BOSTON UNIVERSITY

The Biostatistics Graduate Program at Boston University (MA/PhD)

Program Handbook 2013-2014

Boston University Graduate School of Arts & Sciences

Boston University School of Public Health

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Mission

The mission of the Graduate School of Arts & Sciences (GRS) is the advancement of knowledge through research and scholarship, and the preparation of future researchers, scholars, college and university teachers, and other professionals.

The mission of the Boston University School of Public Health is to improve the health of local, national and international populations, particularly the disadvantaged, underserved and vulnerable, through excellence and innovation in education, research and service.

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Section 1 Introduction to the Biostatistics Graduate Program

OVERVIEW

Today, biostatisticians play a critical role in studies of risk factors for disease, in assessing safety and efficacy of new therapies in clinical trials and in the evaluation of patient outcomes. The results of these studies have public health and policy implications. From discussions with investigators about fine-tuning research questions to developing appropriate study designs, planning and implementing proper statistical analyses and writing up the results, biostatisticians are involved in all aspects of research investigations. The goal of the faculty of the Department of Biostatistics is to participate actively in innovative research, advance medical and statistical science, and to teach and work closely with students so that they may acquire the knowledge to pursue productive careers in medical and public health research and academia at the highest levels.

Students may pursue graduate study in biostatistics through the Biostatistics Graduate Program, jointly administered by the Department of Biostatistics of the School of Public Health and the Department of Mathematics and Statistics of the Graduate School of Arts and Sciences. The program offers students the opportunity to not only gain expertise in mathematical statistics, but also to specialize in the epidemiologic, medical, and bioscientific applications of statistics. Students are required to take courses in both the Department of Mathematics and Statistics and the Department of Biostatistics. The program offers a Master of Arts (MA) in Biostatistics and a Doctor of Philosophy (PhD) in Biostatistics. Students may pursue these programs on a part- or full-time basis, although they must complete their programs within a specified period of time as required by the Graduate School of Arts & Sciences.

Students who complete these programs will gain knowledge in probability, statistical inference and hypothesis testing, the design and conduct of experimental and epidemiological studies, statistical computation, and data analysis. Research interests of the faculty include multivariate analysis, survival analysis, medical statistics, clinical trials methodology, statistical genetics, robust statistics, longitudinal data analysis, time series, regression, estimation theory, and the design of experiments. Further information can be obtained from the directors of the program.

The mission of the Department of Biostatistics:

- To teach students the proper conduct of research studies through rigorous study design and appropriate descriptive and analytic methods that enable valid, interpretable conclusions to be drawn
- To collaborate in research projects to ensure that studies are properly designed, appropriately analyzed and suitably interpreted
- To develop and evaluate new methods of biostatistical analysis and strategies for study design

Section 2 Admission Requirements

APPLICATION FOR ADMISSION

The application deadline for the Biostatistics Program for Fall 2014 admission is December 15th for all MA, MA/PhD, and PhD applicants. All applications for admission are to be completed online through the Graduate School of Arts and Sciences (GRS): www.bu.edu/cas/admissions/graduate. GRS Admissions will no longer accept paper applications except in extenuating circumstances. All supplemental materials should be sent to the GRS.

Graduate School of Arts and Sciences
Boston University
705 Commonwealth Avenue, Suite 112
Boston, MA 02215, USA
(617) 353-2696

REQUIREMENTS FOR ADMISSION

- At least the equivalent of Bachelor of Arts degree. No specific undergraduate major is required
- One year of calculus including multivariate calculus
- One formal course in linear algebra (with a minimum of four credits)
- Official transcripts from all colleges and universities attended
- One page personal statement
- Three letters of recommendation
- Official report of GRE scores from within the past 5 years (The school code is 3087.)
- Official report of TOEFL scores for Applicants whose native language is not English
- Previous coursework document

Applicants who have not met the pre-requisites of the program will not have their applications reviewed for admission.

International students
Students from abroad must submit official English translations of all academic records. We do not accept transcripts or evaluations from WES. Official transcripts must be in English and sent directly from the college/university attended. If admitted, students from abroad must also complete an International Student Data Form. Students must also submit results of the Test of English as a Foreign Language (TOEFL), with minimum score requirements of 550 for the paper-based test. GRS policy requires that applicants meet the minimum requirements of each section on the internet-based test:

Reading—21
Listening—18
Speaking—23
Writing—22.

In addition to the TOEFL, the International English Language Testing System (IELTS) is also accepted as proof of English proficiency. The band score of 7.0 is required for admission to the Graduate School of Arts & Sciences.

Applicants who do not meet the minimum requirements of English proficiency are not eligible for admission. This requirement is waived *only* if the student has received, or expects to receive, an undergraduate or graduate degree from a college or university in any of the following countries prior to enrollment in the Graduate School of Arts & Sciences: The United States, Canada, The United Kingdom, Australia, New Zealand, or Ireland. Studying in the medium of English in a country other than the ones previously listed or studying as an exchange student in an English-speaking country without completing a degree program is not sufficient to waive the English proficiency requirement.

Department-specific admissions questions should be directed to biostat@bu.edu. Questions about the general admissions process should be directed to the Graduate School, grs@bu.edu.

Section 3 MA Degree Requirements

OVERVIEW OF THE MA DEGREE

The Master of Arts in Biostatistics program is aimed primarily at students with the equivalent of a bachelor's degree who wish to pursue advanced study in the theory and methods of biostatistics. The program prepares students to function as collaborators on research projects in academia, industry or government, and prepares students for doctoral programs.

MA LEARNING OUTCOMES

A candidate for a Master of Arts degree in Biostatistics is expected to demonstrate mastery of knowledge in biostatistics by

- Demonstrating mastery at a Master's level of biostatistical theory and application through high achievement in course work and on written comprehensive examinations.
- Demonstrating commitment to advancing the values of scholarship by keeping abreast of current advances within biostatistics and showing commitment to personal professional development through engagement in professional societies and publication.
- Conducting scholarly work in a professional and ethical manner guided by the principles of the profession.

MA DEGREE REQUIREMENTS

The Graduate School or Arts & Sciences requires students pursuing a Master of Arts in Biostatistics to:

- Complete the 32-credit curriculum
- Fulfill the Residency Requirement
- Fulfill the Grade Requirement
- Pass the Qualifying Examinations
- Complete the MA degree within three years

Curriculum
Students in the MA program must complete a total of 32 credits as follows:

Course #	Course Title	When Offered
1. Six Core Courses, required (23 credits):		
CAS MA575	Linear Models	Fall
CAS/MET MA581	Probability	Fall
CAS/MET MA582	Mathematical Statistics	Spring
SPH EP713	Introduction to Epidemiology	Fall/Spring
SPH BS805	Intermediate Statistical Computing and Applied Regression	Fall/Spring/Summer

SPH BS852	Statistical Methods in Epidemiology	Fall/Spring
2. Elective Courses (9 credits):		
CAS MA576	Generalized Linear Models	Spring
CAS MA583	Introduction to Stochastic Processes	Spring
CAS MA584	Multivariate Statistical Analysis	Spring
CAS MA585	Time Series Modeling and Forecasting	Spring
CAS MA586	The Design of Experiments	Spring
CAS MA587	Sampling Design: Theory and Methods	Spring
CAS MA588	Nonparametric Statistics	Spring
CAS MA685	Advanced Topics in Statistics	Fall
GRS MA751	Advanced Statistical Methods II	Spring
GRS MA882	Seminar: Statistics (Limit 4 credits)	Fall/Spring
SPH BS715	Practical Skills for Biostatistics Collaboration (1 cr)	Spring
SPH BS722	Design and Conduct of Clinical Trials	Fall/Spring
SPH BS728	Public Health Surveillance, a Methods Based Approach (2 cr)	Fall
SPH BS775	Applications of Statistical Methods in Clinical Research	Alt Springs (even years)
SPH BS810	Meta-analysis for Public Health and Medical Research	Fall
SPH BS820	Logistic Regression/Survival Analysis	Spring
SPH BS821	Categorical Data Analysis	Fall
SPH BS822	Advanced Statistical Computing	Alt Springs (even years)
SPH BS830	Design and Analysis of Microarray Experiments and Next Generation Sequencing	Alt Falls (odd years)
SPH BS845	Applied Statistical Modeling & Programming in R	Alt Falls (odd years)
SPH BS851	Applied Statistics in Clinical Trials I	Alt Springs (odd years) & Summers (even years)
SPH BS853	Generalized Linear Models with Applications	Spring
SPH BS854*	Bayesian Methods in Clinical Trials	Alt Falls (odd years)
SPH BS855	Bayesian Modeling for Biomedical Research	Alt Falls (even years)
SPH BS856	Adaptive Designs for Clinical Trials	Alt Springs (even years)
SPH BS857	Analysis of Correlated Data	Spring
SPH BS858	Statistical Genetics I	Fall
SPH BS859	Applied Genetic Analysis	Alt Springs (odd years)
SPH BS860	Statistical Genetics II	Alt Springs (even years)
SPH BS861	Applied Statistics in Clinical Trials II	Fall
GRS MA861*	Seminar: Applied Mathematics	Fall/Spring
GRS MA781*	Estimation Theory	Fall

GRS MA782*	Hypothesis Testing	Spring
SPH EP813*	Intermediate Epidemiology	Spring
SPH EP854‡†	Modern Epidemiology	Fall
SPH EP855‡	Design Issues in Epidemiology	Alt Springs (odd years)
SPH EP856‡†	Selected Topics in Epidemiologic Methods	Alt Springs (even years)
SPH BS901**	Directed Study in Biostatistics	TBD
SPH BS902**	Directed Research in Biostatistics	TBD

* Must obtain permission from academic advisor and/or instructor to take this course as an elective.
‡ Only one of these three courses may count as an elective.
** A maximum of 4 credits is allowed across these two courses.

