take three electives from this list and two additional electives chosen in consultation with their adviser:

BIS 505	Biostatistics in Public Health II	1
BIS 621	Regression Models for Public Health	1
or BIS 623	Advanced Regression Models	
BIS 628	Longitudinal and Multilevel Data Analysis	1
BIS 630	Applied Survival Analysis	1
CDE 516	Principles of Epidemiology II	1
CDE 566	Causal Inference Methods in Public Health Research	1
or EMD 582	Political Epidemiology	
EPH 505	Biostatistics in Public Health	1

HPM 575	Evaluation of Global Health Policies and Programs	1
S&DS 563	Multivariate Statistical Methods for the Social Sciences	1

### *Qualifying Examination*

The qualifying examinations in SBS have two primary components: (1) A written draft of the dissertation prospectus (2) an oral presentation of the proposal. The expected timeline for SBS Qualifying exams ranges from the end of the spring term in the second year to the end of the spring term in the third year. Students will submit their written dissertation prospectus to the SBS Chair and a date for the oral presentation will be scheduled approximately three weeks after the student submits to the SBS Chair.

Detailed information regarding the SBS Qualifying Examinations can be obtained from the GSEC Departmental Representative.

### *Research Experience*

Students are strongly encouraged to get involved in research by working with faculty members on ongoing research studies throughout their doctoral work. Further, students will gain research experience during their coursework by working on real data. Ideally students should publish one to two papers a year during the doctoral program to develop their research portfolio and to be competitive for academic positions after completion of their doctoral degree.

### *The Dissertation*

SBS uses a three-paper model, where students complete three research papers (of publication quality) on a related topic that demonstrates mastery of content, theory, and methods. In addition, the dissertation will have an introductory chapter that ties the three papers together and a conclusion chapter that summarizes main findings and their research and public health implications. The research papers can involve original data collection, secondary data analysis (using faculty data or national data sets), or some combination of the two.