Program Guide

Milken Institute School of Public Health THE GEORGE WASHINGTON UNIVERSITY	**Department of Biostatistics and Bioinformatics** **Bachelor of Science** **Health Data Science** Academic Year 2025 – 2026 All curriculum revisions will be updated immediately on the website http://www.publichealth.gwu.edu

Program Director

Name: Ali Rahnavard
Rank: Assistant Professor
Office Address: SEH 7570
Phone: (202) 994-2214
Email: rahnavard@gwu.edu

Mission

The mission of the Health Data Sciences (HDS) program is to prepare students for graduate school or employment in the health data science sector. Students will gain analytical skills and experience with designing, conducting, analyzing, and reporting studies utilizing health data. Data will include omics, epidemiological, environmental, biomedical, public health, and demographic data. The HDS program prepares students for immediate: post-graduate employment and/or entry into graduate programs in health data science, biostatistics, bioinformatics, computational biology, or other professional programs, including medical, dental, business (biotech, pharma), and law (biotech, pharma).

Program Overview

Advancements in innovative technologies and collaborations across the globe generate vast amounts of health and related data that enable our understanding of complex systems in human health, nature, behavior, society, and beyond. Exploring health data and finding evidence and patterns provide opportunities to make informed decisions. The HDS curriculum designs a roadmap of skills and training in learning from quantitative and qualitative data, forming questions, generating and evaluating hypotheses, and making inferences.

The major in Health Data Science will provide students with a solid foundation in data science, mathematics, computer science, health, and biology, enhanced by specially designed biostatistics and bioinformatics analytics and ethics courses. A hands-on program will enable students to apply analytic methods to various real-world applications, take the skills learned in the classroom and practice them in real-world problems, preparing them to address new challenges and questions.

Goals

The goals of the Bachelor of Science in Health Data Science are to ensure graduates can:

- Apply interdisciplinary knowledge of biostatistics, bioinformatics, computational biology, and health data science
- Design, conduct, analyze, and report results from experiments and other scientific studies
- Wrangle and manipulate data
- Effectively visualize data

- Analyze and interpret data
- Function effectively on multidisciplinary teams
- Integrate knowledge and experience across disciplines
- Communicate effectively
- Provide programming expertise to solve biomedical problems and answer biological questions

Program Specific Competencies

Upon completion of the Bachelor of Science in Health Data Science, students will possess the following functional competencies:

1. Identify important health-related problems and apply health data science as a method to find solutions [Relevant Courses: PUBH, 1010, 1101, 2110, 1142, 3131, 3151, 2110, 3131]

2. Generate and manage a health data science project as a solution to a health-related problem [Relevant Courses: PUBH 1142, 4202, 3232, 2242, 2103, 3242, 3199]

3. Design, apply, and use data gathering, analytical, and reporting technologies inherent to health data science projects [Relevant Courses: PUBH 3232, 2242, 2142, 3242, 2118, 3199]

4. Generate and interpret the results of health data science analyses [Relevant Courses: PUBH 2142, 2110, 2142, 2242, 3199]

5. Assess the potential impact of policy changes based on health data analytical insights from health and/or biomedical data ecosystems [Relevant Courses: PUBH 1101, 3131, 3242, 1142, 4202, STAT 2118, STAT 2183, STAT 4157, MATH 1231]

6. Develop skill sets as problem solvers and leaders in health data science [Relevant Courses: PUBH 1142, 3232, 2110, 2142, 2242, 2103, 3131, 3242, 4202]

7. Communicate the results of data science projects [Relevant Courses: PUBH 3242, 2142, 1101, 1101, 3131]

Milken Institute School of Public Health THE GEORGE WASHINGTON UNIVERSITY	**Milken Institute School of Public Health** **Bachelor of Science** **Health Data Science** **Program-at-a-Glance** **2025-2026**

Degree Requirements

There are four categories of Degree Requirements for all students: (1) University General Education Requirements*; (2) Health Data Science Core Courses; (3) Health Data Science Electives; and 4) General Electives. Students in the **Pre-medical Professional Concentration** will also take **Pre-medical Professional Concentration** requirements/recommended courses. Students take additional elective courses to reach the 120 total credits required to graduate. The Health Data Science program follows the University's General Education Requirements (20 credits). Students complete 34 credits in specified courses for the concentration. These courses are double counted in other categories and are not taken in addition to the 120 total credits for the graduation. For any listed course, its Writing in the Disciplines (WID) version is also accepted. See the University Bulletin website for the most up-to-date version of Gen Ed requirements and approved courses: http://bulletin.gwu.edu/university-regulations/general-education/

*Students must take one of the approved oral communications courses listed in APPENDIX at the end of the program guide.

