Milken Institute School of Public Health
THE GEORGE WASHINGTON UNIVERSITY

Department of Biostatistics and Bioinformatics

PhD in Health Data Science
2025-2026
Note: All curriculum revisions will be updated immediately on the website
http://www.publichealth.gwu.edu

Program Co-Directors

Biostatistics Concentration		**Bioinformatics Concentration**
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Mission

The PhD in Health Data Science trains the next generation of data science leaders for applications in public health and medicine. Students in the program develop innovative statistical and computational methods for data analysis and for deriving new scientific discoveries in the public health and biomedical sciences. The program takes advantage of the rich biostatistical and bioinformatics resources at GWU and in the Nation's Capital and is designed to prepare students to be independent researchers in the development of methodologies, and effective collaborators in interdisciplinary studies.

Competencies

Biostatistics Concentration Competencies

1. **Biostatistical Methodology**: Develop and implement innovative biostatistical methodologies that can be utilized to solve complex problems in and improve efficiency of biomedical and public health research.
2. **Advanced Statistics & Computation**: Implement fundamental and advanced statistical methods and associated computing to effectively and accurately analyze complex public health and medical data.
3. **Communication**: Communicate and collaborate with scientific colleagues such as public health, medical professionals, and research scientists via effective listening, critical questioning, clear written documentation, and oral presentation skills.
4. **Leadership**: Provide biostatistical leadership in the design, conduct, analysis, and reporting of collaborative research studies.
5. **Teaching**: Educate health professionals, research scientists, and students using effective didactic and instructive methodologies to relay complicated mathematical and statistical analyses.

Bioinformatics Concentration Competencies

1. **Computation**: Apply skills in software design and programming to create algorithms for biological data analyses.
2. **Biology**: Apply knowledge of molecular biology, genomics, genetics, evolution, and systems biology through statistics and computation to address novel research questions.
3. **Statistics**: Create modeling and data analyses using statistical and mathematical applications.
4. **Conceptual Integration and Application in Bioinformatics**: Develop project management skills and critical thinking and apply integrated concepts and data across fields of computer science, statistics, data science, biology, and health sciences through bioinformatics.

5. **Independent Research:** Plan and conduct original, independent research through application and integration of skills and knowledge developed through the preliminary phase of the PhD program.

Admission Requirements

Applicants must hold an undergraduate degree from an accredited institution of higher learning exhibiting a strong background in mathematics. Normally, a B average (or equivalent) from an accredited college is required. With evidence of special promise, such as high Graduate Record Examination (GRE) scores, an applicant whose academic record falls short of a B average may be accepted on a conditional basis. **All applicants for the biostatistics track are required to submit current GRE scores (within 5 years of matriculation date)**. GRE scores are optional for the bioinformatics track, but strongly encouraged. Meeting the minimum requirements does not assure acceptance. The department may set higher admission standards and financial support packages available for new students limits the number of applicants accepted. Applicants must provide evidence of the completion of their undergraduate and/or graduate work before registration in the Milken Institute School of Public Health (GWSPH) is permitted. Graduate courses taken prior to admission while in non-degree status may not be transferable into GWSPH programs. The PhD program is designed to serve students coming directly from an undergraduate degree or from a Master's degree program. Students completing a master's degree prior to admission to the PhD degree program may transfer up to 24 credits towards the PhD coursework requirements. External credits must have been earned from an accredited institution in the last 6 years with a minimum grade of 3.0 (B) in each course. In this case, 48 hours of additional coursework and dissertation research will be required, including the instructional opportunities.

Concentration-Specific Requirements/Pre-requisites

Biostatistics Concentration	*Bioinformatics Concentration*
• Three semesters of calculus (through multivariable calculus) • A course in linear algebra • A course in undergraduate statistics Additional advanced courses in mathematics and calculus-based probability are encouraged but not a requirement for admission.	• A course in statistics • A course in introductory biology and/or a course in computer programming • Typically, an undergraduate major in either biology, statistics, mathematics, computer science, bioinformatics, and/or bioengineering

All applications are submitted through SOPHAS.org. Information about GWSPH Admissions and policies are available online at http://publichealth.gwu.edu/admissions.

Qualifying Exam

Biostatistics Concentration:

The Qualifying Examination is given over a two-week period in the summer before the third (fourth) year of the program for full-time (part-time) students, with a theory examination in the first week and an applications examination in the second week. The theory examination (5 hours, in-class, open-book) covers material in the areas of statistical inference, linear model, and generalized linear model. The applications examination (4 days, take-home, open-book) focuses on applied problems requiring statistical inference based on data analysis. See the HDS PhD (Biostatistics) Qualifying Exam Guidelines for details. The essential skills for this examination are generally developed through coursework in the first two years of the program. A student who fails to pass the comprehensive examination may, with the approval of the program director, repeat the examination the following year. Failure on the second attempt will result in termination from the PhD program.

