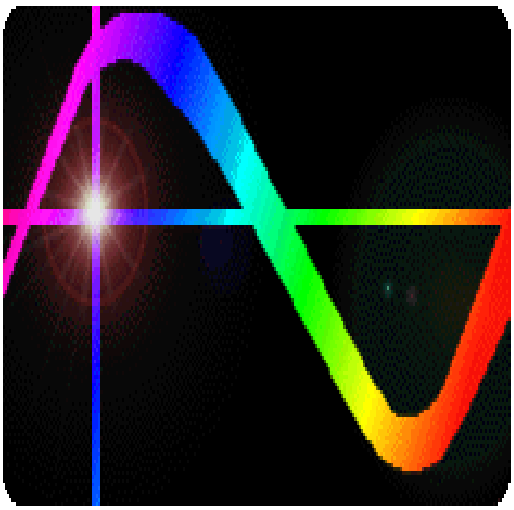

BIOSTATISTICS

ACADEMIC INFORMATION MANUAL

2009 – 2010 Edition

DEPARTMENT OF BIOSTATISTICS
GILLINGS SCHOOL OF GLOBAL PUBLIC HEALTH
3101 McGavran-Greenberg Hall, CB# 7420
The University of North Carolina at Chapel Hill
Chapel Hill, NC 27599-7420
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Welcome from the Chair

Scientists in nearly all disciplines collect quantifiable data. We biostatisticians, working with our scientist colleagues, develop methods to optimally collect and analyze the data from the many types of studies conducted in the health sciences. The field of biostatistics is thus at the cutting edge of all new developments in the health sciences. The Department of Biostatistics at the University of North Carolina is proud to be one of the leading academic research departments of biostatistics in the world. For over fifty years, our department has been at the forefront of biostatistical and public health training and research.

The graduate and undergraduate training in our department is rigorous, challenging, and state-of-the art. Our students take difficult and interesting courses in statistical theory and applications. At the same time, most of our students participate actively in the methodological and collaborative research that our faculty is conducting. Graduates of our program are prepared to be leaders in biostatistics, and a roster of over 1000 successful alumni illustrates this. Our graduates are faculty members at leading universities around the world, directors of units at the National Institutes of Health and Centers for Disease Control, and are leaders of research units in the pharmaceutical industry.

Essentially all of our graduate students receive at least partial financial support. This comes from our training grants in environmental biostatistics, demography, and clinical trials, as well as from actual research projects of our faculty. Faculty research projects currently funding graduate students include studies of methods of increasing physical activity in teen-age girls, new methods of producing and reading mammograms, treatments of HIV/AIDS, cancer and cardiovascular disease, statistical genomics, and many others too numerous to list here.

As you can see from this partial list of research projects, our faculty is very actively involved in important and timely research. At the same time, they are excellent teachers, and several of our faculty members have won teaching awards given by the Gillings School of Global Public Health and the University.

Our faculty also value and enjoy working with students one-on-one on research projects, and many of our students co-author several peer-reviewed publications before they graduate.

I personally look forward to getting to know you better in the coming years and wish you the best of success.

Michael R. Kosorok, Ph.D.
Chair of Biostatistics

Department overview

The UNC Department of Biostatistics is one of the strongest academic units in the University of North Carolina Gillings School of Global Public Health, and it stands as one of the best departments of its kind in the world. The Department was established in 1949 with the goals to advance statistical science, and, ultimately by its application, to improve human health. To achieve these goals, the Department of Biostatistics offers training and research programs to develop and apply innovative statistical methods to problems of human health and disease, including basic biomedical sciences.

Mission Statement

Our mission is to forge dramatic advances in health science research that benefit human health in North Carolina, the US, and globally through the development of profound and paradigm-shifting innovations in biostatistical methodology and the thoughtful implementation of biostatistical practice to solve public health problems.

We bring about positive, sustainable changes in health by:

- Supporting excellence in biostatistical practice by conducting theory and methods research of clear relevance to practice
- Promoting sound application of new and existing statistical methods
- Improving biostatistical education at the undergraduate and graduate levels
- Working with undergraduate colleges to promote biostatistics as a discipline for graduate studies and professional career
- Anticipating and meeting the learning needs of our students
- Using the tools of our discipline to enhance human welfare through collaboration in the research with colleagues in the biological and health sciences
- Seeking opportunities to advance the biostatistics profession.

Goal

- Our goal is to be a world leader in statistical research and statistical practice for the purposes of improving the public's health, improving biostatistical education, and advancing the biostatistics profession.

