

## PHS Course Competencies

Competencies for Academic Doctoral Degrees in Public Health, Population Health Sciences	
Competency	How Is This Competency Covered?
1. Critically evaluate published studies in the population health sciences literature for theoretical frameworks, methodologic strengths, limitations, data quality, and interpretation of study findings	<p><b>Theoretical Frameworks:</b> All Population Health Sciences (PHS) students are required to take <b>PHS 2506 / SBS 506: An Introduction to History, Politics, and Public Health: Theories of Disease Distribution and Health Inequities</b>. This course offers an introduction to the social and scientific contexts, content, and implications of theories of disease distribution, past and present. The course considers how these theories shape questions people ask about (and explanations and interventions they offer for) patterns of health, disease and well-being in their societies. Students complete weekly reading responses and are assessed via midterm and final exams in which they evaluate a public health topic through varied theoretical lenses.</p> <p><b>Methodologic Strengths, Limitations, Data Quality, and Interpretation of Study Findings:</b> All Population Health Sciences (PHS) students are required to take <b>PHS 2000 A&amp;B</b>, PHS 2000A covers foundational statistical methods including linear and logistic regression, generalized linear models, survival analysis, and longitudinal data analysis. Discussion is given to important concepts including sampling, measurement, model specification, interpretation, estimation and diagnostics. PHS2000B focuses on scientific inference and causal reasoning in the population health sciences and provides an overview of methods for sensitivity analysis, interaction, mediation, propensity scores, time-varying exposures, measurement and correction for measurement error, instrumental variables, regression discontinuity designs, difference-in-difference methods, time series, missing data, multiple testing, replication, and met-analysis.</p>
2. Design, implement, and interpret empirical research to address questions in the population health sciences using appropriate statistical and quantitative research methodologies	<b>All PHS students are required to take PHS 2000A &amp; 2000B.</b> Throughout this course, students engage with varied quantitative and statistical methodologies (described above) via lectures, labs, and weekly problem sets. Students learn about each of the topics via lectures, are provided opportunity to deeply interrogate the topics via labs, and then apply and interpret their outcomes via assigned weekly problem sets and exams.
3. Articulate and uphold ethical theories and principles in the collection and use of data for research purposes	All PHS students are required to complete a program-approved course on <b>Responsible Conduct of Research (RCR)</b> by the end of their second year of the program. All course options meet NIH and NSF requirements for RCR instruction. Course model is group based and heavily focused on discussion. Upon completion, students receive a certificate of completion. The courses from which the students may choose: <ul style="list-style-type: none"> <li>• Faculty of Arts and Sciences January or August sessions of Responsible Conduct of Research: <a href="https://research.fas.harvard.edu/responsible-conduct-research-course">https://research.fas.harvard.edu/responsible-conduct-research-course</a></li> <li>• <b>HPM 548: Responsible Conduct of Research</b></li> </ul>
4. Demonstrate expertise in a specific area of environmental health, epidemiology, global health and population, nutrition, or social and behavioral sciences or collaboration between two or more fields of study; including data handling.	All PHS students must successfully pass Field-specific coursework (described below) and the Field of Study Preliminary Qualifying Examinations (PQEs). Details of content, timing, and grading of PQE I and PQE II are specific to each Field of Study.  Upon completion of the two qualifying exams (both completed at the Field of Study-level), all PHS students are required to form a Dissertation Advisory Committee (DAC). The DAC helps the student set research goals and directions, while assessing progress toward the completion of an original body of research. The DAC evaluates the scientific maturity, independence, and original thinking in assessing student readiness to graduate. Students meet with their DAC every 3-6 months to assess progress towards completion of their independent dissertation work.