Always see your advisor for course scheduling and sequencing strategies but remember that proper course selection, fulfilling requirements, and on-time graduation are your responsibilities.

SPH Double-Counting Policy

Students pursuing a second major may double-count up to three courses (maximum of 10 credits) toward their BS core requirements or guided electives. Students with a declared SPH major who pursue a minor may double-count up to two courses (maximum of 7 credits). Students may also double-count SPH undergraduate core courses toward another program's major or minor requirements, but only if the other program permits it. There are two exceptions to this policy:

- Double-Counting Across SPH Programs: Students who pursue a double major in two SPH programs will be permitted to double-count one additional course, for a maximum of 13 credits. SPH majors can similarly share three courses (maximum of 10 credits) with an SPH minor.
- BS Nutrition, Minor in Food Leadership: Students pursuing a minor in Food Leadership may only double-count EXNS 2119 Introduction to Nutrition Science (3 credits) toward both their BS in Nutrition requirements and the minor. No other Nutrition core requirements or guided electives may be double-counted.

Bachelor of Science in Health Data Science -No Concentration- Must Fulfill the Following Degree Requirements	
Requirement	**Credits**
General Education*	24
Health Data Science Core (see program curriculum)	37
Health Data Science Electives (pre-approved or approved by advisor) – Guided Electives	18
General Electives (to be chosen with advisor)	41
Total	**120**

Bachelor of Science in Health Data Science - Pre-medical Professional Concentration - Must Fulfill the Following Degree Requirements	
Requirement	**Credits**
General Education*	24
Health Data Science Core (see program curriculum)	37
Health Data Science Electives (pre-approved or approved by advisor) – Guided Electives	6
Concentration	34
General Electives (to be chosen with advisor)	19
Total	**120**

Students are strongly encouraged to consult the GW Schedule of Classes and meet with their advisor before finalizing their class schedule.

*Students must take one of the approved oral communications courses listed in APPENDIX at the end of the program guide.

Program Curriculum

Core Area	**Required Core HDS Courses – 37 credits**				
	Course number	**Course title**	**Credits**	**Prerequisites**	**Semester offered**
Programming and Data Processing	PUBH 4202	Bioinformatics Algorithms and Data Structures	3	PUBH 4201	Spr
Data Science	PUBH 1142	Introduction to Health Data Science	3	none	Fall
	PUBH 3232	Health Data Mining	3	(CSCI 1012, PUBH 4201, or STAT 1129) and (STAT 1051, STAT 1053, STAT 1111, or STAT 1127)	Spr
	PUBH 2242	Natural Language Processing for Healthcare	3	PUBH 1142	Fall
	PUBH 3242	Health Data Visualization	3	PUBH 1142	Spr
Biology	PUBH 2110	Public Health Biology	3	BISC 1005, BISC 1006, BISC1007, BISC 1008, BISC 1111, BISC 1112, or HONR 1033 in a biology topic	Fall, Spr
Probability and Statistics	PUBH 2142	Introductory Biostatistics	3	none	Fall, Spr

	STAT 4157	Introductory Probability (calculus based)	3	MATH 1232	Fall, Spr
	STAT 2183	Regression Analysis or Applied Statistical Methods	3	An introductory statistics course	Fall, Spr, Sum
Public Health	PUBH 1010	First-Year Experience in Public Health	1	none	Fall, Sum
	PUBH 1101	Introduction to Public Health and Health Services	3	none	Fall, Spr, Sum
	PUBH 3131	Epidemiology	3	PUBH 2142, STAT 1051, STAT 1053, STAT 1111, or STAT 1127	Fall, Spr
	PUBH 2140	Foundations of Research Methods	3	none	Fall, Spr
	TOTAL				**37 credits**

Pre-medical Professional Concentration		
Course Title	**Course Number**	**Credits**
Biology 2	BISC 1112	4
General Chemistry 1	CHEM 1111	4
General Chemistry 2	CHEM 1112	4
Organic Chemistry 1	CHEM 2151/2153	4
Organic Chemistry 2	CHEM 2152/2154	4
Introduction to Biochemistry	BISC 3261 or CHEM 3165	3
General physics 1	PHYS 1011 or 1021 or 1025	4
General physics 2	PHYS 1012 or 1022 or 1026	4
Psychology or Sociology	PSYC 1001 or SOC 1001	3
Total		**34**