ADMINISTRATIVE PERSONNEL

Department of Biostatistics

Chair – Michael R. Kosorok
Associate Chair – Jianwen Cai

Director of Undergraduate Admissions – Jane Monaco
Director of Graduate Admissions – Chirayath M. Suchindran

Director of Undergraduate Studies - Jane Monaco
Director of Graduate Studies - Joseph G. Ibrahim

Director, Biometric Consulting Laboratory - Gary G. Koch
Director, Collaborative Studies Coordinating Center - Lisa LaVange
Director, Survey Research Unit - William D. Kalsbeek
Director, Center for Innovation Clinical Trials - Joseph G. Ibrahim

Program Directors:

Bioinformatics and Computational Biology – Fred A. Wright
Environmental Biostatistics – Amy H. Herring
Genomics and Cancer – Joseph G. Ibrahim
Initiative for Minority Student Development – Lloyd J. Edwards
Population Studies - Chirayath M. Suchindran
AIDS Research – Jason Fine and Haitao Chu

Business Manager – Evie E. McKee

Administrative Secretary – Betsy S. Seagroves

Network Administrator – Scott Zentz

Student Services Managers/Registrars – Melissa C. Hobgood and Veronica P. Stallings

DEPARTMENT/FACULTY MEETINGS

At the beginning of each academic year, the Administrative Secretary and Chair decide the time and days of regular Departmental Meetings. Additional meetings may be called by the Chair as needed.

All faculty (Instructors and above), and up to five student representatives (chosen by the student body), are eligible to vote at the regular Departmental Meetings.

The Agenda for each meeting is initiated by the Administrative Secretary and given to the Chair for completion. Items to be put on the Agenda should be given to the Administrative Secretary one week before the meeting.

The Chair (or an appointed representative) presides over all meetings. In general, Robert's Rules of Order are followed in the conduct of the meetings.

A Faculty Meeting may be held when necessary to consider business of such a nature that students should not be present (for example, decisions with respect to Department-wide written examinations). Attendance is restricted to faculty.

Minutes are prepared by the Administrative Secretary and given to the Associate Chair for approval. Copies are distributed to everyone eligible to vote at the meeting.

ORIENTATION AND ADVISING

ORIENTATION

The Department Student Services Mangers/Registrars, with the help of the Directors of Undergraduate and Graduate Admissions, organize orientation meetings for all new students. At these meetings, students are introduced to key members of the faculty, such as the Department Chair, Associate Chair, the Directors of Undergraduate and Graduate Admissions and Studies, and the Chairs of the Examinations Committee. They are also given current information about the department, degree requirements, and departmental research activities.

APPOINTMENT OF ACADEMIC ADVISORS

The Director of Undergraduate Studies usually advises all undergraduates.

The Registrars office and the Director of Graduate Admissions appoint faculty advisors for newly admitted graduate students. The selections are made with consideration of such factors as interests of the students and faculty, any specialized fellowship support, and faculty commitments. Any request for change in advisor assignment should be directed to the Director of Graduate Studies (DSG) and/or Registrars.

DUTIES OF STUDENT SERVICES MANAGERS/REGISTRARS

Prior to the entry of new students, the Registrar sends the advisors information about the backgrounds of their advisees and the degree program to which each advisee has been admitted. Before each registration, the Registrar also sends the advisee a copy of the course schedule and other relevant registration material. At the start of the fall semester, the advisee is provided with a copy of the latest version of the Academic Information Manual (AIM). Subsequent meetings between the advisor and advisee should be arranged by them directly.

DUTIES OF ADVISORS

The primary responsibilities of the faculty member appointed as advisor for a newly admitted student are to provide initial guidance regarding the academic program of the advisee and to carry out selected academic functions (such as assistance regarding options for practical training or for a research project**)** related to completion of academic program requirements. Also, for MPH students, a great deal of flexibility in course selection is possible (see section on the MPH degree program). **However, after the first semester, primary responsibility should shift to students for updating plans to satisfy their degree programs and for discussing such plans with their advisors. Students are expected to meet with their advisor at the beginning of each semester to discuss course selection and academic progress.**

Advisors are specifically expected to confer with their advisees in all selections of courses, and to sign appropriate forms showing their approval of the course plans (as well as any subsequent course additions or drops) of their advisees.

In carrying out their responsibilities, advisors need to keep “up-to-date” on the academic and related requirements of the degree programs for which they are advising students, and to monitor the progress of their advisees in meeting these requirements.

Every student is responsible for keeping an updated degree checklist in order to monitor their progress. This should be done with their advisor at the beginning and end of each semester. In the final year, the checklist must be verified and signed off by the Director of Graduate Studies. The academic advisor is not committed to continuing as the advisor of the Master's paper or doctoral dissertation.

ABSENCE OF ADVISORS

Advisors who have to be away during registration, or for any length of time during the year, should make arrangements, in consultation with the Registrar, for another faculty member to meet with their advisees when they need faculty assistance. If such arrangements are not made, changes in a student's program may be made at the discretion of the Director of Graduate Studies and the Registrar.

