

# 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. Our faculty members are active researchers who collaborate and consult on research projects and initiatives at the Medical Center while pursuing their own research agendas and participating in curricular instruction. Expertise within the Department includes linear, nonlinear, and longitudinal modeling, clinical trial and experimental design, survival analysis, categorical data analysis, statistical 'omics, bioinformatics, data integration, artificial intelligence, machine learning, computational statistics, and Bayesian methodology.

The Ph.D. program produces biostatisticians who develop biostatistical methodology that can be used to solve complex 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.

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 & Data Science (<https://www.kumc.edu/school-of-medicine/academics/departments/biostatistics-and-data-science/academics/phd-in-biostatistics/admissions.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 (<https://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.

Applicants will be assessed based on these requirements.

After an applicant has been admitted, a program may defer an applicant's admission for one year after which time the applicant must submit a new application.

Admission requirements are subject to change. In most cases, use the catalog of the year the 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 considered 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 an M.S. in Biostatistics or a directly relevant area. The course plan for a student who has previously completed an 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:

- Students who have previously completed an M.S. in Biostatistics typically complete degree requirements within 4 years of admission to the program.
- A cumulative grade-point average (GPA) of at least 3.0 for all KU graduate coursework.
- Successful completion of the Written Qualifying Examination. This examination is given upon completion of the following courses (or equivalent): BIOS 830, BIOS 835, BIOS 840, BIOS 871, BIOS 872, and BIOS 900. The exam has a written component only.
- Successful completion of the Written Comprehensive Examination. This examination is typically given when a doctoral aspirant has completed the majority of the Ph.D. coursework satisfactorily and successfully completed the Written Qualifying Examination. The exam has a written component, an oral presentation, and an oral defense.
- Successful completion of the University's Research Skills and Responsible Scholarship (<https://catalog.ku.edu/graduate-studies/kumc/#ResearchSkillsandResponsibleScholarship>) requirement. This requirement must be met before scheduling the Oral Comprehensive Examination.

- Successful completion of BIOS 898 Collaborative Research Experience (or equivalent) and documented participation in the Department of Biostatistics & Data Science Journal Club and Seminar Series meets the Research Skills requirement.
- Successful completion of BIOS 805 Professionalism, Ethics and Leadership in the Statistical Sciences and completion of the KUMC Human Subjects Protection training module meets the Responsible Scholarship requirement. Student must keep their certification current throughout their tenure in the Ph.D. program.
- Successful completion of the Residence Requirement (<https://catalog.ku.edu/graduate-studies/kumc/#programstext>) before scheduling the Oral Comprehensive Examination. The requirement is met by full-time enrollment status for a minimum of two semesters.
- Successful completion of the Oral Comprehensive Examination (<https://catalog.ku.edu/graduate-studies/kumc/#ComprehensiveOralExamination>) (dissertation proposal). This examination is typically given when a doctoral aspirant has completed all coursework satisfactorily, successfully completed the Written Comprehensive Examination, and completed all other prerequisites as outlined above. The exam has a written component, an oral presentation, and an oral defense. Students are recognized as formal candidates for the Ph.D. only after they have passed this examination.
- Successful completion of Post-Comprehensive Enrollment (<https://catalog.ku.edu/graduate-studies/kumc/#PostComprehensiveEnrollment>) requirement.
- Enrollment in a minimum of one credit hour of dissertation BIOS 999 Doctoral Dissertation the semester the student will defend the dissertation and graduate.
- Successful completion of the Final Oral Examination (<https://catalog.ku.edu/graduate-studies/kumc/#FinalOralExamination>) (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 and 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 dissertation committee has accepted the completed dissertation 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 (<https://catalog.ku.edu/graduate-studies/kumc/#DissertationSubmissionandPublication>) (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 or HDSC prefix. Course equivalence should be determined in consultation with the student's advisor.
- Successful completion of any elective coursework as determined in consultation with the student's advisor. Any coursework under the STAT, DATA, and HDSC prefixes may be considered internal elective credit.
- Students are required to present at least once in each of the Department Journal Club and Seminar Series during their time in residence.
- Regular attendance at the Department Journal Club and Seminar Series is required.
- Students are required to participate in at least one event in each of the five Growth Pathways each calendar year through the KUMC ASCEND Program.

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 the student entered the program. *Other years' catalogs*».

### Annual Evaluations:

Students are evaluated each May by their graduate advisors and the graduate program director. These evaluations provide feedback to the student regarding their progress 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	
	<b>9</b>	<b>9</b>	<b>3</b>

#### 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.		
	<b>9</b>	<b>9</b>	<b>3</b>

**Year 3**

Fall	Hours Spring	Hours Summer	Hours
BIOS 902	3 BIOS 999	6-9 BIOS 999	3-6
Elective	3		
Elective	3		
Written Comprehensive Exam should be completed prior to enrolling in BIOS 999; Oral Comprehensive Exam (dissertation proposal defense) may be scheduled as early as this semester if approved by committee to proceed.			
	<b>9</b>	<b>6-9</b>	<b>3-6</b>

**Year 4**

Fall	Hours Spring	Hours
BIOS 999	1-6 BIOS 999	1-6
	Final Oral Exam (dissertation defense) may be scheduled if approved by committee to defend and graduate.	
	<b>1-6</b>	<b>1-6</b>

**Total Hours 62-78**

- Students may take up to 12 credit hours of equivalent coursework under the STAT, DATA or HDSC prefix. Course equivalence should be determined in consultation with the student's advisor.
- Successful completion of any elective coursework as determined in consultation with the student's advisor. Any coursework under the STAT, DATA, or HDSC prefixes may be considered as internal elective credit.

Graduates of the Biostatistics Ph.D. program will be able to:

1. Demonstrate a comprehensive knowledge and understanding of statistical practice as applicable in the health sciences.
2. Demonstrate a solid theoretical knowledge and understanding necessary for the development and study of new statistical methods.
3. Function as a collaborator or co-investigator on a research team.
4. Take a leadership role in the design and implementation of a health science project.
5. Assume responsibility for the design and implementation of analyses for health science investigations.
6. Oversee the design and implementation of data management systems for large health science studies.

7. Prepare statistical methods sections for protocols and grant proposals; Prepare reports and publications resulting from the analyses for health science studies.
8. Effectively communicate the principles of statistics and analytics with his or her peers with varying statistical backgrounds.
9. Serve as an advocate for good statistical design and practice in health science investigations.

Because the M.S. and Ph.D. 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 M.S. and Ph.D. 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.