Bioinformatics Concentration: The Qualifying Examination is given by the end of the second semester of the second year of the PhD program (can be earlier for those coming in with a Master's degree and/or equivalent work experience) and consists of a written and oral component.

The written component is an NIH F31 award application focused on the student's current concept of a research project. The written component is developed in coordination with the dissertation advisor.

With advisor approval, the student schedules the oral exam component and delivers the written component to the advisory committee at least one week before the oral examination meeting. The oral exam covers concepts presented in the written component and addresses coursework concepts acquired through the graduate program.

Upon successful completion of the required course work and the PhD Qualifying Examination the candidate advances to PhD Candidacy: the dissertation research.

Program Requirements

Biostatistics Concentration

The curriculum includes parallel development of theory and applications as well as coverage of specific biostatistical topic areas and ethical issues in the conduct of biostatistical and medical research. The program requires a total of 72 credit hours of coursework and research with a minimum of 12 credits of dissertation research.

Course Distribution Summary	Credits
Required Core Courses	12
Required Concentration Courses	27
Electives • Bioinformatics (at least 3 credits) • Cognate Area (at least 3 credits) • Additional Electives (at least 3 credits)	12 Minimum
Dissertation Research Note: Research may be taken in 1 credit increments, but a minimum total of 12 credits are required and a maximum of 24 credits can be taken.	12-24
Total credits	**72**

Bioinformatics Concentration

The curriculum includes broad training across core areas of bioinformatics, including statistics, biology, computer science, and ethical issues in the conduct of biomedical research. The program requires a total of 72 credit hours of coursework and research with a minimum of 12 credits of dissertation research.

Course Distribution Summary	Credits
Required Core Courses	12
Required Concentration Courses	5
Electives • Biostatistics (at least 3 credits) • Cognate Area (at least 3 credits) • Additional Electives (at least 12 credits)	18 Minimum
Dissertation Research Note: Research may be taken in 1 credit increments, but a minimum total of 12 credits are required with a maximum of 24 credits can be taken.	12-24
Total credits	**72**

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Required Core Courses – Both Concentrations (12 credits)		
Course	**Course Name**	**Credits**
PUBH 6080^	Pathways to Public Health	0
PUBH 6850	Introduction to SAS for Public Health Research	1
PUBH 6851	Introduction to R for Public Health Research	1
PUBH 6852	Introduction to Python for Public Health Research	1
PUBH 6860	Principles of Bioinformatics	3
PUBH 6886	Statistical and Machine Learning for Public Health Research*****	3
PUBH 8001	PhD Seminar: Cross-Cutting Concepts in Public Health	1
PUBH 8475	Ethics in Domestic and International Research (may be listed as PUBH 8099)	1
PUBH 8413	Research Leadership	1
GTAP**	GradTeachingAsst Certification (This includes UNIV 0250 Graduate Assistant Certification Course and is required before TA-ing; credits do not count towards PhD degree)	--
Required Courses —Biostatistics Concentration (27 credits)		
PUBH 6864	Applied Survival Analysis for Public Health Research*****	3
PUBH 6866	Principles of Clinical Trials*****	3
PUBH 6887	Applied Longitudinal Data Analysis for Public Health Research	3
PUBH 8870	**Statistical Inference for Public Health Research I ***	3
PUBH 8871	**Statistical Inference for Public Health Research II ***	3
PUBH 8875	**Linear Models in Biostatistics***	3
PUBH 8877	**Generalized Linear Models in Biostatistics***	3
PUBH 8879	An Introduction to Causal Inference for Public Health Research	3
PUBH 8880	Statistical Computing for Public Health Research	3
***Courses are basis of comprehensive exam for the Biostatistics concentration.**		
Required Courses —Bioinformatics Concentration (18 credits)		
PUBH 6854	Applied Computing in Health Data Science (or equivalent programming course)	3
PUBH 6859	High Performance and Cloud Computing	3
PUBH 6861	Public Health Genomics	3
PUBH 6868	Quantitative Methods	3
PUBH 6884	Bioinformatics Algorithms and Data Structures	3
PUBH 8885	Computational Biology	3
Dissertation Research (12 Credits Minimum)		
PUBH 8999	Dissertation Research • Biostatistics concentration • Bioinformatics concentration	 12 – 24 12 – 24

Elective Courses

Biostatistics: 12 Credits Minimum Bioinformatics: 18 Credits Minimum

Both Concentrations: at least 3 credits in Biostatistics, 3 credits in Bioinformatics, and 3 credits in a Cognate Area

May Add Additional Elective Courses Approved in Advance by Advisor Electives planned with Advisor

