University of Pennsylvania Perelman School of Medicine

Graduate Group in Epidemiology & Biostatistics Faculty and

Student Handbook

2023-2024

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1   Introduction

This handbook serves as a reference manual for the masters and doctoral programs in biostatistics and the doctoral program in epidemiology at the University of Pennsylvania. It covers the graduate experience, from admission through required course work, examinations, and the MS thesis (biostatistics), and PhD dissertation in both programs. This is a living document; please bring errors and omissions to the attention of the Chair of the Graduate Group in Epidemiology and Biostatistics, or to the Chairs of the respective programs.

Many people made essential contributions to this handbook, most prominently: Eli Elliott; Drs. Nandita Mitra, John Holmes, Mary Putt, Hongzhe Li, Marcella Devoto, Harold Feldman, Stephen Kimmel, J. Richard Landis, Mingyao Li, Daniel Heitjan, Phyllis Gimotty, Kathleen Propert, Scarlett Bellamy, Mary Sammel, Amanda Hyre-Anderson, Adam Naj, Michael Harhay, Taki Shinohara, Ebbing Lautenbach, John Farrar, and Theoklis Zaoutis. We would also like to thank Catherine Vallejo, Marissa Fox, Jennifer Kuklinski, Gabrielle Ostapovich, Thomas Kelly, and Ann Facciolo.

Many others contributed in ways large and small, not least the students in the doctoral program, whose many relevant questions and experiences have led us to review our policies, consider their implications, and write them down clearly. We thank them especially and wish them the best in all their endeavors, at Penn and beyond.

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2   Graduate Group in Epidemiology and Biostatistics

2.1   Overview

The Graduate Group in Epidemiology and Biostatistics (GGEB) is responsible for developing and administering the PhD degree programs in epidemiology and biostatistics as well as the MS program in biostatistics. The PhD programs train individuals to be rigorous and independent academic investigators, who apply and extend the range of approaches available in epidemiology and biostatistics to address questions in biomedical research. The objective of the MS program in biostatistics is to train individuals in the basic theory and applications of statistical methods, especially as applied to problems in the health sciences.

The GGEB is a member of the Biomedical Graduate Studies Program (BGS) in the Perelman School of Medicine of the University of Pennsylvania. It is comprised of faculty from across the university with interests in biostatistics and epidemiology. Notably, many of the members of the Graduate Group have academic appointments within the Department of Biostatistics, Epidemiology and Informatics (DBEI). The Office of Biomedical Graduate Studies provides oversight and coordination for the GGEB and six other graduate groups offering PhD degrees in the biomedical sciences.

Biomedical Graduate Studies (BGS) was established in 1985 and serves as the academic home within the University of Pennsylvania for roughly 700 students pursuing a PhD in the basic biomedical sciences. Although BGS is housed within the School of Medicine, it is composed of more than 750 faculty members across seven Penn schools and several associated institutes. BGS provides training and administration through seven graduate groups, some of which have distinct sub-specialty areas. Each graduate group has its own training mission, leadership, and staff, but there is often significant overlap among the groups in respect to faculty membership, courses offered, policies, and procedures. BGS provides centralized support to the graduate groups for admissions, student fellowships, curricular oversight, record-keeping, and other operations.

Additional up-to-date information about BGS is available at http://www.med.upenn.edu/bgs/.

3   Application and Admission

3.1   Affirmative Action

The GGEB values diversity and seeks talented students from all backgrounds. The GGEB does not discriminate on the basis of color, sex, sexual orientation, religion, national or ethnic origin, age, disability, or status as a disabled or Vietnam Era veteran in the administration of its educational policies, programs or activities, admissions policies and procedures, and scholarship programs. Women and minorities are especially encouraged to apply to the GGEB's educational programs.

3.2   The Application Process: All GGEB Programs

Applicants must complete the standard online BGS application form and upload the following documents:

- **Personal Statement** – This statement discusses the applicant's academic and career objectives. It should be around 500 words in length. Applicants are asked to be as specific as they can about the area in which they plan to study and your reasons for wishing to study at the University of Pennsylvania. In addition, if they are applying to a certificate program, their personal statement should include a paragraph (~200 words) reflecting their interest in those programs in addition to the doctoral discipline.
- **Research Statement** – This provides a description of their research experience(s), including the goals of each project, approaches used, results obtained, and implications of the findings for the project and the field at large. You may choose to describe a single research experience or several experiences, but please limit your statement to around 1000 words in length.
- **Resume/CV** (Please *DO NOT* include GPA and/or GRE information)
- **Transcripts** - All BGS applicants are required to upload up-to-date unofficial transcripts from all institutions attended. These transcripts must include the most immediate Spring semester grades and indicate the courses they are enrolled in for the current Fall semester. Transcripts from completed programs should show proof of degree conferral. A final, official transcript showing conferral of degree will be required of all accepted students prior to matriculation.
- **Letters of Recommendation** - Applicants will also be prompted to send requests to three (3) people who are able to provide letters of recommendation. They will be sent an email notification with a link to the online recommendation form, which will allow them to upload a PDF of the letter. The letters should identify personal attributes, experiences, accomplishments, and goals relevant to success in graduate study in biostatistics or epidemiology, depending on the program. Applicants who are currently enrolled in a degree program must arrange for at least one letter of recommendation to be sent from a faculty member in that program.

- **Standardized Test Scores** – BGS no longer requires applicants to submit GRE scores but does require an English proficiency exam (either the TOEFL or the IELTS) for applicants for whom English is not their native language. TOEFL scores should be sent directly from the testing service. As part of the review process, Penn will waive the English Proficiency requirement for applicants who have or will have obtained a degree from a US or other approved English-instructed institution. There are no minimum score requirements. For an application to be considered complete, official score reports must be received by the application deadline. To ensure that official scores are received in time, we suggest that applicants take the exam no later than mid-November.

3.2.1 Waiver of Fees for the Application

U.S. citizens and permanent residents may request a waiver in cases of documented financial hardship. To request a waiver, email the admissions coordinator for BGS prior to submitting your application (bgs@pennmedicine.upenn.edu). Explain your situation and reasons for requesting a waiver of fees. The coordinator may ask for additional documentation e.g. documentation by the Financial Aid Officer from a relevant undergraduate institution, or, if not applicable, documentation of information about income, assets, family situation, etc. University rules prevent the waiver of application fees for international applicants.

3.2.2 Graduate Record Examination (GRE)

As of fall 2018, we no longer require GRE scores.

3.2.3 Test of English as a Foreign Language (TOEFL)

All applicants whose native language is not English must arrange for ETS to submit an official TOEFL score as part of the application by the application deadline. The TOEFL requirement is waived for a student who has been enrolled in an English-speaking university for at least two years upon application. TOEFL scores are valid for two years.

3.2.4 Application Deadline and Notification

Students are admitted once per year, for the fall term. Information and application materials are available by October of the preceding year with a typical application deadline of December 1 (please check the on-line application form for the exact date for the year that you are applying). After reviewing the files, the Admissions Committee for the individual programs recommends candidates for the GGEB to the BGS Admissions Committee and the Director of BGS. Students are usually notified of admissions decisions by the end of March.

3.2.5 Initiating an Application

Those interested in applying for admission to graduate study can access the online application through https://www.med.upenn.edu/bgs/. For questions on the application process contact the Coordinator:

Eli Elliott
Coordinator, Graduate Group in Epidemiology and Biostatistics
Perelman School of Medicine at the University of Pennsylvania
E-mail: Eli.Elliott@Pennmedicine.upenn.edu

3.3 Admission Requirements Specific to the Biostatistics Programs

Entering students must have completed at least one year of calculus (including multivariable methods), one semester of linear algebra, and have a working knowledge of a programming language. Previous experience with data analysis and statistical packages is desirable but not required. Advanced courses in mathematics are particularly important for students who intend to pursue the PhD degree.

3.3.1 Applicants from the MS Program

Students in the Biostatistics MS program who seek admission to the Biostatistics PhD program must submit a formal application. Typically, such students apply in the fall preceding their projected graduation with the MS. Results on the written qualifications examination are considered in the admission decision (see the section on "Evaluations and Examinations").

3.4 Admission Requirements Specific to the PhD Program in Epidemiology

Applicants must demonstrate prior training and experience in epidemiology, clinical sciences, or a public health-related field. This requirement can be satisfied by having a Master's degree in public health, epidemiology, biostatistics, or related field, OR at least two years of relevant work experience. Individuals admitted without clinical or other biomedical training may be required to take biomedical science courses in addition to the courses required for the PhD in Epidemiology. These courses will not count as electives and must be taken in addition to the required courses and credits. The Admission Committee will determine the need for additional courses at the time of acceptance.

Each student admitted to the program will be adjudicated by the Admissions Committee as having either "*adequate prior training*" or "*additional training required*", with areas for which additional training are required specified included in the documentation on admitted students shared by the Admissions Committee chair with the Epidemiology Doctoral Program Chair. For those admitted without prior clinical or other biomedical training, the doctoral program chair will convene an *ad hoc* committee consisting of the student's anticipated academic advisor and two (2) additional epidemiologists selected by the chair and advisor who are members of the Graduate Group. The advisor will be responsible for identifying those two faculty members. At least one of the three members of this committee must hold a clinical doctorate and at least one member of the committee must hold a doctorate in epidemiology or a related field without a clinical doctorate. This committee will identify specific courses to be taken based on a review of the candidate's academic record/transcripts and research interests as well as interactions with the candidate. The candidate will be informed of the additional required courses prior to first

semester enrollment by the academic advisor, and documentation of the committee's decision will be shared with the doctoral program academic coordinator. Additional coursework may increase the amount of time it takes for the candidate to successfully complete the PhD degree requirements.

Combined degree (MD-PhD, VMD-PhD, and DMD-PhD) applicants are exempt from this requirement since they will have had at least two years of relevant coursework in their professional degree program prior to starting coursework for the PhD.

4   Financial Obligations and Support

Tuition costs are determined each year and a memorandum of expected costs is shared via email with all members of the graduate group. The Trustees of the University of Pennsylvania reserve the right to increase tuition and fees and to otherwise amend the regulations concerning tuition and fees at any time and to make such changes applicable to students in the University at that time.

PhD students are guaranteed funding for the first five (5) years of their program provided they maintain an average GPA greater than or equal to 2.75 on a 4.0 scale (equivalent to a "B-"); for students with average GPAs below that threshold, funding is provided provisionally and contingent on completion of requirements of an academic remediation plan. Students first receive up to 21 months of funding from BGS covering their tuition, certain expenses, and stipend their first and second academic years and the summer semester between (except where students are funded through other sources including fellowships and the MSTP program). During these initial 21 months, students identify a dissertation advisor and work with the advisor and the program to develop a funding plan for the remainder of their graduate program. Most PhD students receive financial support through one or more of the following sources: assistantships supported by research grants, training grant fellowships, and fellowships from research institutions or private industry. A limited number of teaching assistantships which may provide financial compensation are available. These and other sources of financial support are described in more detail below. Students who receive full-time support may accept no additional employment during the period of the support. Support for Biostatistics MS students depends on the availability of funds, with priority given to PhD students.

All rotation mentors and dissertation advisors of PhD students must acknowledge by signature on documentation kept with the PhD program coordinator their willingness to be responsible for ensuring the funding of those students after the completion of their second academic year in the program when BGS funding concludes.

Note: This does not formally require rotation mentors or dissertation advisors to assume <u>direct</u> financial responsibility for students. However a funding source, whether training grants, scholarships, fellowships, or support from other Penn faculty member must be available to cover all student tuition costs, stipends, and related expenses; in the case of dissertation advisors, these must be formally identified prior to June 30th of the second year in the PhD program and shared with the PhD program coordinator.

For rotation mentors and dissertation advisors who are unaware of whether they have adequate funds or resources to support PhD students, a request can be made with appropriate PSOM departmental business offices to assess financial capacity to fund students for three academic years and any findings should be made available to the PhD program coordinator to record this information.

PhD students in combined degree programs at Penn (including MD-PhD, VMD-PhD, and DMD-

PhD programs of the Medical Scientist Training Program (MSTP)) receive financial support from the program until June 30th of their first year in the PhD phase of their program and are supported by their dissertation advisors starting from July 1 of the same year. As with other PhD students, dissertation advisors should plan for three years of financial support for these students during their PhD phase.

Additional financial liabilities for rotation mentors *may* include (a) costs of scientific society memberships; (b) costs of travel, presentation, and attendance at scientific conferences at which students are presenting work performed on projects of the rotation mentor or dissertation advisor; and (c) costs of scientific publication or other presentations of findings of work performed on the projects of the rotation mentor or dissertation advisor. These costs should be factored into financial considerations for supporting PhD students during and after rotations and for dissertation advisors during the dissertation phase of their training. Student travel funds may be available to mitigate costs for attendance of scientific meetings (see section **5.5**).

Any potential rotation mentors and/or dissertation advisors are strongly recommended to reach out to the PhD program coordinator and respective business offices to assess their financial capacity to support PhD trainees.

4.1   Financial Aid

The University's Office of Student Financial Services provides information on student expenses and billing; processes financial aid applications, awards financial assistance; and administers the Penn Plan payment programs. Students may contact the Office directly at:

Office of Student Financial Services
University of Pennsylvania
Room 100 Franklin Building
3451 Walnut Street
Philadelphia, PA 19104-6270
Tel: 215-898 -1988
Email: sfsmail@SFS.upenn.edu

5   Resources for Students

5.1   PennCard

The PennCard is the official identification card of the University of Pennsylvania. The PennCard Center is located on the second floor of the Penn Bookstore, 3601 Walnut Street. A valid, government-issued photo identification is required to receive a PennCard. The first issued PennCard is free, while any replacement cards may incur additional fees. Information about the PennCard, its availability, and its uses are provided at http://cms.business-services.upenn.edu/penncard/home.html.

5.2   PennKey

The PennKey username and password provides access to PennNet, the University's network permitting wired and wireless network access; Penn e-mail accounts, including Penn Medicine and UPHS domains; and many other essential services managed through the PhD program and around Penn. All students are required to have a current, active PennKey username and password. Students are issued a PennKey Setup Code when they pick up their PennCard.

5.3   The PennPortal

The PennPortal webpage bundles together links to important information for students. To access the PennPortal (located at https://portal.apps.upenn.edu/penn_portal/portal.php, students should log in with their PennKey username and password. If the "Graduate Students" tab does not automatically appear, students should click on the "My Tabs" button to add the "Graduate Students" tab from the list of available tabs.

5.4   Health Care Coverage

Penn students are automatically eligible for Penn Student Health Services and Chickering Health Insurance. Once a student has matriculated, the University will assume that this health coverage is needed and they will bill for the service. Students who wish to waive the Penn sponsored insurance should do so at [http://medley.isc- seo.upenn.edu/penn_portal/portal.php](http://medley.isc-seo.upenn.edu/penn_portal/portal.php) to do so. It is necessary that students watch their bill to ensure that no health insurance fee is incurred. If one is charged to the student account, the GGEB Academic Coordinator should be notified.

5.5   Student Travel Funds

BGS allows doctoral students to apply for partial reimbursement (currently, up to $1,000/year) for travel to professional meetings if they are making a presentation. Applicants must justify the expenses prior to attending the meetings. Dissertation advisors are expected to augment these travel funds. In addition, some training grants provide funds for student travel. Information and application are at http://www.med.upenn.edu/bgs/travel_funds.shtml

6 Academic Policies

Students in the PhD programs are subject to academic policies of BGS (detailed at https://www.med.upenn.edu/bgs/assets/user-content/new-student-information/expectationsofbgsstudents2019-1.pdf as well as the specific policies of the GGEB and PhD program as defined below. Certain policies may not apply to GGEB Biostatistics MS students; questions about which policies are valid for these students should be addressed to the Biostatistics Program Chair and the GGEB Academic Coordinator.

6.1 Code of Conduct and Academic Integrity

6.1.1 Code of General Conduct

All BGS students must conduct themselves at all times in a mature and responsible manner. The rights and property of all persons are to be respected regardless of time or place. For dual degree students (MD-PhD, VMD-PhD, or DMD-PhD), or graduate students who conduct research in a clinical venue, this also includes compliance with rules, procedures and accepted practices in the clinical setting. In addition, BGS students must comply with the University's code of general conduct and other University policies related to student conduct that are described in The Penn Book: Policies and Procedures Handbook of the University of Pennsylvania (https://catalog.upenn.edu/pennbook). These policies include, but are not limited to, policies on sexual harassment, acquaintance rape and sexual violence, open expression, drug and alcohol usage, and the drug-free workplace. The judicial charter contained within that document is not applicable to BGS students; rather, BGS students are subject to the Charter of Biomedical Graduate Studies Student Judicial System which can be found on the BGS website.

6.1.2 Code of Academic Integrity

The most fundamental value of any academic community is intellectual honesty; accordingly, all academic communities rely upon the integrity of each and every member. Students are responsible not only for adhering to the highest standards of truth and honesty but also for upholding the principles and spirit of the following Code. Violations of this Code include but are not limited to the following acts:

A. ***Cheating:*** using or attempting to use unauthorized assistance, material or study aids in examinations or any other academic work, or preventing, or attempting to prevent another from using authorized assistance, material, or study aids.
B. ***Plagiarism:*** using the ideas, data or language of another without specific and proper acknowledgment.
C. ***Fabrication:*** submitting contrived or altered information in any academic exercise.
D. ***Multiple Submission:*** submitting, without prior permission, any work submitted to fulfill another academic requirement.
E. ***Misrepresentation of Academic Records:*** misrepresenting or tampering with, or

attempting to tamper with, any portion of one's own or any other person's transcripts or academic record, either before or after coming to the University of Pennsylvania.

F. ***Facilitating Academic Dishonesty:*** knowingly helping or attempting to help another violate provisions of this Code.

G. ***Unfair Advantage:*** attempting to gain unauthorized advantage over fellow students in an academic exercise.

The Penn library website has excellent resources on this topic. The links below provide resources on the specific topic of plagiarism:

http://gethelp.library.upenn.edu/PORT/documentation/plagiarism_policy.html
http://gethelp.library.upenn.edu/PORT/documentation/avoidingplagiarism.html

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Note that it is the policy of the GGEB that students may collaborate on homework/coursework solutions but must submit their own independent response to any homework assignment.

Exceptions to this policy may be made explicitly and in writing by the course instructor.

Given our daily reliance on numerous sources of information, it is essential for faculty and students alike to understand their responsibilities in adhering to the University's Code of Academic Integrity. To ensure that each student's work represents the effort envisioned by faculty for a given assignment, these two principles must be observed:

1. It is essential for faculty to indicate in writing for each assignment the parameters for completing that assignment. This should be a statement of exactly what is allowed and what is not allowed in terms of the use of outside material, consultation with other students or faculty, and the use of material previously created by the student for another course.