<p><b>Environmental Health (EH)</b></p>	<p><b>1. Apply principles of environmental exposure assessment, study design, and analysis to environmental health research questions.</b></p> <p>All Environmental Health PHS students are required to complete the following:</p> <p><b>EH 206: Foundations of Environmental Health.</b> This course is designed to lay a foundation in environmental health, integrating key disciplines such as risk assessment, exposure assessment, epidemiology, toxicology, data analytics, physical science, and science policy. Students' critical thinking and quantitative abilities are enhanced through interactive workshops, case studies, assignments, and insightful readings.</p> <p><b>ID 215: Environmental and Occupational Epidemiology.</b> Relevant topics covered in this course include: (1) Discussion of Exposure Assessment, (2) Epidemiological Methods Issues with Environmental Exposures, (3) The Contribution of Quantitative Exposure Assessment to Occupational Epidemiology, and (4) Multiple Exposures and Contextual Factors. Student assessments include a group project in which they must critically review several peer-reviewed articles to determine whether there is sufficient evidence of a specific environmental/occupational exposure and associated health risk based on the presented evidence. Students are also assessed via a group project and final paper.</p> <p><b>2. Design and propose original research in environmental health</b></p> <p><b>EH 520: Research Design in Environmental Health</b> before taking their PQEs. Students are required to develop, present, and defend a research proposal to students and Faculty members. Students are required to read all other students' proposals and offer critiques for other students' research proposals.</p> <p>Students complete their PQE I (a single written exam) at the end of their 2nd year (or 1st year if continuing masters' students) before they may become eligible for their PQE II.</p>
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<p><b>Epidemiology (EPI)</b></p>	<p><b>1. Apply principles of study design, analysis, and causal inference to epidemiologic research questions.</b></p> <p>All Epidemiology PHS students are required to complete the following:</p> <p><b>EPI 203: Study Design in Epidemiologic Research.</b> This course begins with the randomized clinical trial as a paradigm, then examines common problems in the design, analysis, and interpretation of observational studies. Cohort and case-control studies are the focus, but not to the exclusion of other designs. Problems of exposure and disease definitions, time-dependent effects, confounding, and misclassification are considered in the type of data sources typically available. Students are assessed via four homework assignments with the following topics: Study design proposal, screening, infectious disease epidemiology, and sensitivity analysis.</p> <p><b>EPI 289: Models for Causal Inference.</b> This course introduces outcome regression, propensity score methods, the parametric g-formula, inverse probability weighting of marginal structural models, g-estimation of nested structural models, and instrumental variable methods. Each week students are asked to analyze the same data using a different method as weekly graded problem sets. Students are also assessed via a final exam.</p> <p><b>2. Design and propose original research in epidemiology.</b></p> <p>All Epidemiology PHS students are required to complete <b>EPI 205: Practice of Epidemiology</b> the spring before they take their PQE I. Each student prepares and presents a research proposal. Students also offer critiques of other students' research proposals.</p> <p>Students complete two written exams as their PQE I. The first covers methods, including aspects of study design, analysis, and causal inference. The second covers substantive knowledge of epidemiology and exams breadth in the field.</p>
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**Global Health & Population (GHP)**

**1. Apply theoretical frameworks of global health and principles of study design and analysis to global health and population research questions.**

All Global Health and Population PHS students are required to complete **GHP 210: Concepts and Methods in Global Health and Population Studies**. This course is intended as a survey of the main perspectives, methods, insights, and issues in the study of global health and population dynamics, focused on the themes of population dynamics and health systems. Students complete 5 essays to demonstrate ability to synthesize and apply course content. The Seminar provides the opportunity for students to present their work and received feedback from both students and Faculty.

**2. Design and propose original research in global health.**

Students complete two Written Qualifying Exams (two papers: the first a written exam, the second a submitted research paper) before advancing to their PQE II.

**Nutrition (NUT)**

**1. Critique and apply principles of dietary assessment, study design, and analysis to nutrition research questions.**

All Nutrition PHS students are required to complete **ID 214: Nutritional Epidemiology** before their PQE I. The first half of the course reviews methods for assessing the dietary intake of populations and individuals. Students gain experience in the actual collection, analysis, and interpretation of dietary intake. During the second half of the semester the course reviews several specific diet/disease relationships, integrating information from international studies, secular trends, clinical trials, analytical epidemiology, and animal experiments. Students are assessed via 4 homework assignments in which they must analyze data and respond to written prompts. There is also a midterm and final exam, as well as a Food Frequency Questionnaire project in which students assess their own dietary intake and then analyze their own data.