Health Data Science Guided Electives

Biochemistry

BIOC 3820	Bioinformatics and Computational Biochemistry	2

Biological Sciences

BISC 1111	Biology: Cells & Molecules	4
BISC 1112	Introductory Biology: The Biology of Organisms	4
BISC 2207	Genetics	3
BISC 2213	Biology of Cancer	3
BISC 2214	Developmental Biology	3
BISC 2336	Introductory Microbiology	3
BISC 2583	Biology of Proteins	3
BISC 2585	Biometry	3
BISC 3261	Introductory Medical Biochemistry	3

Biomedical Engineering

BME 3825	Medical Measurement Laboratory	1
BME 4482	Medical Measurements	3

Computer Science

CSCI 1112	Algorithms and Data Structures	3
CSCI 1121	Introduction to C Programming	3
CSCI 1132	Data Structures and Software Design	3
CSCI 1311	Discrete Structures I	3
CSCI 2312	Discrete Structures II	3
CSCI 2441	Database Systems and Team Projects	3
CSCI 3212	Algorithms	4
CSCI 3362	Probability for Computer Science	3
CSCI 4314	Discrete Analysis-Computer Science	3
CSCI 4341	Continuous Algorithms	3
CSCI 4342	Computational Linear Algebra and Applications	3
CSCI 4364	Machine Learning	3
CSCI 4572	Computational Biology	3
CSCI 4576	Introduction to Biomedical Computing	3
CSCI 4577	Biomedical Computing	3

Data Science

DATS 2101	Ethical Life in a Digital World	3
DATS 2102	Data Visualization for Data Science	3
DATS 2103	Data Mining	
DATS 2104	Data Warehousing for Data Science	3

Economics

ECON 2123	Introduction to Econometrics	3
ECON 3105	Economic Forecasting	3
ECON 3148	Health Economics	3

Electrical and Computer Engineering

ECE 1120	C Programming for Electrical and Computer Engineering	3
ECE 1125	Data Structures and Algorithms for ECE	3
ECE 3220	Introduction to Digital Signal Processing	3
ECE 3225	Signal and Image Analysis	3

Mathematics

MATH 1231	Calculus 1	3
MATH 1232	Calculus 2	3
MATH 2184	Linear Algebra	3
MATH 2233	Multivariable Calculus	3
MATH 3125	Linear Algebra II	3
MATH 3342	Ordinary Differential Equations	3
MATH 3359	Introduction to Mathematical Modeling	3
MATH 3553	Introduction to Numerical Analysis	3

MATH 3740	Computational Complexity	3
MATH 4239	Real Analysis I	3
MATH 4240	Real Analysis II	3

Mechanical and Aerospace Engineering

MAE 1117	Introduction to Engineering Computations	3

Physics

PHYS 3100	Math Methods for Physics	3
PHYS 3181	Computational Physics	3

Chemistry

CHEM 3165	Biochemistry I	3

Public Health

PUBH 4201	Practical Computing	3
PUBH 3136 or PUBH 3151	Ethics in Public Health or Health Law	3
PUBH 3201	Introduction to Bioinformatics	3
PUBH 3202	Introduction to Genomics	3
PUBH 4199	Independent Study (capstone project)	3
PUBH 3995	Undergraduate Research	1-6

Statistics

STAT 2118	Regression Analysis	3
STAT 2123	Introduction to Econometrics	3
STAT 3119	Analysis of Variance	3
STAT 4158	Introduction to Mathematical Statistics II	3
STAT 418	Applied Time Series Analysis	3
STAT 4188	Nonparametric Statistics Inference	3
STAT 4189	Mathematical Probability and Applications I	3
STAT 4190	Mathematical Probability and Applications II	3
STAT 4197	Fundamentals of SAS Programming for Data Management	3

Sample Course Schedule for Bachelor of Science in Health Data Science

Fall 1	Credits		Spring 1	Credits
PUBH 1010	1		PUBH 1142	3
PUBH 1101	3		PUBH 2142	3
BISC 1111	4		PUBH 2110	3
MATH 1231	3		MATH 1232	3
UW 1020 - university writing (gen-ed req.)	4		Humanities gen-ed	3
Total	**15**			**16**

Fall 2	Credits		Spring 2	Credits
PUBH 4201	3		PUBH 4202	3
PUBH 3131	3		PUBH 3136	3
Social Science gen-ed 1	3		STAT 2183	3
Social Science gen-ed 2	3		elective	3
elective	3		elective	3
Total	**15**		**Total**	**15**

Fall 3	Credits		Spring 3	Credits
PUBH 3232	3		PUBH 3242	3
PUBH 2242	3		STAT 4157	3
elective	3		elective	3
elective	3		elective	3
elective	3		elective	3
Total	**15**		**Total**	**15**

Fall 4	Credits		Spring 4	Credits
PUBH 2140	3		capstone project or undergraduate research course	3
elective	3		elective	3
elective	3		elective	3
elective	3		elective	3
elective	3		elective	3
Total	**15**		**Total**	**15**

Admission

Incoming freshman and external transfer students may apply directly to the major through GW admissions. Internal transfer students accepted into the program matriculate in the semester following admission. We will accept transfers from students with a GPA of 2.75 or higher. Students should use the internal transfer form found on the Registrar's website: https://registrar.gwu.edu/undergraduate-internal-transfer. The internal transfer application deadline is October 15th in the fall semester and February 15th in the spring semester. Students follow the prescribed curriculum effective in the year that they matriculate into the BS in Health Data Science program.