2. Students must be sure they understand the parameters for every assignment. While the instructor is responsible for providing a clear description of these parameters, it is the student's responsibility to understand them, and to discuss with the instructor any concerns or questions about them.

6.1.3   Code of Clinical Conduct

The relationship of modern biomedical research to the clinical setting may place BGS students in direct contact with patients, patient medical records, or health care workers. BGS students must behave with paramount concern for patients' welfare and with respect for the rights of patients. The expectations of BGS students' conduct in the clinical setting include the following:

A. *Adherence to appropriate standards of behavior in the presence of patients;*
B. *Adherence to appropriate standards of confidentiality with respect to information about patients;*
C. *Honesty in interactions with clinical colleagues and in record keeping;*
D. *Respect for the limits of responsibility and activity set forth by supervisors; and*
E. *Appropriate interactions with colleagues and co-workers.*

6.1.4   Policy on Plagiarism

Plagiarism – defined by the University's Code of Academic Conduct as the use of existing ideas, data, or language without proper attribution to the original source – is prohibited in all forms. No large language model (LLM)-driven chatbots, including ChatGPT, will be accepted as a credited author in your work. All cited author attributions included in your answers must demonstrate accountability for the work, and LLM tools cannot take such responsibility. As a result, you are not allowed to copy (in part or in whole) or cite (in part or in whole) any result from a query posed to a LLM application. In some cases, an instructor may approve the use of LLMs for specific tasks. Use without prior approval from the course director or dissertation advisor is not allowed.

If a student is suspected of having violated this policy, either intentionally or unintentionally, the work in question will be reviewed by a committee consisting of the course instructor, the program chair, the graduate group chair, and an additional GGEB faculty member selected by the graduate group chair. This committee will meet in-person to discuss the issue, and the instructor will provide the committee with a written summary of the accusation. If the committee determines that the student has plagiarized:

1. First time offenders will automatically fail the course (with a grade of F) for which the assignment was completed. If the course is part of the core curriculum, the student will retake the course the following year. In some instances, cases may be referred to the Office of Student Conduct for additional disciplinary action.
2. Second time offenders will be removed from their program of graduate study.

6.2 Academic Standards

6.2.1 Course Grades and Academic Probation

Grades for all formal courses are assigned as follows: "A," distinguished; "B," good; "C," unsatisfactory; "D," poor; "F," failure. Course directors may award pluses and minuses at their discretion. Grades of "B-" or above are considered acceptable; grades of "C+" or below are unacceptable. A student who receives an unacceptable grade ("C+" or lower) in any course is automatically placed on academic probation, an enrollment status that indicates an unsatisfactory level of academic performance. A student who is on probation may take other courses and exams but may not graduate. The probation is automatically lifted when the student has made up the deficient work by receiving an acceptable grade. The student must arrange with the director of the course in question a program of study that will accomplish this end. One option is to redo the assignments or exams that led to the unsatisfactory grade.

Another is to take the course again during the next semester in which it is offered. In any event, a student who fails to redress the deficiency within one year of being placed on academic probation will be dismissed and considered ineligible for re-admission. If a student receives a second unacceptable grade in another course while already on academic probation, the Graduate Group Chair will convene a committee to review the case. The committee, which will consist of the student's academic advisor and two other members of the Graduate Group faculty,

is authorized to recommend either immediate dismissal or continuation of the probationary status, subject to approval by the Graduate Group Chair and BGS.

6.2.2   Incompletes

To graduate, students must satisfactorily complete their course work. There may be times when, for some reason, a student cannot complete the course work within the allotted time. In this case, the student must formally request, in writing, a grade of Incomplete ("I") for the course. Requests for Incompletes are not automatically granted, and the course director must agree to enter the grade for that course. ***Students and faculty should be aware that incompletes become permanent after a period of one year****.* Thus, course requirements must be completed and a grade reported within one year or the student will not receive credit for the course even though tuition was paid. ***If the incomplete is not resolved within the one-year period, then the student will be required to take an additional course to complete the requirements of the curriculum. The student must obtain approvals for the replacement course from the advisor and the respective Program Chair prior to registering for it.***

6.2.3   Individual Development Plans (IDPs)

BGS requires an annual IDP for all pre-doctoral students (PhD, MD-PhD, and VMD-PhD). The goals of the IDP are to make sure students and mentors are communicating openly and that students are working proactively toward developing the skills they will need to succeed in their program. Separate forms are used by pre-dissertation and dissertation level students. Please see https://https://www.med.upenn.edu/bgs/assets/user-content/documents/idp-phd-thesis-20180626.pdf for specific requirements regarding the IDP and examples of completed IDP forms.

6.3   Additional Academic Requirements and Policies

6.3.1   Collaborative Institutional Training Initiative (CITI) Training Program

This program is mandatory for all School of Medicine faculty, clinical care associate physicians, physicians at affiliated hospitals, and research staff working with physicians who conduct patient-oriented research. Researchers conducting clinical studies with federal funding are also required to take human subjects research training. The Office of the Provost of Research has identified online training devices provided by the CITI program as the accepted standard for fulfilling the requirement for training certification in human research protections. Penn's IRB requires that researchers conducting clinical trials complete patient-oriented research training, and the CITI program can also fulfill this requirement.

Penn IRB CITI Training webpage: https://irb.upenn.edu/homepage/education/required-hsr-training-citi/

6.3.2   Health Insurance Portability and Accountability Act (HIPAA) training

HIPAA is a federal law that provides for the protection of the confidentiality of patient health

records. All students must complete a University-approved course in HIPAA compliance.

6.3.3   Knowledge Link Training Portal

Knowledge Link is the Penn web portal for access to online training courses for human subjects research, health data privacy, and multiple other forms of certification. It can be accesses with a PennKey login/password at: http://knowledgelink.upenn.edu/

6.3.4   Responsible Conduct of Research

Students are required to take training in the responsible conduct of research (RCR) every academic year. First-year students satisfy this requirement by participating in an on-line Bioethics Symposium. Second-, third-, and fourth-year students attend small-group workshops in which relevant case studies are discussed. Students whose studies extend beyond four years must continue to participate in a yearly training session of their choice. Such students can satisfy the responsible conduct of research requirement by participating in various University-sanctioned bioethics courses and symposia or by serving as an assistant facilitator in a workshop for second-, third-, and fourth-year students.

Faculty must dedicate at least two meetings (1-2 hours each) per year to RCR training. To this end, faculty have access to case studies to use as discussion pieces, in addition to their own resources or examples from their own experience. The expectation is for these events to be interactive discussions that ideally include all project personnel, but minimally explicitly include all graduate students who work on that project.

After each any such session, the Faculty member is expected to fill out the online form found here: http://www.med.upenn.edu/bgs/RCR_FORM.shtml

Additional information can be found on the BGS RCR/SRR website:
https://www.med.upenn.edu/bgs-rcr-exdes/

6.3.5   Scientific Rigor and Reproducibility

Students are also required to complete training in scientific rigor and reproducibility (SRR). First-year students receive SRR training during orientation on the core tenets of SRR through a session focusing on the maintenance of laboratory notebooks, focusing on the topics of data acquisition, recordkeeping, file organization, and storage and management of data, with extensive background on Electronic Lab Notebooks (ELNs). Discussions and exercises on SRR are also threaded through first-year courses. Second-year students are exposed to the key aspects of rigorous study design through seminar courses; preparation of and course work related to their submission of NIH NRSA grants; and through their development of their dissertation proposal, as well as through a 90-minute session led by faculty dedicated to this topic. Third-, fourth-, and fifth-year students are required to participate in a 90-minute lab meeting each year where their adviser and/or lab PI (if different from the advisor) selects one or two topics for discussion based on the trainees' areas of focus with an emphasis on SRR.

As with RCR, faculty must dedicate at least two meetings (1-2 hours each) per year to SRR

training. Faculty may use have access to case studies to use as discussion pieces, in addition to their own resources or examples from their own experience. These interactive discussions are recommended to address the students' research directly to encourage evaluation of the rigor and reproducibility of their own studies.

Additional information including instructional materials like NIH case studies can be found on the BGS RCR/SRR website: https://www.med.upenn.edu/bgs-rcr-exdes/

6.3.6 Course Evaluations

Students are requested to submit their feedback promptly and completely at the end of each course throughout their time in graduate training. We take what students say seriously about a course and make every effort to improve each year based on students' feedback.

Students should also be aware that faculty promotions can be affected by how they are evaluated. This is not meant to dissuade students from honestly rating the course faculty, but rather as an invitation to take the course evaluation process seriously and be thoughtful about how they rate the faculty's effort, skill, and teaching abilities. Constructive criticism is helpful and truly appreciated by both faculty and the graduate group. Disparaging comments are less helpful and are discouraged. The Program Chairs are always ready to discuss in person any concerns that students may have.

6.4   Leaves of Absence

The University allows graduate students to take leaves of absence with the permission of the graduate group chair and the graduate dean. Students must write to the graduate group requesting the leave; if the chair approves, the request will be forwarded to the graduate dean (i.e., the BGS Director) for approval. The required BGS form can be found here: https://www.med.upenn.edu/bgs/assets/user-content/documents/bgs-student-leave-of-absence-request-form.pdf

The main types of leave are medical, family, and paid time off for the birth or adoption of a child. Under medical and unpaid family leaves, stipends are suspended during the leave period and are guaranteed upon return from leave under the conditions of the original award guarantee, i.e., as long as the student remains in good academic standing; students who wish to continue their health insurance coverage past the current cycle may arrange to do so through Student Health Services, and financial assistance for health insurance may be arranged through BGS. Note that students who have passed the candidacy exam may need to arrange fellowship support from a mentor in order to return; there is no guarantee that the original mentor will be able to provide financial support when the student returns from leave. For most forms of leave, students receiving NIH NRSA support in the form of a training grant appointment or individual fellowship must also obtain permission for a leave from NIH.

6.4.1 Medical Leaves of Absence

Students who wish to take medical leave should submit a request to their graduate group chair,

including the leave start date and anticipated return date. The student should consult with their lab advisor regarding the timing of the leave, if possible. The graduate group chair will forward the request to BGS, which will follow up with Student Health and Counseling (SHC; formerly known as Student Health Services Services (SHS) and Counseling and Psychological Services (CAPS)) to obtain a recommendation for the leave. Students who are being treated outside of SHC should arrange for a letter from the treating professional(s) justifying the leave to be sent to SHC.

Students on medical leave are expected to seek and follow the advice of the graduate group chair or his/her designate to remediate any work and to devise a course of study for re-enrollment. Students are also expected to make appropriate arrangements to continue any necessary treatment during the leave and to arrange for an appropriate support system. To return from medical leave, students must contact their graduate group chair, advisor, and BGS at least 30 days prior to the expected date of return. Students must also submit paperwork (links to forms below) and arrange for their treating professional(s) to provide documentation of treatment and progress to SHC. Students may not return from leave until arrangements are approved by the graduate group to resume the course of study and until BGS approves the return, in consultation with SHC. The required SHC forms can be found here:

Medical/Counseling: https://wellness.upenn.edu/immunization-insurance-compliance/medical-forms

Questions regarding the processes for leave approvals and returns from leave may be sent to the BGS Administrative Director, Judy Jackson, jajackso@pennmedicine.upenn.edu.

6.4.2 Childbirth or Adoption

A student in a PhD program at Penn is eligible for eight weeks of time off for the birth or adoption of a child. The student must complete the online New Parent Accommodation/Family Leave Request Form (link) at least 60 days prior to the anticipated start date of the leave so that appropriate arrangements can be made to cover any teaching/research responsibilities. Details are provided at https://catalog.upenn.edu/pennbook/family-friendly-policies-phd-students/

6.4.3 Family Leave

University policy allows PhD students to take an unpaid Family Leave of Absence for the birth or adoption of a child, childcare, or care of an immediate family member (spouse, domestic partner, child, or parent) with a serious health condition. Details are provided at https://catalog.upenn.edu/pennbook/family-friendly-policies-phd-students/

6.4.4 Vacation

Graduate fellowships provide tuition, fees, health insurance, and a stipend for eligible full-time doctoral students in residence who remain in good academic standing. A student who accepts a full-time funded position is expected to devote full time to graduate study.

BGS and GGEB offer a 12-month annual training program for funded students. Students are expected to work full-time toward the degree. They are entitled to take University and GGEB staff holidays and two weeks per year for personal vacation time. The timing of the vacation must be approved by the supervisor of the entity that provides financial support for the student. Students who have not yet passed the candidacy exam (see below) must receive permission from the Chair of the GGEB for any additional time away from the University. A student who has passed the candidacy exam may schedule time away only with the prior approval of his or her dissertation advisor, the individual who is supporting his or her assistantship or traineeship, the Program Chair and the GGEB Chair.

6.5   Transfer of Credit

At least twelve course units must be completed while enrolled in a degree program at Penn; for the PhD degree, a maximum of eight units may be transferred from graduate work done at other institutions. Transfer of credit must be approved by the respective Program Chair, Graduate Group Chair, and the BGS Director. If the requested transfer of credit is for a required core course, then the current course instructor must approve the transfer as well.

6.5.1 Transfer from Other Graduate Groups

Students who are currently enrolled in another graduate group within BGS may apply for transfer into the GGEB by submitting an application for admission to the PhD Program in Epidemiology or the MS or PhD Programs in Biostatistics. Students wishing to transfer must inform their original program of their intent. If the student is admitted, the student should have the chair of the original program sign a "Transfer of Graduate Group Form" to release the student from the original graduate group and then have the chair of the new program sign the same form to accept the student into the new graduate group. The GGEB will then request that the student's academic file be transferred from the former graduate group office. A similar procedure will be used for students transferring from other graduate programs within the university.

6.6   Residency, Time Limits, and Fees

Students must complete all course requirements, pass the required examinations, and complete the dissertation within ten years of matriculation. A student who fails to complete the dissertation within the time limit must petition a committee, composed of the student's academic advisor, the Program Chair (or a designated surrogate if the Chair is also the advisor), and a third member of the faculty designated by the GGEB Chair, to be recertified as a PhD candidate. The petition must name the student's dissertation advisor and committee members, describe a plan to finish the research needed to complete the dissertation, and indicate an expected date for the defense and deposit of the dissertation. Should the committee support the petition, it will submit a detailed recertification plan for review and approval by the Director of BGS, as specified in the University-Wide Academic Rules for Graduate Degrees.

In addition, PhD candidates must complete the dissertation within five years of passing the

Qualifications Examination or being admitted into the PhD program (the latter if admitted to the PhD program after passing the Qualifications Examination at the PhD level as an MS student). A student who does not complete the degree within five years must petition the GGEB for an extension of the time limit. The petition must indicate a detailed plan for completing the PhD research, including anticipated dates for defending and depositing the dissertation. The petition will be considered by a committee that includes the student's academic advisor, the Program Chair (or a surrogate as indicated above) and a third faculty member designated by the GGEB Chair.

A candidate who withdraws from the PhD program after reaching dissertation status and subsequently applies for re-admission must pay the dissertation fees that would otherwise have been due during the withdrawal period.

7 Graduate Training Programs in Biostatistics

This version of the biostatistics portion of the handbook applies to students who entered the program in the Fall of 2022. For students who matriculated in years other than this, please refer to the version of the handbook that is specific to the student's matriculation year found at https://www.med.upenn.edu/ggeb/handbook-ggeb.html. Questions about the program for any cohort should be referred to the student's academic advisor, the Program Chair, or the GGEB Chair.

The PhD program in biostatistics is designed to prepare students to be independent researchers in the development of statistical methodologies and in the appropriate and innovative application of these methodologies to biomedical research problems. In the first five semesters of the program, students complete a series of courses in both theory and applied methodology, engage in individually mentored research experiences, explore statistical collaboration, and complete the qualifications examination. Within this period, students also identify a dissertation research problem and an advisor and present a research proposal as part of the candidacy examination. Students typically defend their dissertations and graduate within five years of matriculation.

The MS program is designed to prepare students to be practitioners of biostatistical methodologies. MS students must formally apply to enter the PhD program. The MS program closely parallels the first two years of the PhD program and requires four full-time semesters of course work, exploration of practical aspects of collaboration, and an independent research project which serves as the MS thesis.

7.1 Elements Common to MS and PhD Programs

7.1.1 Academic Advisor

Each incoming student is assigned an academic advisor who serves as the student's primary mentor, advising in course selection and related academic matters. The program attempts to match students to advisors who have similar backgrounds and interests. A student may change advisors at any time by request to the Program Chair. A PhD student's dissertation advisor, once selected, assumes the role of academic advisor during the later years of study. Furthermore, at any time a student may refer questions about his or her program to the chair of the GGEB.

At the beginning of the academic year, each student, in collaboration with his/her advisor, prepares a proposed academic program, including courses to be taken, courses to be transferred, and timelines for examinations and dissertation preparation.

7.1.2 Non-Credit Requirements

The department hosts a weekly biostatistics research seminar that invites speakers from other universities, industry, and government. All students are expected to attend at least six seminars per semester, provided there is no conflict with courses. Other non-credit requirements include

Responsible Conduct of Research, CITI, and HIPAA training. These requirements are described in detail in Section 6.3. PhD students must also serve as teaching assistants which is also a non-credit requirement (see Sections 7.3.9 and 7.5, respectively).

7.1.3 Transfer of Credit

Only courses considered at the graduate level may be transferred from previous training. At least eight course units of the total program required for the MS degree must be completed while enrolled in a graduate program at UPenn. Because the MS program requires only 12 total course units, no more than four may be satisfied by transfer credit. A maximum of eight units may be transferred from previous training towards the PhD degree. Courses proposed for transfer credit must be relevant to training in biostatistics and may include courses in theory or methods. Transfer of credit must be approved by the Program Chair and the GGEB Chair.

Combined degree students receive an automatic credit transfer (MD-PhD, 10 units; VMD-PhD, 14 units). These credits can only count towards advanced elective courses.

7.1.4 Auditing

Auditing a course is not allowed for any students in the PhD program. For MS students, auditing of a course is strongly discouraged. If an MS student wishes to audit a course, they must consult their academic advisor, the course director, and prepare a written request to the Program Chair explaining reasons for the proposed course audit. Final approval must be obtained from the GGEB Chair.

7.2 Master of Science (MS) in Biostatistics

7.2.1 Course Requirements

Candidates for the MS degree must complete 12 units of course credit and prepare a Master's Thesis. Required courses cover probability, mathematical statistics, and statistical methods including categorical data analysis, linear models, survival analysis, and applied data analysis. MS students have the option to take the written qualifying exam, but it is not required to obtain a master's in biostatistics.

