GRADUATE STUDENT Handbook
Master of Science in Health Data Science 2024–2025
1 INTRODUCTION

This handbook describes the Master’s Degree Program in Health Data Science offered by the Department of Biostatistics at Harvard University. The SM program prepares graduates to handle “Big Data” in addressing the biomedical research questions that are becoming increasingly commonplace in hospitals and universities, research organizations, and the pharmaceutical and biotechnology industries. It can also provide the foundation for further doctoral studies.

The sections of this handbook include information and regulations concerning entrance requirements, program descriptions, degree requirements, and other program policies. Policies and official requirements of the School of Public Health are set forth in the Harvard T. H. Chan School of Public Health Student Handbook (https://www.hsph.harvard.edu/student-handbook/). Each graduate student is responsible for general knowledge of, and adherence to, the policies and requirements of the degree program in which the student is enrolled. Vitally important for our community is that all members demonstrate respect for each other and our discipline. For all members of the community, respect is demonstrated by attending all scheduled classes or meetings, and arriving on time, fully prepared, and ready to participate.

This handbook was prepared by the Executive Committee of the Program in Health Data Science. Dr. Heather Mattie is responsible for reviewing the student’s program of study, and has the authority to consider exceptions to the rules and regulations established by the Executive Committee. The Program Directors welcome suggestions and comments.
PROGRAM LEADERSHIP AND ADMINISTRATION

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Websites
Department of Biostatistics
2 Master of Science in Health Data Science

2.1 Core Competencies

This 60-credit program, offered by the Department of Biostatistics, is designed to provide students with targeted skills and knowledge required for work in health data science. These specific skills and knowledge domains are:

- Recognize study design and its scientific and/or societal context
- Practice data gathering, preparation, transformation, and exploration
- Prepare data visualization, presentation, and communication
- Employ appropriate computing paradigms for efficiency and reproducibility
- Evaluate modeling context, apply suitable models and methods, and interpret results

The SM in Health Data Science is intended as a terminal professional degree which will enable students to launch their careers in health-related data science. It can also provide the foundation for further doctoral studies in biostatistics or other quantitative or computational sciences with an emphasis in data science.

Students will receive training in quantitative methods, including applied regression, statistical inference, statistical computing, machine learning, statistical consultation and collaboration, and epidemiology.

2.2 Admissions Procedures and Requirements

2.2.1 Harvard T.H. Chan School of Public Health Requirements

Application for admission to the SM program is available online on the Admissions Office website (https://www.hsph.harvard.edu/admissions/admissions/how-to-apply/application-requirements/). For information on general requirements for admission, contact the Admissions Office by phone (617-432-1031) or through their website (https://www.hsph.harvard.edu/admissions/).

2.2.2 Program Requirements

All candidates for admission to the SM in Health Data Science program must have the following:

- An undergraduate degree in the mathematical sciences or allied fields (statistics, economics, etc.) or computer science, with a strong interest in health science,
- Practical knowledge of computer scripting and programming, as well as experience with a statistical computing language such as R or Python,
- Calculus through multivariable integration,
- One semester of linear algebra or matrix methods, and
- Excellent written and spoken English.

Additional research or work experience would be considered beneficial, but not required.

Evidence that these requirements have been fulfilled should form part of the application.

If candidates have questions about whether their coursework is meeting the requirements above, we recommend that they look at the required courses for the program in this handbook and decide. Also, we generally prefer in-person courses for such requirements, but if you choose an online course from platforms like edX or Coursera, such is only acceptable if the material and assessments are comparable to an in-person university course. See this linked list of examples for comparison. If the courses taken do not have the titles mentioned above (like linear algebra or multivariable calculus), then make sure to explain in your statement of purpose in the application which courses you have taken that covered the materials. Please include dates taken, grades received, and institution (whether online or not) in the statement as well.
2.3 Intra/Inter-departmental Biostatistics Degree Program Switch Protocol

The Department of Biostatistics, and several other academic departments at the School (such as Epidemiology), offer master’s degree programs. These programs each have their own goals and requirements and make independent decisions about admissions. Students should carefully choose the program to which they apply and we expect students admitted to a program to meet the requirements of that program.

However, we recognize that the interests of some students may change during their time in graduate school. Therefore, the Department has established the following procedure for students applying for a change in program. This applies to students applying for a switch within the Department of Biostatistics, or between the Department of Biostatistics and another department at the School, such as Epidemiology. Please note that transfers between programs are not automatic and may not be approved, and if a student has received a scholarship or other funds from a degree program, that funding will not transfer to the new degree.

