

# Doctor of Philosophy in Biostatistics

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The biostatistics M.S. and Ph.D. programs were created to help meet the ever-increasing demand for biostatisticians to take leadership roles in careers as researchers and educators in academia, government, and industry. Faculty members are active researchers collaborating and consulting in research projects and initiatives at the Medical Center, in addition to pursuing their own research agendas and participating in curricular instruction. Expertise in the Department includes linear, nonlinear, and longitudinal modeling; clinical trial and experimental design; survival analysis; categorical data analysis; robust statistics; psychometric methods; statistical genomics; bioinformatics; Bayesian methodology; data science; and machine learning.

The Ph.D. program produces biostatisticians who can develop biostatistical methodology that can be used to solve problems in public health and the biomedical sciences. In addition, graduates are prepared to apply biostatistical and epidemiology methodology for the design and analysis of public health and biomedical research investigations. Finally, graduates are well suited to function as collaborators or team leaders on research projects in the biomedical and public health sciences.

In addition to the characteristics outlined in the M.S. section of this proposal, graduates of the Ph.D. program in Biostatistics will have:

1. the ability to develop careers in academia, research institutes, government, and industry;
2. a broad understanding of current statistical methods and practices in the health sciences;
3. a solid theoretical training necessary for the development and study of new statistical methods;
4. the ability to assume all responsibilities of a statistician in collaborative health science research; in particular, the graduate will have experience in the design, data management, analysis, and interpretation of a variety of experimental and observational studies;
5. experience in writing reports and giving oral presentations describing health science studies.

The application process for the Ph.D. in Biostatistics is an online process. Detailed instructions on how to apply are posted on the Department of Biostatistics (<http://www.kumc.edu/school-of-medicine/department-of-biostatistics/biostatistics-graduate-program/prospective-students/admissions-procedure.html>) website. Students are admitted for the fall semester only. Applications for the fall semester must be received by February 1st for consideration.

## Admission Requirements:

- A master's degree in statistics, biostatistics, mathematics or applied mathematics from a regionally accredited institution or a terminal degree (M.D., Ph.D.) in another field with approval from the program. Students not meeting this criteria should apply to the M.S. program (<http://catalog.ku.edu/medicine/biostatistics/ms>). Completion of degree is documented by submission of an official transcript indicating the degree has been conferred before entering the program. Official transcripts from institutions attended post-baccalaureate are also required.

Students with degrees from outside the U.S. may be subject to transcript evaluation indicating the degree is equivalent to a U.S. degree and meets the minimum cumulative GPA requirements.

- A cumulative grade-point average (GPA) of at least a 3.0 on a 4.0 scale for the bachelor's degree.
- Applicants who are not native speakers of English, whether domestic or international, must demonstrate they meet the Minimum English Proficiency Requirement.
- A background check is required during the admission process; it may affect the student's eligibility to enter the program.
- An official copy of the Graduate Record Examination (GRE) score sent from Educational Testing Service (ETS) to University of Kansas Medical Center - ETS institutional 6895.
- A letter grade of a B or better in Calculus I through III (or equivalent.)
- Successful completion of at least one of the following courses: linear algebra, differential equations, numerical analysis.
- Successful completion of a course in any computer programming language or demonstration of mastery via credentials or work experience.
- Research experience (beyond labs associated with lecture courses) is highly recommended, but not required.
- Contact information for three references who are familiar with the applicant's work and character and who have agreed to write letters of recommendation.
- A personal statement regarding your interest in biostatistics and in biomedical research.
- A current resume or curriculum vitae.
- A personal interview is required of all applicants who meet the minimum admissions standards. If travel to the area is impossible, a telephone or online interview may be substituted.

Applicants will be assessed based on these requirements.

Admission requirements are subject to change. In most cases, use the catalog of the year student entered the program. *Other years' catalogs*».

The typical program consists of 63 credit hours including collaborative research experience, annual evaluations, graduate examinations, and the successful completion of a doctoral dissertation. Dissertation research culminates in a final dissertation examination consisting of an oral presentation by the candidate and an examination by the faculty.

Relevant prior graduate work is taken into consideration in setting up individual programs of study leading to the Ph.D. The typical course plan consisting of 63 credit hours is designed for students who have not previously completed a M.S. in biostatistics or directly relevant area. The course plan for a student who has previously completed a M.S. in biostatistics or directly relevant area is customized to account for master's-level courses already taken; therefore the total credit hours required will vary.