The MS in Biostatistics typically requires four semesters of formal course work. Students must complete nine units of required courses, three units of electives, and the Biostatistics in Practice and project requirements (see Section 7.2.3). The required courses are described below. The courses in **bold** type are the "core" courses for the MS degree.

	Course #	Course Title	# Units
Theory	**BSTA 6200**	Probability	1
	BSTA 6210	Statistical Inference I	1
Methods	BSTA 5110	Biostatistics in Practice	1
	BSTA 6300	Statistical Methods and Data Analysis I	1
	BSTA 6320	Statistical Methods for Categorical and Survival Data (Methods II)	1
	BSTA 6510	Introduction to Linear Models & Generalized Linear Models	1
	BSTA 6560	Longitudinal Data Analysis	1
	BSTA 6600	Design of Observational Studies	0.5
	BSTA 6610	Design of Interventional Studies I	0.5
	BSTA 6700	Programming and Computation for Biomedical Data Science	1
	BSTA 7540	Advanced Survival Analysis	0.5

7.2.1.1 Electives

Students in the MS program choose three additional units from a list of advanced courses in biostatistics and related topics. At least two of these courses must be quantitative; the third may be in a related scientific field subject to approval by the Program Chair and GGEB Chair. A partial listing appears under the section on electives for the PhD program (Section 7.3.3). In addition to these electives, BSTA 622 Inference II, which is a required course for the PhD program, may be used as an advanced elective for the MS program. Courses not described here may be used as advanced electives for the MS program upon receiving approval from the Program Chair and GGEB Chair.

7.2.2 Biostatistics in Practice and the MS Thesis

All MS students must participate in Biostatistics in Practice and complete a Biostatistics in Practice project, which serves as the MS thesis. The project may be completed in any semester.

See the description of the Biostatistics in Practice requirements in [Section 7.3.8](#).

7.2.3 Typical Course Sequence for Full-Time Students in the MS Program

		Course #	Course Title	# Units
Year 1	Fall	BSTA 6200	Probability	1
		BSTA 6300	Statistical Methods and Data Analysis I	1
		BSTA 6600	Design of Observational Studies	0.5
		BSTA 6610	Design of Interventional Studies I	0.5
	Spring	BSTA 6210	Statistical Inference I	1
		BSTA 6320	Statistical Methods for Categorical and Survival Data (Methods II)	1
		BSTA 6510	Introduction to Linear Models & Generalized Linear Models	1
	Summer		*Written Qualifications Examination (Optional for MS Students)*	
Year 2	Fall	BSTA 5110	Biostatistics in Practice	1
		BSTA 6560	Longitudinal Data Analysis	1
		BSTA 7540	Advanced Survival Analysis	0.5
		xxxx xxxx	Advanced Elective(s)	1
	Spring	BSTA 6700	Programming and Computation for Biomedical Data Science	1
		xxxx xxxx	Advanced Elective(s)	2
			MS Thesis Presentation	

7.3   Doctor of Philosophy (PhD) in Biostatistics

7.3.1 Funding Policies

Full-time PhD students are eligible for funding in the form of fellowships and research assistantships. The work associated with these sources of support is an essential part of the graduate training program.

At the beginning of the academic year, each funded student will receive a letter describing sources of support and associated obligations. All doctoral students admitted to the program receive support from BGS for up to 21 months. During this time students take courses and explore research opportunities with faculty in the department. Once students decide on a dissertation advisor, the advisor, the student, and the Program Chair will work to develop a sustained funding plan that will cover the student's time during the remainder of their graduate program. Multiple funding opportunities are available including through federally funded research and training grants as well as funding through partnerships with industry. The typical length of time in the program is five years. Students in good academic standing have occasionally received funding for up to six years in the program.

Combined degree (MD-PhD, VMD-PhD, and DMD-PhD) students receive financial support from the program until June 30th of the first year in the PhD phase of their program and are supported by fellowships or research assistantships starting from July 1 of the same year.

7.3.2 Course Requirements

The PhD in Biostatistics typically requires four and a half semesters of coursework and additional semesters devoted to dissertation research. This is usually accomplished in four to five years of full-time study. The standard course sequence for PhD students consists of 3 units in theory, 7 units in statistical methods, and 5 units of advanced electives. At least 3 of these advanced electives must be in theory and methods and 2 may be taken outside of these areas. In addition, a minimum of three semesters of lab rotations (BSTA 699) is required. In general, students are expected to have completed all required courses by the end of their third year (or equivalent for those who enter with a Master's degree). In rare cases substitutions may be made. Such alternatives must be pre-approved by the chair of the Curriculum Committee, the Program Chair, GGEB Chair and the director of the course being waived, who is in the best position to evaluate whether the necessary skills are met by the substitution.

Below are the required core courses; the courses in **bold** type are PhD "core" courses that are covered on the written qualifying examination.

	Course #	Course Title	# Units
Theory	**BSTA 6200**	Probability	1
	BSTA 6210	Statistical Inference I	1
	BSTA 6220	Statistical Inference II	1
Methods	BSTA 5110	Biostatistics in Practice	1
	BSTA 6300	Statistical Methods and Data Analysis I	1
	BSTA 6320	Statistical Methods for Categorical and Survival Data (Methods II)	1
	BSTA 6510	Introduction to Linear Models & Generalized Linear Models	1
	BSTA 6560	Longitudinal Data Analysis	1
	BSTA 6600	Design of Observational Studies	0.5
	BSTA 6610	Design of Interventional Studies I	0.5
	BSTA 6700	Programming and Computation for Biomedical Data Science	1
	BSTA 7540	Advanced Survival Analysis	0.5

7.3.3 Electives and Independent Study

Students are required to take 5 additional advanced electives; a partial listing of such courses is given below. In addition to this list, other courses offered by graduate groups outside of GGEB and outside of the other graduate programs affiliated with DBEI may be appropriate advanced electives and may be used as an advanced elective for the PhD program upon receiving approval from the student's academic advisor and the Program Chair. At most one of the five required advanced electives may be a reading course, and only on a topic not offered as a formal course within a year.

Course #	Course Title	# Units
STAT 5300	Probability	1
STAT 5310	Stochastic Processes	1
STAT 9210	Observational Studies	1
STAT 9250	Multivariate Analysis: Theory	1
OPIM 9300	Stochastic Models II	1
BSTA 7510	Statistical Methods for Neuroimaging	1
BSTA 7710	Applied Bayesian Analysis	1
BSTA 7740	Statistical Methods for Evaluating Diagnostic Tests	0.5/1
BSTA 7750/STAT 9200	Sample Survey Methods	1
BSTA 7770	Systematic Reviews and Meta-analyses	1
BSTA 7820	Statistical Methods for Incomplete Data	1
BSTA 7830	Multivariate and Functional Data Analysis	1
BSTA 7850	Statistical Methods for Genomic Data Analysis	1
BSTA 7860	Advanced Topics in Clinical Trials	1

BSTA 7870	Methods for Statistical Genetics in Complex Human Disease	1
BSTA 7880	Functional Data Analysis	1
BSTA 7890	Big Data	1
BSTA 7900	Causal Inference in Biomedical Research	1
BSTA 8200/STAT 5520	Statistical Inference III	1
BSTA 8520/STAT 9100	Forecasting and Time Series	1
BSTA 8540/STAT 9270	Bayesian Statistical Theory and Methods	1

7.3.4 Applied Research Requirement, Equivalent of MS Thesis

All PhD students must participate in Biostatistics in Practice and complete a Biostatistics in Practice project, a requirement that students typically satisfy during the first or second year. See Section 7.3.8 for further details.

7.3.5 Teaching Practicum

All students in the PhD program must provide teaching support for courses offered by the Department of Biostatistics, Epidemiology, and Informatics or related or affiliated programs. This is discussed in detail in Section 8.4.5.

7.3.6 Examinations

The PhD program requires the successful passing of three examinations: the written Qualifications Examination, the oral Candidacy Examination, and the Dissertation Examination. Later sections outline the procedures for each of these.

7.3.7 Research Rotations

7.3.7.1   Goals and Objectives

The overall goal of the rotations is to expose students to biomedical research, and in particular research related to statistical methodology early in their training. In addition, students will rotate through a number of different labs to get a broad perspective on research and faculty. Only GGEB faculty are eligible to lead a lab rotation (students with interests in rotating with non-GGEB faculty may address this with the graduate group chair). This will also assist students in identifying their research interests and dissertation topic earlier in their educational process. In addition, both the students and faculty can assess whether they are a good match for possible dissertation advisor/advisee relationships. By the end of 21 months of training (summer of year 2) students who were initially funded by BGS will identify their dissertation advisor, have a foundation for the first topic in their dissertation work, and move off BGS funding and onto funding that is related to their dissertation work. Students will normally identify their PhD mentor through working with them on a lab rotation. Students who are funded by a training grant during their first 21 months in the program will remain on the training grant throughout their program. Students who are currently funded or who have interests in receiving funding during their

dissertation research from a training grant should discuss how to structure their lab rotations with the training grant director. Lab rotations that offer research experience in areas relevant to our training grants will be available each year.

Combined degree students (MD-PhD, VMD-PhD, and DMD-PhD) receive financial support from the program until June 30th of the first year in the PhD phase of their program and are supported by their dissertation advisors starting from July 1 of the same year.

7.3.7.2   Research Rotation Content

Laboratory rotations should focus on statistical research as opposed to simple data analysis or service/project work. Ideas include implementation of a method from the literature, literature review of methods, running and summarizing simulations, or the analysis of a complicated dataset. It is recognized that, depending upon the background of the students matriculating into the program, the first lab rotation may need to be a lighter introduction to the methodological area such as focusing on literature review, study design, logistics, and data management and/or data analysis.

7.3.7.3   Duration and Number of Individual Rotations

Students are expected to participate in 3-5 rotations in total with a minimum of 2 different mentors. First year students will have 3 rotations: fall, spring, and summer. Students can expect to spend 20+ hours per week during the fall/spring semesters and full-time 40+ hours during the summer.

7.3.7.4   Dissertation Advisor Choice

In the second year it is expected that students will settle into a relationship with a potential PhD dissertation advisor with the goal of focusing their research in an area of research related to that of the advisor. Nevertheless, if needed, a fourth or even fifth lab rotation may occur in the second year to help the student decide on a research topic and mentor. In addition to determining an area of research interest, the dissertation advisor must show willingness to, at least partially, support the student.

7.3.7.5   Laboratory Rotation Assignments

Prior to the arrival of the new students, interested faculty will submit a short summary describing their proposed laboratory rotation (similar to a course description). During new student orientation and the first week of classes, faculty who are interested in serving as a mentor for the upcoming semester will make a brief presentation of their projects. Faculty mentors can also distribute a handout with a more detailed project description to interested students. Each student should schedule meetings with 2 or 3 potential faculty mentors. This should occur within one week after the faculty presentations so that lab rotation assignments can be made and lab rotations can begin in a timely fashion for the Fall semester. Students will rank their choice of projects and the rankings will be reviewed by members of the Academic Advising Committee. The Academic Advising Committee will take this information and facilitate matching students to

faculty. It is important to note that each student will be working in three labs during their first year, so students and faculty will have ample opportunity to work with each other over the course of the program and initial matches do not preclude options for other collaborations. The same process will be used to match first year students to faculty mentors for lab rotations in Spring semester.

For subsequent lab rotations (Summer of first year and Fall and Spring of second year) students may identify faculty mentors on their own without participating in this formal matching process. In the case of lab rotations that are arranged outside of the formal match process, students should email the Chair of the Academic Advising Committee, copying their faculty mentor, with their choice of lab rotation mentor. Students and faculty are asked not to arrange lab rotations outside of the formal match process during Fall and Spring of first year.

It is the responsibility of faculty mentors to make sure any required IRB approvals are obtained, and that students have the requisite CITI training to work with any data related to their laboratory rotation project.

7.3.7.6   Evaluation

At the initiation of each new lab rotation, the advisor and mentee will write a short summary of the goals and expectations for the laboratory rotation. This document will be submitted to the Academic Advising Committee for review. Laboratory rotations are taken for credit (1 unit, BSTA 6990) and students receive both a written evaluation and a letter grade. Summer rotations also receive a letter grade; however, these will not appear on the formal transcript. In addition, each student will present their progress on their laboratory rotation work at least once per year during a "chalk talk". Attendance will be required for all students participating in lab rotations and encouraged for more senior students as well as faculty.

7.3.7.7   Laboratory Rotation Lab Notebook

PhD students are required to keep a formal record/notebook of work being conducted during mentored laboratory rotations as part of the first 21 months in the PhD programs. The lab notebook should be a shared document between the mentor and mentee. This document should be stored in a location that both mentor and mentee can access such as a project directory or a shared PennBox folder. Both mentor and mentee should continue to have access to the shared folder once the lab rotation has been completed.

The lab notebook should contain dated entries including a list of the goal(s) for each week, and a summary of progress towards those goals. Progress captured in the notebook should be reviewed at weekly meetings between the mentee and mentor with new goals set for the following week.

A copy of the lab notebook along with all work products should be retained by the mentor at the end of each rotation.

7.3.8   Biostatistics in Practice (BIP)

The Biostatistics in Practice (BIP) project is required for both the MS and PhD degrees. It offers the student an opportunity to acquire and demonstrate proficiency in statistical collaboration, data analysis, and scientific writing. Students typically start their BIP project in the summer prior to the start of their second year and must submit the final written report by April 15 the next year. The project is defined by several elements: A scientific question or hypothesis arising in medical research; the statistical methodology to address the question; the development of a study design and/or analysis of a relevant data set; and a summary of the results of these analyses. In most cases, a collaborating medical scientist provides the research question and the data. The student, under the supervision of a biostatistics faculty member, identifies the appropriate statistical methods and conducts the analysis. The analysis should be sufficiently extensive and detailed to support a manuscript publishable in the medical literature.

7.3.8.1 BIP Project Components

The project consists of two parts. The first is a written report including: a description of the research question; background and significance; a description of the statistical methods applied; the results of the analysis; and summary of the major findings and conclusions. The written report should be at the level of a completed manuscript that includes Introduction, Methods, Results, Discussion, Literature cited etc. Each BIP project will be supervised by one Biostatistics program faculty member and a secondary subject area advisor, Students may use this Biostatistics in Practice project write-up as their MS thesis. The second part of the project is a short (20 minute) oral presentation of the project to the biostatistics faculty and students.

7.3.8.2   BIP Project IRB Requirements

All data analyses done as part of the Biostatistics in Practice project must have IRB approval. In most cases this requirement is satisfied if the research objectives are part of an existing protocol of the participating medical research collaborator, as long as the student is added to the protocol according to the standard modification procedures required by the IRB.

7.3.9   Typical Course Sequence or Full-Time Students in the PhD Program

Year	Semester (Funding)	Course #	Course Title	# Units
1	Fall (BGS)	BSTA 6200	Probability	1
		BSTA 6300	Statistical Methods and Data Analysis I	1
		BSTA 6600	Design of Observational Studies	0.5
		BSTA 6610	Design of Interventional Studies I	0.5
		BSTA 6990	Research Rotation	1
	Spring (BGS)	BSTA 6210	Statistical Inference I	1
		BSTA 6320	Statistical Methods for Categorical and Survival Data (Methods II)	1

		BSTA 6510	Introduction to Linear Models & Generalized Linear Models	1
		BSTA 6990	Research Rotation	1
	Summer		***Written Qualifying Examination***	
	(BGS)	BSTA 6990	Research Rotation	1
2	Fall (BGS)	BSTA 6220	Statistical Inference II	1
		BSTA 6560	Longitudinal Data Analysis	0.5
		BSTA 7980	Advanced Topics in Biostatistics	0.5
		BSTA 5110	Biostatistics in Practice	1
		BSTA 6990/ BSTA 8990	Lab Rotation or Pre-dissertation Research (*if dissertation advisor already chosen*)	0.33-1
	Spring (BGS)	BSTA 6700	Programming and Computation for Biomedical Data Science	1
		xxxx xxxx	Advanced Elective(s)	2
		BSTA 6990/ BSTA 8990	Research Rotation or Pre-dissertation Research (*if dissertation advisor already chosen*)	0.33-1
	Summer (BSTA)		***Oral Candidacy Examination***	
			PhD Dissertation (non-course credit)	
3	Fall (BSTA)	BSTA 8990/ BSTA 9950	Pre-dissertation Research or Dissertation Research (*if candidacy examination not complete*)	0.33-3
		xxxx xxxx	Advanced Elective(s)	3
			Oral Candidacy Examination (if not completed in summer)	
	Spring (BSTA)	BSTA 9950	Dissertation Research	0.33-3
	Summer (BSTA)		*PhD Dissertation (non-course credit)*	
4-5	All (BGS)	BSTA 9950	Dissertation Research	0.33-3

7.3.10 Evaluation and Examinations

Evaluation for the MS degree is based on performance in the required and elective courses, and completion of the MS thesis/Biostatistics in Practice project. Evaluation for the PhD degree is based on these criteria plus ongoing interactions with the faculty advisor(s), laboratory rotations, successful performance on the written Qualifications Examination, Candidacy and Dissertation Examinations, and the dissertation itself.

7.3.10.1 The Written Qualifying Examination (MS and PhD)

The following guidelines refer to the written Qualifying Examination (QE) required for all PhD students and optional for MS students in Biostatistics. The Qualifying Examination Committee develops and administers the examination each year and presents the results to the full faculty.

Passing the Written Qualifying Examination is required for continuation in the PhD program. This examination also satisfies the Penn examination requirements as outlined below.

7.3.10.2 MS Program Examination Requirements

Students in the MS program in Biostatistics, are not required to take and pass the written qualifying examination. In order to obtain the degree, students will need to write and deposit an MS thesis and conduct an oral presentation of their work on one of the designated Biostatistics in Practice presentation days. MS candidates will have the option to take the exam if they are considering PhD work but it is not required. If the MS student passes the QE at the PhD level and is subsequently admitted to our PhD program, he/she will not need to take the exam again. MS candidates who take the QE are not guaranteed admission into our PhD program; however, their exam results may be considered in the admissions process.

7.3.10.3 PhD Program Examination Requirements

The written Qualifications Examination serves as the university-required "Qualifications Evaluation" as defined in the Graduate Studies catalog. PhD students must pass the written Qualifications Examination as the first step toward full PhD candidacy. The Qualifying Examination Committee (QEC) develops and administers the examination each year and presents the results to the full faculty.