Residency Requirements

Students must be registered in both the semester in which the last degree requirements are completed and in the preceding semester. For example, if a student plans to complete their degree requirements in the Spring of 2014, s/he must be registered in both Spring 2014 and Fall 2013.

Grade Requirements

Students must earn a grade of B- or better in all courses applied to the MA.

Qualifying Examinations

The MA candidate must satisfactorily pass two comprehensive written examinations upon completion of coursework. These will require proficiency in the material covered in the six core courses.

The statistical theory qualifying examination is given in the spring semester. Candidates must satisfactorily answer four of six questions based on material covered in MA581 and MA582. The applied statistics qualifying examination is given in December and in April each year. Candidates must satisfactorily answer a total of four questions based on material covered in MA575, BS805, and BS852 with at least one question from each of the three course areas.

Students can use one single-sided reference sheet (printer size [8.5in x 11in] or smaller, handwritten or typed) in the Applied examination. A reference sheet is not allowed in the Theory examination. The reference sheet will be collected at the end of the exam.

Students are strongly urged to meet with their advisors to discuss preparation for the qualifying examinations. Students are allowed two attempts to pass a qualifying exam. The Biostatistics Qualifying Exam Committee will evaluate requests by students to take an exam for the third time on a case-by-case basis.

Time Limit

The program shall be completed within three years after the first registration for study leading to the MA degree.

Important Note: For May graduates only, diplomas will be available at the commencement ceremonies. Otherwise, approximately one month following the date of graduation and depending on a student's preference, the diploma is either available for pick-up from the Diploma Office at the Office of the University Registrar, 881 Commonwealth Avenue, or it will be mailed to the address specified on the Diploma Dispersal form that is submitted with the Diploma Application.

Section 4

PhD Degree Requirements

OVERVIEW OF THE PHD DEGREE

The PhD program in Biostatistics is geared towards the graduate student who seeks a career as a professional, academic or industrial biostatistician in biomedical or epidemiologic sciences. The program meets the needs of the health professional who wishes to continue with public health training and achieve a higher and more specialized degree and the statistician who wishes to specialize in statistical methods for biomedical or epidemiologic applications.

PHD LEARNING OUTCOMES

A candidate for a Doctor of Philosophy degree in Biostatistics is expected to demonstrate mastery of knowledge in biostatistics and to synthesize and create new knowledge, making an original and substantial contribution to the field in a timely fashion by:

- Demonstrating mastery at a doctoral level of biostatistical theory and application through high achievement in course work and on written comprehensive examinations.
- Making an independent, original, and substantial contribution to the field of biostatistics assessed through an oral defense of the dissertation work.
- Demonstrating commitment to advancing the values of scholarship by keeping abreast of current advances in the field of biostatistics and showing commitment to personal professional development through engagement in professional societies and publication.
- Conducting scholarly work in a professional and ethical manner guided by the principles of the profession.

PHD DEGREE REQUIREMENTS

The Graduate School of Arts & Sciences requires students pursuing a Doctor of Philosophy in Biostatistics to:

- Complete the 64-credit (post-BA), or 32-credit + co-requisites (post-MA) curriculum
- Fulfill the Residency Requirement
- Fulfill the Grade Requirement
- Pass the Qualifying Examinations
- Complete the PhD degree within 7 years (post-bachelor's), 5 years (post-master's)

Dissertation Phase

- Participate in one doctoral dissertation presentation per year
- Attend at least one doctoral dissertation presentation per month
- Meet with dissertation committee twice a year
- Complete dissertation that is the equivalent of three publishable paper
- Pass Final Oral Defense Examination

Curriculum

The intent of the curriculum is to provide a firm foundation in biostatistics and mastery of a broad range of applied techniques. Students in the PhD program entering with only a bachelor's degree must complete a total of 64 credits.

Students entering the PhD program with MA degrees may be accepted into an eight-course, (32 credits) post-master's PhD program. However, they may be required to take additional co-requisites if there are deficiencies in their background. For post-master's PhD students, the core courses required will be determined at the start of their program by the Co-Directors. The remaining courses must come from the list of Biostatistics (either BS or MA) or Elective courses.

Course #	Course Title	When Offered
1. Nine Core Courses, required (35 credits):		
CAS MA575	Linear Models	Fall
CAS/MET MA581	Probability	Fall
CAS/MET MA582	Mathematical Statistics	Spring
SPH EP713	Introduction to Epidemiology	Fall/Spring
SPH BS805	Interm. Statistical Computing & Applied Regression	Fall/Spring/Summer
SPH BS852	Statistical Methods in Epidemiology	Fall/Spring
SPH BS853	Generalized Linear Models with Applications	Spring
GRS MA781	Estimation Theory	Fall
GRS MA782	Hypothesis Testing	Spring
2. At Least four of the following electives, including at least one each from the MA and BS series (16 credits):		
MA Series		
CAS MA576	Generalized Linear Models	Spring
CAS MA583	Introduction to Stochastic Processes	Spring
CAS MA584	Multivariate Statistical Analysis	Spring
CAS MA585	Time Series Modeling and Forecasting	Spring
CAS MA586	The Design of Experiments	Spring
CAS MA587	Sampling Design: Theory and Methods	Spring
CAS MA588	Nonparametric Statistics	Spring
CAS MA685	Advanced Topics in Statistics	Fall
CAS MA750	Advanced Statistical Methods I	Fall
GRS MA751	Advanced Statistical Methods II	Spring
BS Series		
SPH BS722	Design and Conduct of Clinical Trials	Fall/Spring
SPH BS728	Public Health Surveillance, a Methods Based Approach (2 credits)	Fall
SPH BS775	Applications of Statistical Methods in Clinical Research	Alt Springs (even years)
SPH BS810	Meta-analysis for Public Health and Medical Research	Fall
SPH BS820	Logistic Regression/Survival Analysis	Spring
SPH BS821	Categorical Data Analysis	Fall
SPH BS822	Advanced Statistical Computing	Alt Springs (odd years)
SPH BS830	Design and Analysis of Microarray Experiments and	Alt Falls (odd years)

	Next Generation Sequencing	
SPH BS845	Applied Statistical Modeling and Programming in R	Alt Falls (odd years)
SPH BS851	Applied Statistics in Clinical Trials I	Alt Springs (odd years) & Summers (even years)
SPH BS854	Bayesian Methods in Clinical Trials	Alt Falls (odd years)
SPH BS855	Bayesian Modeling for Biomedical Research	Alt Falls (even years)
SPH BS856	Adaptive Design for Clinical Trials	Alt Springs (even years)
SPH BS857	Analysis of Correlated Data	Spring
SPH BS858	Statistical Genetics I	Fall
SPH BS859	Applied Genetic Analysis	Alt Springs (odd years)
SPH BS860	Statistical Genetics II	Alt Springs (even years)
SPH BS861	Applied Statistics in Clinical Trials II	Fall

3. The remaining courses may be selected from the above series of courses or from the following Elective Courses. One elective may be in the biological sciences[#] (13 credits):

CAS MA511	Introduction to Analysis I	Fall
CAS MA512	Introduction to Analysis II	Spring
CAS MA539	Methods of Scientific Computing	Spring
CAS MA555	Numerical Analysis I	Spring
CAS MA556	Numerical Analysis II	Fall
CAS MA578	Bayesian Statistics	Spring
GRS MA703	Statistical Analysis of Network Data	Alt Falls (odd years)
GRS MA711	Real Analysis	Fall
GRS MA750	Advanced Statistical Methods I	Fall
GRS MA751	Advanced Statistical Methods II	Spring
GRS MA779	Probability Theory I	Fall
GRS MA780	Probability Theory II	Spring
GRS MA861*	Seminar: Applied Mathematics	Fall/Spring
GRS MA 882*	Seminar: Statistics	Spring
SPH BS715	Practical Skills for Biostatistics Collaboration (1cr)	Spring
SPH BS771	Topics in Biostatistics (also 871)	TBD
SPH EP813	Intermediate Epidemiology	Spring
SPH EP854[‡†]	Modern Epidemiology	Fall
SPH EP855[‡†]	Design Issues in Epidemiology	Alt Springs (odd years)
SPH EP856[‡†]	Selected Topics in Epidemiologic Methods	Alt Springs (even years)
SPH BS901**	Directed Study in Biostatistics	TBD
SPH BS902**	Directed Research in Biostatistics	TBD

* Only one of these courses may be taken as an elective.
‡ Only one of these three courses may count as an elective.
** Post-bachelor's PhD students may petition Co-Directors to allow more than 4 credits.
# Given the large number of biology courses, a comprehensive list is not provided here. Please contact the Program Co-Directors to seek permission for a specific course in the biological sciences.

