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Biostatistics PhD Program Revision

Background

The Interdisciplinary PhD program in Biostatistics is a collaboration between the Department of Statistics and the Division of Biostatistics in the College of Public Health.

The program was originally started with two tracks offering different emphasis within areas of biostatistics at that time (2008). Since that time, revisions to the program have reduced the differences between the tracks (now called specializations). These revisions included eliminating separate qualifying exams for each specialization (students now take the same two qualifying exams, regardless of specialization) and the creation of a common core of courses. The last major changes to the Interdisciplinary PhD program in biostatistics were reviewed and approved by CAA in November 2015. A few minor changes have been made to the program since then as summarized in the Appendix.

Rationale

As noted above, the program has been moving toward a more unified curriculum as the field of biostatistics has evolved since 2008. Faculty meetings throughout 2022-2023 reflected a desire to unify the curriculum, allow students additional flexibility when selecting statistics/biostatistics electives not required by the common core courses (shared between the two specializations), and ensure that program learning objectives are met. As such, this proposal presents a single set of curriculum requirements for students in the Interdisciplinary PhD program.

A second rationale for many changes is that many of the courses in the first two years of the Biostatistics PhD program are shared with the Statistics PhD program. Therefore, the proposed changes to the Statistics PhD courses will also apply to the Biostatistics PhD program. Detailed information on the revised Statistics PhD program and the rationale for these revisions can be found in the “Statistics PhD Program Revision” document that accompanies this proposal.

Outline of the Proposed Changes

Unifying under one curriculum

This revision eliminates the two specializations within the Biostatistics PhD program. Students will follow the single curriculum proposed herein. As a single curriculum, we have also renamed sections of the curriculum for clarity.

Course changes (changes to Statistics PhD program coursework)

Revisions to the Statistics PhD curriculum include changes to the following 5 courses that directly affect the Biostatistics PhD program.

- 6111 (3 credits) & 6112 (3 credits): a new sequence for reviewing and introducing mathematical foundations necessary for the coursework in PhD and MS programs. This sequence with 6 credits total will replace MATH 4545 (4 credits) and STAT 6860 (2 credits).
- 6910 (4 credits) & 6950 (4 credits): resequencing of 6910 and 6950 changing their order.
- 7301 (3 credits): reduce redundancy with 6802 (first-year theory course) and introduce topics in high dimensional estimation which are relevant to contemporary applications.
- 7410 (3 credits): refocus course content to cover more applied statistical modeling techniques.

Course changes (required public health-related courses)

Under a single curriculum, the Biostatistics PhD program also added the following courses as required for all students to reflect program learning goals and student professional development:

- Require PUBHEPI 6410 (was previously required only for public health specialization students and as a “pick two [of three]” elective for methodology students)
- Require PUBHLTH 6010 (was previously required only for public health students)
- Require PUBHBIO 6260 (students have been previously encouraged but not required to take this course)
- Require PUBHBIO 8899 (students have been previously strongly encouraged but not required to take this course as preparation for statistical research)

Course changes (adding elective flexibility)

This revision also eliminates several explicitly required courses and increases the number of biostatistics electives. This change allows more flexibility for students pursuing different areas of interest within the field of biostatistics, while ensuring that the program learning goals are being met.

Current vs. Proposed Curriculum

The tables below compare the proposed and current curricula. The current program guide for Biostatistics PhD program is available [here](#).

Proposed: Foundational Math (currently “Core Math”)

Current			Proposed			
Code	Credits	Title	Code	Credits	Title	Notes
MATH 4545	4	Analysis Overview				Removed
			6111	3	Foundations of Statistical Theory I	New course*
			6112	3	Foundations of Statistical Theory II	New course*

*6111-6112 replace MATH 4545 and STAT 6860.