All Nutrition PHS students are required to complete **NUT 201: Introduction to Nutrition in Public Health** before their PQE I. This course provides an overview of current topics in nutrition in public health. Students critically evaluate scientific evidence on current topics and compare them to public health practices and policies. Topics explored include dietary assessment and nutritional epidemiology, diet and health, diet and global nutrition, social determinants of health, public health policy, community nutrition, translational applications, food systems and sustainability, and nutrition communication. Throughout the semester, students complete **individual summary reports** reflecting upon topical cases and ideas and innovations for developing solutions. They also research a topic of interest in small groups in which they critically synthesize scientific evidence, public health policy or clinical implications, and recommendations for future research.

Students are required to attend weekly Human Nutrition Seminars. Topics focus on applied areas of Nutrition, work-in-progress presentations, and presentations by invited speakers.

**2. Design and propose original research in nutrition.**

All Nutrition PHS students are required to complete **EPI 205: Practice of Epidemiology** the spring before they take their PQE I. Each student prepares and presents a research proposal. Students also offer critiques of other students' research proposals.

The Nutrition PQE I tests the student's general knowledge in the major field of nutrition and their chosen minor fields. Students administer a 10-minute presentation on a topic discussed by the Committee members. They are questioned on topics related to their research experiences and future plans. Examiners test the student's ability to do doctoral-level research by asking them to formulate research approaches to the thesis research problem they have selected.

**Social & Behavioral Sciences (SBS)**

**1. Apply theories of population health distribution and behavior theories and principles of study design and analysis to social and behavioral research questions.**

All Social and Behavioral Science PHS students are required to complete the following:

**SBS 507: Advanced Seminar in Theories of Disease Distribution and Health Inequities.** This course builds upon the core required PHS course PHS 2506 / SBS 506 (described above). It deepens historical and present-day understanding of contemporary mainstream theories of disease distribution and their social epidemiologic alternatives. The course builds substantive knowledge regarding the content and public health implications of theories of disease distribution while also developing skills in conducting literature searches about and engaging with complex scholarly arguments and discourse. Students are assessed via a final paper in which they examine a public health challenge via public health theoretical lenses that do or do not affect health inequities.

**SBS 522: Multi-Level Approaches to Population Health and Health-Related Behavior Change.** This course introduces an array of conceptual theories, models, and frameworks across multiple levels of influence (ranging from individual factors to macro-social factors) and examines their role in understanding and improving health-related behavior and population health outcomes. Students are assessed via regular homework assignments in which they examine a specific health-related change target and population and identify a determinant or construct they feel would apply to change target and population, and how they would intervene on that construct. Students also submit a final paper in which they describe a multi-level theory-based approach to addressing their topic, inclusive of several ecological levels and systems.

**2. Design and propose original research in the social and behavioral sciences.**

**SBS 245: Social and Behavioral Research Methods.** This course focuses on key quantitative methods pertaining to measurement, design, and analysis in studies of social and behavioral phenomena and health. In addition to learning specific techniques for establishing reliability and validity of measures, investigating underlying latent factor structure, designing experiments, analyzing quasi-experimental data, and analyzing longitudinal observational data, students engage with ongoing debates on causal inference in the social and behavioral sciences, give and receive constructive peer feedback, and practice communicating their work both orally and in written form. Students are assessed via two final papers detailing the analyses conducted as part of a group measurement project and individual longitudinal analysis project.

**SBS 500: Developing a Research Protocol.** Students focus on the process of turning scientific questions into specific aims appropriate for an NIH-style grant proposal and justifying the significance of the research question(s). Drawing on principles of study design, sampling, measurement, and analysis, students discuss how to develop the approach section of a grant proposal to address those specific aims. Students are assessed via a final project written as the research approach section of an NIH-style grant proposal.