Specialization Areas

Students in the PhD program may also select one of three areas of specialization by completing the nine core courses, at least one of the courses in the MA series above, and three courses from the four listed within a specific area as follows

Analysis of Observational Studies	
SPH BS820	Logistic Regression/Survival Analysis
SPH EP813	Intermediate Epidemiology
SPH BS857	Analysis of Correlated Data
SPH BS810	Meta-analysis for Public Health and Medical Research
Clinical Trials	
SPH BS722	Design and Conduct of Clinical Trials
SPH BS851	Applied Statistics in Clinical Trials I
SPH BS854	Bayesian Methods in Clinical Trials
SPH BS856	Adaptive Designs for Clinical Trials
SPH BS861	Applied Statistics in Clinical Trials II
SPH BS810	Meta-analysis for Public Health and Medical Research
Statistical Genetics	
SPH BS830	Design and Analysis of Microarray Experiments
SPH BS858	Statistical Genetics I
SPH BS859	Applied Genetic Analysis
SPH BS860	Statistical Genetics II

Residency Requirements

The minimum residency requirement is the equivalent of two consecutive regular semesters of full-time graduate study at Boston University. Students who have completed their course requirements must register each subsequent academic-year semester for BS980 Continuing Study/Dissertation Seminar until they have completed all requirements for the degree. Upon written petition and appropriate cause, students will be allowed up to two semesters of leave of absence.

Students must be registered in both the semester in which the last degree requirements are completed and in the preceding semester. For example, if a student plans to complete their degree requirements in Spring of 2014, s/he must be registered in both Spring 2014 and Fall 2013. If a student plans to defend in Summer 2014, s/he must be registered in Spring 2014 and Summer 2014. If a student defends in late Fall 2013, s/he needs to be registered in only Spring and Fall 2013. (Students should see Martha Khan (GRS) if s/he plans on defending in early Fall.)

Grade Requirements

Students must earn a grade of B- or better in all courses applied to the PhD.

Qualifying Examinations

The doctoral candidate must satisfactorily pass two comprehensive written examinations upon completion of coursework. These will require proficiency in material covered in the nine core courses. Students can use one single-sided reference sheet (printer size [8.5in x 11in] or smaller, handwritten or typed) for both examinations. The reference sheet will be collected at the end of the exam.

The statistical theory qualifying examination is given each year in the fall semester. Candidates must answer a total of four of six questions based on material covered in MA781 and MA782. The applied statistics qualifying examination is given each year in December and in April. Candidates must satisfactorily answer one of two questions based on material covered in BS853, plus a total of four questions based on material covered in MA575, BS805, and BS852, with at least one question from each of the three course areas.

Students are strongly urged to meet with their advisors to discuss preparation for the qualifying examinations. Students are allowed two attempts to pass a qualifying. The Biostatistics Qualifying Exam Committee will evaluate requests by students to take an exam for the third time on a case-by-case basis.

Dissertation

Upon successful completion of the qualifying examinations, doctoral students select thesis advisors who will guide them through their dissertation research. The PhD dissertation provides students with the opportunity to design, conduct, and report on independent, original research in biostatistics. The dissertation consists of original research in the development of statistical methodology for biomedical or epidemiologic applications. The dissertation must be an original contribution to the body of knowledge in biostatistics. It is expected that the dissertation content will address a relevant question in statistical methodology and will pose a new approach, extend an existing approach, or provide novel application of an existing method. Dissertations will often utilize simulation, but simulation studies without methodological development or a theoretical component are not sufficient. Additionally, simulations are not required and use of real data sets in combination with theoretical work may suffice.

The dissertation must meet all formatting requirements specified by GRS. Within these requirements, two approaches to the dissertation are allowed. The first is a single body of work comprehensively addressing one problem. The second format consists of two or three problems in a single area of research. For either format, the content of the dissertation should be at least equal to the content of three journal articles. The format of the dissertation (single body of work versus multiple related problems) should be agreed upon by consensus of the student, the major advisor and the committee members.

Doctoral Dissertation Presentations

Bi-monthly seminars are held throughout the academic year for student presentations. Students who have completed coursework and have passed their qualifying examinations must (a) present the status of their thesis work in at least one seminar per year, and (b) attend at least one seminar each month. There are no exceptions.

In addition, students are required to complete a paper based on their dissertation that is ready to submit to a peer-reviewed journal for consideration of publication, and be listed as first author. The article must conform to the requirements of a specific statistical or otherwise appropriate journal.

Dissertation Progress

Doctoral students in the dissertation stage of the program are required to meet with their dissertation committee twice a year. At least three committee members must be in attendance.

A dissertation progress update form should be submitted to the Curriculum Coordinator no later than May 15th and December 15th of each year.

Final Oral Defense Examination

The candidate presents an oral defense of the dissertation before a five-member doctoral committee.

Time Limit

The post-bachelor's PhD program must be completed within seven years after the first registration for doctoral study. The post-master's PhD program must be completed within five years after the first registration for the doctoral program. All doctoral students are expected also to adhere to Biostatistics Program guidelines regarding the following milestones in their programs of study toward degree completion:

- Successfully complete all core courses no later than 3 years after matriculation
- Pass at least one (Theoretical or Applied) Biostatistics qualifying examinations no later than 3 years after matriculation.
- Pass both qualifying exams no later than 4 years after matriculation.
- Establish the members of the dissertation committee no later than 6 months after passing the final qualifying exam.

Diploma Application

Diploma applications are available in the Graduate School (GRS) Records Office. The Graduation Calendar can be found on GRS' website.

Section 5

Administrative Timeline & Policies to Degree

TIMELINE TO DOCTORAL DEGREE

Students are responsible for monitoring the progress of their program with the help of their academic advisor. The following are steps students should take to completing their PhD Dissertation. Students should direct questions to the one of the Co-Directors.

1-4 years	Complete coursework Sit for Qualifying Exams o Applied Qualifying Exam offered in April and December. o Theory Qualifying Exam offered in October.
Upon completion of coursework, qualifying and language exams	Students should identify dissertation advisor(s), topic, and committee. o A Committee consists of five members. One person will serve as Chair of committee. At least two members, including the chair must be faculty members from the student's graduate program or department. If a committee member does not have a BU faculty appointment, the student must file a Special Service Appointment form with the Curriculum Coordinator. Doctoral Student Presentation Seminars o Students must participate in one doctoral student presentation seminar per academic year after completing coursework and passing the qualifying exams. o Abstract and summary are to be sent one week prior to presenting to Howard Cabral (hjcab@bu.edu).
7-9 months prior to defense	Depending on when degree will be awarded, dissertation prospectus is due to GRS. Prior to submitting, students should work with advisor and send a copy to all committee members for review and comment. Provide copy to Curriculum Coordinator. Get Copy of Dissertation Format Requirements.
2-3 months prior to graduation	Depending on when degree will be awarded, students need to file a diploma application with GRS.
3 months prior to defense	First draft of dissertation should be submitted to readers. Schedule an Appointment at GRS to review format of dissertation
1 month prior to defense	Students must prepare one article for submission to a peer-reviewed journal for consideration of publication and be listed as first author. The dissertation advisor can sign off on fulfillment of this requirement. In special circumstances the submission may take place after the dissertation defense. Students should meet with their committee to make final preparations for defense; however, students should be meeting with their committee frequently throughout the dissertation phase. Students should schedule individual meetings with members of the committee to discuss the content and presentation of material in the dissertation.
3 weeks prior to defense	Students need to submit abstract to committee to review and to GRS for Dean's approval.

	Submit draft of dissertation to Martha Khan (wellman@bu.edu). You will be notified if the format is approved, or if any changes are required. Students should provide a final copy of dissertation to each member of the committee.
3 weeks prior to defense	Students should select a Chair of Committee and notify GRS of the name of the Chair. (Appropriate paperwork will be sent to Chair in advance of the defense.)
2-3 weeks prior to defense	Schedule defense and submit 2 copies of abstract to GRS. Submit electronic copy of abstract to Curriculum Coordinator for announcement.
Day of defense	Students should prepare appropriate signature pages according to GRS specifications for the defense. Students will use a power point presentation to present dissertation.
After defense	Submit final approved dissertation electronically to the ETD Administrator and make an appointment with Martha Khan to submit required materials. Submit a bound version of the dissertation to the Co-Directors of the Program. Complete an exit interview form and meeting with one of the Co-Directors within one month of program completion.