Department of Biostatistics Guidelines for Awarding Tuition Remissions

The following criteria will be used by the Department of Biostatistics (and followed by the Chair, Directors of Graduate Admissions and Studies, and by the Department Registrar) for making decisions about Tuition Remission awards. All such awards are, of course, subject to the availability of funds, which are allocated by the Graduate School.

When possible, approximately five Tuition Remissions may be awarded to new students, and the remaining available Tuition Remissions will be awarded to eligible returning students. Each award to a new student will be for one academic year (fall and spring). Returning student Tuition Remission eligibility is determined on a semester basis and is contingent:

(a) full time student status;
(b) high quality performance in course work;
(c) high quality performance in GRA activities;
(d) financial need;
(e) compliance with guidelines set by the Graduate School.

Enrollment Requirements

Doctoral or Master's/Doctoral Sequence Students:

Full enrollment is required (9 hours or more) during the first two years of graduate study. Thereafter, once all other degree requirements have been satisfied, students must enroll for at least 3 hours of 994.

Master's Students:

Full enrollment is required (9 hours or more) during the first three semesters of graduate study. Thereafter, once all other degree requirements have been satisfied, students must enroll for at least 3 hours of 992.

All students must remain appropriately enrolled for the entire semester to be eligible for, and to retain tuition remission or an in-state tuition award for the relevant semester.

Dropping below the minimum enrollment requirement during the semaster will result in the loss of tuition remission and the financial responsibility rests on the student.

Duration of Support

1. Students in terminal masters' programs are eligible for tuition remission and/or in-state tuition awards from the designated tuition fund for four semesters;

2. Doctoral students (or students in masters then doctoral sequence programs) are eligible for tuition remission and/or in-state tuition awards from the designated tuition fund for up to ten semesters.

3. A student who completes a degree in one academic program, then enrolls in another academic program or changes academic programs without receiving a degree, is only eligible for the maximum semesters of eligibility as noted above during their enrollment at the university, or no more than ten semesters

Criteria indicating lack of excellent academic progress include poor academic performance (e.g., as indicated by the grade of F or L in any course) and/or the inability to maintain full time student status (except in certain circumstance such as a major illness or personal hardship).

BACHELOR OF SCIENCE IN PUBLIC HEALTH (BSPH)

OBJECTIVES OF THE PROGRAM

The Bachelor of Science in Public Health (BSPH) degree program trains students for entry-level statistical positions in health and health-related organizations, as well as for subsequent graduate education-- not necessarily in biostatistics.

Upon satisfactory completion of this course of study the student will be able to:

1. demonstrate familiarity with elementary statistical theory;

2. formulate and conduct tests to explore the validity of a statistical dataset;

3. formulate and perform a descriptive and/or inferential analysis of a study or related dataset and interpret the findings in an appropriate manner;

4. develop an efficient design of an experiment or observational study in the health sciences;

5. design surveys and devise sampling schemes appropriate in the broad area of public health;

6. apply quantitative knowledge to a variety of health and related matters that deal with the physical environment, the population, patterns of disease/disability/death, and the effects of health services; and

7. apply his/her knowledge and skills at the entry management level of federal, state, and local health agencies.

ADMISSION REQUIREMENTS

The first two years of the four-year course of study are usually within UNC-CH's General College. Upon successful completion of Freshman-Sophomore work in the General College with a cumulative GPA of at least 3.0 (4-point scale), the BSPH candidate applies to the Gillings School of Global Public Health. The final two years are completed under the administration of this School.

In addition to UNC-CH's General College requirements, applicants must have completed (by the time of enrollment): BIOL 101 and 101L; MATH 231, MATH 232, and MATH 233; and COMP 110 or 116.

The basic admissions procedures and schedules for the BSPH program conform to UNC-CH's and the School of Public Health's regulations. Prospective students should familiarize themselves with program prerequisites early in their General College studies and discuss their plans with the Program Director (Dr. Jane Monaco).

PROGRAM REQUIREMENTS

A Junior-Senior distribution of about 60 semester hours including: BIOL 201 (or 202); BIOS 600, 511, 545, 550, 664, 668 (or 662) and 691; ENVR 600; EPID 600; MATH 381, 521 (or 528), and 547; and a minimum of three electives outside the Gillings School of Global Public Health.

UNC-CH requires: At least 120 semester hours, not counting required physical education; a 2.0 (C) average on all work attempted at UNC-CH (which must be earned in a total number of hours not to exceed 45 beyond the minimum graduation requirement of 120 hours); and residence in Chapel Hill for the last 30 hours of degree credit.

BSPH students are required to earn a grade of C (or higher) for all Biostatistics required courses, core Public Health courses, and Prerequisite (for admission) courses.