7.3.11   Examination Guidelines and Recommendations

7.3.11.1 Examination Eligibility

All full-time PhD students are expected to sit for the examination after their first year of study, with the option to retake the exam the following year if the exam failed the first time. Students in the MS program in Biostatistics are not required to take and pass the written qualifying examination. However, MS candidates have the option to take the exam if they are considering PhD work. If the MS student passes the QE at the PhD level and is subsequently admitted to the PhD program, they will not need to take the exam again. While MS candidates who take the QE are not guaranteed admission into our PhD program, their exam results may be considered in the admissions process.

7.3.11.2 Preparation Support

The material on the qualifying exam consists of all topics covered in the five core first-year courses: Probability (BSTA 620), Statistical Methods and Data Analysis (BSTA 630), Statistical Inference (BSTA 621), Statistical Methods for Categorical and Survival Data (BSTA 632) and Linear Models and Generalized Linear Models (BSTA 651). To assist with exam preparation, the Chair of the QEC will meet with students preparing for the exam during the fall of the first year. They will explain the process outlined in this document, answer any questions about the examination procedure, and share best practices for studying. Students will also have access to all previous years' exams, which will be provided by the Graduate Group Coordinator upon

request.

7.3.11.3 Examination Timing

The examination is offered each summer, in June, to allow for grading and faculty review such that students will have results before the July 4 holiday.

7.3.11.4 Examination Format

This one-day written exam will consist of questions stemming from the five first-year core courses and aims to test theoretical and methodological foundations of the course materials. The exam includes some questions that require the integration of theory, methodology, and applied materials. The exam is 6 hours and is closed book/notes.

7.3.11.5 Constructing the Examination

The qualifying exam is written by the QEC, which includes all instructors of core, first-year courses and several other faculty. Each instructor writes a question that covers material from their course and provides an electronic copy of the question as well as a solution with a detailed schema of how partial credit for any multi-part questions will be adjudicated. In some cases in which an instructor is unable to write a question, an exception by the Chair of the QEC may be granted, and another member of the QEC will write the relevant question. Each question is then discussed by the QEC, and feedback is provided back to the exam question writer. This iterative process often occurs repeatedly until the QEC and question writer are in consensus, and the question is included in the examination. The final examination draft is then reviewed and approved by the QEC.

7.3.11.6 Administering the Examination

The examination is conducted in-person as a closed-book test. The QEC and QEC Chair proctor the examination. All students are randomly assigned a pseudonym by the Graduate Group Coordinator, and only these pseudonyms are used to identify the test taker on the exam papers. The key indicating which student was assigned to each pseudonym is kept strictly confidential by the Graduate Group Coordinator. The exam papers consist of the question booklet as well as five separate booklets for responses for each of the five questions. Students are provided with lunch during the course of the examination day.

7.3.11.7 Maintaining the Integrity of the Examination Papers

After students have completed the examination, The exam papers must remain in the custody of the Chair of the QEC until distribution for grading. These are sorted by question and sealed with a signature immediately following the examination administration.

7.3.11.8 Grading the Examination Papers

Each qualifying exam question is graded by the question writer. Question booklets are hand-delivered or picked up by the question writer, and a signature is required to ensure accounting

for each envelope of exam booklets.

Each question is worth 25 points and is recorded on a separate score sheet per question and per student. If a question has multiple parts, the question writer determines how many points each part is worth and documents how the pre-specified criteria (see the Constructing the Examination Section) were employed for scoring each part. All question writers must also determine whether each student passed each question, conditionally passed, or neither. This latter determination is based on the grader's impression of the quality of understanding, knowledge, and critical thinking exhibited in the question response.

7.3.11.9 Examination Review and Decision Process

Once grading is complete (typically two weeks after the exam), the faculty of the Biostatistics program meet to review the examination. All Standing Faculty in Biostatistics who are members of the GGEB are invited to participate. All discussions are conducted subject to blinding by the assigned pseudonyms.

The format of the meeting is as follows: all meeting participants are provided with a booklet containing the blinded examination scores. Scores are given in raw and z-score forms, which are presented in table as well as scatter plot format. The examination is then presented by the QEC. Each question is presented by the question writer who discusses each student's response to the question. After each question is presented, the floor is opened for discussion and questions from the full faculty. After all questions have been presented, the group determines a threshold for passing, conditionally passing, and failing. Because the difficulty of the examination may vary from year to year, there are no absolute cut-offs for these outcomes. After all decisions have been made, the meeting is unblinded by providing a key between students' names and their pseudonyms.

The result is based on the written examination score only. Course grades, performance in lab rotations, and related materials are not considered.

7.3.11.10 Examination Results

Possible outcomes for PhD students include: pass, conditional pass, and fail. MS students will receive a pass or fail only and are not eligible for a conditional pass.

A pass indicates satisfactory performance, as determined by the full faculty, demonstrating mastery of the covered material at a level sufficient to proceed to dissertation work. A conditional pass indicates partial mastery of the covered material, which may be ameliorated via a short period of self-directed study and re-examination.

7.3.11.11 Notification of Examination Results

A letter notifies the student of the outcome of the exam, recommendations for the oral exam for those who receive a conditional pass, and for continued study for those who fail the written exam along with the process for discussion of the exam with the QEC if needed.

7.3.11.12 Examination Outcomes and Next Steps

Because the written exam is offered only once per academic year, PhD students who fail the written exam and elect to take it a second time have the opportunity to take two additional semesters of course work between examinations. Students who receive a conditional pass have the option to take an oral exam within one month of being notified of their written exam result. Students who receive a conditional pass and opt to take an oral exam will receive questions one week ahead and present the solutions to QEC members. Questions will be designed to target the subjects of weakness identified through their written exam. If a student fails the oral exam, they have the option to take two additional semesters of course work and take the written exam a second time. If a student fails the written exam a second time, the student must leave the PhD Program. The student may receive an MS in Biostatistics if all requirements for the MS are met. Each student who takes the exam receives written notification of their outcome as soon as possible after the faculty grading meeting.

7.3.11.13 Examination Viewing

A student who does not pass the examination may request to review his/her exam paper with the QEC chair and together with his/her academic advisor. The purpose of such a review is to help the student evaluate the types of mistakes made and identify areas where further study is needed. The QEC retains the graded exam bluebooks and does not return them to the students. A student may appeal the outcome of the qualifying examination to the QEC Chair, who together with the QEC membership evaluates the appeal and judges whether it has merit.

7.3.11.14 Score Appeals

A grade can only be changed in cases of a specific error in scoring. The QEC refers any grade change that could affect the student's exam outcome to the full Biostatistics program faculty, who decide whether to revise the exam outcome.

Because a minor revision of the score is unlikely to change the exam outcome, a student should only initiate a formal appeal if there were egregious errors in the problem or in its grading, the correction of which would likely lead to a substantial increase in the score. The QEC Chair can advise the student on the prospects for success of a proposed appeal. A student who seeks a formal review must request it, in writing, from the QEC Chair within one week of the issuance of the letter notifying the student of the exam result.

7.3.11.15 Sickness Policy

A student who has declared an intention to sit for the exam, but at the time of the exam is too ill to attend, may request a deferment by contacting both his/her academic advisor and the Chair of the QEC. A deferment can be granted only if the student provides an official note from a medical doctor excusing him or her from the exam as a result of the illness. The request must be made before taking the exam. If the request is approved, the student may then be allowed to take the exam on or before the first business day when the note indicates that the student may

return to work.

7.3.12   MS Students Applying to the PhD Program

Students enrolled in the MS program who wish to apply to the PhD program must submit a formal application. As the written qualifications examination is typically administered in the summer after the first year of study, it is likely that the results will be known to the Admissions Committee. The Admissions Committee determines how to use the results of the written examination in the admissions process.

MS students who pass the written qualifying examination and later enroll in the PhD program are not required to take the written qualifying examination again.

7.3.13   The PhD Candidacy Examination

In order to advance to candidacy for the PhD degree in Biostatistics, a student must successfully pass a candidacy examination. This examination satisfies the requirements of the University's required "Candidacy Examination".

The purpose of the candidacy examination is to evaluate whether the student is qualified to proceed to dissertation research. Although the examination is structured around the dissertation proposal, it may also cover any material in the student's course work. This includes the core courses and other requirements. The examination should emphasize the student's qualification to continue as well as the content of the dissertation proposal.

Committee members are encouraged to communicate to both the student and the dissertation advisor suggestions regarding the proposed research, as well as the feasibility of completing the project in a reasonable time.

7.3.13.1   Candidacy Examination Committee Membership

The committee will consist of a minimum of three members, not counting the advisor(s), of whom two must be faculty members of the GGEB, and one must be an external (non GGEB) member. A GGEB faculty member will be appointed as the Chair of the committee by the student's advisor (the advisor cannot serve as the Chair). The role of the Chair is to run committee meetings and to oversee the candidacy examination and final defense. Committee members will be collectively responsible for administering and evaluating the oral Candidacy Examination, reading the dissertation, and evaluating the final defense. Additional content experts from within or outside the GGEB may be added to the committee as needed. The initial constituency and any changes in the membership must be approved by the Program Chair and the Graduate Group Chair. This Committee will be in place at all times during the dissertation phase. If for some reason, a student changes to a different area of research, a new Dissertation Committee must be appointed immediately and must meet within three months to discuss new plans for the dissertation research.

7.3.13.2   Candidacy Examination Scheduling

To maintain good academic standing, students must advance to candidacy by 18 months after passing their written qualifications examination. In typical cases this will occur no later than the beginning of the student's fifth (spring) semester, although students are encouraged to complete their candidacy examination within one year of passing the written qualifications examination. It is the responsibility of the dissertation advisor to work with the student to schedule the candidacy exam once the dissertation research has been clearly outlined. The Program Chair will schedule the candidacy examination for any student who has not met this deadline.

7.3.13.3   Content of the Dissertation Proposal

The student should provide a written dissertation proposal to the committee at least two (2) weeks prior to the scheduled examination date. The members review the proposal and prepare questions for the exam.

The dissertation proposal in general should include a review of the literature relevant to the topic to be studied. The proposal may, but need not, include preliminary research results. The paper should be primarily a true proposal and should typically not exceed twenty pages.

The examination lasts up to two hours and typically includes three parts: First, the student gives a formal presentation of the proposal, generally not to exceed 45 minutes (which may be extended if there are questions during the talk). Next, committee members question the student on the proposal or on topics in biostatistics. Once all committee members are satisfied that the questioning is complete, the student is asked to leave the room. The committee then discusses the examination, votes the outcome (see below), and makes recommendations (if any) for future research and study. The student is then readmitted and informed of the outcome. The committee chair ensures that necessary forms are signed and returned to the graduate program office.

7.3.13.4   Candidacy Examination Outcomes

The candidacy exam has four potential outcomes:

a) *Pass:* The student has sufficiently mastered the material and advances to PhD candidacy.

b) *Conditional Pass:* Additional evidence of mastery of the material is required, the nature of this evidence to be determined by the committee. An example would be a revised dissertation proposal that better represents the nature of the problem to be studied. Once all committee members agree that the additional requirements have been met, the outcome of the examination is changed to a "Pass". The student is not required to retake the candidacy exam.

c) *Fail with Possibility of Retaking the Examination:* The student has not mastered the required material and must retake the examination within 6 months in order to progress to PhD candidacy.

d) *Fail without Possibility of Retaking the Examination:* The student has not mastered the required material and the committee determines that the student should not continue in the program.

7.3.13.5   Retaking the Candidacy Examination

A student who fails the candidacy exam after taking it a second time, or who does not make a second attempt within six months of the first (unsuccessful) attempt, is automatically withdrawn from the program.

A student who has passed the candidacy exam but wishes to change dissertation topics must prepare a new proposal and submit it to his or her committee. A discussion of the new proposal should be scheduled within three months of its submission. If there is no substantial change in the statistical content area, the candidacy exam need not be retaken, and the committee need not be reconstituted. If there is a substantial change in the statistical content area, the full committee determines whether an additional candidacy exam is required. The student, the advisor for the new proposal, and the other members of the committee also decide on any changes in the composition of the committee.

7.3.13.6   Review of "Lab Notebook"

BGS mandates that the student's dissertation committee review the student's "lab notebook" at each of its meetings. The Biostatistics PhD program interprets this to mean that the student should make available for faculty review, upon request, primary documentation of any substantial element of the dissertation. Such a review takes place at the candidacy exam and any subsequent meetings of the committee, and following the closed session of the dissertation defense. Examples of materials subject to review include the statement and formal proof of a key theorem; the code and results of a simulation study; or the data, code and results of a data analysis in keeping with reproducible research best practices. Prior to the meeting, the student's advisor, in consultation with the dissertation committee, designates a short list of such items that the student makes available in electronic or hard-copy format. The committee chair sets aside time at the meeting for the review of this material. In keeping with the BGS policy, there is no expectation that the committee should scrutinize all such documents "in their entirety"; rather, the review should be sufficient to satisfy the committee that the student's research records are "complete and well managed".

7.3.13.7   Frequency of Dissertation Committee Meetings

Once a student has advanced to candidacy, their dissertation committee must meet at least once every six months to review goals and progress. A review of the "lab notebook" (see above) must accompany each such meeting. The advisor, working with the chair of the committee, schedules the meetings. The student is responsible for providing any review materials needed by the committee in a timely fashion, typically at least two weeks before a meeting.

7.3.13.8   PhD Dissertation Examination

This section provides guidelines for the content of the dissertation and the format of the defense. The Biostatistics Program follows the regulations described by BGS. The final steps toward the PhD degree are the preparation of an acceptable dissertation and the dissertation defense.

7.3.13.9 Permission to Write and Defend the Dissertation

The dissertation committee must formally grant permission to write the dissertation. Students must submit the dissertation to the graduate group within six months of receiving permission to write.

If the student will not meet the six-month deadline, they must meet with the committee again before the end of the six months. The committee will review the student's progress and set a new deadline for the submission of the dissertation. Under normal circumstances, no more than one additional month will be granted. If the student does not submit the dissertation or meet with the committee during the six-month period, the graduate group will put the student on academic probation. The graduate group's academic review committee will determine whether the student should be given permission to defend the dissertation, and under what circumstances, or whether the student should be withdrawn from the program. After the student submits the dissertation, the committee has up to one month to review it. If the committee determines that the student must revise the dissertation prior to defending it, the student will have one month to make the revisions.

Once the committee approves the dissertation, the student will have one month in which to finalize the defense arrangements. It is expected that the student will make tentative arrangements for the defense before this point.

7.3.13.10 Students Leaving the Department Prior to Defending the Dissertation

Refer to http://www.med.upenn.edu/bgs/dissertation_policies.shtml

7.3.13.11 Dissertation-Level Students Changing Mentors

Refer to http://www.med.upenn.edu/bgs/dissertation_policies.shtml

7.3.13.12 Scheduling

The dissertation defense should be scheduled when the candidate and the dissertation advisor agree that the research is near completion and the draft dissertation is in a format suitable for distribution to the committee. As soon as a date and time are fixed, the graduate program coordinator reserves a room (for at least two hours) and prepares the necessary public announcements. In order to accommodate space and scheduling constraints, the date of the exam should be set at least one month before it will take place. All dissertation committee members must attend the exam in person.

7.3.13.13 Content and Format of the Dissertation

A typical dissertation consists of five chapters: The first is an introduction and brief literature review; in many cases, this is similar to the dissertation proposal. The next three cover the three main topics of the dissertation; these may be written in a format suitable for submission as

individual articles to peer-reviewed journals. The final chapter summarizes the dissertation findings and indicates possible future research directions. There are no upper or lower limits on the length of the document. It is the expectation that at least two of the three middle chapters will be methodological and have been submitted to peer-reviewed journals at least two weeks prior to the dissertation defense. Exceptions to this submitted paper requirement would need prior approval from the dissertation committee and the Chair of the Graduate Program.

7.3.13.14 Content and Format of the Defense

At least four weeks prior to the exam, the student should provide each committee member with a copy of the full dissertation. The committee members review the dissertation and prepare exam questions based on it. The defense consists of two parts:

a) Open session. The advisor introduces the student and describes the process to all attendees. The candidate then presents his/her research in the style of a departmental colloquium. Typically, the candidate presents one chapter in depth, with a very brief overview of the others. This presentation should not exceed 45 minutes. At the close of the formal presentation the candidate takes questions from the audience. To leave sufficient time for the closed portion of the exam, the chair has the responsibility to terminate the open session if it goes on beyond one hour.

b) Closed session. In this part of the exam, attended only by the student and the committee, committee members ask specific questions related to the dissertation. Because the committee members have read the entire dissertation, this is their opportunity to ask questions about any part of it, including chapters not presented in detail in the open session. Once all committee members are satisfied that the questioning is complete, the student is asked to leave the room. The committee then discusses the exam and votes an outcome (see below). The student is then asked to return to the examination room and informed of the outcome. The committee chair sees that necessary forms are signed and returned to the graduate program office.

7.3.13.15 Dissertation Examination Outcomes

The dissertation exam has three potential outcomes:

a) Pass. The student has completed the dissertation requirements for a PhD in biostatistics. The student then works with the graduate program coordinator to ensure that all other requirements are met prior to deadlines for the proposed graduation date.

b) Conditional pass. The defense was satisfactory but additional requirements must be met. Commonly, the student is asked to address specific questions raised at the defense, or to incorporate edits proposed by committee members. The dissertation advisor typically oversees these changes, but other committee members may also review changes at their discretion. Once the additional requirements are met, the student is considered to have completed the dissertation. The student is not required to defend the dissertation again.

c) Fail. The student must defend the dissertation again.

7.3.14 Teaching Assistants

7.3.14.1 Courses That Receive Teaching Assistants

The program assigns TAs to courses in the biostatistics and epidemiology graduate programs as well as programs outside of the graduate group. The Program Chair assigns TAs to courses based on course needs and student qualifications.

7.3.14.2 Students Who Serve As Teaching Assistants

All doctoral students are required to serve as a teaching assistant for a minimum of two but typically three semesters as assigned by the graduate program chair. Each TA will spend the equivalent of six hours per week for each semester course. Some students may be assigned to TA a full semester course that requires additional hours (12-14). Beyond the first course, students may be eligible to receive supplementary compensation for additional teaching.

7.3.14.3 Benefits and duties of Serving as a Teaching Assistant

In addition to being a degree requirement for all doctoral students, the teaching experience is an opportunity to work closely with a faculty member in the department, review and deepen understanding of the material being taught, and acquire and sharpen teaching skills. TA duties typically include some or all of the following:

a) Attend regular meetings with the course instructor
b) Attend lectures
c) Hold office hours
d) Assist in or teach lab sessions
e) Assist in the preparation of written course materials, exams and solution sets
f) Grade assignments or exams and record the grades
g) Coordinate access to computing facilities, online data sets, and web applications

Timeliness in the completion of these duties is essential. The course instructor and TA should communicate regularly to discuss duties, to share feedback from the students, and to ensure that the TA's time is being used efficiently. A student who feels they are spending on average more than the designated number of hours on teaching activities should speak to the instructor or, if concerns remain, with the Program Chair. Both instructors and TAs should recognize that time pressures can vary greatly over the course of a semester. Open communication is the key to a successful teaching experience.