Master's Degree Forms

- Graduation Information
  http://www.bu.edu/cas/students/graduate/graduation-information/
- Diploma Application
  http://www.bu.edu/cas/files/2012/01/MA-diploma-app-editable2.pdf

Doctoral Degree Forms

- Graduation Information
  http://www.bu.edu/cas/students/graduate/graduation-information/
- Dissertation Format and Guidelines
  http://www.bu.edu/cas/files/2011/12/ElectronicGuide20131.pdf
- Dissertation Prospectus
  http://www.bu.edu/cas/files/2011/12/Dissertation-Prospectus-editable5.pdf
- Diploma application
  http://www.bu.edu/cas/files/2011/12/PhD-diploma-app-editable.pdf
- Dissertation Defense Abstract
  http://www.bu.edu/cas/files/2011/12/PhD-Diss-Def.-Abstract-editable1.pdf
- Schedule Defense
  http://www.bu.edu/cas/files/2011/12/Schedule-of-final-oral-exam-editable.pdf
- Special Service Appointment
  http://www.bu.edu/cas/files/2011/12/Special-Service-App-editable4.pdf

All GRS forms can be found on:
http://www.bu.edu/cas/students/grad-resources/forms/

Policies

All students must adhere to all Boston University Graduate School of Arts & Sciences academic policies, available at www.bu.edu/academics/grs/policies/; and the University's Administrative Policies, available at bu.edu/lifebook. Note that this information may change at any time.

Questions?

Contact:

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aavelez@bu.edu
(p) 617-638-5207

Martha Wellman Khan
GRS Records Officer
705 Commonwealth Ave Rm 112
Boston, MA 02215
wellman@bu.edu
(p) 617-353-2694

Section 6 Course Descriptions

BIOSTATISTICS COURSE DESCRIPTIONS

Comprehensive and up to date course descriptions can be found on:
https://www.bu.edu/phpbin/course-search/index.php.

SPH BS 715 - Practical Skills for Biostatistics Collaboration
This course will focus on skills required for effective research collaboration with investigators from various disciplines. Emphasis will be on the development of skills to communicate effectively with biostatistician and non-biostatisticians collaborators, to write data collection and statistical analysis plans for grants and/or publications, and to organize results in appropriate visual displays and tables. Other issues, including techniques to work efficiently in multi-disciplinary research teams (e.g constructing timelines and deliverables,) will also be discussed. Weekly discussions will address challenges in collaborative research, along with approaches, skills and guidelines necessary to overcome these challenges. Students will have hands-on experience with case studies of particular data sets or projects, development of analysis plans, and dissemination of the analysis results. Grad Prereq: The biostatistics MPH core requirement. [1cr.]

SPH BS 722 - Design and Conduct of Clinical Trials
This course covers the development, conduct, and interpretation of clinical trials. It is suitable for concentrators in any department. Topics include principles and practical features such as choice of experimental design, choice of controls, sample size determination, methods of randomization, adverse event monitoring, research ethics, informed consent, data management, and statistical analysis issues. Students write a clinical trial protocol during the semester. [4 cr.]

SPH BS 728 - Public Health Surveillance, a Methods Based Approach
Thacker wrote, "Surveillance is the cornerstone of public health practice." This course will provide an introduction to surveillance and explore its connections to biostatistics and public health practice. Topics will include complex survey design, weighted sampling, capture-recapture methods, time series analyses and basic spatial analyses. Students will learn about available surveillance data, how to analyze these data, and how to write about their findings. Additionally students will propose a new surveillance system or modification of an existing system. This class carries Epidemiology concentration credit. [2 cr.]

SPH BS 771 - Topics in Biostatistics
Two and four credit topics courses may be offered throughout the academic year as a means of exploring new areas of study in the discipline. Topics vary by semester. Please refer to the print schedule for the specific course in any given semester. Not taught every year or semester. [4 cr.]

SPH BS 775 - Applications of Advanced Statistical Methods in Clinical Research
This course provides a non-technical (no computer programming) overview of concepts in statistical methods used for clinical research and their applications. Each week, students read a methodologic article and a clinical research article. The first portion of the class is a didactic presentation; the second portion is a discussion of the clinical research article, incorporating the concepts discussed in the didactic presentation. Students explore statistical test selection, alternative tests or approaches. Students examine interpretations of scientific articles in the lay press. [4 cr.]

SPH BS 805 - Intermediate Statistical Computing and Applied Regression Analysis
This course is a sequel to BS723. Emphasis is placed on the use of intermediate-level programming with the SAS statistical computer package to perform analyses using statistical models with emphasis

on linear models. Computing topics include advanced data file manipulation, concatenating and merging data sets, working with date variables, array and do-loop programming, and macro construction. Statistical topics include analysis of variance and covariance, multiple linear regression, logistic regression, survival analysis, the analysis of correlated data, and statistical power. Includes a required lab section (BS805 B1 OR BS805 C1 for which students must register). [4 cr.]

SPH BS 810 - Meta-Analysis for Public Health & Medical Research
Meta-analysis is the statistical analysis of research findings and is widely used in public health and medical research. Typically meta-analysis is employed to provide summary results of the research in an area, but other uses include exploratory analyses to find types of subjects who best respond to a treatment or find study-level factors that affect outcomes. The course will cover the theory and use of the most common meta-analytic methods, the interpretation and limitations of results from these methods, diagnostic procedures, and some advanced topics with a focus on public health application. Grading will be based on homework, an exam and a project. [4 cr.]
Grad Prereq: The biostatistics and epidemiology MPH core course requirements and SPH BS723 or consent of instructor, mlava@bu.edu.

SPH BS 820 - Logistic Regression and Survival Analysis
This course provides basic knowledge of logistic regression and analysis of survival data. Regression modeling of categorical or time-to-event outcomes with continuous and categorical predictors is covered. Checking of model assumptions, goodness of fit, use of maximum likelihood to determine estimates and test hypotheses, use of descriptive and diagnostic plots are emphasized. The SAS statistical package is used to perform analyses. Grading will be based on homework and exams. [4 cr.]
Grad Prereq: The biostatistics and epidemiology MPH core course requirements and BS723 or BS852.

SPH BS 821 - Categorical Data Analysis
This course focuses on the statistical analysis of categorical outcome data. Topics include the binomial and Poisson distributions, logistic and Poisson regression, nonparametric methods for ordinal data, smoothed regression modeling, the analysis of correlated categorical outcome data, cluster analysis, missing data and sample size calculations. The course emphasizes practical application and makes extensive use of the SAS programming language. [4 cr.]
Grad Prereq: The biostatistics MPH core requirement and BS723 or consent of instructor.

SPH BS 822 - Advanced Methods in Statistical Computing
This course introduces advanced statistical methods and programming techniques that allow students to examine advanced statistical models that go beyond that available with standard SAS procedures taught in BS805. Topics include simulation studies, bootstrapping and Bayesian analysis. Students will apply these methods in homework assignments. [4 cr.]
Grad Prereq: SPH BS805 & linear algebra (CAS 142 or equivalent) or permission

SPH BS 830 - Design and Analysis of Microarray Data
In this course, students will be presented with the methods for the analysis of gene expression data measured through microarrays. The course will start with a review of the basic biology of gene expression and an overview of microarray technology. The course will then describe the statistical techniques used to compare gene expression across different conditions and it will progress to describe the analysis of more complex experiments designed to identify genes with similar functions and to build models for molecular classification. The statistical techniques described in this course will include general methods for comparing population means, clustering, classification, simple graphical models and Bayesian networks. Methods for computational and biological validation will be discussed. [4 cr.]
Grad Prereq: MPH biostatistics core course or BS723 required or consent of instructor (sebas@bu.edu). Recommended: Basic biology.

SPH BS 845 - Applied Statistical Modeling and Programming in R
This course covers applications of modern statistical methods using R, a free and open source statistical computing package with powerful yet intuitive graphic tools. R is under more active

development for new methods than other packages. We will first review data manipulation and programming in R, then cover theory and applications in R for topics such as linear and smooth regressions, survival analysis, mixed effects model, tree based methods, multivariate analysis, boot strapping and permutation. [4 cr.]
Grad Prereq: The MPH biostatistics core core and SPH BS723 or consent of instructor

SPH BS 851 - Applied Statistics in Clinical Trials I
This is an intermediate statistics course, focused on statistical issues applicable to analyzing efficacy data for clinical trials. Topics include design and analysis considerations for clinical trials, such as randomization and sample size determination, and the application of statistical methods such as analysis of variance, logistic regression and survival analysis to superiority and non-inferiority clinical trials. This course includes lectures and computer instructions. Upon completion of the course, the student will be able to have a working knowledge of how to collect and manage clinical trial data; will be to analyze continuous, dichotomous, and time-to-event clinical trial data; and will be able to contribute to the statistical portions of a clinical trial study design. The student will also gain the overall knowledge required to interpret clinical trial statistical results. [4 cr.]
Grad Prereq: The MPH epidemiology and biostatistics core course requirements and SPH BS73 or consent of instructor, jmm@bu.edu.