1. Students must complete at least one full semester of coursework before applying for a program transfer.

2. Students must enroll in and successfully pass any required coursework for their current program before beginning the transfer process. Please see your current degree program handbook for a list of required coursework. Students may also need to complete coursework in their proposed program so as to not fall behind in requirements to finish their program on time if approved for transfer.

3. Students must complete and submit a formal application and include an updated statement of purpose describing the reason for seeking a program transfer, current CV and one letter of recommendation.

4. The Directors of department master’s programs, including the Directors of the student’s current program and prospective program, will schedule an interview with the students to assess their application. At the meeting, students will provide a copy of their CV and statement of purpose to the program director(s), and will briefly explain their decision to apply for a transfer. The Directors will consider the applications and render a decision whether to approve or deny the transfer. These meetings will be scheduled in early January for students applying for transfer to start in the Spring semester, and in late May for students applying to transfer after the Spring semester.

5. The Directors will discuss and notify the student of their decision within three days. All decisions are final, and students are not allowed to reapply.

6. If approved, completed paperwork must be submitted to the Registrar’s Office, and then to the Senior Manager of Academic Services.

Note that all program transfers are at the discretion of the program Directors and are not guaranteed. If approved, students will be assigned a new academic advisor affiliated with the chosen degree program. It is the responsibility of the students to ensure that they complete all requirements for their degree program.

2.4 Curricular Practical Training (CPT) Approval for Students with F-1 Visas

To be considered CPT, the work must not only be related to the student’s major field of study but must also be an integral part of an established curriculum. Before seeking off-campus internship opportunities, students are required to discuss their plans with Elizabeth Capuano (elizabeth.capuano@harvard.edu), our representative at the Harvard International Office (HIO), to determine their CPT eligibility.

There are two ways in which students are eligible for CPT:

1. Employment that is a required part of a degree program, such as a thesis or capstone. This requirement must be formally documented in school publications, such as a student handbook.
2. Employment that is not required by a degree program, but for which a program will award academic credits. This could include training courses such as a field studies course, or an independent study (see Section 2.5) course that is based on an internship.

Students are also required to speak to one of their program directors about whether their employment would qualify for academic credits, as the academic credits are required for CPT authorization. In order to be a CPT-eligible opportunity, any internship, work experience or independent study must be quantitative in nature and in health care or a related sector (medical device companies, pharma, biotech, health-related consulting, health-tech, non-profit health organizations such as hospitals or NGOs, government health sector, business health, health policy, etc.). Roles in banking, finance, hedge funds, general consulting, etc., would not be eligible unless the work directly involves health-related data, questions, and applications. For example, working for a consulting firm may be acceptable provided that ALL project work is clearly based in the health care sector. This work must be described in full with clear, complete connections to health care or public health in order to be eligible for any CPT-related academic credits. When contacting the program directors, please complete the HDS CPT Project Proposal form to submit to them for review (see details about submission in Section 2.5). If CPT eligibility is established, please note that students MUST obtain CPT authorization PRIOR to beginning the internship. If doing a summer internship for academic credit, students must sign up for BST 305 CPT-Related Independent Study (Section 2.5) during the summer, or in the following fall semester.

The most up-to-date information about CPT will be found here (https://www.hio.harvard.edu/curricular-practical-training-cpt), and students must review this information before speaking with Elizabeth. Please click on the link for the CPT Instructions and Application - HSPH, read the information, and view the video linked there.

2.5 Independent Studies

2.5.1 General Independent Study

For independent study not related to a required thesis project or curricular practical training (CPT), the student should discuss with the chosen supervisor the credit hours needed (usually 2.5 credits per term*), and the scope of the work involved before enrolling. The student should submit a 1-page proposal of the work to be done during this project into a Qualtrics survey designed to capture the information. If the direct supervisor is not at the School, you’ll need to find a department faculty member here who will agree to review your progress, even if they are not involved in the project day-to-day. This person can be your academic advisor, one of the program directors, or any other member of the executive committee (Page 2). To register for independent study, the student should sign up for a section of BST 300 with Dr. Brent Coull (who is the Associate Chair). For information about how to enroll and how many credits you should take, please see the Registrar’s Office website link about independent study credits (including work expectations to credit allotment).