In cases where TA duties include assisting in the grading of exams, course instructors should provide the TA with clear guidance on how to assign points. Instructors should also recognize that some students may feel awkward evaluating their peers.

TAs should share their e-mail addresses and mailbox locations with their students. TAs are not

on call for their students; nevertheless, students should expect reasonable access to TAs, particularly in the days leading up to exams and project due dates.

TAs are encouraged to speak with the instructor, their academic advisor and the Program Chair about their teaching experiences, particularly if difficulties arise. A potential conflict can often be avoided if its warning signs are recognized early and the situation is handled thoughtfully.

7.4   Other Policies

7.4.1 International Students Travelling Abroad

Students are entitled to two weeks of vacation per year. Unfortunately, it is sometimes difficult for international students leaving the US to re-enter in a timely fashion, often due to visa issues. While the program understands that these issues are largely out of the control of our international students, it also puts a strain on financial sponsors when students are unavailable to carry out the obligations of their research assistantships in person.

International students who leave the country for vacation must make a plan with their sponsor in advance to address the possibility of delayed re-entry. The written plan must be approved by both the research sponsor and the Program Chair. Sponsors are not required to allow students to work remotely and, in particular, are not expected to fund students to work remotely for indefinite periods of time. International students should expect that funding will be suspended if suitable arrangements are not made and/or if students are absent for more than two weeks. Details on travel requirements for international students can be found at https://global.upenn.edu/isss/travel

7.4.1 Registration in Biostatistics Courses

Any student who does not have dissertation status and who wishes to take a course in Biostatistics must formally register for the course. The University reserves the term "auditor" for a student who registers for a course without the intention of receiving a grade and academic credit. BGS PhD students are not allowed to audit a course. MS students may request a waiver of this policy from the Chair of the GGEB.

A student with dissertation status (i.e., who is paying dissertation fees and therefore does not pay for course units) may sit in on a course without registering for it. Students who intend to participate in a course in this way must agree to participate in the course in a manner defined by the instructor, and must obtain the instructor's prior approval.

7.5   Committees

Six committees provide governance and administrative leadership to the Biostatistics graduate programs. Membership is subject to change annually.

The *Admissions Committee* is responsible for the application and admission process. Responsibilities include developing admission policies; identifying qualified students; reviewing applications; selecting students to interview; ranking students for admission; and reviewing

applications from students in other BGS programs who seek to transfer into Biostatistics. Admission decisions are subject to approval by the GGEB Chair, the GGEB Executive Committee and the BGS Admission Committee. The chair of the Biostatistics Admissions Committee, together with the chair of the Epidemiology Admissions Committee, represents the GGEB in the BGS Admission Committee.

The *Curriculum Committee* is responsible for all rules and policies related to courses, MS theses and doctoral dissertations. Responsibilities include developing policies related to course content; reviewing requirements for MS theses and PhD dissertations; approving proposals for the creation of new courses; and reviewing student course evaluations.

The *Academic Advising Committee* was created to facilitate the assignment of academic advisors, lab rotation mentors and to ensure that each student is meeting program requirements in a timely fashion. This committee works closely with the curriculum committee to ensure that all faculty mentors are up-to-date on the curriculum and all requirements.

The *Qualifying Examination Committee* conducts the Program's written qualifications exam. Responsibilities include developing guidelines, policies, and procedures for the exam; soliciting questions for the exam; reviewing and selecting questions; creating the exam itself; managing its grading; presenting results to the faculty; and evaluating the merits of appeals of exam results. Decisions on the outcome of the exam are made by the Biostatistics program faculty assembled as a committee of the whole.

The *Student Recruitment Committee* conducts outreach to establish and maintain a pipeline of talented undergraduate students to apply to the GGEB MS and PhD programs in biostatistics. Activities include informational presentations to undergraduate departments of mathematics and statistics in Greater Philadelphia and additional targeted areas, attendance and recruitment at national undergraduate research conferences, creation and national circulation of program announcements, communication with prospective applicants, and hosting an informational open-house each fall. The Student Recruitment Committee also aims to increase awareness and enrollment in Penn's summer undergraduate research opportunities in biostatistics.

The *Student Awards Committee* explores opportunities and supports applications for student awards. The Committee chooses the award winner for the Saul Winegrad Award for Best Dissertation. In addition, along with students in the program, the Committee nominates an outstanding faculty member for the Jane M. Glick Graduate Student Teaching Award. Additionally, there are three awards exclusive to the GGEB: the Tom Ten Have Student Leadership Award, the Graduate Student Teaching Award, and the Faculty Teaching Award. These are awarded at the end of every academic year.

8   Graduate Training Program in Epidemiology (PhD in Epidemiology)

This version of the epidemiology portion of the handbook applies to students who entered the program in the Fall of 2023. For students who matriculated in years other than this, please refer to the version of the handbook that is specific to the student's matriculation year found at http://www.med.upenn.edu/ggeb/GGEB_Handbook.shtml. Questions about the program for any cohort should be referred to the student's academic advisor, the Program Chair, or the GGEB Chair.

The Graduate Training Program in Epidemiology consists of the PhD Program in Epidemiology (described in [Section 8.1](#)), administered by the GGEB and led by the Epidemiology Doctoral Program Chair, as well as courses taught by/for and jointly directed with the Master's of Science in Clinical Epidemiology (MSCE; administered by the Center for Clinical Epidemiology and Biostatistics (CCEB) and led by the MSCE Director), the Master's in Public Health Epidemiology Track (MPH-Epi; administered by the Masters of Public Health Program and led by the MPH Program and MPH-Epi Track Directors), and the Master's of Science in Health Policy (MSHP; led by the MSHP Director), and multiple certificate-granting programs at PSOM. These Master's degree programs and certification programs are not administered in any way by the GGEB or BGS, but through the Masters and Certificates program in PSOM. They are referred to here as they interact and share some resources with the PhD in Epidemiology, and those interactions and shared resources are discussed and enumerated in [Section 8.2](#).

Additional Information on these programs is available here:

Training Programs

PhD in Epidemiology: https://www.med.upenn.edu/ggeb/epid-academics.html

MSCE: http://www.med.upenn.edu/cceb/epi/edu/msce/index.shtml

MPH-Epi: https://www.publichealth.med.upenn.edu/

MSHP: https://mshp.med.upenn.edu/welcome-mshp

Certificate Programs:

Public Health Certificate Program (PHCP): https://www.med.upenn.edu/phcp/

8.1 Overview of the PhD in Epidemiology

The mission of the PhD Program in Epidemiology is to train independent researchers in the development and application of epidemiologic methods and to prepare them for positions as scientific leaders in academia, industry, and the public sector. The PhD is a research degree; it indicates the highest attainable level of scholarship and prepares one for a research career. The PhD does not represent merely the accumulation of course credits, but rather, the development and completion of a well-designed and conscientious program of scientific investigation that makes a unique contribution to the field of epidemiology.

The PhD Program in Epidemiology requires basic and advanced courses in epidemiology, statistical methods, and electives drawn from the Department of Biostatistics, Epidemiology, and Informatics and other departments and schools that serve the student's research interests. The program also requires written and oral qualifying and oral candidacy examinations, and the successful defense of a doctoral dissertation, in accordance with University of Pennsylvania policy.

The PhD program typically requires the equivalent of at least four (4) years of full-time study, in three defined phases: *coursework*, *pre-candidacy*, and *candidacy*. The *coursework phase* typically takes two years of full-time study and is intended to provide the student with the knowledge needed to pursue advanced, independent study and investigation in epidemiologic research. This phase culminates in the two-part written and oral Qualifying Examination, normally taken after all or most of the student's coursework has been completed. The *pre-candidacy phase* focuses on the preparation of a scientifically unique, methodologically sound, and feasible dissertation proposal. This phase ends with passing the oral Candidacy Examination. At that time, the student enters the *candidacy phase* and is recognized as a Candidate for the PhD and focuses his or her effort on performing the research for and writing the dissertation. A successful public defense of the dissertation then completes the academic requirements for the PhD.

8.2 Academic Advising

At the time of admission, each incoming student will be assigned an academic advisor who advises the student in course selection and related academic matters. Academic advisors work with PhD students in order to ensure that they develop a course plan that meets the requirements of the program; to identify any course- or program-related problems or issues a student may be experiencing; and to provide general guidance as they progress in their program from core coursework to preparing for and taking the qualifications examination to identifying a dissertation advisor. The program attempts to match students to advisors who have similar backgrounds and interests. A student may change academic advisors by request to the Program Chair. Once a PhD student's dissertation advisor has been selected and formally declared, the dissertation advisor will normally assume the role of academic advisor during the later years of study (*pre-candidacy* and *candidacy* phases).

At the beginning of each academic year, each student, in collaboration with his/her academic

advisor, prepares a proposed academic program including courses to be taken, courses to be transferred, and preliminary timelines for examinations and dissertation preparation.

Students who are on a training grant will have two co-advisors: 1) the Principal Investigator or other senior faculty on the training grant and 2) the Epidemiology PhD Program academic advisor. This is to ensure that all academic advising meets the course and other requirements of the training grant in addition to those of the Epidemiology Program.

It is recommended that students meet with their academic advisors at least twice each semester, typically by the end of the second week of classes, and approximately two-thirds of the way through the semester, or by the 10th week.

For first- and second-year students, academic advising activities should generally follow this schedule:

a) First-Year Fall Semester: First meeting (during New Student Orientation)
   - Make introductions; review the orientation activities; discuss the student's interests and plans for the student's research program in more detail; provide some background on the advisor's research interests; and discuss potential future plans.
   - Review the first-year course plan in detail, go over syllabi for planned courses (if syllabi are available), and answer any questions related to these courses, including contacting course directors for clarifications.
   - Be prepared to discuss the GGEB Handbook and especially the program-specific sections, including any questions that may arise about its contents; questions that cannot be answered can be referred to the Program Chair and/or GGEB chair.
   - Set up a mid-semester and end-of-semester appointment to review progress and talk about any issues or concerns that student may have or any challenges they may be encountering; students are encouraged to have open communications with their academic advisors for them to able to support their needs.

b) First- and Second-Year Fall Semester: Second meeting (by early to mid-November)
   - Review academic progress, identifying any issues or problems; create a mitigation plan as needed (no formal structure for this plan, but should include tasks and deadlines; the advisor may consult with the Program Chair of Academic Advising Committee Chair).
   - Review the course plan, discuss course selection for the next semester as appropriate for the year of study.

c) First- and Second-Year Spring Semester: First meeting (by end of January)
   - Check in, identifying any issues or problems and creating a mitigation plan as needed.

d) First- and Second-Year Spring Semester: Second meeting (by beginning of April)
   - Check in; identify any issues or problems and create a mitigation plan as needed.
   - Review the course plan, and discuss course selection for the next semester, as appropriate for the year of study.
   - Prepare the Individualized Development Plan; student must file with BGS by August.

8.3   PhD Program Residency/Timeline

The degree can be accomplished in the equivalent of four to five years of full-time study, although depending on the student's research program, six or even seven years may be needed to complete the program. The progress of students requiring longer than six years to complete the program will be reviewed semi-annually by the Epidemiology Program Chair and the Chair of the Examinations and Academic Review Committee. In any event, according to University policy, the program must be completed in 10 years.

8.4   PhD Program Course and Training Requirements

8.4.1   Course Requirements

The PhD degree in Epidemiology typically requires the equivalent of four (4) to six (6) semesters of coursework plus additional semesters devoted to dissertation research. The current standard course sequence for PhD students consists of up to seven (7) core courses (see below). Four (4) additional course units are taken in electives (advanced epidemiology and/or biostatistics courses and courses outside the department and school as needed to serve the student's specific interests). In addition, a minimum of three (3) semesters of lab rotations (EPID 6990) and one unit of dissertation research (EPID 9950) are required.

Note: the PhD curriculum is continuously under review and these requirements may change; these changes will be reflected in a subsequent version of the Handbook, pending approval by the Graduate Group and Biomedical Graduate Studies. Students are subject to the course requirements in place at the time of admission.

Course descriptions are provided at: https://www.med.upenn.edu/ggeb/ggeb-courses.html

The core courses required for all PhD students are:

Year	Course #	Course Title	# Units
1	EPID 6000	Data Science for Biomedical Informatics	1
	EPID 7010	Introduction to Epidemiologic Research	1
	EPID 7020	Advanced Topics in Epidemiologic Research	1
	BSTA 5500*	Applied Regression and Analysis of Variance *OR*	1
	BSTA 6300‡	Statistical Methods and Data Analysis I *AND*	1
	BSTA 6320‡	Statistical Methods for Categorical and Survival Data (Methods II)	1
		Career Development Workshops	--
2	EPID 7000	Doctoral Seminar	1
	EPID 7050	Grantwriting and Scientific Writing	1
	BIOE xxxx§	Biomedical Ethics Courses *OR*	1
		MSCE Ethics Workshops (4)	--

* BSTA 5500 is recommended for those not taking BSTA 6300 and BSTA 6320.

‡ For those desiring a more advanced statistical analysis background, BSTA 6300 and BSTA 6320 are recommended if you have previously completed coursework in calculus through multivariable calculus and linear

algebra. The permissions of the instructors are required to take these courses.

§ Bioethics requirements can be satisfied by either attending all four (4) non-credit MSCE Ethics Workshops or by taking one (1) of the following bioethics (BIOE) courses: BIOE 5700 (Public Health Ethics), BIOE 5800 (Research Ethics), BIOE 6010 (Introduction to Bioethics), or BIOE 6020 (Conceptual Foundations in Bioethics). Other bioethics courses may be considered upon request of the Program Chair or Academic Advising Committee Chair.

8.4.2 Electives

PhD students take elective courses totaling to 12 course units. At least two (2) of these courses must be advanced courses in statistical applications, such as (but not limited to):

Semester	Course #	Course Title	# Units
Fall	EPID 5160	Mathematical Models for the Control of Infectious Diseases	1
	EPID 5180	Geography & Public Health	1
	EPID 5800	Outcomes Research	1
	EPID 6380	Topics in Clinical Trial Design and Analysis	1
	EPID 6210	Longitudinal and Clustered Data*§	1
	EPID 6220	Applied Regression Models for Categorical Data*§	1
	EPID 6230	Survival Data Analysis*§	1
	EPID 7110	Environmental Epidemiology	1
	BSTA 6300	Statistical Methods and Data Analysis I**§	1
	BSTA 6600	Design of Observational Studies**§	0.5
	BSTA 6610	Design of Interventional Studies**§	0.5
Spring	EPID 5500	Clinical Economics and Decision Making	1
	EPID 5750	Introduction to Genetic Epidemiology	1
	EPID 6240	Methods in Patient Centered Outcomes and Effectiveness Research	1
	EPID 6250	Advanced Biostatistical Methods for Multivariable Prediction Models§	1
	EPID 6300	Clinical Trials	1
	EPID 6360	Epidemiology Methods of Acute Care	1
	EPID 6460	Reproductive Epidemiology	1
	EPID 6520	Renal and Urologic Epidemiology	1
	EPID 6580	Gastrointestinal Epidemiology	1
	EPID 6640	Methods in Neurologic Clinical Epidemiology	1
	EPID 6660	Pharmacoepidemiology Research Methods	1
	EPID 7040	Methods for Social Epidemiologic Research	1
	BSTA 6320	Statistical Methods for Categorical and Survival Data [Methods II]** §	1
	BSTA 7870	Methods for Statistical Genetics and Genomics in Complex Human Disease**§	1

* Recommend prior calculus

** Require prior calculus, linear algebra, and/or permission of the instructor

§ Biostatistics or Biostatistics-focused (meeting Biostatistics course requirements)

Elective courses include advanced courses in epidemiology and biostatistics, as well as advanced courses in related disciplines, such as biostatistics, statistics, demographics, sociology, anthropology, economics, and psychology. Registration for elective courses without EPID, BSTA, or BMIN course codes must be approved by the student's academic advisor, and inquiries about whether the course(s) meet program standards may be directed to the PhD Program Chair. Students may not take electives held during the summer until after they have entered the candidacy phase and the student submits an approval form signed by their Dissertation Advisor and Program Chair to BGS (submitted by the Graduate Group Coordinator) indicating that the course is necessary for their professional advancement. The form will then be reviewed by BGS and the students' summer registration approved or denied.

Students may also arrange to take independent study courses taught by members of the Graduate Group faculty or courses taught elsewhere in the University. However, it is important to select independent study courses carefully since it is assumed that students will have completed the core at the time of the Qualifications Examination. The student and faculty member will design the activity and the form of the evaluation for the independent study course. Any such proposed independent study course must be approved in advance by the PhD Program Chair. Finally, all electives will be chosen in consultation with the trainee's faculty advisor.

8.4.3 Course Plans

All students are expected to develop and maintain a current course plan with their academic advisor. This course plan must be approved by the advisor and the Program Chair and filed with the department's Office of Graduate Programs. The course plan will be reviewed annually to monitor the student's progress and identify potential delays in completing the program. Typical course plans are shown below.

Typical PhD Student Course Plan

Year	Semester (Funding)	Course #	Course Title	# Units
1	Fall (BGS)	EPID 6000	Data Science for Biomedical Informatics	1
		EPID 7010	Introduction to Epidemiologic Research	1
		BSTA 5500*	Applied Regression and Analysis of Variance *OR*	0.5
		BSTA 6300‡	Statistical Methods and Data Analysis I	0.5
		EPID 6990	Research Rotation	1
			Career Development Workshop	1
	Spring (BGS)	EPID 7020	Advanced Topics in Epidemiologic Research	1
		BSTA 6320‡	Statistical Methods for Categorical and Survival Data (Methods II)	1
		EPID 6990	Research Rotation	1
		xxxx xxxx	Advanced Elective	1
	Summer (BGS)		***Oral and Written Qualifying Examinations***	
		BSTA 6990	Research Rotation	1
2	Fall (BGS)	EPID 7050	Grantwriting and Scientific Writing	1
		xxxx xxxx	Advanced Elective(s)	1-3
		BSTA 6990/ BSTA 8990	Lab Rotation or Pre-dissertation Research (*if dissertation advisor already chosen*)	0.33-1
	Spring (BGS)	EPID 7000	Doctoral Seminar	1
		xxxx xxxx	Advanced Elective(s)	1-3
		BSTA 6990/ BSTA 8990	Lab Rotation or Pre-dissertation Research (*if dissertation advisor already chosen*)	0.33-1
	Summer (EPID)		***Oral Candidacy Examination***	
			PhD Dissertation (non-course credit)	
3	Fall (EPID)	BSTA 8990/ BSTA 9950	Pre-dissertation Research or Dissertation Research (*if candidacy examination not complete*)	0.33-3
		xxxx xxxx	Advanced Elective(s)	1-3
			Oral Candidacy Examination (if not completed in summer)	
	Spring (EPID)	BSTA 9950	Dissertation Research	0.33-3
		xxxx xxxx	Advanced Elective(s)	1-3
	Summer (EPID)		*PhD Dissertation (non-course credit)*	
4-5	All (EPID)	BSTA 9950	Dissertation Research	0.33-3

* BSTA 5500 is recommended for those not taking BSTA 6300 and BSTA 6320.