TYPICAL BSPH (IN BIOS PROGRAM)

FRESHMAN-SOPHOMORE YEARS: **Usually 60 credit hours including:**

BIOL 101 and 101L	Principles of Biology and its Laboratory (4)
COMP 110 or 116	Introduction to Programming (3)
MATH 231	Calculus of Functions of One Variable I (3)
MATH 232	Calculus of Functions of One Variable II (3)
MATH 233	Calculus of Functions of Several Variables (3)

JUNIOR-SENIOR YEARS: **Usually 60 credit hours that including:**

FALL 3:

BIOS 600	Principles of Statistical Inference (3)
BIOS 511	Introduction to Statistical Computing and Data Management (4)
MATH 381	Discrete Mathematics (3)
FREE ELECTIVE	
FREE ELECTIVE	

SPRING 3:

BIOS 545	Principles of Experimental Analysis (3)
MATH 521	Advanced Calculus I or MATH 528 (3)
EPID 600	Principles of Epidemiology (3)
FREE ELECTIVE	
FREE ELECTIVE	

FALL 4:

BIOS 550	Basic Elements of Probability and Statistical Inference (4)
BIOS 691	Field Observations in Biostatistics (1)
MATH 547	Linear Algebra for Applications (3)
ENVR 600	Environmental Health (3)
FREE ELECTIVE	
FREE ELECTIVE	

SPRING 4:

BIOS 664	Sample Survey Methodology (4)
BIOS 668	Design of Public Health Studies (3)
BIOL 201*	Ecology and Population Biology or BIOL 202 (4)
FREE ELECTIVE	
FREE ELECTIVE	

CONTACT **DR. JANE MONACO** (jmonaco@bios.unc.edu) TO SCHEDULE AN INFORMAL DISCUSSION ABOUT THE PROGRAM

*BIOL 201 AND 202 have a prerequisite, CHEM 101.

MASTER OF PUBLIC HEALTH (MPH)

OBJECTIVES OF THE PROGRAM

The Master of Public Health (MPH) program is designed to prepare individuals who have at least one year of prior work experience at admission for positions that require knowledge of the broad field of public health as well as specialized knowledge of biostatistics.

Upon satisfactory completion of this program the student will have:

1. demonstrated an understanding of the foundations of public health, including the physical, biological, and social/behavioral factors which affect the health of the community, and systems for health services delivery [SPH core course requirements];

2. demonstrated an understanding of the elements of probability and statistical inference, including the fundamental laws of classical probability, descriptive statistics, discrete and continuous distributions, functions of random variables, sampling distributions, and ability to apply them to a variety of estimation and hypothesis testing situations [BIOS 550, 663, and possibly 660-661];

3. used computers for research data management (applying a defensible standard of documentation, archiving, protection of confidentiality, and audit trail) and for the analysis of data with standard statistical program packages [BIOS 511, also 842];

4. learned to develop an efficient design of an observational or experimental study in the health sciences [BIOS 668, 670];

5. gained successful experience in statistical consulting, including interaction with research workers in the health sciences, abstracting statistical aspects of substantive problems, and communicating the results to persons without specialized biostatistical training (as evaluated by the consultees) [BIOS 841/842];

6. written an adequate report related to the statistical aspects of a problem in the health sciences [BIOS 992].

ADMISSION REQUIREMENTS

Requirements for admission include:

1. An acceptable Bachelor's degree with mathematics training at least including multivariable calculus and linear algebra.

2. At least 12 months of acceptable fulltime, relevant post-baccalaureate work experience in public health, with an option to substitute an acceptable prior advanced degree (such as an MD degree) for the experience.

TIME/RESIDENCE REQUIREMENTS

The Graduate School requires a minimum residence period of only two semesters for any Master's degree, but students in the MPH program will typically need almost two years to complete all MPH degree requirements. All requirements for the degree must be completed within five years of matriculation. See the following for information ***Please refer to the Graduate School Handbook located in the appendix for additional information***.

COURSE REQUIREMENTS

The Graduate School requires at least 42 semester hours of course work. A maximum of six hours credit may be transferred from other institutions, or from Continuing Studies, in partial satisfaction of this 42 hour requirement. The transfer must be recommended by the Department and approved by the Graduate School. The residence requirement is not affected. The necessary letter to the Graduate School is prepared by the Registrar. The Graduate School notifies the student directly by letter when action has been taken on the request for transfer of credits.

The Gillings School of Global Public Health requires MPH students to take certain courses to insure that they are knowledgeable in the five basic public health content areas. There are several options for satisfying this requirement. For the standard option, students take one course in each of the core areas. The core areas are epidemiology, biostatistics, health policy and management, environmental health sciences, and social and behavioral sciences. Each department registrar has a list of approved courses that satisfy this requirement. In addition to the standard option, there are several alternative options. Students should consult their academic advisors about these alternatives.

The Department of Biostatistics requires:

1. Basic Statistical Tools
   BIOS 511, 550, 663, 664, 668 and 670 except that any of these may be waived by the Director of Graduate Studies if the student has equivalent training.