SPH BS 852 - Statistical Methods in Epidemiology
This course covers study design and intermediate-level data analysis techniques for handling confounding in epidemiologic studies. Confounding is carefully defined and distinguished from interaction. Course content covers stratification and multivariable techniques for controlling confounding in both matched and independent sample study designs, including analysis of covariance, logistic regression, and proportional hazards models. Model fit and prediction are discussed. Students are required to apply these methods with the aid of computerized statistical packages. [4 cr.]
Grad Prereq: BS703, BS723 and the epidemiology MPH core requirement or consent of instructor

SPH BS 853 - Generalized Linear Models with Applications
This course introduces statistical models for the analysis of quantitative and qualitative data, of the types usually encountered in health science research. The statistical models discussed include: Logistic regression for binary and binomial data, Nominal and Ordinal Multinomial logistic regression for multinomial data, Poisson regression for count data, and Gamma regression for data with constant coefficient of variation. All of these models are covered as special cases of the Generalized Linear Statistical Model, which provides an overarching statistical framework for these models. We will also introduce Generalized Estimating Equations (GEE) as an extension to the generalized models to the case of repeated measures data. The course emphasizes practical applications, making extensive use of SAS for data analysis. [4 cr.]
Grad Prereq: The biostatistics and epidemiology MPH core course requirements and BS805 or consent of instructor

SPH BS 854 - Bayesian Methods in Clinical Trials
Bayesian statistical methods use prior information or beliefs, along with the current data, to guide the search for parameter estimates. In the Bayesian paradigm probabilities are subjective beliefs. Prior information/ beliefs are input as a distribution, and the data then helps refine that distribution. The choice of prior distributions, posterior updating, as well as dedicated computing techniques are introduced through simple examples. Bayesian methods for design, monitoring analysis for randomized clinical trials are taught in this class. These methods are contrasted with traditional (frequentist) methods. The emphasis will be on concepts. Examples are case studies from the instructors' work and from medical literature. R will be the main computing tool used. [4 cr.]
Grad Prereq: SPH BS851 or BS861 or consent of instructor

SPH BS 855 - Bayesian Modeling for Biomedical Research & Public Health
The purpose of this course is to present Bayesian modeling techniques in a variety of data analysis applications, including both hypothesis and data driven modeling. The course will start with an overview of Bayesian principles through simple statistical models that will be used to introduce the concept of marginal and conditional independence, graphical modeling and stochastic computations.

The course will proceed with the description of advanced Bayesian methods for estimation of odds and risk in observational studies, multiple regression modeling, loglinear and logistic regression, latent class modeling including hidden Markov models and application to model-based clustering, graphical models and Bayesian networks. Applications from genetics, genomics, and observational studies will be included. These topics will be taught using real examples, class discussion and critical reading. Students will be asked to analyze real data sets in their homework and final project. [4 cr.]
Grad Prereq: BS805 or MA684 and MA581/MA582 or equivalent or consent

SPH BS 856 - Adaptive Designs for Clinical Trials
An adaptive design is a clinical trial design that allows modification to aspects of the trial after its initiation without undermining the validity and integrity of the trial. Adaptive designs have become very popular in the pharmaceutical industry because they can increase the probability of success, considerably reduce the cost and time of the overall drug development process. With a recent rapid development in this area, there is a high demand for statisticians proficient in designing and conducting adaptive clinical trials. Students will learn different (both frequentist and Bayesian) adaptive designs and gain hands-on experiences on adaptive randomization, adaptive dose-finding, group sequential, and sample-size reestimation designs. [4 cr.]
Grad Prereq: SPH BS851

SPH BS 857 - Analysis of Correlated Data
The purpose of this advanced seminar is to present some of the modern methods for analyzing tricorrelated observations. Such data may arise in longitudinal studies where repeated observations are collected on study subjects or in studies in which there is a natural clustering of observations, such as a multi-center study of observations clustered within families. Students start with a review of methods for repeated measures analysis of variance and proceed to more complicated study designs. The course presents both likelihood-based methods and quasi-likelihood methods. Marginal, random effects and transition models are discussed. Students apply these methods in homework assignments and a project. [4 cr.]

SPH BS 858 - Statistical Genetics I
This course covers a variety of statistical applications to human genetic data, including collection and data management of genetic and family history information, and statistical techniques used to identify genes contributing to disease and quantitative traits in humans. Specific topics include basic population genetics, linkage analysis and genetic association analyses with related and unrelated individuals. [4 cr.]

SPH BS 859 - Applied Genetic Analysis
Statistical tools such as linkage and association analysis are used to unravel the genetic component of complex disease. Investigators interested in the genetic analysis of complex traits need a basic understanding of the strengths and weaknesses of these methodologies. This course will provide the student with practical, applied experience in performing linkage and association analyses, including genome-wide analyses. Special emphasis is placed on understanding assumptions and issues related to statistical methodologies for genetic analysis to identify genes influencing complex traits. Students will use specialized genetics software for homework assignments. [4 cr.]

SPH BS 860 - Statistical Genetics II
This course covers current topics in statistical genetics, with emphasis on how statistical techniques can be used with various types of genetics data for mapping genes responsible/contributing to complex human diseases. Topics such as genetics map functions, gene mapping in experimental organisms, advanced linkage analysis methods, statistical approaches for the analysis of genome-wide high density SNP scans in unrelated and family samples will be discussed. [4 cr.]

SPH BS 861 - Applied Statistics in Clinical Trials II
This course covers a variety of biostatistical topics in clinical trials, including presentation of statistical results to regulatory agencies for product approval, analysis of safety data, intent-to-treat analyses and handling of missing data, interim analyses and adaptive designs, and analyses of multiple endpoints. Upon completion of the course, students will be able to make and defend decisions for many study designs and for issues faced when analyzing efficacy and safety data from clinical trials.

Students will also be able to present, in a written format following standard guidelines accepted by the clinical trials' community, results of such efficacy and safety analyses to the medical reviewers and statistical reviewers of regulatory agencies. [4 cr.]
Grad Prereq: BS851 or consent of instructor (jmm@bu.edu).

SPH BS 865 - Statistical Consulting
Consulting is an integral part of a career in biostatistics. This course introduces students to the skills needed to become an effective consultant and provides opportunities for practical training through mock consultations, video consulting sessions and case studies. Topics covered include steps in a consulting session, project/data management, and oral and written presentation of results. Students will also gain experience in writing data analysis plans, performing sample size/power calculations and data analysis. [2 cr.]
Grad Prereq: SPH BS805 AND BS851 or BS852 or instructor consent

SPH BS 871 - Advanced Topics in Biostatistics
Advanced Topics in Biostatistics explores various areas of study within the field of biostatistics in greater depth. Two and four credit topics classes vary by semester. See the print or web-based School of Public Health semester schedule for more information pertaining to the advanced topics course for a specific semester. [4 cr.]
Grad Prereq: BS703, BS723, or consent.

SPH BS 980 - Continuing Study in Biostatistics
Doctoral students in Biostatistics register each summer and fall for Continuing Study in Biostatistics until they have graduated from their doctoral program. Students will participate in a dissertation workshop and other activities while they are preparing their dissertation. Students are charged for 2 credits equivalent of tuition and for medical insurance. They are certified full time. Students must be registered for this course at GRS. [0 cr.]
Grad Prereq: For students in the doctoral program in Biostatistics who are approved for dissertation work. Students must be registered for this course by the GRS Registrar.

MATHEMATICS COURSE DESCRIPTIONS

CAS MA575 – Linear Models This course covers the general linear model, generalized inverse, quadratic forms and their distributions, least-square estimation, estimable function, Gauss-Markov Theorem, confidence region, test of linear hypothesis, and prediction. [4 cr.]
Prerequisite: one semester each of college-level linear algebra and applied statistics, or Mathematical Statistics (CAS MA582), or consent of instructor.

CAS MA576 – Generalized Linear Models
This continuation of CAS MA 575 covers analysis of variance, analysis of repeated measures, random-effect models, regression with random coefficients, multivariate models, two-stage linear models, and generalized estimating equations. [4 cr.]
Prerequisite: Linear Models (CAS MA575) or consent of instructor.

CAS MA578 – Bayesian Statistics
This course covers principles and methods of Bayesian statistics including subjective probability, Bayes rule, posterior distributions, and predictive distributions. Computationally based inference using Monte Carlo integration, Markov chain simulation, hierarchical models, mixture models, model checking, and methods for Bayesian model selection are also covered. [4 cr.]
Prerequisite: Probability (CAS MA581), Mathematical Statistics (CAS MA582), or consent of instructor.

CAS MA581 - Probability
This course covers basic probability, conditional probability, independence, discrete and continuous random variables, mean and variance, functions of random variables, and moment generating functions. Jointly distributed random variables, conditional distributions, independent random variables, methods of transformations, law of large numbers, and the central limit theorem are also covered. [4 cr.]

Prerequisite: One semester of college-level multivariable calculus or consent of instructor.

CAS MA582 - Mathematical Statistics
The goal of this course is to provide a basic foundation in mathematical statistics. Topics include: point estimation including unbiasedness, efficiency, consistency, sufficiency, minimum variance unbiased estimator, the Rao-Blackwell theorem, and the Rao-Cramer inequality. The course also covers maximum likelihood and method of moment estimations; interval estimation; tests of hypothesis, uniformly most powerful tests, uniformly most powerful unbiased tests, likelihood ratio test, and the chi-square test. [4 cr.]
Prerequisite: Probability (CAS MA581).