Proposed: Biostatistics Core (currently “Core Statistics”)

Current			Proposed			
Code	Credits	Title	Code	Credits	Title	Notes
STAT 6570	2	Applied Bayesian Analysis	STAT 6570	2		
STAT 6801	4	Statistical Theory I	STAT 6801	4		
STAT 6802	4	Statistical Theory II	STAT 6802	4		
STAT 6860	2	Foundations of the Linear Model	STAT 6860			Removed*
STAT 6910	4	Applied Statistics I	STAT 6910	4	Applied Statistics II	Resequenced and revised
STAT 6950	4	Applied Statistics II	STAT 6950	4	Applied Statistics I	Resequenced and revised
STAT 7301	3	Advanced Statistical Theory I	STAT 7301	3	Advanced Statistical Theory	Revised
STAT 7410	3	Theory of the Linear Model	STAT 7410	3	Linear Models	Revised
STAT 7430	3	Generalized Linear Models	STAT 7430	3		
STAT 7730	3	Advanced Computational Statistics	STAT 7730	3		

PUBHBIO 7245	2	Biostatistical Collaboration	PUBHBIO 7245	2		
PUBHBIO 8235	3	Advanced Regression Modeling for Time-to-Event Data	PUBHBIO 8235	3		

Proposed: Public Health Courses (consolidating into one curriculum)

Current			Proposed			
Code	Credits	Title	Code	Credits	Title	Notes
			PUBHEPI 6410	3	Principles of Epidemiology	
			PUBHLTH 6010	3	Essentials of Public Health	
			PUBHBIO 6260	1	Ethics in Biostatistics	
			PUBHBIO 8899	1	Doctoral Seminar in Biostatistics	

Current: Methodology Specialization Required Courses

Required Advanced Statistics courses:

Current			Proposed			
Code	Credits	Title	Code	Credits	Title	Notes
STAT 7201	3	Theory of Probability				Changed to elective
STAT 7540	3	Theory of Stochastic Processes				Changed to elective

“Pick two” Biostatistics courses:

Current			Proposed			
Code	Credits	Title	Code	Credits	Title	Notes
PUBHEPI 6410	3	Principles of Epidemiology				Required for all students
PUBHBIO 7215 / STAT 6615	2	Design and Analysis of Clinical Trials				Changed to elective

STAT 8625/6625	3	Stat Methods for Genetic Data				Changed to elective
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Current: Public Health Specialization Required Courses

Required Biostatistics courses:

Current			Proposed			
Code	Credits	Title	Code	Credits	Title	Notes
PUBHBIO 7215 / STAT 6615	2	Design and Analysis of Clinical Trials				Changed to elective
STAT 6540 / 7540	3	Applied Stochastic Processes / Theory of Stochastic Processes				Changed to electives

Public Health-related courses:

Current			Proposed			
Code	Credits	Title	Code	Credits	Title	Notes
PUBHEPI 6410	3	Principles of Epidemiology				Required for all students
PUBHLTH 6010	3	Essentials of Public Health				Required for all students
Public Health Elective	3	n/a				Removed

The percent change of the revision:

The proposed program revision adds STAT 6111 (3 cr) and STAT 6112 (3 cr) as new courses although they can be viewed as replacements of the existing courses covering similar course content. The rest of the revised statistics courses (STAT 6910, 6950, 7301, and 7410) have about 15% of change on average in the course content (5-25% change depending on the course). This revision also requires specific public health courses for all students: PUBHEPI 6410 (3 cr), PUBHLTH 6010 (3 cr), PUBHBIO 6260 (1 cr), PUBHBIO 8899 (1 cr), although some of these courses were previously required or frequently taken as electives. Thus, at a maximum, this change represents 16.1 credits out 80 credits; representing a change of 20% to the program.

Transition Plan

We will enact this program change for students entering the program in the academic year 2024-2025. Students who matriculated prior to Autumn 2024 will continue with the current program and will not be impacted by this redesign either in terms of progress towards their degree or their expected date of graduation. We do not anticipate any students will have taken only part of the applied statistics sequence (STAT 6910/6950) and thus be 'out of sequence' due to the course sequence change starting in Autumn 2024. In the unlikely event that this would occur, the Graduate Studies Chair will work individually with the student and appropriate instructors.

Appendix

A. Changes in the current Biostatistics PhD curriculum since last major changes (2015)

This section briefly describes changes in [the current Biostatistics PhD curriculum](#) from the curriculum in 2015 when major changes were made to the program. See [the Biostatistics PhD curriculum](#) approved by CAA in November 2015.

The core math and core statistics courses have not changed since 2015.

The additional courses required by the methodology specialization have not changed since 2015.

There was one change to the additional courses required by the public health specialization.