   (Note that multivariable calculus is a prerequisite for BIOS 550). Additionally, BIOS 550 is an abbreviated and less theoretical version of BIOS 660/661, and it is designed specifically for the MPH program. BIOS 660 alone cannot serve as a substitute for BIOS 550, although the sequence BIOS 660-661 can.

2. Intermediate or Advanced Statistics
   Either BIOS 662 or one course numbered above BIOS 664.

4. Practicum

   a) BIOS 841
   b) BIOS 842
   c) BIOS 843 (2 semesters (credits) are required)
   d) Must complete online form to report practicum experience. Visit www.sph.unc.edu/careers. Online form located in the second paragraph of the NEWS section.

Note: A very flexible Master's program within the MPH program is available for students with strong undergraduate programs who are not seeking the stronger theoretical base of the MS degree. For example, BSPH graduates may have already satisfied requirements #1 and #2 above. They have also taken EPID 600 so that their remaining coursework requirements are to complete the School's “core

curriculum" requirement, the practicum (#3 above), and the Graduate School's 42 hour requirement (with an allowance for 6 hours which could be transferred toward this total).

EXAMINATIONS

All candidates are required to pass the MPH Written Examination in Biostatistics at least one month before the degree is expected: See Page 34 for details. No formal oral examination is required.

APPLICATION FOR GRADUATION

Students must notify the Graduate School of their plan to graduate by applying to graduate through eGraduation Central no later than the deadline shown in the University Registrar's Calendar for the semester in which they expect to graduate. Applications should only be submitted when the student realistically intends to graduate that semester and are valid for one semester only. If a student does not graduate in the semester expected, s/he must submit another application for graduation in a future semester. The department registrar will also notify students via emai1 of deadlines. See appendix for link.

MASTER'S PAPER

Each MPH candidate is required to earn at least three credits in BIOS 992 by writing a Master's Paper (a substitute for a Master's Thesis). This paper should show some synthesis of knowledge, and advance or contribute to the field of Public Health. The Master's paper is presented orally and submitted in a suitable written format: See Page 40 for details.

Entering Master's students are strongly encouraged to identify a Master's paper topic by no later than the end of their first 12 months of residency.

It is recommended that the text of the Master's Paper should be 20-30 pages, excluding tables, figures, appendices, and bibliography. Students must provide faculty readers with a copy of the paper at least two weeks before graduation deadlines.

POLICY ON ENROLLMENT

The policy on enrollment for Master's Paper/thesis/doctoral dissertation only is stated below.

"Students who have completed all course work and residency requirements for their graduate degree program and who are using University resources (including faculty time) to conduct their Master's paper/thesis/doctoral dissertation research will be required to register and pay tuition for at least 3 hours of Master's paper/thesis/doctoral dissertation credit (992/993/994). As in the past, students must be registered in Master's paper/thesis/doctoral dissertation (992/993/994) for 3 hours during the semester in which they complete their graduate work or are scheduled to receive their degree."

"Students who are not using university resources may apply for a leave of absence. It should be emphasized, however, that students must be registered for at least 3 hours in order to receive a stipend, qualify for University Graduate Student Health Insurance, or maintain full-time student status for loan deferment or student visa status."

Please refer to the Graduate School Handbook for additional information.

MASTER OF SCIENCE (MS)

OBJECTIVES OF THE PROGRAM

The Master of Science (MS) program is designed to provide research-oriented training in the theory and methodology of biostatistics and its applications to the solution of problems in the health sciences.

Upon satisfactory completion of this program, the student will have:

1. demonstrated an understanding of probability and statistical inference, including the fundamental laws of classical probability, discrete and continuous random variables, expectation theory, bivariate and multivariate distribution theory, maximum likelihood methods, hypothesis testing, power, and likelihood ratio, score, and Wald tests [BIOS 660, 661];

2. demonstrated ability to apply the elementary methods of statistical analysis, including those based on classical linear models and on nonparametric alternatives, involving categorical, discrete, normal, or ranked data, to problems of description, goodness of fit, univariate location and scale, bivariate independence and correlation, regression analysis, and the comparison of independent and matched samples possibly adjusting for covariables [BIOS 662,663];

3. used computers for research data management (applying a defensible standard of documentation, archiving, protection of confidentiality, and audit trail) and for the analysis of data with standard statistical program packages [BIOS 511];

4. learned to develop an efficient design of an observational or experimental study in the health sciences [possibly BIOS 664];

5. demonstrated basic knowledge of one or more substantive areas of statistical application in the health sciences [supporting program];

6. gained successful experience in statistical consulting, including interaction with research workers in the health sciences, abstracting statistical aspects of substantive problems, and communicating the results to persons without specialized biostatistical training (as evaluated by the consultees), and observed and evaluated nonacademic biostatistical programs in the Research Triangle area [BIOS 841];

7. written an adequate report related to the statistical aspects of a problem in the health sciences, or a contribution to statistical methodology [BIOS 992].