2.5.2 CPT-related Independent Study

For independent study related to curricular practical training (CPT), the student should follow the instructions of Section 2.4, and submit a 1-page proposal of the work to be done during this CPT project into a Qualtrics survey designed to capture the information, along with the information required by the Harvard International Office (HIO). Program directors will need both before approving the CPT work. If the direct supervisor is not at the School, you’ll need to find a department faculty member here who will agree to review your progress, even if they are not involved in the project day-to-day. This person can be your academic advisor, one of the program directors, or any other member of the executive committee (Page 2). To register for independent study, the student should sign up for a section of BST 305 with Dr. Brent Coull (who is the Associate Chair). For information about how to enroll and how many credits you should take,

*Students may enroll in a maximum of 5 credits of independent study for the degree program.
please see the Registrar’s Office website link about research credits (including work expectations to credit allotment).

For either of these options for independent study, at the end of the study, students should submit a 1-page report on the work done, signed by their off-campus direct supervisor (if applicable). Both the proposal and the report should tie back to the competencies of the degree program (listed in Section 2.1 of this handbook).

2.6 Change to Part-Time Study / Leave of Absence

If students find it necessary to change their status, they may do so by submitting a General Petition to the Registrar’s Office. Part-time master of science students may take fewer than 15 credits per term. Please read the information found at the Student Knowledge Center about changing your status (https://www.hsph.harvard.edu/r-o-student-knowledge-center/changing-full-time-part-time-status/).

Because of the core course schedule for the HDS degree program, you need to be aware that if you take a leave of absence from the program, you should take a full year, and not just a semester. Taking a semester will disrupt your ability to complete the program in time, and you may have to pay a continuation fee or a full semester’s worth of tuition for the extension needed. Please check with the Registrar’s Office to confirm the charge that may be added.

2.7 Program Extension

Occasionally students may need to extend the program to four semesters. In general, if there is not a documented physical or mental health reason for an extension, the extension petition will be denied and the student will be forced to complete all degree credit requirements in three semesters, or risk not graduating. If research projects or outside work are preventing a student from completing their coursework in a reasonable timeframe, they should prioritize their coursework and may need to drop any outside projects.

Students who think they may need to petition for an extension should first contact Dr. Mattie to discuss the reason for the extension. If Dr. Mattie thinks an extension is warranted, students must then submit a petition for an extension that includes their reason for an extension along with a proposed course schedule for the remaining semesters of the degree, including the extra semester. Students must have completed less than 60 credits in the first three semesters to petition for an extension. International students will also need to discuss the implications of an extension with the Harvard International Office. If an extension petition is approved by both HDS program directors and the Registrar’s Office, there is a $3,381 continuation fee (subject to change), and the possibility of paying extra tuition. Students with an approved extension may only enroll in the number of credits needed to complete their degree requirements in the fourth semester.

2.8 Advising and Degree Program Approval

2.8.1 Academic Advisor

All entering students are assigned an academic advisor to help plan course loads and explain program requirements. At the earliest possible date, the student and the academic advisor will develop a program of study. Should a student wish to change their academic advisor, they are encouraged to discuss this with Dr. Mattie. In addition, SPH provides services for all students with clinically documented learning and/or physical disabilities.

2.8.2 Departmental Approval of Program

The Master’s degree program plan must be submitted to the student’s academic advisor and Dr. Mattie, for approval by the Executive Committee, using the Master’s Degree Program form provided. This plan should be submitted at least one semester prior to your expected graduation date.
2.8.3 Epidemiology Requirement

The School of Public Health requires that Master’s students successfully pass one epidemiology course. The program requires that EPI 201 (Fall 1, 2.5 credits) be taken to satisfy this requirement in the first semester of the degree program. If the student has the background (having taken a graduate-level course in epidemiology), the School will allow them to waive this requirement. There will be an announcement about how to do this sent in email over the summer every year.

2.8.4 Public Health Practice Requirement

Students may be required to take a public health course by the School of Public Health as part of their accreditation requirements. These requirements will be communicated to all incoming students by the School of Public Health directly.

2.8.5 Research Ethics Requirement

Students must satisfy a research ethics requirement by completing a course in responsible conduct of research or by completing an online training course during the first year in the program. Students who feel they have already completed an equivalent training program must submit adequate documentation to, and receive approval from, the Senior Manager of Academic Services in Biostatistics (see contact list on page 1) during the first semester in residence.