## Degree requirements:

- Degree requirements are normally completed within 4 years of admission to the program although a maximum of 8 years is allowed.
- Cumulative grade-point average (GPA) of at least a 3.0 for all KU graduate coursework.
- Successful completion of the Qualifying Examination. The qualifying examination is given upon completion of the following courses

(or equivalent): BIOS 820, BIOS 830, BIOS 835, BIOS 840, BIOS 871 and BIOS 872. The examination has two purposes 1) to assess the student's strengths and weaknesses and 2) determine whether the student is sufficiently prepared to continue in the Ph.D. program.

- Successful completion of the University's Research Skills and Responsible Scholarship (<http://www.kumc.edu/Documents/graduate%20studies/Res%20SKills%20and%20Respon%20Scholar%20Doctoral%2016-Oct.pdf>) requirement prior to the semester the Oral Comprehensive Examination is scheduled.
  - Successful completion of BIOS 898 Collaborative Research Experience (or equivalent) meets the Research Skills requirement.
  - Successful completion of BIOS 805 Professionalism, Ethics and Leadership in the Statistical Sciences and/or documented participation in the Biostatistics Graduate Students Association Seminar Series and completion of the KUMC Human Subjects Protection training module meets this requirement. Student must keep their certification current throughout their tenure in the Ph.D. program.
- Successful completion of the Residence Requirement ([http://www.kumc.edu/Documents/graduate%20studies/Residence%20Requirement%20PhD%2016-Oct\(0\).pdf](http://www.kumc.edu/Documents/graduate%20studies/Residence%20Requirement%20PhD%2016-Oct(0).pdf)) prior to the semester the Oral Comprehensive Examination is scheduled. The requirement is met by enrollment in full-time status a minimum of two semesters.
- Successful completion of the Oral Comprehensive Examination (<http://www.kumc.edu/Documents/graduate%20studies/Comprehensive%20Oral%20Exam%20PhD%2016-Oct.pdf>). The comprehensive examination is typically given when a doctoral aspirant has completed the major portion of the course work at a satisfactory level and met all other prerequisites to the comprehensive examination. The examination assesses the student's strengths and weaknesses and determines whether the student should continue in the Ph.D. program. There is both a written component to the exam and a subsequent presentation and defense of a dissertation proposal. Students are recognized as formal candidates for the Ph.D. only after they have passed the comprehensive examination.
- Successful completion of Post-Comprehensive Enrollment (<http://www.kumc.edu/Documents/graduate%20studies/Post-Comp%20Enrollment%20PhD%2016-Oct.pdf>) requirement.
- Enrollment in a minimum of one credit hour of dissertation BIOS 999 Doctoral Dissertation the semester the student will defend dissertation and graduate.
- Successful completion of the Final Oral Examination (<http://www.kumc.edu/Documents/graduate%20studies/Final%20Oral%20Exam%20PhD%2016-Oct.pdf>) (dissertation defense.) The candidate must present a dissertation showing the planning, conduct, and results of original research and scholarly activity. The purpose of the dissertation is to encourage and ensure the development of broad intellectual capabilities as well as to demonstrate an intensive focus on a problem or research area. This work is carried out under the guidance of a dissertation advisor. When the completed dissertation has been accepted by the dissertation committee in final draft form and all other degree requirements have been satisfied the chair of the committee requests (at least 3 weeks before the date of the

examination) Graduate Studies approval to proceed with the final oral examination.

- Successful Dissertation Submission and Publication (<http://www.kumc.edu/Documents/graduate%20studies/Dissertation%20Submit%20and%20Pub%2016-Oct.pdf>) (according to Office of Graduate Studies policy.)
- Successful completion of the following Biostatistics courses (or equivalent):

Code	Title	Hours
BIOS 805	Professionalism, Ethics and Leadership in the Statistical Sciences	3
BIOS 820	SAS Programming I	3
BIOS 825	Nonparametric Methods	3
BIOS 830	Experimental Design	3
BIOS 835	Categorical Data Analysis	3
BIOS 840	Linear Regression	3
BIOS 845	Survival Analysis	3
BIOS 871	Mathematical Statistics	3
BIOS 872	Mathematical Statistics II	3
BIOS 898	Collaborative Research Experience	3
BIOS 900	Linear Models	3
BIOS 902	Bayesian Statistics	3
BIOS 905	Theory of Statistical Inference	3
BIOS 999	Doctoral Dissertation	1-6

- Students may take up to 12 credit hours of equivalent coursework under the STAT prefix. Courses considered equivalent include STAT 805, STAT 820, STAT 821, STAT 830, STAT 840, STAT 850, and STAT 880.
- Successful completion of any elective coursework as determined in consultation with the student's advisor.