CAS MA583 - Introduction to Stochastic Processes
This course provides a working knowledge of basic concepts and techniques of stochastic processes as they are most often used to construct models for a variety of problems of practical interest. Topics include Markov Chains, Poisson processes, birth and death processes, queuing theory, renewal processes, and reliability. [4 cr.]
Prerequisite: Probability (CAS MA581) or consent of instructor.

CAS MA584 - Multivariate Statistical Analysis
Presents statistical concepts and methods and their application for the exploration, regression, testing, visualization, and clustering of multivariate data. Both classical and modern techniques are developed, including methods for analysis of high dimensional and non-euclidean data. [4 cr.]
Prerequisite: Probability (CAS MA581) or consent of instructor.

CAS MA585 - Time Series and Forecasting
Autocorrelation and partial autocorrelation functions; stationary and nonstationary processes; ARIMA and Seasonal ARIMA model identification, estimation, diagnostics, and forecasting. Modeling financial data via ARCH and GARCH models. Volatility estimation; additional topics, including long-range dependence and state-space models. [4 cr.]
Prerequisite: Probability (CAS MA581) or consent of instructor.

CAS MA586 - The Design of Experiments
This is a traditional course in the design of experiments. It covers randomized blocks, Latin and Graeco-Latin squares, factorial arrangements with confounding and fractional replication, split-plot, cross-over, and response surface designs, treatment of missing data, of group sizes, and of relative efficiency, and relationship between design and analysis. [4 cr.]
Prerequisite: Mathematical Statistics (CAS MA582) or equivalent, or consent of instructor.

CAS MA587 - Sampling Design: Theory and Methods
This course provides a basic introduction to sampling, including stratified, cluster, systematic, multistage, double, and inverse sampling; optimum sample size, relative efficiency, sampling with unequal probabilities, types of estimators (ratio and regression) and their properties; measurement error response and randomized response models. [4 cr.]
Prerequisite: Mathematical Statistics (CAS MA582) or equivalent, or consent of instructor.

CAS MA588 - Nonparametric Statistics
This course examines theory and logic in the development of nonparametric techniques including order statistics, tests based on runs, goodness-of-fit, rank-order (for location and scale), measures of association, analysis of variance, asymptotic relative efficiency. [4 cr.]
Prerequisite: Mathematical Statistics (CAS MA582) or equivalent, or consent of instructor.

CAS MA684 - Applied Multiple Regression and Multivariable Methods
Application of multivariate data analytic techniques. Multiple regression and correlation, confounding and interaction, variable selection, categorical predictors and outcomes, logistic regression, factor analysis, MANOVA, discriminant analysis, regression with longitudinal data, repeated measures, ANOVA. [4 cr.]
Prerequisite: One year of college-level statistics.

CAS MA685 - Advanced Topics in Applied Statistics Analysis
Topics covered in CAS MA 684 are examined at a more advanced level: canonical correlation, multivariate analysis of variance, multivariate regressions, categorical dependent variables techniques, discriminant analysis, principal-axes, rotations, factor scores, cluster analysis, power analysis, and extensive use of statistical software. [4 cr.]
Prerequisite: Applied Multiple Regression and Multivariable Methods (CAS MA684) or consent of instructor.

GRS MA703 – Statistical Analysis of Network Data
Methods and models for the statistical analysis of network data, including network mapping and characterization, community detection, network sampling and measurement, and the modeling and inference of network and networked-indexed processes. Balance of theory and concepts, illustrated through various applications.
Prerequisite: Linear Models (CAS MA575) or Accelerated Introduction to Statistical Methods for Quantitative Research (GRS MA681) or consent of instructor.

GRS MA750 - Advanced Statistical Methods I
First course in a two-semester PhD sequence on post-classical statistical methods and their applications. Selection from topics in non- and semi-parametric modeling and inference, such as smoothing, splines, generalized additive models, projection pursuit, and classification and regression trees. [4 cr.]
Prerequisite: Linear Models (CAS MA575) & Probability (CAS MA581) or consent of instructor.

GRS MA751 - Advanced Statistical Methods II
Second course in a two-semester PhD sequence on post-classical statistical methods and their applications. Selection from topics in statistical learning, such as regularized basis methods, kernel methods, boosting, neural networks, support vector machines, and graphical models. [4 cr.]
Prerequisite: Linear Models (CAS MA575) & Probability (CAS MA581) or consent of instructor.

GRS MA781 - Estimation Theory
This course provides a review of probability, populations, samples, sampling distributions, delta theorems; parametric point estimation, Rao-Cramer inequality, sufficient statistics, Rao-Blackwell theorem, maximum likelihood estimation, least squares estimation, general linear model of full rank, confidence intervals, Bayesian analysis, and decision theory.
[4 cr.]
Prerequisite: Probability (CAS MA581) Mathematical Statistics (CAS MA582), or consent of instructor.

GRS MA782 - Hypothesis Testing
This course is an advanced course in mathematical statistics and covers the following topics: parametric hypothesis testing, uniformly and locally the most powerful tests, similar tests, invariant tests, likelihood ratio tests, linear model testing, asymptotic theory of likelihood ratio, and chi-squared test, Logit and log-lin analysis of contingency tables. [4 cr.]
Prerequisite: Estimation Theory (GRS MA781) or consent of instructor.

EPIDEMIOLOGY COURSE DESCRIPTIONS

SPH EP 713 - Introduction to Epidemiology
Epidemiology is a discipline that identifies the determinants of defects, disease and injury in human populations and provides a means of assessing the magnitude of public health problems and the success of interventions designed to control them. The goals of EP713 are to introduce the basic principles and methods of epidemiology and demonstrate their applicability to public health and research and to provide fundamental skills needed to begin to interpret and critically evaluate literature relevant to public health professionals. Topics include measures of disease frequency and effect, epidemiologic study designs, bias, and screening for disease. Class lectures are interspersed with active learning exercises consisting of a mixture of in-class problems, exercises, and discussions, and online and independent learning modules further enable students to achieve the learning objectives. [3 cr.]

SPH EP 813 - Intermediate Epidemiology
The purpose of this course is to further develop the methodologic concepts underlying the science of epidemiology. The material covered is intended to broaden and extend the student's understanding of the elements of study design, data analysis, and inference in epidemiologic research, including issues related to causation, bias, and confounding. The primary aims of the course are to provide working knowledge of the fundamentals of epidemiology as well as to serve as a foundation for more advanced study of epidemiologic methods. The course consists of lectures and workshop sessions. The workshop sessions are designed to reinforce the concepts/topics covered in the lectures. [4 cr.]
Grad Prereq: EP713 and the Biostatistics core course requirements or consent of instructor.

SPH EP 854 - Advanced Epidemiology (formerly Modern Epidemiology)
This course covers the theory and application of key principles and methods of epidemiologic research in depth. The topics include causal models, confounding, randomization, interaction, statistical analysis and inference, and causal inference. Special emphasis is given to the meaning and interpretation of p-values, confidence intervals, and likelihoods. Alternative approaches are identified for selecting and interpreting measures of disease frequency and measures of effect. Guidance is offered for determining objectives and strategies in study design and analysis, especially for case-control research. Methods are presented for the assessment and control of confounding, misclassification bias, and selection bias. Strengths and weaknesses of standardization, pooling, modeling, and exposure-response analysis are reviewed. Formerly called "Modern Epidemiology." [4 cr.]
Grad Prereq: Masters students must obtain permission of instructor, mfox@bu.edu, before registering for course.

SPH EP 855 - Advanced Epidemiology Seminar: Issues in Study Design
This course is structured around reading and discussing both historical and current methodological papers. The first section of the course focuses on papers by early theoreticians and methodologists. The second section focuses on contemporary methodologic questions. Substantive areas may evolve and vary over time. Recent topics have included case-control studies, study efficiency, measures of effect, exposure misclassification, sensitivity analysis, casual diagrams, and direct and indirect effects. [4 cr.]
Grad Prereq: Primarily for DSc students. MPH students must have completed EP854 and have consent of the instructor.

SPH EP 856 - Selected Topics in Epidemiologic Methods
Course focuses on advanced design and analysis topics. Three to five topics will be covered from the following list of topics: Case-crossover / case-specular design and analysis; G-estimation / IPTW / marginal structural models / nested marginal structural models; Bias analysis; Propensity scores / disease scores / other scoring; Instrumental variables and aggregate analysis; Hierarchical modeling; Bayesian analysis; Missing data methods; Longitudinal data analysis. For each topic, there will be a week of reading and review on the theory, a week introducing an applied example, followed by a week of group or individual work during which the example problem will be solved by conventional and then also the advanced method. We will reconvene for a last week when the results of the analytic work will be reviewed and compared across groups and individuals. [4 cr.]
Grad Prereq: BS703 and EP813 or consent of instructor.