2.9 Teaching Fellow Guidelines

The department’s current Teaching Fellow Guidelines may be found here (https://hsph.me/TF_Guidelines.pdf). If you are assigned a teaching fellow appointment, please reference this document to understand the policies surrounding teaching at the department and the School.

2.10 Satisfactory Progress Requirements

For students in the program, a total of 60 credits are required with a minimum of 55 ordinal credits from the core courses, computer science courses, and electives listed in Section 2.11.1, the epidemiology requirement in Section 2.8.3, and the Health Data Science Capstone Course in Section 2.11.2. In addition, SPH students must remain in good academic standing, must complete program requirements within the designated time to degree, and must maintain a cumulative grade point average of 2.70 or above. All ordinal grades for courses used to satisfy program requirements specified in Section 2.11.1 and Section 2.11.2 must be at the level of B- or higher. Courses taken on a pass/fail basis cannot be used to satisfy ordinally graded program requirements.

A detailed presentation of SPH’s policies for Master’s students is found at https://www.hsph.harvard.edu/student-handbook/. All Master’s students and their advisors should make sure that SPH and HDS program requirements are met according to schedule.

2.11 Degree Requirements

A total of 60 credits are required for the SM60 in Health Data Science. Students with prior equivalent background to any of the required courses or strong reasons to take a different course can request permission from Dr. Mattie, for approval by the Executive Committee, for a substitution of one or more of the required courses. Students should submit a degree program form to Dr. Mattie at least one semester prior to their expected graduation date.

2.11.1 Course Requirements for the Health Data Science SM60 Degree

The degree requirements include a 20 credit ordinally graded core curriculum consisting of:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>BST 222</td>
<td>Basics of Statistical Inference (Fall, 5 credits)</td>
<td></td>
</tr>
<tr>
<td>BST 260</td>
<td>Introduction to Data Science (Fall, 5 credits)</td>
<td></td>
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</tbody>
</table>
BST 261 Data Science II (Spring 2, 2.5 credits)
BST 262 Computing for Big Data (Fall 2, 2.5 credits)
BST 263 Statistical Learning (Spring, 5 credits)

An additional five ordinal credits must be taken in computer science from the following list

BST 221 Applied Data Structures and Algorithms (5 credits)
BST 249 Bayesian Methodology in Biostatistics (5 credits)
BST 281 Genomic Data Manipulation (5 credits)
BST 282 Introduction to Computational Biology and Bioinformatics (5 credits)
APMTH 120 Applied Linear Algebra and Big Data (5 credits)
APMTH 207 Advanced Scientific Computing: Stochastic Methods for Data Analysis, Inference and Optimization (5 credits)

or

STAT 220 Bayesian Data Analysis (5 credits)

BST 223 Applied Survival Analysis (5 credits)
BST 226 Applied Longitudinal Analysis (5 credits)
BST 227 Introduction to Statistical Genetics (2.5 credits)
BST 228 Applied Bayesian Analysis (5 credits)
BST 267 Introduction to Social and Biological Networks (2.5 credits)
BST 273 Introduction to Programming (2.5 credits)
BST 280 Introductory Genomics & Bioinformatics for Health Research (2.5 credits)
BST 283 Cancer Genome Data Science (5 credits)
EPI 202 Epidemiologic Methods 2: Elements of Epidemiologic Research (2.5 credits)
EPI 203 Study Design in Epidemiologic Research (2.5 credits)
EPI 204 Analysis of Case-Control, Cohort and Other Epidemiologic Data (2.5 credits)
EPI 233 Research Synthesis & Meta-Analysis (2.5 credits)
EPI 271 Propensity Score Analysis: Theoretical & Practical Considerations (1.25 credits)
EPI 286 Database Analytics in Pharmacoepidemiology (2.5 credits)
EPI 288 Introduction to Machine Learning and Risk Prediction (2.5 credits)
EPI 293 Analysis of Genetic Association Studies (2.5 credits)
EPI 511 Advanced Population and Medical Genetics (5 credits)
RDS 280 Decision Analysis for Health and Medical Practices (2.5 credits)
RDS 282 Economic Evaluation of Health Policy and Program Management (2.5 credits)
RDS 285 Decision Analysis Methods in Public Health and Medicine (2.5 credits)
APCOMP 221 Critical Thinking in Data Science (5 credits)
BMI 701 Foundations of Biomedical Informatics I (5 credits)
BMI 706 Data Visualization for Biomedical Applications (2.5 credits)
BMI 708 Precision Medicine: Integrating Clinical and Genomic Data (2.5 credits)
APCOMP 209A  Data Science 1: Introduction to Data Science (5 credits)
APCOMP 209B  Data Science 2: Advanced Topics in Data Science (5 credits)
HST  .953   Clinical Data Learning, Visualization, and Deployments (5 credits)
MIT  6.8610  Quantitative Methods for Natural Language Processing (5 credits)
MIT  6.7930  Machine Learning for Healthcare [aka HST .956] (5 credits)
STAT 117    Data Analysis in Modern Biostatistics (5 credits)
STAT 131    Introduction to Time Series & Prediction (5 credits)

1Not all courses in this list will be offered every year.