Graduation Requirements

1. **Credit Requirement:** 120 credits are required.
2. **Course Requirements:** Successful completion of the Core Courses and the Program-Specific Courses are required.
3. **CITI Training requirement:** All students are required to 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. *(required for ALL SPH programs)*

4. **Integrity Quiz & Plagiarism Requirement**: All students are required to review the George Washington University Code of Academic Integrity and take the quiz within their first semester of study. The Code of Integrity and step-by-step instructions can be found here: http://publichealth.gwu.edu/integrity *(required for ALL SPH programs)*
5. Remember to submit your documentation before you apply to graduate! *(required for ALL SPH programs)*

Student Expectations and Policies

1. Consult your GWSPH Undergraduate Program Advisor prior to the first term's course registration and in future terms as needed. Students are expected to consult a program advisor in all matters affecting the program of study, such as substitutions or withdrawals.
2. Students following the PMP and pre-health concentration must consult with the University Pre-Health advising team (https://prehealth.gwu.edu/) regarding pre-health expectations and procedures.
3. Students must earn a C- or higher in all courses required for the major (core and elective) to graduate with a BSHDS major.
4. SPH Double-Counting Policy: Students pursuing a second major may double-count up to three courses (maximum of 10 credits) toward their BS core requirements or guided electives. Students with a declared SPH major who pursue a minor may double-count up to two courses (maximum of 7 credits). Students may also double-count SPH undergraduate core courses toward another program's major or minor requirements, but only if the other program permits it. There are two exceptions to this policy:
    a. Double-Counting Across SPH Programs: Students who pursue a double major in two SPH programs will be permitted to double-count one additional course, for a maximum of 13 credits. SPH majors can similarly share three courses (maximum of 10 credits) with an SPH minor.
    b. BS Nutrition, Minor in Food Leadership: Students pursuing a minor in Food Leadership may only double-count EXNS 2119 Introduction to Nutrition Science (3 credits) toward both their BS in Nutrition requirements and the minor. No other Nutrition core requirements or guided electives may be double-counted.
5. Students are responsible for reviewing, understanding, and following the policies and requirements as outlined in the Undergraduate Student Handbook (https://publichealth.gwu.edu/content/services-students)and the University's Bulletin (www.gwu.edu/~bulletin/).
6. Earn 120 total credits and satisfy all course requirements for the Health Data Science major and the **Pre-medical Professional Concentration** as listed above.

APPENDIX

Oral communication courses

- AMST 2450 History and Meaning of Higher Education in the United States (effective Fall 2021)
- AMST 2620 Human Mind and Artificial Intelligence (effective Spring 2018)
- ANTH 1004 Language in Culture and Society
- ANTH 3838/ANTH 3838W Theory and Practice in Archaeology
- CHEM 2118W Practicing Science Communications (effective Summer 2020)
- COMM 1040 Public Communication
- COMM 1041 Interpersonal Communication

- EAP 1010 Oral Academic Communication for International Students (effective Fall 2019)
- ENGL 1365 Literature and the Environment (effective Fall 2017)
- GER 2109 Advanced Conversation and Composition (effective Fall 2018)
- GER 2109W Advanced Conversation and Composition (effective Fall 2020)
- GTCH 2003 Step 1 and 2 Hybrid: Inquiry Approaches to Teaching and Lesson Design (new number effective Spring 2021) (formerly known as GTCH 1003) (effective Fall 2019)
- HONR 1034 Honors Seminar: Scientific Reasoning and Discovery (effective Spring 2018)
- ORSC 2000 Sophomore Colloquium: Diversity in Organizations (effective Spring 2018)
- SLHS 4201 Social Communication Development (ends effective Summer 2021)
- SOC 4195 Senior Research Seminar (effective Spring 2020)
- SOC 4195W Senior Research Seminar (effective Fall 2020)
- SPAN 3022 Advanced Oral Proficiency: Environmental and Social Sustainability in Latin America
- WLP 1020 Writing, Literature, and Society (effective Spring 2022)