Section 7

Biostatistics Faculty

The Department of Biostatistics faculty is committed to their roles of teacher and mentor inside and outside of the classroom. Their research brings depth and a real-life context to the classroom. The department's faculty has analyzed the multigenerational risk factors that contribute to heart disease, which led to a predictive tool for physicians to determine treatment strategies for patients with cardiovascular disease. In partnership with other academic institutions, members of the department have isolated and identified key factors that contribute to higher incidences of breast cancer and other diseases in African-American women. In addition, the department has designed and implemented an important comparative study that pinpoints risk factors for Alzheimer's disease. Members of the department are also actively engaged in clinical trials and methods for public health surveillance, designed to improve clinical treatments and aid the public health delivery system to identify disease hotspots.

Faculty bios can be found under the Faculty & Staff tab on http://sph.bu.edu
To learn about faculty research, visit the “Research” section of our website.

Faculty Name	Title	Area of Expertise	Courses taught	E-mail & Office
Lisa Sullivan, PhD	Chair and Professor; Associate Dean of Education	Design and analysis of epidemiological studies, risk functions, clinical trials undergraduate education	BS704 Biostatistics	lsull@bu.edu CT324
Josée Dupuis, PhD	Associate Chair and Professor	Genetic linkage analysis, statistical methodologies, mapping of complex traits	BS858 Statistical Genetics, BS860 Statistical Genetics II	dupuis@bu.edu CT321
Howard Cabral, PhD, MPH	Professor, Co-Director of Biostatistics Graduate Program	Analysis of longitudinal data, statistical computing, effects of missing data on estimation	BS805 Intermediate Statistical Computing and Applied Regression Analysis	hjcab@bu.edu CT310
Christine Chaisson, MPH	Research Assistant Professor	(Director, Data Coordinating Center, School of Public Health)	n/a	chaisson@bu.edu CT341
Bei Chang, ScD, MA, MS	Associate Professor	(Veterans Affairs)		bhchang@bu.edu VA
Debbie Cheng, ScD	Professor	Design and analysis of clinical trials, infectious disease research	BS722 Design and Conduct of Clinical Trials	dmcheng@bu.edu CT319
Gerald Coffman, MD, MS	Research Assistant Professor	(Data Coordinating Center, School of Public Health)	n/a	coffman@bu.edu CT336
L. Adrienne Cupples, PhD	Professor, Executive Co-Director of Biostatistics Program, Co-Director of Training Grant	Statistical methods for observational Studies, survival analysis, statistical genetics	n/a	adrienne@bu.edu CT311
Ralph B. D'Agostino, PhD, AM	Professor, Chair of Mathematics & Statistics; Professor, Executive Co-Director of Biostatistics Program	Clinical trials, epidemiology, prognostics models, longitudinal analysis, multivariate analysis, robustness, outcomes/effectiveness research	n/a	ralph@bu.edu MCS154
Serkalem Demissie, PhD, MPH	Associate Professor, Co-Director of Biostatistics Graduate Program	Epidemiology, statistical genetics, missing data methods	n/a	demissie@bu.edu CT315
Anita DeStefano, PhD	Professor	Statistical genetics	n/a	adestef@bu.edu CT314
Gheorghe Doros, PhD	Associate Professor, Co-Director of Biostatistics Graduate Program	Censored data, data analysis, asymptotics, nonparametric estimation	BS853 Generalized Linear Models with Applications, BS854 Bayesian Methods in Clinical Trials	doros@bu.edu CT331
Susan Fish, Pharm. D, MPH	Professor	Clinical trials, human subjects research, research ethics, study designs	BS722 Design and Conduct of Clinical Trials	sfish@bu.edu CT330
David Gagnon, MD, MPH, PhD	Associate Professor	Survival analysis, categorical data analysis, statistical programming, longitudinal data analysis, pharmaco-epidemiology	BS775 Applications of Advanced Statistical Methods in Clinical Research, BS820 Logistic Regression & Survival Analysis, BS821 Categorical Data Analysis,	gagnon@bu.edu CT328

Faculty Name	Title	Area of Expertise	Courses taught	E-mail & Office
Ashis Gangopadhyay, PhD, MS	Associate Professor and Associate Chair of Mathematics & Statistics	Nonparametric and semiparametric models, Bayesian Markov Chain Monte Carlo techniques, financial time series modeling	MA781 Estimation Theory	ag@math.bu.edu MCS 245
Timothy Heeren, PhD	Professor, Director of MPH Biostatistics Program	Biostatistics, analysis of scaled data	BS704 Biostatistics	tch@bu.edu CT309
Eric Kolaczyk, PhD, MS	Professor of Mathematics & Statistics, Director of Statistics Program	Statistical analysis of network-indexed data, development of basic methodology and interdisciplinary, statistical multi-scale modeling	MA575 Linear Models	kolaczyk@bu.edu MCS223
Michael LaValley, PhD	Professor	Meta-analysis, analysis of longitudinal and correlated data, analysis of survival data, analysis of ordinal data	BS810 Meta-Analysis for Public Health and Medical Research, BS820 Logistic Regression & Survival Analysis	mlava@bu.edu CT322
Suzette Levenson, MPH, MEd	Research Assistant Professor	(Assistant Dean, Administration and Finance, School of Public Health)	n/a	sml@bu.edu T305C
Ching-Ti Liu, PhD	Assistant Professor	Statistical Genetics and Bioinformatics	BS720 Introduction to R, BS723 Intro to Statistical Computing	ctliu@bu.edu CT329
Kathryn Lunetta, PhD	Professor	Statistical genetics, mapping of complex traits	BS858 Statistical Genetics, BS859 Applied Genetic Analysis, BS860 Statistical Genetics II	klunetta@bu.edu CT313
Joseph Massaro, PhD	Professor	Clinical trials, goodness-of-fit, cardiovascular disease	BS851 and BS861 Applied Statistics in Clinical Trials I & II	jmm@bu.edu CT327
Jacqueline Milton, PhD	Clinical Assistant Professor		BS704 Biostatistics, BS723 Intro to Statistical Computing	jnmilton@bu.edu CT348
Kerrie Nelson, PhD	Associate Research Professor	Statistical methods for reliability, modeling longitudinal and clustered data, diagnostic testing	BS704 Biostatistics	kerrie@bu.edu CT318
Sarah Rosner Preis, ScD	Research Assistant Professor	Cardiovascular and nutritional epidemiology, epidemiologic methods	n/a	srpreis@bu.edu CT327
Paola Sebastiani, PhD	Professor, Co-Director of Training Grant	Bioinformatics, Bayesian modeling, experimental design, machine learning, epidemic surveillance, time series analysis	BS852 Statistical Methods in Epidemiology, BS855 Bayesian Modeling for Biomedical Research	sebas@bu.edu CT317
Fangui Sun, PhD	Research Assistant Professor	case-control studies, longitudinal data analysis and generalized linear models	n/a	jennysun@bu.edu CT316
Yorghos Tripodis, PhD	Assistant Professor	Time series modeling and statistical inference	BS704 Biostatistics, BS857 Analysis of Correlated Data	yorghos@bu.edu CT312
Janice Weinberg, ScD	Professor	Design and analysis of clinical trials, statistical methods for environmental epidemiology	BS722 Design & Conduct of Clinical Trials	janicew@bu.edu CT330

Faculty Name	Title	Area of Expertise	Courses taught	E-mail & Office
Daniel Weiner, PhD, MA	Associate Professor of Mathematics & Statistics	mathematics, statistics	MA581 Probability, MA581 Mathematical Statistics	weiner@bu.edu MCS246
Laura F. White, PhD	Associate Professor	Public health surveillance, infectious disease modeling, spatial cluster detection	BS728 Public Health Surveillance, a Methods Based Approach	lfwhite@bu.edu CT325
Qiong Yang, PhD	Associate Professor	Biostatistics, statistical genetics	BS845 Applied Statistical Modeling and Programming with R	qyang@bu.edu CT325

Adjunct and Secondary Appointment Faculty

In addition to the faculty based at the School, BUSPH employs a number of experienced public health professionals from the community as adjunct faculty. These adjunct faculty bring a wealth of knowledge to the classroom as well as help build bridges between the communities that surround the Medical Campus. They often connect students with practica, research opportunities, and community events.