Competencies for Academic Doctoral Degrees in Public Health, Population Health Sciences, Environmental Health Concentration, Areas of Specialization		
Area of Specialization	Competency	How Is This Competency Covered?
<b>Environmental Health Bioengineering or Mechanisms of Disease</b>	Evaluate public health policy and research based on the implications of the basic mechanisms that give rise to disease, including genetics, epigenetic modulation, nutritional factors, toxicity, radiation, injury, inflammation, infection, and/or repair	Students are required to take <b>EH 208: Pathophysiology of Human Disease</b> . The course surveys major human disease problems in the cardiovascular, respiratory, hematopoietic, reproductive and gastrointestinal systems, with a focus on understanding the pathophysiologic basis of common disease manifestations and the pathogenesis of the disease process. Assessments include problem sets, a presentation, two midterm exams, and a final exam.
<b>Environmental Health Epidemiology</b>	Analyze the scientific evidence of environmental and health policies, focusing on the influence of physical, chemical, and biological environmental factors on human disease in communities	Students are required to take <b>EPI 203: Study Design in Epidemiologic Research</b> . Students develop a detailed understanding of common problems in the design of epidemiologic studies, including problems of exposure and disease definitions, time-dependent effects, confounding, and misclassification. Assessments include several homework assignments and a study design proposal for a study design protocol to evaluate a health-related question.
<b>Environmental Health Exposure Assessment</b>	Develop strategies to control environmental hazards, allergens, and pathogens taking into account the chemical, physical, microbiological, and/or engineering aspects of environmental and occupational hazards	Students are required to take <b>EH 257: Water Pollution, and EH 297: Atmospheric Environment</b> . These courses cover the basic principles of water and air pollution, including basic chemical, physical and biological processes, specific contaminants, monitoring and mitigation techniques and regulatory approaches and policies to protect water and air resources. Assessments in these courses include homeworks, midterm and final exam, book report, and a final project.
<b>Environmental Health Justice</b>	Develop approaches to lessen environmental health disparities using environmental justice as a framework	Students are required to take <b>EH 525: Environmental Justice: Concepts and Practice</b> . The course introduces the topic of environmental justice as it relates to public health. Topics include fundamental principles and frameworks, social and biological mechanisms underlying environmental health disparities; methods for assessing and measuring the disproportionate burden of harmful environmental effects borne by some communities as a consequence of racism and other forms of discrimination; and the practice of environmental justice as a framework for guiding the approach to reducing environmental health disparities. Assessments include presentations and a final project.
<b>Environmental Health Molecular Epidemiology</b>	Design environmental epidemiology studies that combine molecular and genetic laboratory assessments with epidemiology to clarify gene-environment interactions	Students are required to take <b>EPI 249: Molecular Biology for Epidemiologists</b> covers a broad range of topics including, but not limited to, the mechanisms and regulatory processes involved in molecular biology, how cellular mechanisms go awry and can be repaired, and other classical and novel molecular biology tools. Assignments include problem sets and quizzes.

<p><b>Environmental Health Molecular Physiology</b></p>	<p>Investigate research approaches, including study design and interpretation, to determine functional outcomes of environmental and agents' exposures on cells, tissues, and organs, especially as disease manifestations</p>	<p>Students are required to take <b>EH 512</b> and <b>EH 513, Interdisciplinary Training in Pulmonary Sciences Parts I and II</b>. These courses approach lung biology and respiratory diseases with an interdisciplinary perspective, bridging the gap between life sciences and physical/engineering sciences. With a focus on laboratory sciences and on mechanistic levels of understanding, the courses focus on asthma, air pollution, and lung infection. Students in this course are assessed via a case-study oral presentation and a Cutting-Edge Research Summary written assignment.</p>
<p><b>Environmental Health Occupational Health and Occupational Epidemiology</b></p>	<p>Design workplace programs and regulatory policies that reduce harmful health outcomes by analyzing occupational and environmental exposures</p>	<p>Students are required to take <b>EH 236: <i>Epidemiology of Environmental &amp; Occupational Health Regulations</i></b>, and <b>ID 263: <i>Practice of Occupational Health</i></b>. EH 236 examines the epidemiologic basis for associating selected occupational and environmental exposures with health outcomes and possible approaches to regulate these exposures. ID 263 focuses on the assessment of workplace hazards, the physiology and biomechanical aspects of work, and a practical problem-solving approach to health problems in various work settings. Assessments feature written assignments.</p>
<p><b>Environmental Health Risk Sciences</b></p>	<p>Apply health decision science, including cost effectiveness analysis, to environmental risk assessment, including the design and assessment of different environmental health programs.</p>	<p>Students are required to take <b>RDS 282: <i>Economic Evaluation of Health Policy &amp; Program Management</i></b>. In RDS 282, students cover the theoretical foundations of cost-effectiveness analysis, challenges of using CEA in practice, and the role of evidence of economic value versus other criteria in program evaluations. Assessments include three graded assignments and a final exam.</p>