‡ For those desiring a more advanced statistical analysis background, BSTA 6300 and BSTA 6320 are recommended if you have previously completed coursework in calculus through multivariable calculus and linear algebra. The permissions of the instructors are required to take these courses.

§ Bioethics requirements can be satisfied by either attending all four (4) non-credit MSCE Ethics Workshops or by taking one (1) of the following bioethics (BIOE) courses: BIOE 5700 (Public Health Ethics), BIOE 5800 (Research Ethics), BIOE 6010 (Introduction to Bioethics), or BIOE 6020 (Conceptual Foundations in Bioethics). Other bioethics courses may be considered upon request of the Program Chair or Academic Advising Committee Chair.

Typical MD-PhD/VMD-PhD/DMD-PhD Student Course Plan

Year	Semester	MD/VMD/DMD Program	Epidemiology PhD Program
1	Fall	Pre-clinical MD curriculum	Independent study (or course if avail)
	Spring	Pre-clinical MD curriculum	Independent study (or course if avail)
	Summer		~8 weeks for full-time research
2	Fall	Pre-clinical MD curriculum	Case Studies in Translational Research or independent study (or EPID course if avail)
	Spring	Clinical Clerkships	
	Summer	Clinical Clerkships and Step 1 (USMLE)	Typically begin research mid-August, slightly before grad semester starts
3	Fall		4-5 Epidemiology course units; Epidemiology lab rotation, EPID Seminars; work on selecting advisor
	Spring		4-5 Epidemiology course units; Epidemiology lab rotation, EPID Seminars
	Summer		2-3 Epidemiology course units; Written and Oral Qualifying Examinations
4	Fall	Clinical Connections	2-3 Epidemiology course units; Grant writing workshop; Submit F30
	Spring		2-3 Epidemiology course units Submit F30 (if not submitted in fall)
	Summer		Oral candidacy examination
5	Fall	Clinical Connections	Dissertation research
	Spring		Dissertation research
	Summer		Dissertation research
6	Fall	Clinical Connections	Dissertation research
	Spring		Dissertation research
	Summer		Dissertation defense
7	Fall	Clinical courses (after defending)	
	Spring	Clinical courses	
	Summer	Clinical courses	
8	Fall	Clinical courses and Step 2 (USMLE)	

	Spring	Clinical courses; Dean's letter (Oct 1); Residency interviews (~Nov-Jan)	
	Summer	Clinical courses and/or research GRADUATION	

8.4.4 Research Rotations

To provide doctoral students with as much exposure as possible to a broad range of research activities and opportunities during their first year of study, they are required to engage in project rotations with GGEB faculty.

The overall goal of the rotations is to expose doctoral students to biomedical research, and in particular research related to their epidemiologic research interests, early in their training. To do so, students will rotate through a number of different labs to get a broad perspective on research and faculty. Only GGEB faculty are eligible to lead a lab rotation (students with interests in rotating with non-GGEB faculty may address this with the Graduate Group Chair). The rotation approach will also assist students in identifying their research interests and dissertation topic earlier in their educational process. During this time, both the students and faculty can assess whether they are a good match as a possible dissertation advisor and advisee.

This section describes the procedures for engaging in these rotations:

- Each student is required to complete three rotations during the first year in the doctoral program: fall, spring, and summer.

- Each rotation will last 12 weeks. Students can expect to spend approximately 20+ hours per week during the fall/spring semesters and full-time (40+ hours) during the summer.

- Each August, the epidemiology faculty in the GGEB will be provided with a short description of each new student's interests and background by the Graduate Group Coordinator and will be asked to confirm their willingness to serve as a rotation preceptor.

- When possible, at the beginning of each term, a chalk talks session will be organized during which GGEB faculty will present the rotation projects to the students. Alternatively, students will be informed by the Graduate Group Coordinator of the names and contacts of the faculty members who agreed to serve as rotation preceptors. Students are also welcome to reach out to GGEB members to inquire about potential projects beyond those discussed during chalk talks. The students will contact the faculty members whose research matches their interests to discuss the details of a potential rotation. Once an agreement is reached between the student and the faculty member, they will submit a short proposal describing the content and goals of the rotation for approval by the Academic Review Committee.

- Research rotations should focus on epidemiological research as opposed to simple data analysis or service/project work. Ideas include implementation of a method from the literature, literature review of methods, or the analysis of a complex dataset. It is recognized that, depending upon the background of the students matriculating into the program, the first lab rotation may need to be a lighter introduction to the methodological area such as focusing

on literature review, study design, logistics, and data management and/or data analysis.

- Research rotations are taken for credit (0.33 unit per rotation, 1-unit total) and students receive both a written evaluation and a letter grade.

- At the end of each rotation, students will give a scheduled chalk talk of 10-12 minutes length to present background, progress, and any findings from their rotation project.

- At the end of each rotation, the supervising faculty member will provide a brief summary of the student's involvement in the project, including any scholarly output such as abstracts and manuscripts. In addition, the faculty member will indicate his or her desire to mentor the student, **as well as willingness to take on the financial responsibilities associated with mentoring.**

By the end of 21 months of training (summer of the second year), students who were initially funded by BGS will have identified their dissertation advisor, have formed a foundation for the first topic in their dissertation work, and will move off BGS funding and onto funding that is related to their dissertation work. Students will normally identify their PhD mentor through working with them on a research rotation. Students who are funded by a training grant during their first 21 months in the program will remain on the training grant throughout their program. Students who are currently funded or who have interests in receiving funding during their dissertation research from a training grant should discuss how to structure their lab rotations with the training grant director. Lab rotations that offer research experience in areas relevant to our training grants will be available each year.

Combined degree students (MD-PhD, VMD-PhD, and DMD-PhD) receive financial support from the program until June 30 of the first year in the PhD phase of their program and are supported by their dissertation advisors starting from July 1 of the same year.

8.4.4.1   Duration and Number of Individual Rotations

Students are expected to participate in three (3) to five (5) rotations in total with a minimum of two (2) different mentors. First year students will have three (3) rotations: fall, spring, and summer. Students can expect to spend 20+ hours per week during the fall/spring semesters and full-time 40+ hours during the summer.

8.4.4.2   Rotation Mentor Obligations

It is the responsibility of faculty mentors to make sure any required IRB approvals are obtained, and that students have the requisite CITI training and data access approvals to work with any data related to their laboratory rotation project. By taking on a rotation mentee, the rotation mentor takes on financial responsibilities associated with related analyses (e.g., computing costs, research supplies) and, should work result in an accepted abstract or a publication led by the mentee, the costs of abstract submission, society memberships (if needed to attend), costs of presentation (e.g., poster printing), and costs of conference attendance including travel and lodging, or for publication, publication fees and associated publication costs.

Travel costs for students to attend conferences can be mitigated in part by application to receive

BGS Travel Funds, which provides $1,000 per fiscal year per student to offset costs of conferences and off-site courses (not that maximum awards are $1,000 for off-site conferences and $1,500 for off-site conferences). Additional information is available here: https://www.med.upenn.edu/bgs/student-funding.html#travel-funds

8.4.4.3 Rotation Evaluation

At the initiation of each new lab rotation, the advisor and mentee will write a short summary of the goals and expectations for the research rotation. This document (form here) will be submitted to the Academic Coordinator and Program Chair who will share it with the Academic Advising Committee for review and approval. Research rotations are taken for credit (1 unit, EPID 6990) and students receive both a written evaluation and a letter grade. Summer rotations also receive a letter grade; however, these will not appear on the formal transcript. In addition, each student will present their progress on their research rotation work at least once per rotation during a "chalk talk". Attendance will be required for all students participating in research rotations and encouraged for more senior students as well as faculty.

8.4.4.4 Research Rotation Laboratory Notebook

PhD students are required to keep a formal record/notebook of work being conducted during mentored laboratory rotations as part of the first 21 months in the PhD programs. The lab notebook should be a shared document between the mentor and mentee. This document should be stored in a location that both mentor and mentee can access such as a project directory or a shared PennBox folder. Both mentor and mentee should continue to have access to the shared folder once the lab rotation has been completed.

The lab notebook should contain dated entries including a list of the goal(s) for each week, and a summary of progress towards those goals. Progress captured in the notebook should be reviewed at weekly meetings between the mentee and mentor with new goals set for the following week.

A copy of the lab notebook along with all work products should be retained by the mentor at the end of each rotation.

8.4.5 Teaching Assistantships

All students in the PhD program must provide teaching support for at least one (1) course offered by the Department of Biostatistics, Epidemiology, and Informatics or related or affiliated programs as an unpaid 'teaching practicum' to fulfill graduation requirements. Students may take additional teaching assistantships and be paid for those teaching assistantships.

8.4.5.1 Courses That Receive Teaching Assistants

The program assigns TAs to courses in the biostatistics and epidemiology graduate programs as well as programs outside of the graduate group. Teaching assistantships are organized with the Academic Coordinator and additional teaching assistantships beyond the teaching

practicum requirement must be approved by the Academic/Dissertation Advisor and the PhD Program Chair.

8.4.5.2   Students Who Serve As Teaching Assistants

All doctoral students are required to serve as a teaching assistant minimum of one (1) but can serve as TA for multiple courses with the approval of their Academic/Dissertation Advisor and PhD Program Chair. Each TA will spend the equivalent of six hours per week for each semester course. Some students may be assigned to TA a full semester course that requires additional hours (12-14). Beyond the first course, students may be eligible to receive supplementary compensation for additional teaching.

8.4.5.3   Benefits and Duties of Serving as a Teaching Assistant

In addition to being a degree requirement for all doctoral students, the teaching experience is an opportunity to work closely with a faculty member in the department, review and deepen understanding of the material being taught, and acquire and sharpen teaching skills.

TA duties typically include some or all of the following:

a) Attend regular meetings with the course instructor

b) Attend lectures

c) Hold office hours

d) Assist in or teach lab sessions

e) Assist in the preparation of written course materials, exams and solution sets

f) Grade assignments or exams and record the grades

g) Coordinate access to computing facilities, online data sets, and web applications

h) Attending regular meetings with the course instructor(s)

Please note that merely serving as a grader in a course does not fulfill the TA requirement for the doctoral program. The student must make a substantive contribution to the course.

Timeliness in the completion of these duties is essential. The course instructor and TA should communicate regularly to discuss duties, to share feedback from the students, and to ensure that the TA's time is being used efficiently. A student who feels they are spending on average more than the designated number of hours on teaching activities should speak to the instructor or, if concerns remain, with the Program Chair.

Both instructors and TAs should recognize that time pressures can vary greatly over the course of a semester. For instance, TA duties usually are light at the start of the course, heavy in the middle, and then light again toward the end (unless assistance is required grading exams). Experience shows that grading homework and preparing and directing lab or discussion sessions are the two items that occupy most of a TA's time, especially for first-time TAs. TAs should not hesitate to request specific direction on what to present in lab or discussion sessions. Although the success of a course is ultimately the instructor's responsibility, students should

recognize that instructors cannot be expected to solve problems that they don't know exist. Open communication is the key to a successful teaching experience.

In cases where TA duties include assisting in the grading of exams, course instructors should provide the TA with clear guidance on how to assign points. Instructors should also recognize that some students may feel awkward evaluating their peers.

The course director may provide the opportunity for the TA to prepare and deliver at least one lecture. In this case, the course director should allow the TA sufficient time to prepare the lecture and should offer any necessary guidance about what is to be covered. Whenever possible, the TA's lecture will be videotaped and reviewed with the course director and his/her dissertation advisor in order to identify strengths and weaknesses.

To ease communication, TAs should share their e-mail addresses and/or other appropriate contact information with their students. TAs are not on call for their students; nevertheless, students should expect reasonable access to TAs, particularly in the days leading up to exams and project due dates.

TAs are encouraged to speak with the instructor, their Academic/Dissertation Advisor, and the PhD Program Chair about their teaching experiences, particularly if difficulties arise. A potential conflict can often be avoided if its warning signs are recognized early and the situation is handled thoughtfully.

8.4.6   Fellowship Grant Requirement

All students are required to prepare and submit a fellowship grant. This is typically done at the beginning of the PhD student's second year and the development of this application is facilitated by taking the EPID 7050 Grant Writing course taught in the Fall semester. It is advised as preparation for this class that students coordinate over the summer prior to the second year with their prospective dissertation advisor or academic advisor to develop specific aims for the proposal and begin drafting preliminary text for the different components of the application during that time, however this is not strictly required. During the course, students will draft research and training plans for their dissertation projects, identify the appropriate faculty and necessary resources to help support the aims of the project, and construct a plan of execution and timeline for the completion of the dissertation. These are typically constructed in the formats of traditional National Research Service Award (NRSA) fellowship grants, however the structures may vary depending on the funding agency or group to which the application is submitted.

For domestic students, these fellowship grant proposals are typically submitted for funding through two NIH mechanisms. The F30 is used for MSTP students and is described in this Funding Opportunity Announcement (FOA): https://grants.nih.gov/grants/guide/pa-files/PA-23-260.html. The F31 mechanism is used for all other students and is described here in this FOA: https://grants.nih.gov/grants/guide/pa-files/PA-23-272.html. There are additional guides and instructions available here: https://grants.nih.gov/grants/how-to-apply-application-guide.html. Specific instructions for F30/31 grants can be found here: https://grants.nih.gov/grants/how-to-

apply-application-guide/forms-h/fellowship-forms-h.pdf. Foreign students and students who do not meet eligibility criteria (such as those with certain advanced degrees) may not be eligible to submit F30/F31 applications, however they may be eligible for fellowship funding from other sources. grants from other federal agencies in some instances as well as grants from private funding resources including foundations, research organizations, industry, and various non-profit entities.

Other sources of fellowship funding can include disease-specific support associations, such as the American Cancer Society and American Heart Association; non-profit organizations and scholarship funds, like the Robert Wood Johnson Foundation and the Howard Hughes Medical Institute; and various federal departments and agencies including the Centers for Disease Control & Prevention (CDC), US Department of Agriculture (USDA), US Department of Defense (DoD), and the National Science Foundation (NSF). Students are advised to consult the list of funding opportunities that is maintained by BGS: https://www.med.upenn.edu/bgs/predoctoral-fellowships.html. Sample applications, as well as successful applications previously submitted and successfully funded are available for access on the Doctoral Pogram's PennBox folders to which PhD student are individually invited by the GGEB Academic Coordinator upon request.

During the course, fellowship applications will be reviewed and critiqued during their preparation by students and faculty advisors in several ways, including a "mock study section" to evaluate the proposal as a NIH submission for F30/F31 grants. The mock study section will be composed of at least three GGEB faculty with experience in sponsoring or writing a successful fellowship grant and/or experience in reviewing such grants. The results of this process will be shared with the student and the student's advisor and mentoring team as a summary statement of the strengths and weaknesses of the application, and suggestions for improvement, as needed.

8.4.6.1   Differences between the Fellowship Proposal and Dissertation Proposal

It should be noted that in prior years the preparation of a graduate fellowship application was encouraged once a dissertation proposal and a robust research and training plan had been developed by the student with his/her dissertation advisor, and a dissertation committee had been assembled to provide input on the proposal. However, as the development of the graduate fellowship proposal is encouraged at the beginning of the second year of doctoral training, this framework may no longer apply for most students.

Instead, it is encouraged that students and faculty advisors view the process of developing their fellowship proposal as occurring in concert with the preparation of their dissertation proposal. The identification of a faculty sponsor or co-sponsors for the grant may coincide with the formal identification of a dissertation advisor and the inclusion of collaboration with faculty members can be the same as the identification of dissertation committee members. Even the structure and content of the proposal itself may largely or entirely overlap with the dissertation proposal. For this reason, the fellowship grant proposals submitted as F30/F31 applications for the December 8 or April 8 deadlines may precede the completion of the dissertation proposal, and the content of the dissertation proposal may often be derived from the fellowship grant

application, often with some modifications to the content of the fellowship proposal to improve the dissertation proposal.

There are several examples of differences and potential modifications to the fellowship proposal for suitability as a dissertation proposal. Often F30/F31 applications are recommended to be constrained to two (2) specific aims, whereas the dissertation requirement is for three (3) specific aims; this is often dealt with by the presentation of two dissertation aims as separate sub-aims of a single fellowship specific aim. Often, page limitations restrict the depth of the significance section and the background literature review provided; students have more space to extend and include a more detailed review in their dissertation proposal. This may be accomplished by writing a longer literature review for the dissertation proposal and trimming content for the dissertation proposal. In addition, more emphasis may be placed on a detailed analytical plan and timeline for the dissertation proposal than truncated forms presented in the dissertation proposal. While the science and training plans for the NIH F30/F31 submissions are constrained to six (6) pages each, the whole of the dissertation proposal may be up to 20 pages in length.

8.4.7 Weekly Seminar Attendance/Participation

A fundamental component of the PhD program is regular attendance of the weekly DBEI/CCEB Seminar at which faculty and researchers within and outside of Penn present their work or discuss timely issues in epidemiology. For the 2023-2024 Academic Year, these seminars will be held on Wednesdays at 9 A.M., typically in 701 Blockley Hall and participation through Zoom is also permissible. All PhD students are required to attend this seminar series at least six (6) times each semester, unless excused due to scheduling conflicts, illness, or other reason. If students are unable to attend the seminar, they should contact the GGEB Academic Coordinator to record the reason for their inability to attend, either before or as soon as possible after missing seminars.

Advanced PhD students are also welcome to present at this seminar. However, slots fill up early in the academic year, so it is best for the student to discuss any plans to present with their advisor and the Chair of the Seminar Committee. Students are also encouraged to suggest experts from the field as potential seminar speakers to the Seminar Committee.

Members of the Seminar Committee include:

Ricardo Castillo (Chair) (ricardo.castillo@pennmedicine.upenn.edu)

Ellie Caniglia (ellen.caniglia@pennmedicine.upenn.edu)

8.4.8 Examinations

The PhD program requires the successful passing of three examinations: the written Qualifications Examination, the oral Candidacy Examination, and the Dissertation Examination. These are detailed in Section 8.5 below.