ADMISSION REQUIREMENTS

Requirements for admission include an acceptable Bachelor's degree with mathematics training at least including multivariable calculus and linear algebra.

TIME/RESIDENCE REQUIREMENTS

The Graduate School requires a minimum residence period of two semesters, but the MS in Biostatistics usually requires about two years for completion. All requirements for the degree must be completed within five years of matriculation. ***Please refer to the Graduate School Handbook located in the appendix for additional information***.

COURSE REQUIREMENTS

Although the Graduate School requires only 30 semester hours of course work, the Department's 36 credit hours requirement is greater. A maximum of six hours credit may be transferred from other institutions, or from Continuing Studies, in partial satisfaction of this requirement. The transfer must be recommended by the Department and approved by the Graduate School. The residence requirement is not affected. The necessary letter to the Graduate School is prepared by the Registrar. The Graduate School notifies the student directly by letter when action has been taken on the request for the transfer of credits.

Basic Statistics

BIOS 511, BIOS 660, BIOS 661, BIOS 662, BIOS 663, 667 and 680 are required.

Intermediate and Advanced Statistics

Six hours of course work numbered 664 or higher not including 667 and 680 in Biostatistics, or equivalent in Statistics at UNC, or in Statistics at NCSU.

Practicum

a) BIOS 841
b) BIOS 843 (2 semesters (credits) are required)
c) In addition, each MS student may be required to grade up to two courses: See Page 48 for details.

Supporting Program

EPID 600 or 710 (or equivalent), plus 3 other hours (not necessarily confined to SPH courses), is required. See Page 34 for details. The Supporting Program Proposal Form and MS Degree Checklist (see Appendix) are to be used by the advisor to monitor the student's progress toward the MS degree. The Supporting Program Proposal Form should be approved by the student's advisor and the Director of Graduate Studies before submission to the Registrar.

NOTE: Typically, BIOS 511, 660, 661, 662, 663, and 843 are first-year MS courses; BIOS 667, 680, 841, 992, and BIOS electives (e.g., 664, 665, 668, 670, etc.) are usually second-year MS courses; supporting program courses can be taken at any time.

EXAMINATIONS

All candidates are required to pass the MS Written Examination. All candidates are required to take the examination after they have completed their first year in this Department: See Page 34 for details. No formal oral examination is required (unless the student elects to write a Master's Thesis: see Master's Paper section).

APPLICATION FOR GRADUATION

Students must notify the Graduate School of their plan to graduate by applying to graduate through eGraduation Central no later than the deadline shown in the University Registrar's Calendar for the semester in which they expect to graduate. Applications should only be submitted when the student realistically intends to graduate that semester and are valid for one semester only. If a student does not graduate in the semester expected, s/he must submit another application for graduation in a future semester. The department registrar will also notify students via emai1 of deadlines. See appendix for link.

MASTER'S PAPER

Each MS candidate is required to earn at least three hours of credit in BIOS 992 by writing a Master's Paper (a substitute for a Master's Thesis). This paper might consist of a theoretical exposition of a methodological topic in Biostatistics or Statistics, or it might describe in detail the analysis of data considered during the consulting component of the student's program. The Master's Paper is both presented orally and also submitted in a suitable written format. See Page 40 for details. Alternatively, any MS candidate may elect to write a Master's Thesis in accordance with the regulations of the Graduate School; in this case, the candidate must also pass a formal oral examination.

Entering Master's students are strongly encouraged to identify a Master's paper topic by no later than the end of their first 12 months of residency.

It is recommended that the text of the Master's Paper should be 20-30 pages, excluding tables, figures, appendices, and bibliography. Students must provide faculty readers with a copy of the paper and present their Master's paper before graduation deadlines.

POLICY ON ENROLLMENT

The policy on enrollment for Master's Paper/thesis/doctoral dissertation only is stated below.

"Students who have completed all course work and residency requirements for their graduate degree program and who are using University resources (including faculty time) to conduct their Master's paper/thesis/doctoral dissertation research will be required to register and pay tuition for at least 3 hours of Master's paper/thesis/doctoral dissertation credit (992/993/994). As in the past, students must be registered in Master's paper/thesis/doctoral dissertation (992/993/994) for 3 hours during the semester in which they complete their graduate work or are scheduled to receive their degree."

"Students who are not using university resources may apply for a leave of absence. It should be emphasized, however, that students must be registered for at least 3 hours in order to receive a stipend, qualify for University Graduate Student Health Insurance, or maintain full-time student status for loan deferment or student visa status."

Please refer to the Graduate School Handbook for additional information.