Degree requirements and course descriptions are subject to change. Any courses taken as an equivalent must be approved by the Graduate Director and the Office of Graduate Studies. In most cases, use the catalog of the year student entered the program. *Other years' catalogs*».

### Annual Evaluations:

Students are evaluated each May by their graduate advisors and the director of the graduate program. These evaluations provide feedback to the student regarding the progress they are making in meeting program requirements, classroom performance, and research performance.

### Typical Plan of Study

Year 1			
Fall	Hours Spring	Hours Summer	Hours
BIOS 820	3 BIOS 830	3 BIOS 805	3
BIOS 840	3 BIOS 872	3	
BIOS 871	3 Elective	3	
	9	9	3
Year 2			
Fall	Hours Spring	Hours Summer	Hours
BIOS 835	3 BIOS 825	3 BIOS 905	3
BIOS 898	3 BIOS 845	3	

BIOS 900	3 Elective	3	
	Qualifying Examination given in this semester.		
	9	9	3

**Year 3**

Fall	Hours Spring	Hours Summer	Hours
BIOS 902	3 BIOS 999	6-9 BIOS 999	3-6
Elective	3		
Elective	3		
Oral Comprehensive Exam may be scheduled as early as this semester if approved by committee to proceed.			
	9	6-9	3-6

**Year 4**

Fall	Hours Spring	Hours
BIOS 999	1-6 BIOS 999	1-6
Final Oral Exam (dissertation defense) scheduled semester approved by committee to defend and graduate.		
	1-6	1-6

Total Hours 62-78

Because the MS and PhD in Biostatistics degrees signify that the holder is prepared for entry into the practice of biostatistics research, it follows that graduates must have the knowledge and skills necessary to function in a broad range of academic and research situations. The **Technical Standards** include those physical, cognitive, and behavioral standards that are required for the satisfactory completion of all aspects of the curriculum and the development of professional attributes required by all students at graduation. Therefore, the following abilities and expectations must be met by all students **with or without accommodations** admitted to the MS and PhD programs:

**1. Observation.** A student must be able to observe and evaluate class demonstrations and field experiences relevant to the field of statistics. He or she must be able to read and comprehend text, numbers, tables and graphs, both in print and displayed electronically. Observation necessitates the functional use of the senses of vision and hearing.

**2. Communication.** A student must be able to communicate effectively and efficiently in English in oral, written, and electronic form with other students, faculty, staff, researchers, and the public. Effective communication includes: the ability to understand assigned readings, lectures, and technical and professional materials; the ability to analyze information; the ability to present results of such analyses verbally and in

writing; the ability to independently prepare papers and presentations; and the ability to follow verbal and written instructions. Use of computers and other technology is imperative to this communication.

**3. Motor.** A student must have sufficient motor function to attend classes, prepare assignments, use electronic media, deliver lectures and make public presentations. Class requirements may also include field work in a variety of collaborative environments.

**4. Intellectual, conceptual, integrative and quantitative abilities.** A student must possess the ability to understand and read and understand documents written in English, to understand and work with measurements and calculations, and to engage in reasoning, analysis, synthesis and critical thinking. A student must be able to exercise sufficient judgment to recognize and correct performance deviations, and be able to draw on all the above mentioned abilities to be an effective problem solver, researcher, and communicator.

**5. Behavioral and social attributes.** A student must have the emotional health required for the full use of his or her intellectual ability. A student must be able to exercise sound judgment, and to act ethically and with integrity. He or she must develop mature, sensitive, and effective professional relationships with others. A student must be self-motivated, reliable and responsible to complete assigned tasks in a timely manner with no supervision. Students must be able to give attention to detail and have the flexibility to function in a research setting, including adapting to changes in time, place and structure of academic and research settings. The student must have the ability to work with diverse groups.

**NOTE:** Reasonable accommodations will be considered and may be made to qualified students who disclose a disability, so long as such accommodation does not significantly alter the essential requirements of the curriculum and the training program, or significantly affect the safety of patient care. Students who disclose that they have a disability are considered for the program if they are otherwise qualified. Qualified students with a disability who wish to request accommodations should provide the appropriate documentation of disability and submit a request for accommodation to the University's Office for Academic Accommodations.