8.4.9 Additional Program Requirements

These are outlined in the section on Additional Academic Requirements and Policies (outlined

in [Section 6](#)).

8.5   PhD Examinations

In addition to course-specific examinations, there are three PhD examinations required to ensure rigorous, appropriate evaluations during the phases of a student's program. These examinations are described below.

8.5.1   Qualifying Examination

The goal of the Qualifications Examination is to assess the foundational knowledge of epidemiologic and biostatistical concepts and methods after completion of one year of study within our program. It serves as a benchmark to qualify a student to proceed in the program and to advance to the next stage of independent mentored epidemiological research.

Qualifying Examination consists of three components:
1) *Qualification Review*
2) *Timed Written Qualifying Examination*
3) *Critical Appraisal with Oral Review (Oral Qualifying Examination)*

8.5.1.1   Qualification Review *(late April)*

At the end of the first year of coursework, the Academic Advising Committee will review each student's academic record. Students will be expected to provide these to the committee at least four weeks prior to the Timed Written Qualifying Examination. The review will take place no sooner than two weeks prior to the Written Qualifying Examination. Students are expected to have a minimum GPA of 3.0, with no grades lower than B. Students meeting this threshold will be approved and the approval notice shared with the Qualifying Exam Committee. Any grade lower than B (B- and below) will require that the student's record be referred to the Academic Advising Committee and the pertinent course director(s) for remediation. Remediation could include retaking the course(s) in question or taking another course as substitution.

Upon completing remediation, the student will have the opportunity to request a second Qualification Review, using the same procedure as if it were the first review. If the remediation is satisfactory, the student can proceed to the Written Qualifying Examination. However, if the remediation is determined to be unsatisfactory by the Academic Advising Committee, the student may be dismissed from the program, as determined by the GGEB leadership and the BGS Curriculum and Academic Standards Committee, the body charged with monitoring student performance.

8.5.1.2   Timed Written Qualifying Examination (mid-May)

Upon successfully passing the Qualifying Review, the student will be eligible to sit for the Timed Written Qualifications Examination. For this examination, each student will be given a set of five questions that will require students to demonstrate their facility in epidemiologic thinking, methods, study design, and biostatistics. Students will answer all five questions.

Preparation of the examination. The questions will be developed by the Academic Advising and Examination Committee, and will address five or more core competencies, a list of which will be provided to all first-year students entering the program. The source of these competencies will include those specified in Table 1 in of the Hlaing 2019 paper (*Ann Epidemiol* 2019; 36: 1-4; PMID: 31320154) as well as new competency areas as they arise. The Epidemiology Program leadership will review a draft list of the competencies, which will be vetted by the Epidemiology PhD Program faculty, then submitted for approval by the GGEB leadership, and finally circulated to each incoming cohort at the beginning of the academic year. All core course material and topics, including assigned readings are considered when the committee drafts the exam.

Conduct of the examination. All students will take the examination on the same day at the same time. Five hours will be allowed for the examination. This will be an "open-book" examination in which students will be able to use any written materials, software, or Internet resources they may need in order to complete the examination. However, students will complete the examination in separate closed rooms on campus. Students are not permitted to communicate with each other during the examination. Communication in this context includes text messages, Slack/Facebook messaging or any other forms of communication. Students found communicating during the examination will receive a grade of fail without the option of retaking the exam.

Evaluation of the examination. Each examination question will be graded blindly by members of the Academic Advising and Examination Committee. Because the questions of the examination may vary from year to year, there are no absolute cut-offs for passing. Once grading is complete (typically two weeks after the exam), the faculty of the Epidemiology program meet to review the examination.

Confidentiality. The questions in this examination and individual answers and any associated work are to be held in the strictest confidence. For the protection of all students and faculty in the Doctoral Program in Epidemiology, students must attest that they understand that this examination is confidential and agree not to divulge the content or format of this examination to anyone, including future students. At all times students must adhere to the University of Pennsylvania Code of Academic Integrity as defined in The Penn Book (https://catalog.upenn.edu/pennbook/

8.5.1.3   Critical Appraisal with Oral Review (two weeks after the Written Examination)

Each student will be provided with a recent pre-print or publication in the student's stated area of interest, selected by the committee. Students will submit a written peer-review discussing the following domains.

- Sampling strategy
- Unit of analysis
- Outcome, exposure, and covariate measurement
- Statistical methods

- Missing data management
- Sensitivity analyses / subgroup analyses

For each domain, the student will be asked to specifically comment on the strengths and weaknesses of the design and methods that have been used, as well as alternative approaches that could be taken. The goal is to show agility in applied epidemiologic thinking. For example, if this is a cohort study, the student should elaborate on the benefits/weaknesses of alternative strategies, such as a trial, and vice versa. The written document should not exceed three pages (single spaced, 1-inch margins, size 11 text, Arial font preferred), submitted two weeks prior to the last part of this component of the Qualifications Examination, which is a one-hour examination, including a 20-minute (or less) student presentation followed by a question and answering session before the Academic Advising and Examination Committee. During this time, the committee and the student will discuss specifically what was written and will be graded on the scale outlined in the handbook.

Evaluation of the Critical Appraisal and Oral Review. Grading of the examination will use the following rubric:

a) Each domain of the critical appraisal will be scored using the NIH system (1=Exceptional, 9=Poor). A passing score on each of the six domains is 5, for a total passing score of 30. The oral review will be scored for a maximum of 20 points. Thus, the maximum obtainable score on this component of the Qualifications Examination is 50. The minimum passing score is 40. Students scoring either less than 40 total points or less than 2 on any written domain or less than 20 on the critical appraisal will be required to remediate this component.

b) Each committee member will independently score each domain, and the domain scores will be averaged across the committee. In addition, each member will provide specific notes about the student's performance in each domain. Included on this evaluation form is the student's performance on the Oral Review. The notes, in addition to the numeric scores, will be used by the committee to determine the outcome of this component of the Qualifications Examination.

c) Failure to adhere to stated page limits and specifications and presentation times will result in failure without the option of a retake.

Confidentiality. All deliberations by the committee are confidential and to be discussed with no one outside the committee. Students will receive only the final result of their examination and the scores on their written examination and the Critical Appraisal and Oral Review.

8.5.1.4   Qualifying Examination Outcomes

Possible Outcomes:

- *Pass:* Students are eligible to prepare for the Candidacy Examination.
- *Fail:* Students are required to remediate the components with less than a passing score and will retake the component(s) one time. Students who fail the retake will be excused

from the program.

8.5.1.5   Notification of Results and Opportunities to Remediate Outcomes

Each student who takes the exam receives written notification of their outcome as soon as possible after the faculty grading meeting. No other information is made available before that time. The letter notifies the student of the outcome of the exam, recommendations for continued study, and the process for discussion of the exam with the Academic Advising and Examination Committee if needed. Students who do not pass any individual component of the Qualifications Examination will be required to retake the failed component(s). The failed component(s) must be retaken not later than 45 days after the student has received the results of the examination. Extensions to this deadline will be granted only in exceptional circumstances, with the approval of the Epidemiology PhD Program Chair.

8.5.2   Candidacy Examination

In order to advance to candidacy for the PhD degree in Epidemiology, a student must successfully pass a candidacy examination. This examination satisfies the requirements of the University's required "Candidacy Examination".

The purpose of the candidacy examination is to evaluate whether the student is qualified to proceed to dissertation research. Although the examination is structured around the dissertation proposal, it may also cover any material in the student's course work. This includes the core courses and other requirements. The examination should emphasize the student's qualification to continue as well as the content of the dissertation proposal. Committee members are encouraged to communicate to both the student and the dissertation advisor suggestions regarding the proposed research, as well as the feasibility of completing the project in a reasonable time.

The Candidacy Examination is administered by the Dissertation Committee (see Section 8.6.2) and must be passed within 18 months of completing the Qualifying Examination.

The Candidacy Examination will consist of two parts:

- **Written**: dissertation proposal, submitted to the student's committee at least one month prior to oral proposal defense, and approved by the committee prior to the oral proposal defense
- **Oral**: Oral defense of proposal (non-public) before the committee with the inclusion of additional pertinent material at the discretion of committee. All dissertation committee members should be present for the oral phase of the candidacy examination. In emergencies, one member may participate in the defense by video remote connection, such as Zoom. That member cannot be the committee chair or the student's advisor. If one or more committee members are absent (i.e., not present or not remotely participating) from the examination, it cannot proceed and must be rescheduled. During times of extenuating circumstances, such as inclement weather or global health emergencies that result in closure of University facilities (such as the SARS-CoV-2

pandemic), the examination will be conducted entirely using a video remote connection, such as Zoom.

Students must pass both parts of the Candidacy Examination in order to advance to the final phase of the PhD program. Those who fail the Candidacy Examination may re-take it once, at the discretion of the committee.

Once the Candidacy Examination has been passed, the student officially transitions from the *pre-candidacy phase* to the *candidacy phase* (or *dissertation phase*) in their training.

8.5.3 Dissertation Defense

The final oral examination is the Dissertation Defense. A student must successfully pass their dissertation defense to complete their training and receive the PhD degree in Epidemiology. This examination satisfies the requirements of the University's required "Dissertation Defense" as described in the Academic Rules on the Provost website. Key aspects of the dissertation defense are described here:

a) *Announcements:* The defense must be announced by public advertisement at least four weeks in advance using such venues as the GGEB website, posted announcements in Penn Medicine spaces (as allowed), and electronic mail.

b) *Scheduling:* The defense should be scheduled when the candidate and the dissertation advisor agree that the research is near completion and the draft dissertation is in a format suitable for distribution to the committee. As soon as a date and time are fixed, the graduate program staff reserves a room (for at least two hours) and prepares the necessary public announcements.

c) *Attendance:* All dissertation committee members should be present for the final defense. In emergencies, one member may participate in the defense by remote video connection, such as Zoom. That member cannot be the committee chair or the student's advisor. If one or more committee members are absent (i.e., not present or not participating via remote connection) from the final defense, it cannot proceed and must be rescheduled. During times of major health emergencies that result in closure of University facilities (such as the SARS-CoV-2 pandemic), the defense will be conducted entirely using a video remote connection, such as Zoom.

d) *Format*: At least two weeks prior to the exam, the student should provide each committee member with a copy of the full dissertation. The committee members review the dissertation and prepare exam questions based on it. The defense consists of two parts:

- **Open session**. The committee chair describes the process to all attendees and the dissertation advisor introduces the candidate. The candidate then presents his/her research in the style of a departmental colloquium. Typically, the candidate presents one chapter in depth, with a very brief overview of the others. *This presentation should not exceed 45 minutes*. At the close of the formal presentation the candidate takes questions from the audience. The committee chair has the right to terminate the open session if it goes beyond one hour.

- **Closed session**. In this part of the examination, attended only by the student and members of the committee, the student is asked specific questions pertaining to the dissertation. Because the committee members have read the entire dissertation, this is their opportunity to ask any questions about any part of it, including material not presented in the open session. Once the committee members are satisfied that the questioning is complete, the student is asked to leave the room and the committee deliberates in closed session. During this time, the committee reviews the student's work, draws up a list of recommendations, and votes an outcome. The student is then readmitted to the room, informed of the outcome, and is provided with any recommendations. The committee chair sees that necessary forms are signed and returned to the graduate program office.

The defense will be coordinated by the dissertation committee chair. This individual will be responsible for maintaining order and the sequence and timely completion of the examination.

e) *Outcomes:* The dissertation exam has three potential outcomes:

- **Pass**. The student has completed the dissertation requirements for a PhD in epidemiology. The student then works with the graduate program staff to ensure that all other requirements are met prior to deadlines for the proposed graduation date.
- **Conditional pass**. The defense was satisfactory but additional requirements, usually minor, must be satisfied. Commonly, the student is asked to address specific questions raised at the defense, or to incorporate edits proposed by committee members. The dissertation advisor typically oversees these changes, but other committee members may also review changes at their discretion. Once the additional requirements are met, the student is considered to have completed the dissertation. The student is not required to defend the dissertation again.
- **Fail**. The student must defend the dissertation again; only one additional attempt at the final defense is allowed.

f) *Finalization:* Dissertation acceptances must be unanimous, in writing, and signed by all members of the dissertation committee. Approved dissertations must be submitted to the Graduate Council of the Faculties in a format that meets the style standards established by the Vice Provost for Graduate Education.

8.6   Preparing the Dissertation

The dissertation is the culmination of the PhD student's training and captures the graduate research they have performed in a detailed written report illustrating their proficiency in their chosen area of research. Coupled with the oral dissertation defense, this is the final requirement to attain the doctoral degree. The details of the process of preparing the dissertation are described in the sections below.

8.6.1 Dissertation Advisor

Epidemiology PhD students must carry out their dissertation research under the mentorship of a faculty member of the GGEB. The dissertation advisor is the most important individual the student will interact with during their graduate training. For this reason, students should carefully evaluate their interests and experiences in choosing the advisor. The student's dissertation advisor may not be the Dissertation Committee chair but may have been the student's academic advisor. Dissertation advisors for students pursuing the PhD in epidemiology must have extensive training and experience in epidemiologic research.

Generally, they will have a PhD (or equivalent) in epidemiology or related field, *OR* a professional doctorate (MD, PharmD, DNP, VMD, etc.) *and* Master's degree in epidemiology or a related field and experience as an independent investigator as demonstrated through receipt of funding as principal investigator or similar role such as a project or core lead on a program project or center grant *and* significant contributions to the epidemiologic literature. Dissertation advisors not holding the PhD are strongly urged to work closely with the Program Chair and other PhD faculty throughout the student's program in order to ensure that the special and intensive demands of mentoring PhD students are met. *Dissertation advisors should expect to dedicate considerable time and effort to one-on-one student supervision*.

Previous experience as a PhD dissertation committee member for at least one student in epidemiology or biostatistics at the Master's level or beyond, including advising through all phases from protocol development to submission of a dissertation, is desirable but not required. However, faculty who have been selected to be a student's dissertation advisor and who have not previously mentored a PhD student in the GGEB will be assigned a faculty mentor with that experience. The secondary mentor will be designated a formal dissertation co-advisor, upon review and approval by the Program Chair. Faculty members who do not fulfill these criteria may be approved in individual cases by the Graduate Group Chair, in consultation with the Graduate Group Executive Committee.

In addition, the Program expects dissertation advisors to adhere to the University guidelines for mentoring PhD students as articulated in the Graduate Catalog: https://catalog.upenn.edu/graduate/academic-resources/advising-mentoring/.

Additional material can be found in this document, prepared by the American Association of Medical Colleges: https://www.aamc.org/what-we-do/mission-areas/medical-research/grad-compact.

8.6.1.0   Accommodations for Relocation of Dissertation Advisor

In rare instances, a dissertation advisor may change institutions during a student's dissertation research. In these circumstances, the dissertation advisor would become a dissertation co-advisor for the student along with a co-advisor remaining in GGEB. Typically, the co-advisor would be selected from among existing dissertation committee members. In the unlikely event that a suitable and appropriate dissertation co-advisor cannot be identified from within the GGEB members of the dissertation committee, the student may identify another member of the GGEB to be added to their dissertation committee as a co-advisor and modify their committee

membership by sharing an updated dissertation committee form with the Academic Coordinator and Doctoral Program Chair. Additional issues with changes in committee membership may be discussed and addressed with the Academic Coordinator and Doctoral Program Chair.

8.6.2 Content and Recommended Structure of the Dissertation Proposal

The student should provide a written dissertation proposal to the committee at least two (2) weeks prior to the scheduled examination date. The members review the proposal and prepare questions for the exam.

The dissertation proposal structure is flexible, but in general, it should include a review of the literature relevant to the topic to be studied. The proposal may, but need not, include preliminary research results. The paper should be primarily a true proposal and should typically not exceed twenty pages.

The preferred format of the dissertation proposal is to implement a structure similar to the F30/F31 grant proposal with the inclusion of the following sections:

a) Project Summary/Abstract

b) Specific Aims

c) Introduction
- Literature Review
- Overall Goal
- Innovation

d) Proposed Research Strategy
- Approach (for each Aim, Sampling or Data Access Description; Proposed Analytic Methods; Expected Outcomes)
- Potential Pitfalls and Alternatives
- Power and Sample Size Requirements
- Description of Methodological Component of Dissertation and Innovation
- Proposed Timeline

Additional formatting information about the dissertation proposal is in

The examination lasts up to two hours and typically includes three parts: First, the student gives a formal presentation of the proposal, generally not to exceed 45 minutes (which may be extended if there are questions during the talk). Next, committee members question the student on the proposal or on topics in biostatistics. Once all committee members are satisfied that the questioning is complete, the student is asked to leave the room. The committee then discusses the examination, votes the outcome (see below), and makes recommendations (if any) for future research and study. The student is then readmitted and informed of the outcome. The committee chair ensures that necessary forms are signed and returned to the graduate program office.

8.6.3 Dissertation Committee

Each PhD student will organize a Dissertation Committee according to the following constituency:

a) *GGEB Membership Requirements*: The committee will consist of a minimum of three members, not counting the advisor(s). Two of these members must be faculty members of the GGEB, and one must be an external (i.e., not a GGEB) member. *Note:* At least 50% of committee members must belong to the GGEB, and this percentage is not affected if a committee member leaves Penn and continues to serve on the committee if they were a GGEB member at the time of appointment to the committee.

b) *Chair Appointment:* From the dissertation committee, a GGEB faculty member will be appointed as the Chair of the committee by the Chair of the Epidemiology PhD Program. Dissertation committee chairs must have served on at least one GGEB dissertation committee before being approved as a chair (special requests may be directed to the Doctoral Program Chair).

c) *Chair Activities:* The role of the Chair is to run committee meetings and to oversee the candidacy examination and final defense, and to ensure the timely and proper deposit of the dissertation. The Chair is also charged with resolving disputes between committee members and the student, with the assistance of the Program Chair and/or GGEB Chair, as needed. The Chair will be expected to agree to the terms required of this position, as provided by the Doctoral Program Chair.

d) *Cross-divisional Committee Membership Requirements:* At least one member of the Dissertation Committee must be a member of the faculty in the Division of Epidemiology and ordinarily at least one other should be a member of the faculty in the Division of Biostatistics or Division of Informatics. These members should provide "biostatistics support" or "informatics support" roles as committee members, assuring the quality of statistical analyses and appropriateness of data for analytic needs.

e) *Candidacy Examination:* Committee members will be collectively responsible for administering and evaluating the oral Candidacy Examination, reading the dissertation, and evaluating the final defense. Additional content experts from within or outside the GGEB may be added to the committee as needed. The initial constituency and any changes in the membership must be approved by the Program Chair and the Graduate Group Chair.

f) *Dissertation Committee Activities:* This Dissertation Committee will be active in the dissertation process at all times during the dissertation phase. If for some reason, a student changes to a different area of research, a new Dissertation Committee must be appointed immediately and must meet within three months to discuss new plans for the dissertation research.

g) *Requirements of Dissertation Committee Members:* All committee members must read and agree to the policies and procedures pertaining to their respective roles, as articulated in this Handbook and by policies of Biomedical Graduate Studies and the

University and indicate their agreement in writing by signing a form to be provided at the time the committee is constituted. Countersigned by the Epidemiology Program and GGEB Chairs, the document will be maintained in the student's portfolio.