Course	Course Name		Credits
Biostatistics (at least 3 credits)			
PUBH 6262	Introduction to Geographic Information Systems		1
PUBH 6263	Advanced GIS		1
PUBH 6856	Advanced SAS for Public Health Research		1
PUBH 6863	Applied Meta-analysis		1
PUBH 6876	Advanced Clinical Trials		2
STAT 6223	Bayesian Statistics: Theory and Applications		3
STAT 6287	Sample Surveys (Modern Theory of Sample Surveys I)		3
STAT 8257	Probability		3
STAT 8265	Multivariate Analysis		3
STAT 8288	Topics in Sample Surveys (Modern Theory of Sample Surveys II)		3
PUBH 6862*	Applied Linear Regression Analysis for Public Health Research	** Not available as electives for Biostatistics Concentration students.*	3
PUBH 6865*	Applied Categorical Data Analysis		3
PUBH 8871*	Statistical Inference for Public Health Research II		3
PUBH 8877*	Generalized Linear Models in Biostatistics		3
Bioinformatics (at least 3 credits) **Required			
PUBH 6854**	Applied Computing in Health Data Science		3
PUBH 6861**	Public Health Genomics		3
PUBH 8885**	Computational Biology		3
PUBH 6859**	High Performance and Cloud Computing		3
PUBH 6884**	Bioinformatics Algorithms and Data Structures		3
Cognate (at least 3 credits)			
BMSC 8210	Genes to Cells		3
BMSC 8212	Systems Physiology		3
PSYC 8202	Psychological Research Methods and Procedures		3
PUBH 6003	Principles and Practice of Epidemiology		3
PUBH 6276	Public Health Microbiology		3
PUBH 6278	Public Health Virology		3
PUBH 8244	Doctoral Topics: Cancer Epidemiology		3
PUBH 8250	Doctoral Topics: Epidemiology of HIV/AIDS		3
PUBH 8259	Doctoral Topics: Epidemiologic Surveillance in Public Health		3
PUBH 8405	Advanced Topics: Health Economics Research		3
PUBH 8408	Advanced Topics: Health Behavior Research & Practice Applications		3
PUBH 8434	Behavioral Medicine and Public Health		3
Other electives (no minimum credit requirement)[#]			
BIOC 6240	Next Generation Sequencing		2
CSCI 6221	Advanced Software Paradigms		3
CSCI 6231	Software Engineering		3
DATS 6101	Introduction to Data Science		3
DATS 6103	Introduction to Data Mining		3
DATS 6202	Machine Learning I: Algorithm Analysis		3
DATS 6203	Machine Learning II: Data Analysis		3
DATS 6450	Topics in Data Science (Deep Learning for Data Science)		3
PUBH 6899	Topics in Biostatistics and Bioinformatics		1
PUBH 8419	Measurement in Public Health and Health Services		3
PUBH 8899	Topics in Biostatistics and Bioinformatics		1-3

^ *Students without a prior degree from a CEPH-accredited program or school of public health are required to successfully complete the zero-credit, online course Pathways to Public Health (PUBH 6080) within one year of matriculation. There is no fee for this course.*

[#] *Other courses can be taken as electives with the program directors' approval.*

Graduation Requirements

1. **Credits:** Successful completion of 72 credits.
2. **Curriculum:** Successful completion of the course requirements.
3. **Qualifying Exam:** Successful completion of all parts of the qualifying examination.
4. **Dissertation Proposal:** After successful completion of the Qualifying Exam, students should develop and present their dissertation proposal to their dissertation committee. This is typically done in the semester following the Qualifying Exam.
5. **Dissertation:** a minimum of 12 credits of dissertation research are required. The oral defense may be scheduled once the proposal has been successfully defended and the dissertation research credit requirement has been met.
6. **Grade Point Average:** A minimum program grade-point average of B (3.0).
7. **Time Limit:** The degree must be completed within seven years of matriculation.
8. **CITI Training:** All students complete training regarding human subject protection regulation and the Health Insurance Portability and Accountability Act of 1996 (HIPAA). To fulfill this requirement, you must complete the Collaborative IRB Training Initiative (CITI) Course in The Protection of Human Research Subjects.
9. **Academic Integrity:** All students are required to review the George Washington University Code of Academic Integrity, take the quiz within their first semester of study, and ensure documentation is submitted to the SPH Office of Student Records.
10. **Professional Enhancement:** Students must participate in 8 hours per degree program of advisor pre-approved Public Health-related lectures, seminars, and symposia, related to the appropriate field of study specifically focused on research and research ethics. Students submit documentation of Professional Enhancement activities to the SPH Office of Student Records. Instructions can be found here: https://publichealth.gwu.edu/academics/forms