Specifically, the “Epidemiology” and “Cognate” required sections were merged into a single “Public health-related courses” section. The newly developed public health overview course PUBHLTH 6010 was added, and the number of public health electives was reduced. These changes are summarized in the table below:

Public Health Specialization: Public Health-Related Courses (Formerly “Epidemiology” and “Cognate”)

2015			Current			
Code	Credits	Title	Code	Credits	Title	Notes
PUBHEPI 6410	3	Principles of Epidemiology	PUBHEPI 6410	3	Principles of Epidemiology	
	6	[elective courses in a field outside of statistics or biostatistics]	PUBHLTH 6010	3	Essentials of Public Health	Added in 2018
				3	[elective course in a field outside of statistics or biostatistics]	

This change was made to ensure public health specialization graduates had an introduction to other areas of public health (beyond epidemiology).

In 2019, the number of elective credits was reduced by 1 in each specialization (to 7 for methodology) and 5 (for public health) to allow for more flexibility around 2 and 3 credit

courses as faculty had noted that students were choosing electives based on credit hours rather than content area.

Some minor language changes have also been added for clarity following faculty discussion.

B. Revised Program Guide

CURRICULUM OVERVIEW

The Interdisciplinary Biostatistics PhD require at least 60 credit hours of coursework. The program is a mix of core statistics courses, public health related coursework, and electives in biostatistics and statistics. The remainder of the minimum of 80 credits required for the PhD comprise individual reading and research related to developing the dissertation or other courses.

REQUIRED COURSEWORK

Area/Course	Title	Credits
Foundational Math		6 total
*STAT 6111	Foundations of Statistical Theory I	3
*STAT 6112	Foundations of Statistical Theory II	3
Biostatistics Core		35 total
STAT 6570	Applied Bayesian Analysis	2
*STAT 6801	Statistical Theory I	4
*STAT 6802	Statistical Theory II	4
*STAT 6910	Applied Statistics II	4
*STAT 6950	Applied Statistics I	4
*STAT 7301	Advanced Statistical Theory	3
*STAT 7410	Linear Models	3
*STAT 7430	Generalized Linear Models	3
STAT 7730	Advanced Computational Statistics	3
*PUBHBIO 7245	Biostatistical Collaboration	2
*PUBHBIO 8235/STAT 7605 or STAT 8605	Advanced Regression Modeling for Time-to-Event Data or Advanced Survival Analysis	3
Public Health Courses		8 total
PUBHEPI 6410	Principles of Epidemiology	3
PUBHLTH 6010	Essentials of Public Health	3
PUBHBIO 6260	Ethics in Biostatistics	1
PUBHBIO 8899	Doctoral Seminar in Biostatistics	1
Biostatistics Electives		11 total
Elective credits can be from any 6000-level or higher STAT or 7000-level or higher PUBHBIO didactic course or other related courses as approved by the student's Candidacy Exam Committee and the Graduate Studies Chair.		
Total Credit Hours		60 total

*Starred courses are pre-requisites for the Biostatistics PhD QII Exam.

SAMPLE PROGRAM

	Autumn Semester	Spring Semester
First Year	STAT 6111 (Foundations I) STAT 6801 (Stat Theory I) STAT 6950 (Appl Stat I)	STAT 6112 (Foundations II) STAT 6802 (Stat Theory II) STAT 6910 (Appl Stat II)
Second Year	STAT 7301 (Adv Stat Theory) STAT 7410 (Lin Mod) PUBHBIO 8899 (Doctoral Seminar) PUBHBIO 6260 (Ethics in Biostat)	STAT 7430 (GLM) PUBHBIO 8235/STAT 7605/STAT 8605 (Adv Survival) PUBHBIO 7245/STAT 7755 (Biostat Collab)
Third Year	Public Health or Elective Courses	STAT 7730 (Stat Computing) STAT 6570 (Applied Bayes)^ Public Health or Elective Courses
Fourth Year and Beyond	Public Health or Elective Courses	Public Health or Elective Courses

^Students are encouraged to consider taking STAT 6570 in the spring of their first year

TOTAL COURSE HOUR REQUIREMENTS

The doctoral program requires a minimum of 80 credits, including the 60 credits of required courses listed above. Note that the required curriculum leaves a maximum of 20 of the required 80 hours available for individual reading and research related to developing the dissertation. However, students may exceed the 80 required hours. A maximum of 30 credits of master's degree work may be applied to PhD requirements if approved by the Graduate Studies Committee. (See the Policies, Rules and Procedures for information about transferring credit from other universities.) A grade of B- or better is required in all courses in the PhD program. Students should be familiar with and follow any additional Graduate School enrollment rules and procedures.