8.6.4 Additional Biostatistics Support

The biostatistics faculty member(s) on the Dissertation Committee will provide advice and collaborate on the scientific design and statistical analyses required for the dissertation research, but it is the student's responsibility to perform such analyses. If appropriate, it may be possible to substitute the GGEB biostatistics faculty member with biostatistics faculty from another department at Penn or from outside the University, upon approval by the Program Chair and the GGEB Chair. If a student's dissertation research area requires additional statistical expertise, appropriate biostatistics faculty should formally be added to the Dissertation Committee.

8.6.5 Computing, Programming, and Database Support

The student is responsible for writing all parts of the dissertation, including any methodological sections, and for conducting or directing all analyses; this ordinarily includes obtaining, preparing, and maintaining data needed for the research. Depending on the student's research program, additional (non-faculty) assistance with computing, programming, and database development may be requested by the student. However, to ensure that the student gains the maximum possible experience with these critically important skills, this request must be approved by the dissertation advisor and the Program Chair. The student and dissertation advisor are responsible for obtaining the necessary funding to defray non-faculty support costs.

8.6.6 Frequency of Dissertation Committee Meetings

Once a student has passed their Candidacy Examination and advanced to the *candidacy phase*, his/her Dissertation Committee will review goals and progress every 6 months. The committee chair should complete the Dissertation Committee Meeting Report form and submit this to the Program Chair within 15 days of each committee meeting.

8.6.7 Laboratory Notebook

BGS mandates that the student's Dissertation Committee, at each of its meetings, review the student's "lab notebook". The PhD Program in Epidemiology interprets this to mean that the student should make available for faculty review, upon request, primary documentation of any substantial element of the dissertation. Such a review takes place at the Candidacy Exam and any subsequent meetings of the committee prior to, but not including the dissertation defense. Examples of materials subject to review include the statement and investigation of a research question; the code and results of a simulation study; or the data, code and results of a data analysis. Prior to the meeting, the student's advisor, in consultation with the Dissertation Committee, designates a short list of such items that the student makes available in electronic

or hard-copy format. The Committee Chair will set aside time at the meeting for the review of this material. In keeping with the BGS policy, there is no expectation that the committee should scrutinize all such documents "in their entirety"; rather, the review should be sufficient to satisfy the committee that the student's research records are "complete and well managed". Note that the University provides the LabArchives Electronic Research Notebook system for researchers, instructors, and students (https://researchnotebooks.upenn.edu/). Penn's license offers the software at no cost to faculty, researchers, staff, graduate students, and undergraduate students for both research activities and coursework. The use of LabArchives for laboratory notebook is strongly encouraged but not mandatory as long as an acceptable alternative like Jupyter notebooks are in place and any alternative laboratory notebook should be approved by the dissertation advisor and dissertation committee chair.

8.6.8 Content and Format of the Dissertation

The dissertation must be a scholarly work, providing a written account of an independent investigation of an epidemiologic question or series of related epidemiologic questions that are driven by a unifying theme. It should be in the form of a monograph, containing one or more research questions about the epidemiology of a particular health topic or disease. Within this monograph, there will be at least three separate manuscripts of publishable quality, relating to the theme of the dissertation, one of which must offer a novel methodologic approach to a question in epidemiologic research. The dissertation will include the formulation and testing of one or more hypotheses, a review of the appropriate literature, a description of the project, data collection, data analysis, data interpretation, discussion of the findings, and limitations of the work. If the dissertation involves the investigation of more than one question, each question must focus on an epidemiologic or methodologic issue related to the health topic or disease under investigation. The dissertation project should demonstrate that the candidate has a command of the subject and a thorough knowledge of the research methodology used to investigate the question(s).

8.6.8.1 Explanation of the Methods Requirement

What specifically constitutes a novel methodological approach should be interpreted broadly. This can include a range of options, including such examples as the elaboration of a new statistical method; the development and validation of a new data collection instrument; or a new application of an existing method to an epidemiological question, to name just a few. Questions or concerns regarding whether the proposed dissertation questions/topics satisfy this requirement may be addressed to the Chair of the Academic Advising Committee.

8.6.8.2 Publication Requirement

At least two of the three component manuscripts of the dissertation must have been, at a minimum, submitted for review for publication at least once by the time of the dissertation defense. The third must be at a stage where submission is planned within 60 days of the defense. Manuscripts that have been submitted but rejected satisfy this requirement, but only if

rejected manuscripts are subsequently submitted to other journals. Students will be required to articulate their plans for submitting publications with their dissertation committee, with specific notation to this effect included in the committee meeting report by the committee chair.

8.7 General program policies

8.7.1 Transfer of Credit

While previous coursework can be used to place out of required courses, due to the streamlined curriculum and small number of elective courses, only in exceptional cases will transfer of credit be allowed. Transfer of credit must be approved by the Doctoral Program Chair and the GGEB Chair.

8.7.2 Auditing

Auditing a course is not allowed for any students in the PhD program as per BGS policy.

8.7.3 Summer Courses

Prior to the dissertation phase of the graduate training, BGS does not permit students to take courses during the Summer Semester. During the dissertation phase, students request to register for these courses using the "Request for Enrollment in Extra Courses and Non-BGS Courses at Thesis Level" form provided by the GGEB Academic Coordinator upon request. Course registration requires approval of the dissertation advisor and GGEB Chair. Courses that require additional tuition approval from BGS must also receive authorization from the BGS Director. Requests to take courses prior to the dissertation phase must be addressed to the Epidemiology Doctoral Program Chair and GGEB Chair for consideration.

8.7.4 Exemptions and Modifications of Course Requirements

Trainees may place out of the following courses if they previously attended equivalent courses: EPID 526: Biostatistics for Epidemiologic Methods I, and EPID 527: Biostatistics for Epidemiologic Methods II.
The student should justify the request to place out of a course, and the request should be accompanied by the equivalent course syllabus, or other appropriate material. Such requests are made in writing as a letter to the Academic Review Committee and **should be made before the end of the first semester in the program.**

8.7.5 Student Memberships in Professional Societies

All PhD students in Epidemiology are encouraged to join one or more professional societies, but especially the American College of Epidemiology as an Associate or the Society for Epidemiologic Research as a Student Member.

8.7.6 Program Web Resources

Student-related forms, resources, and web links are available at the GGEB web site: https://www.med.upenn.edu/ggeb/.

8.7.7   Student Workspaces and Facilities

The PhD program has space for students on the first floor of Blockley Hall with carrels and lockers. There is wireless connectivity throughout the University campus through AirPennNet.

Administration of the carrels and locker assignments is managed by the GGEB Academic Coordinator (627 Blockley Hall). In addition, dissertation advisors may provide workspace in their labs.

8.7.8   Terminal Masters Degree

The PhD Program in Epidemiology does not admit students for study towards a Master's degree. However, in rare cases, students who are unable to complete the PhD may apply for a terminal Master of Science degree, with the following requirements:

- Completion of at least eight (8) course units that includes those from core courses taken in the first year of study, each with a grade of at least B-minus.
- Passing grade on the Qualifications Examination
- Completion of a research project that culminates in the preparation of at least one comprehensive scholarly manuscript of such quality that is appropriate for a peer-reviewed publication. This manuscript will be evaluated by the Program Chair and two additional GGEB faculty to determine its acceptance as a Master's thesis, consonant with the goals and requirements of the program and with the policies set forth in the Pennbook: https://catalog.upenn.edu/pennbook/academic-rules-research-masters/.

8.8   Epidemiology Doctoral Program Administration

8.8.1   Coordination with Other Academic Programs in PSOM

The PhD Program in Epidemiology has loose affiliations with a multitude of programs in the Perelman School of Medicine, including multiple degree and certificate programs affiliated with the PSOM Masters & Certificate Program, like the Master of Science in Clinical Epidemiology, Master of Public Health (including the Epidemiology Track), the Master of Science in Health Policy Research, and the Public Health Certificate Program. Brief descriptions of each program and coordination with the Epidemiology Doctoral Program and described below.

8.8.1.1   Masters of Science in Clinical Epidemiology (MSCE) Program

The MSCE is an intensive program for accomplished medical professionals who seek to further their skills as academic investigators. Applicants who possess an advanced degree in medicine, nursing or another health field learn to design controlled epidemiological studies and acquire biostatistical skills that relate directly to their research interests. With close guidance from a

primary mentor and a mentorship team, students will gain the ability to hone precise research questions and pursue reliable, complex answers.

The MSCE is one of the nation's top offerings in clinical research training with more than 150 active faculty members. It is designed to be completed in two to three years of full-time study and prepares students to:

- Design, implement and analyze an original research project.
- Master the elements of various research designs—randomized clinical trials, cohort and case-control studies, surveys, and quasi-experiments.
- Learn the concepts of health measurement as they apply to epidemiologic research.
- Apply a sophisticated critical perspective in appraising medical literature.
- Understand the principles of biostatistics, especially as they apply to epidemiologic research.
- Be able to use and interpret various statistical programs for analyzing a data set.

Through the program's dedicated faculty mentorship, comprehensive curriculum, study protocol and thesis development, students are poised for academic research careers. Students can focus their elective training in areas such as pharmacoepidemiology, clinical trials, patient-centered outcomes research (PCOR), genetics, and bioethics.

The MSCE draws the majority of its instructors from among DBEI faculty with primary and secondary appointments and members of the CCEB. The MSCE Program is administered by the CCEB with its own Academic Coordinators, and registration for some courses using the EPID course code may be administered through the MSCE Academic Coordinators (the GGEB Academic Coordinator will inform the student). Doctoral students of Epidemiology may request to perform their teaching practicum (teaching assistantship) in many of the MSCE courses.

Additional information on the program is available here: https://www.cceb.med.upenn.edu/master-science-clinical-epidemiology-msce

8.8.1.2   Master of Public Health (MPH) Program

The Penn Master of Public Health Program is a university-wide, interdisciplinary and interprofessional graduate program. The Penn MPH Program prepares students to be public health leaders by integrating research, education, and service to promote the health of populations locally, nationally, and globally. With a 5:1 student to faculty ratio, students have access to public health experts who will mentor them from coursework through their Capstone projects. The program is flexible, allowing for both full-time and part-time study. Students typically complete the program in two years as a full-time student or three years as a part-time student. All MPH students have the same core requirements, including 6 required core courses, two semesters of Capstone Seminar, and Fieldwork Experience. Students take 6 electives based on their chosen track. As part of their choice of electives, students can take up to 3 graduate-level public health courses from anywhere across the University to leverage the

program's interdisciplinary nature.

The MPH has four tracks: *Generalist*, *Global Health*, *One Health*, and *Epidemiology* tracks, the last of which includes coursework that can be used to fulfill course requirements for students who subsequently apply and enter the Doctoral Program in Epidemiology. The courses that MPH-Epidemiology Track students take include EPID 7010, EPID 7020, EPID 6000, and BSTA 5500. MPH Students anticipating application to the Doctoral Program in Epidemiology may contact the Qualifying Exam Committee to participate in first-year qualifying examinations at the end of the academic year in which they anticipate completing the four required courses.

Epidemiology faculty teach several of the core MPH courses, all of which have the PUBH course code. Several of these courses are recommended as electives, though some may require taking other PUBH courses as prerequisites. Doctoral students are permitted to fulfill their teaching practicum (teaching assistantship) requirement by Taking Epidemiology-relevant PUBH courses.

The primary aim of the Epidemiology Track to the MPH program is to equip students with specialized knowledge and skills in the field of epidemiology. This track is intended to address the growing demand for public health professionals who possess a deep understanding of the patterns, causes, and effects of health-related issues within populations. The MPH program aims to produce graduates who can contribute effectively to disease surveillance, outbreak investigation, data analysis, and evidence-based public health interventions by offering an Epidemiology Track alongside the existing Generalist, Global Health, and One Health tracks. This development of this track aligns with the evolving landscape of public health challenges, and the need for experts who can address complex health issues from an epidemiological perspective. This track is a collaboration between the MPH program at the Center for Public Health, the GGEB, and the DBEI. Admissions evaluations for this program are administered jointly by the MPH and GGEB Epidemiology Admissions Committee.

Additional information on the program is available here: https://mph.med.upenn.edu/

8.8.2   The Public Health Certificate Program (PHCP)

The Public Health Certificate Program offers highly motivated, well-qualified doctoral candidates in Biomedical Graduate Studies an opportunity to experience the relationship between public health and biomedical research. Public health can be defined as "the science and art of preventing disease, prolonging life, and promoting physical health and efficiency" (E.A. Winslow, 1920). Public health relies on a variety of disciplines, but the foundation is biomedical research, whose fundamental goal is to acquire new knowledge about living things in order to help us understand how to treat diseases and improve health, with the ultimate goal of improving the public's health.

PHCP produces scientists who can think about the "big picture": how biomedical research directly impacts public health. PHCP students learn population-based approaches and

applications as they are also gaining expertise in molecular, cellular, and biochemical sciences. This two-pronged approach prepares students for broad roles in academic, industrial, and government research.

PHCP provides supplemental training through three mechanisms: formal coursework in public health, a bi-weekly seminar series, and a public health research experience. PHCP students interact with faculty affiliated with the MPH including GGEB Epidemiology faculty participating in the MPH program, as well as Penn's public health community through the Center for Public Health Initiatives (CPHI).

Additional information on the program is available here: https://www.med.upenn.edu/phcp/

8.8.3 Committees

Seven committees provide governance and administrative leadership to the Epidemiology Doctoral Program. Membership is subject to change annually.

8.8.3.1 Admissions Committee

The Admissions Committee is responsible for the application and admission process. Responsibilities include developing admission policies; identifying qualified students; reviewing applications; selecting students to interview; ranking students for admission; and reviewing applications from students in other BGS programs who seek to transfer into Biostatistics. Admission decisions are subject to approval by the GGEB Chair, the GGEB Executive Committee and the BGS Admission Committee. The chair of the Epidemiology Admissions Committee, together with the chair of the Biostatistics Admissions Committee, represents the GGEB in the BGS Admission Committee.

The Epidemiology Admissions Committee also works in conjunction with the MPH program to identify and admit students to the MPH Epidemiology Track.

Chair: Michael Levy (mzlevy@pennmedicine.upenn.edu)

8.8.3.2 Curriculum Committee

The Curriculum Committee is responsible for all rules and policies related to courses, non-course requirements for doctoral trainees, and doctoral dissertations. Responsibilities include developing policies related to course content; reviewing requirements for PhD dissertations; approving proposals for the creation of new courses; and reviewing student course evaluations.

Chair: Kelly Getz (kelly.getz@pennmedicine.upenn.edu)

8.8.3.3 Academic Advising Committee

The Academic Advising Committee was created to facilitate the assignment of academic advisors and lab rotation mentors and to ensure that each student is meeting program requirements in a timely fashion. Activities include responding to academic advisors', dissertation advisors', and doctoral students' questions on academic advising matters and standard practices of the GGEB; reviewing and approving rotation proposals to ensure students

and instructor expectations for each rotation are fair and fully documented; and adjudicating concerns arising due to student or faculty advising performance issues. This committee works closely with the curriculum committee to ensure that all faculty mentors are up-to-date on the curriculum and all requirements.

Chair: John Holmes (jhholmes@pennmedicine.upenn.edu)

8.8.3.4   Qualifying Exam Committee

The Qualifying Examination Committee conducts the Program's written qualifications exam. Responsibilities include developing guidelines, policies, and procedures for the exam; soliciting questions for the exam; reviewing and selecting questions; creating the exam itself; managing its grading; presenting results to the faculty; and evaluating the merits of appeals of exam results. Decisions on the outcome of the exam are made by the committee faculty assembled as a committee of the whole. Summary of exam outcomes are shared with the students following their exams.

Chair: Michael Harhay (mharhay@pennmedicine.upenn.edu)

8.8.3.5   Student Recruitment Committee

The Student Recruitment Committee conducts outreach to establish and maintain a pipeline of talented undergraduate students to apply to the GGEB Doctoral Program in Epidemiology. Activities include informational presentations to undergraduate departments of mathematics, public health, biomedical sciences, and statistics in Greater Philadelphia and additional targeted areas, attendance and recruitment at national undergraduate/graduate research conferences, creation and national circulation of program announcements, communication with prospective applicants, and hosting an informational open-house each fall. The Student Recruitment Committee also aims to increase awareness and enrollment in Penn's summer undergraduate research opportunities in epidemiology.

Chair: Tuhina Srivastava (tuhinas@pennmedicine.upenn.edu)

8.8.3.6   Student Awards Committee

The Student Awards Committee explores opportunities and supports applications for student awards. The Committee chooses the award winner for the Saul Winegrad Award for Best Dissertation. In addition, along with students in the program, the Committee nominates an outstanding faculty member for the Jane M. Glick Graduate Student Teaching Award. Additionally, there are three awards exclusive to the GGEB: the Tom Ten Have Student Leadership Award, the Graduate Student Teaching Award, and the Faculty Teaching Award. These are awarded at the end of every academic year. This committee is jointly administered between the Biostatistics Graduate Programs and the Epidemiology Doctoral Program.

Chair: Jing Huang (jing.huang@pennmdicine.upenn.edu)

Epidemiology Representatives: Andrea Schneider (Andrea.Schneider@pennmedicine.upenn.edu)

8.8.3.7   Epidemiology Teaching Assignment Committee (ETAC)

The ETAC is a committee composed of graduate group leadership from the GGEB Epidemiology Doctoral Program, the MSCE program, and the MPH program to help ensure that core Epidemiology courses across the three programs have faculty instructors assigned to them and that opportunities for course instruction are available for all faculty participating in these training programs. Meeting once or twice annually, this committee prepares instructor assignments for the subsequent academic year and reviews course evaluations in determining assignments. In practice, instructor assignments are given on the basis of prior teaching of the course; interest in teaching a course; and course-specific needs and considerations.

Co-Chairs:

Sean Hennessy (DBEI Epidemiology Division Director) (hennessy@pennmedicine.upenn.edu)

Aimin Chen (DBEI Vice Chair for Education) (aimin.chen@pennmedicine.upenn.edu)