DOCTOR OF PUBLIC HEALTH (DRPH)

OBJECTIVES OF THE PROGRAM

The Doctor of Public Health (DrPH) program is designed to prepare students who have at least one year of prior work experience at admission for positions of leadership in applied research related to health problems and delivery of statistical technical services in the health field. In order to accomplish this goal, the program ensures that students acquire: a thorough and broad knowledge of statistical techniques and their application to a range of health problems; a basic knowledge of public health and an area therein in which the student may specialize; suitable administrative and leadership experiences in applied research or technical assistance projects; and communication skills so that they can function effectively in a multidisciplinary environment.

Upon satisfactory completion of this program the student will have:

1. demonstrated an understanding of the foundations of public health, including the physical, biological, and social/behavioral factors which affect the health of the community, and systems for health services delivery [SPH core course requirements];

2. demonstrated ability to use state-of-the-art design and analysis methods to solve a wide variety of applied statistical problems in the health sciences, by successfully passing the DrPH Basic Written Examination in Biostatistics [Copies of past Basic Written Examinations are available from the Department];

3. learned advanced biostatistical techniques, including the ability to
    - design cost-effective surveys and experiments (including clinical trials) for collecting data on topics relevant to health, taking account of sampling error, measurement error, nonresponse, and other sources of bias and variability;
    - use advanced linear model theory for estimation and statistical inference based on health data, including linear regression and mixed models; models for longitudinal discrete and continuous data, and survival models;
    - discern when standard methods are not appropriate, when nonparametric methods based on randomization and ranks may be substituted, or when new methods must be developed;

4. used computers for research data management (applying a defensible standard of documentation, archiving, protection of confidentiality, and audit trail) and for the analysis of data with standard statistical program packages;

5. carried out independent methodological research, including the writing of a scholarly dissertation and publishing papers based on this research in respected statistical journals;

6. gained successful practical experience in statistical consulting, including interaction with research workers in the health sciences, abstracting statistical aspects of substantive problems, and communicating the results to persons without specialized biostatistical training; if not outside academia, then this consulting experience can be obtained by serving in the Biometric Consulting Laboratory (BCL) or as a member of a university research project team.

ADMISSION REQUIREMENTS

1. An appropriate prior Bachelor's or Master's degree in Statistics, Biostatistics, or in a closely related field.

2. Prior mathematics training at least including advanced calculus and linear algebra.

3. At least 12 months of acceptable fulltime, relevant post-baccalaureate work in public health, with an option to substitute an acceptable prior advanced degree (such as an MD degree) for the experience.

TIME/RESIDENCE REQUIREMENTS

Doctoral students are required to complete a minimum residence credit of four full semesters; at least two of the required four semesters of residence must be earned in contiguous (i.e., fall to spring or spring to fall) registration on this campus. Students attempting to obtain the DrPH degree simultaneously with another Graduate School degree must register full-time in the School Public Health for at least two semesters. All requirements for the degree must be completed within eight years of the time the student matriculated in the program. ***Please refer to the Graduate School Handbook located in the appendix for additional information***.

COURSE REQUIREMENTS

The Gillings School of Global Public Health requires at least 18 semester hours in non-statistical courses relevant to Public Health, including EPID 600 (or an equivalent), as recommended by the student's committee and approved by the DGS. NOTE: These 18 hours must include the MPH core course requirements. The Department of Biostatistics requirements are as indicated below. Requirements (A), (B), and (C) may be waived for students who have had previous training or experience deemed equivalent by the Director of Graduate Studies (DGS). Courses counted toward the School of Public Health requirements, or taken at UNC prior to entry into the program, may be included in (D) and (E). Students who finished their Master's degree at another institution must take or waive the courses indicated on the Master's Elsewhere Form (see Degree Checklist). This form should be completed at the beginning of the first semester of residence and should be approved by the advisor and DGS before submission to the Registrar.

A. Mathematics (advanced calculus and linear algebra)

The student must be prepared for BIOS 758 and BIOS 762, and either BIOS 763 or BIOS 767. This requires working knowledge of the material in MATH 416, 521, 577, and 547 at UNC-CH. BIOS 660, 661, or their equivalents are also required courses, so that a strong background in multivariable calculus is therefore necessary.

B. Statistical Computing and Data Management

BIOS 511 is appropriate. This is self-enforcing, however, since the DrPH Basic Written Examination, and all non-service courses in BIOS, assume that students have mastered the topics covered therein.

C. Basic Statistics

Elementary and intermediate probability, statistical inference, statistical analysis, and sampling. Appropriate courses are: BIOS 660, BIOS 661, BIOS 662, BIOS 663, BIOS 664, and BIOS 665.

D. Advanced Statistics

1. Required Courses

   BIOS 660, BIOS 661, BIOS 758;
   BIOS 762, BIOS 767 or BIOS 763

2. Electives

At least 9 credit hours. Acceptable course include all those numbered at the 700-level in Biostatistics or in (Mathematical) Statistics at UNC-CH, and equivalent courses in Statistics at other institutions as approved by the Director of Graduate Studies (DGS). Requests to count 600-level courses in (Mathematical) Statistics toward this requirement are considered individually.