**Competencies for Academic Doctoral Degrees in Public Health, Population Health Sciences, Global Health and Population Concentration, Areas of Specialization**

Area of Specialization	Competency	How Is This Competency Covered?
<b>Health Systems</b>	Integrate frameworks and methods from various disciplines and apply them to analyze critical health system issues	Students are required to take <b>GHP 202: Comparative Health Systems</b> . The course covers theoretical health systems frameworks as well as essential concepts and methodological issues in comparative health systems research, with a focus on theories of the market and the government as organizing principles. The assessments in this course take the form of written assignments and a group debate.
<b>Population and Family Health</b>	Apply processes, models and methods of demographic analysis to understand key aspects of population and family health, including mortality, fertility and population change.	Students are required to take <b>GHP 220, Introduction to Demographic Methods</b> . Students are introduced to the principal sources and methods used to analyze populations in developed and developing countries and obtain practical training through weekly lab sessions and course assignments. Students are assessed through individual homework assignments, a closed-book exam and a country-specific assignment.

**Competencies for Academic Doctoral Degrees in Public Health, Population Health Sciences, Nutrition Concentration, Areas of Specialization**

Area of Specialization	Competency	How Is This Competency Covered?
<p><b>Nutritional Epidemiology</b></p>	<p>Investigate the mechanisms by which diet can influence health, including metabolism, physiology, and/or molecular genetics</p>	<p>Students are required to take <b>ID 221 Nutritional Epidemiology II</b>, which addresses methodological aspects of research in nutritional epidemiology. Topics include validation studies, adjustment for energy intake, and correction of measurement error. Theoretical, as well as practical aspects, will be covered. Students will be assessed via three assignments, class project and presentation, and closed book final exam.</p>
	<p>Evaluate the relationship between diet and disease relationships in epidemiologic studies through the use of quantitative methods</p>	<p>Students are required to take <b>EPI 203: Study Design in Epidemiologic Research</b>, which reviews the main epidemiologic study designs currently used to describe, predict, and investigate the causes of health outcomes in humans. With the randomized clinical trial as a paradigm, the course examines common problems in the design, analysis, and interpretation of observational studies. Students are assessed via a group project and three homeworks focused on editorial, screening and infectious diseases.</p>
<p><b>Public Health Nutrition</b></p>	<p>Investigate policy, social, and behavioral influences on diet quality and diet-related health conditions through the use of quantitative methods</p>	<p>Students are required to take <b>SBS 245: Social and Behavioral Research Methods</b>, which provides a broad overview of social and behavioral research methodology, including experimental, quasi-experimental, and non-experimental research designs, measurement, sampling, data collection, and causal inference. Students in this course are assessed via participation (30%), Group measurement project (30%) and Final longitudinal project (40%).</p>
	<p>Apply theoretical models to the design, implementation, and evaluation of nutrition interventions.</p>	<p>Students are required to take <b>NUT 232: Designing and Evaluating Behavioral Interventions Targeting Diet and Physical Activity</b>. The course covers methods used to design, evaluate, and disseminate diet and physical activity behavioral interventions in real world settings. This course will review the lifecycle of program planning and evaluation, community needs assessments, the role of program theory, process evaluations, valid and practical measures of diet and physical activity, experimental and pragmatic approaches to impact evaluation, and strategies to disseminate evidence-based programs. Students will be assessed via course engagement, presentation of an intervention critique, and an outcome and process evaluation quiz.</p>

**Note: Epidemiology and Social & Behavioral Sciences do not require Areas of Specialization, and as a result, there are no additional competencies for the Field.**