Adjunct/ Secondary Appointment Faculty Name	Appointment	Primary Appointment/ Positions	Email
Arlene S. Ash, PhD, MS	Research Professor	Professor, Quantitative Health Sciences, University of Massachusetts Medical School	arlene.ash@umassmed.edu
Alexa Beiser, PhD, MA	Professor	Professor of Neurology, Boston University School of Medicine	alexab@bu.edu
Mark Chang, PhD, MS	Adjunct Professor	Executive Director of Department of Biostatistics and Data Management, AMAG Pharmaceuticals	mchang@amagpharma.com
Ming-Huei Chen, PhD	Research Assistant Professor	Research Assistant Professor of Neurology, Boston University School of Medicine	mhchen@bu.edu
Theodore Colton, ScD, MS	Professor	Professor, Chairman Emeritus of Epidemiology, Boston University School of Public Health	tcolton@bu.edu
Kimberly Dukes, PhD, MA	Adjunct Assistant Professor	President, CEO of DM-STAT, Inc	kim.dukes@dmstat.com
Robert J. Glynn, ScD, PhD	Adjunct Assistant Professor	Professor of Medicine (Biostatistics), Harvard Medical School	rglynn@rics.bwh.harvard.edu
C. Robert Horsburgh, MD, MUS	Professor	Professor, Chair of Epidemiology, Boston University School of Public Health	rhorsbu@bu.edu
Nicholas Horton, ScD	Adjunct Associate Professor	Professor of Statistics, Smith College	nhorton@smith.edu
Shih-Jen Hwang, PhD, MHS, MPH	Adjunct Research Assistant Professor	Epidemiologist/Statistician, Framingham Heart Study	shwang2@bu.edu
William Evan Johnson, PhD	Assistant Professor	Assistant Professor of Medicine, Division of Computational Biomedicine, Boston University School of Medicine	wej@bu.edu
Gyungah Jun, PhD, MSIC, MS	Research Assistant Professor	Research Assistant Professor of Medicine, Division of Biomedical Genetics, Boston University School of Medicine	gyungah@bu.edu

Adjunct/ Secondary Appointment Faculty Name	Appointment	Primary Appointment/ Positions	Email
Martin Larson, SD, SM	Research Professor	Research Professor of Mathematics and Statistics, Boston University College of Arts & Sciences; Research Associate Professor of Medicine, Boston University School of Medicine	mlarson@bu.edu
Robert A. Lew, PhD, MS	Associate Professor	Senior Biostatistician, Veterans Affairs	rlew@bu.edu
Chunyu Liu, PhD, MA	Adjunct Assistant Professor	National Institute of Health	liuc@bu.edu
Mark Logue, PhD, MS	Research Assistant Professor	Research Assistant Professor of Molecular Medicine, Boston University School of Medicine	loguem@bu.edu
Elena Losina, PhD, MSc	Adjunct Associate Professor	Associate Professor of Orthopedic Surgery, Brigham and Women's Hospital	elosina@partners.org
Sandeep Menon, PhD	Adjunct Assistant Professor	Director of Biostatistics, Bio-therapeutics Research, Pfizer	sandeep.m.menon@pfizer.com
Al Ozonoff, PhD, MA	Associate Professor	Director of the Design and Analysis Core, Clinical Research Program, Children's Hospital Boston; Adjunct Assistant Professor of Biostatistics HSPH	al.ozonoff@childrens.harvard.edu, aozonoff@bu.edu
P. K. Tandon, PhD	Adjunct Associate Professor	Vice President, Genzyme Corporation	pktandon@genzyme.com
Soe Soe Thwin, PhD, MS	Adjunct Assistant Professor	Biostatistician, Veterans Affairs	sst@bu.edu
Thomas Travison, PhD	Assistant Professor	Assistant Professor of Medicine, Division of Endocrinology, Diabetes & Nutrition, Boston University School of Medicine	tgt@bu.edu
Vanessa Xanthakis, PhD	Instructor	Instructor of Medicine, Investigator for the Framingham Heart Study, Section of Preventive Medicine and Epidemiology, Department of Medicine BUSM	vanessax@bu.edu
Bin Zhang, DSc, MA	Research Assistant Professor	Biostatistician	binzhang@bu.edu

Boston University Graduate School of Arts & Sciences

2014 GRADUATION CALENDAR

A candidate must be registered for the semester or summer term in which degree requirements are completed and during the preceding semester.

MASTER OF ARTS DEGREE CANDIDATES

	January 25, 2014 Award	May 19, 2014 Award	September 25, 2014 Award
Diploma Application due in GRS*	November 1, 2013	February 1, 2014	July 1, 2014

*** The diploma application is valid only for the graduation date specified; you must file a new application if you do not graduate as planned.**

DOCTOR OF PHILOSOPHY DEGREE CANDIDATES

	January 25, 2014 Award	May 18, 2014 Award
Dissertation Prospectus due in the Graduate School Office (GRS)	April 5, 2013	October 5, 2013
Diploma Application due in GRS*	November 1, 2013	February 1, 2014
First draft of dissertation (to readers)	October 4, 2013	February 1, 2014
Dissertation abstract (max. 350 words)approved by department – due in GRS Office for review and approval by the Dean	*At least three weeks prior to Final Oral Exam*	*At least three weeks prior to Final Oral Exam*
Schedule of Final Oral Examination (to be arranged by department) due in GRS with fourteen copies of approved abstract	*At least two weeks prior to Final Oral Exam*	*At least two weeks prior to Final Oral Exam*
Last date to hold Final Oral Exam (Same deadline for submission of the dissertation)	December 13, 2013	April 11, 2014
Approved and signed dissertation (2 copies due in GRS on or before this date)**	December 13, 2013	April 11, 2014

**** Prior to the dissertation defense, you must schedule an appointment with the Records Officer for review of the dissertation format. All PhD degree requirements are complete only when both copies of the dissertation have been certified as meeting the standards of the Graduate School of Arts & Sciences and of the Mugar Memorial Library.**

Biostatistics MA Degree Program of Study (32 credits)

I. MA Degree Required Courses: Six courses (23 credits)	**Semester Completed**	**Grade Earned**	**Credits Earned**
CAS MA 575 Linear Models			
CAS/ MET MA581 Probability			
CAS/ MET MA582 Mathematical Statistics			
SPH EP713 Intro to Epidemiology (3cr)			
SPH BS805 Intermediate Statistical Computing & Applied Regression			
SPH BS852 Statistical Methods in Epidemiology			
II. MA Degree Electives: Any two (9 credits)	**Semester Completed**	**Grade Earned**	**Credits Earned**
CAS MA: 576, 583, 584, 585, 586, 587, 588, 685, GRS MA: 751, 882			
SPH BS: 722, 728, 775, 790, 810, 820, 821, 822, 830, 845, 850, 851, 853, 855,856, 857, 858, 859, 860, 861			
MA 861*, 781*, 782*, 881* SPH EP 813*, 854‡ , 855‡ , 856‡† SPH BS 715, 901**, 902**			
* Must obtain permission from academic advisor to take this elective. †‡ Only one of these three courses may count as an elective. ** Limit of 4 credits among the two.			
III. Qualifying Exams		**Date of Completion**	**Grade Earned**
Applied Qualifying Exam			
Theory Qualifying Exam			

MA Requirements Checklist:

□ Credits total: 32 MA graduate credits or approved transfer courses.
□ Grade of B- or better in all courses applied to the MA
□ Any course waivers or transfer credit approved
□ All incomplete classes completed and grades posted
□ Submitted graduation application to GRS (2-3 months prior to commencement)

Biostatistics Post-BA PhD Degree Audit Sheet (64 credits)
Biostatistics Post-MA PhD Degree Audit Sheet (32 credits + co-requisites)

I. Post- BA PhD Required Courses: Nine courses (35 credits)	**Semester Completed**	**Grade Earned**	**Credits Earned**
CAS MA 575 Linear Models			
CAS/ MET MA581 Probability			
CAS/ MET MA582 Mathematical Statistics			
SPH EP713 Intro to Epidemiology (3cr)			
SPH BS805 Intermediate Statistical Computing & Applied Regression			
SPH BS852 Statistical Methods in Epidemiology			
SPH BS853 Generalized Linear Models with Applications			
GRS MA781 Estimation Theory			
GRS MA782 Hypothesis Testing			
II. PhD degree Electives: At least 4 of the following Biostatistics Courses (16 credits), including at least 1 each from the MA series and BS series:	**Semester Completed**	**Grade Earned**	**Credits Earned**
MA Series CAS MA: 576, 583, 584, 585, 586, 587, 588, 685, 750; GRS MA: 751			
BS Series **S**PH BS: 722, 728, 775, 790, 810, 820, 821, 822, 830, 845, 850, 851, 855, 856, 857, 858, 859, 860, 861			
III. PhD Additional Elective Courses: The remaining courses may be selected from the above series of courses or from the following Elective Courses: (13 credits)	**Semester Completed**	**Grade Earned**	**Credits Earned**
CAS MA: 511, 512, 539, 555, 556, 578; GRS MA: 703, 711, 750, 751, 779, 780, 861, 881, 882*; SPH EP 813, 854‡ , 855‡ , 856‡† SPH BS : 715, 771, 901**, 902**			

* May be taken for a maximum of 4 credits.

‡† Only one of these ourses may count as an elective.

** Limit of 4 credits among the two. Post-bachelor's PhD students may petition Co-Directors to allow more than 4 credits.

IV. Qualifying Exams	**Date of Completion**	**Grade Earned**
Applied Qualifying Exam		
Theory Qualifying Exam		

PhD Requirements Checklist:

□ Credits total: 32-64 PhD graduate credits or approved transfer courses.
□ Grade of B- or better in all courses applied to the PhD
□ Any course waivers or transfer credit approved
□ All incomplete classes completed and grades posted
□ Attended and presented at Doctoral Student Presentation Seminars
□ Submitted graduation application to GRS (2-3 months prior to commencement)