Other courses may also be acceptable. EPI 201 (see Section 2.8.3) and HDSC 325 (see Section 2.11.2) will count toward the 55-credit ordinal courses required. Courses offered to only undergrads are not allowed to be taken for credit by SPH. Because MIT does change course numbers often, please check to make sure that the course has not changed to 'undergrad only'.

Note that a maximum of half your total credits per semester can be cross-registered courses without special permission, and a maximum of half of your required 60 credits can be cross-registered courses. This is a School policy.

If you need cross-registration credit conversion, see: https://www.hsph.harvard.edu/r-o-student-knowledge-center/. Students are advised to consult with Dr. Mattie about any substitutions. To request a substitution, first students should email graduate program coordinator, David Cruikshank, to determine if the course has been approved before. If not, then students should email Dr. Mattie with their reasons for the request (please cc David so that he may file the information for the final degree audit).

2.11.2 Health Data Science Capstone

The health data science capstone course will provide a culminating research experience that tests all competencies through a hands-on semester-long project-based research course (7.5 credits). This course will allow students to immerse themselves in multiple health data science projects in public health and biomedical science.

HDSC 325 Health Data Science Capstone Course (7.5 credits)

The course will be taught by a faculty member who directs an AI team for a clinical department at a major academic hospital. The overall objective of this course is to allow students to integrate and apply various methods introduced in previous core coursework in the Health Data Science program to different real-world data sets across knowledge domains, and to learn the intricacies of building data science solutions for real-world workflows and applications. The course has three main pillars: 1) a mentored semester-long group project; 2) a set of lectures and assignments on how to apply data science solutions into the real world, and 3) career development topics and special advanced topics in data science.

Students will be assigned to teams of 2-3 individuals. Each team will be assigned an affiliate mentor (from Harvard or similar institutions) who will grant access to data at the mentor’s respective institution and assign a semester-long project. Each team will be expected to work on the project outside of class and meet with their project mentor regularly. Course instructors will also regularly check-in with students and project mentors to ensure appropriate project expectations and progress. Teams will also be responsible for 1-2 presentations on the progress of the project before the final presentation of the project on the last day of class. Teams will be expected to complete a project analysis plan, project abstract and final project report including all code and visualizations. Additionally, students will work on a project implementation plan to think through how to apply a project into the real world.
3 ADMINISTRATIVE TIMELINE

Detailed requirements and deadlines for degree completion are given on the Harvard T.H. Chan School of Public Health webpage. All forms linked below are also located on the last page of this Graduate Student Handbook.

- Summer Before Entering Program
  - Take optional R/Python Programming Bootcamp/EdX online course.

- Year One
  - First Semester
    - Complete Research Ethics requirement by taking the free online CITI program or attending HPM 548 (See section 2.8.5). You will receive a reminder about where to find the online course before beginning the Fall term.
    - If planning to waive courses, ask for those waivers of Fall core courses by emailing Dr. Mattie and David Cruikshank with details about the course(s) taken or experience that may qualify for a waiver by the end of the first week of classes in Fall. To waive EPI 201 which is a school-wide core requirement, students must submit this Waiver of Core Courses Form through the online form for approval before August 1, and then submit signed approval form through my.harvard to the Registrar’s Office.

  - Second Semester
    - Complete or waive Spring core courses.
    - Turn in the final program form by May 10.

- Year Two
  - Third Semester
    - Take HDSC 325 Health Data Science Capstone Course.

4 PROGRAM FORMS

- HDS SM60 Degree Program Form
  https://hsph.me/SM60_Degree_Form_HDS.pdf

- HDS CPT Independent Study Proposal Form
  https://hsph.me/HDS_CPT_ProjectProposal.pdf

- HDS Independent Study Proposal Form
  https://hsph.me/HDS_Independent_Study_ProjectProposal.pdf