NOTE: BIOS 758, 762, and 767 are typically taken during the second year of study, following completion of BIOS 660, 661, 662, and 663 during the first year of study.

E. Supporting Program in Public Health

At least 18 semester hours in non-statistical courses relevant to Public Health, including EPID 600 (or an equivalent), as recommended by the student's committee and approved by the DGS. NOTE: These 18 hours must include the MPH core course requirements. The Supporting Program Proposal Form and Degree Checklist (see Appendix) are to be used by the advisor to monitor the student's progress toward the DrPH degree. The Supporting Program Proposal Form requires approval by the student's advisor and the DGS before submission to the Registrar.

F. Practicum

a) BIOS 841
b) BIOS 842. Part or all of this requirement may be waived, upon petition to the DGS, for students with considerable prior experience.
c) BIOS 843 (4 semesters (credits) are required)
d) Must complete online form to report practicum experience. Visit www.sph.unc.edu/careers. Online form located in the second paragraph of the NEWS section.

G. Dissertation Registration

All doctoral students must register for a minimum of 6 credit hours of dissertation work (BIOS 994).

H. Transfer of Credits

A doctoral student may request transfer credit from another institution. Courses transferred are subject to examination at the time of the Doctoral Oral Examination. The Committee may recommend the

transfer of both course and residence credit in its report to the Graduate School, which has the final responsibility for approving the transfer. Transferred credit does not relieve the student of the residence requirement of at least one academic year of continuous full-time study, or the equivalent, at UNC-CH. ***See the appendix for an example of the appropriate form.***

DEGREE EXAMINATIONS AND DISSERTATION

Basic Written Examination

Each DrPH student is required to pass the DrPH Basic Written Examination: This examination is usually taken early in the Fall Semester of the second year of the DrPH program at the end of the first or second year in the program depending on student's prior obtained degree before entering the program. See Page 34 for details.

Doctoral Committee

In the Department of Biostatistics, the Doctoral Committee combines the functions of two committees as specified by the Graduate School: (1) the Doctoral Oral Examination Committee, and (2) the Dissertation Committee.

After the candidate has entered the final stage of planned course work, has chosen a topic for DrPH dissertation research, and has been declared ready by the dissertation advisor, the student and advisor recommend the composition of the Doctoral Committee to the DGS for approval. The composition of each Doctoral Committee is to be approved in writing by both the chairperson of the Department and the DGS. An appropriate form to accommodate this approval process is available from the Departmental Registrar (see Appendix). This form will solicit information regarding the proposed dissertation topic. The student should first consult with the Registrar concerning completion of forms and acceptability of committee appointments.

No fewer than five persons shall constitute the Doctoral Committee. A majority of the members must be full members of the Graduate Faculty. Other members may be limited members of the Graduate Faculty or special appointees. The Committee must also include at least one representative of the supporting program in Public Health.

Preliminary Doctoral Examinations

In the Department of Biostatistics, it is customary to combine the Doctoral Written Examination and the Doctoral Oral Examination specified by the Graduate School into a single Preliminary Oral Examination (or "Prelim", for short) with three parts:

(1) The first part is concerned with the student's supporting program in Public Health and the more advanced work taken for the major. [However, the member(s) of the Committee representing the supporting program may require instead that the candidate pass a written examination on the supporting program.] The result of this part is conveyed to the Graduate School on the appropriate Graduate School form.

(2) The second part is the student's review of the literature for the proposed dissertation topic, on which the student will be questioned by the Committee. The result of this part is conveyed to the Graduate School on the appropriate Graduate School form.

As stated in the Graduate School Handbook, students should have fulfilled, or will have fulfilled by the end of the semester in which the preliminary oral examination is to be taken, all required course work and the minimum residence requirements for the doctorate.

NO DOCTORAL STUDENT IS ALLOWED TO TAK E THE DOCTORAL PRELIMINARY ORAL EXAMINATION UNTIL THEY HAVE PASSED ALL OF THE DOCTORAL BASIC WRITTEN EXAMINATIONS.

A STUDENT MUST BE REGISTERED FOR AT LEAST THREE (3) CREDIT HOURS OF BIOS 994 IN ORDER TO TAKE THE PRELIMINARY ORAL EXAMINATION.

In addition, no preliminary doctoral examination can be scheduled until the student has obtained some tangible research results as judged by the dissertation advisor.

The literature review and proposal to be considered at the preliminary oral examination must be submitted to the Doctoral Committee at least three weeks before the oral is scheduled. An appropriate maximum length for the literature review and proposal is about 40 pages.

At least two weeks before the examination, the student should provide the following information to the Registrar:

1. Date of the Preliminary Oral Examination.

2. Members of the Committee, and mailing addresses of any committee members not on the Biostatistics faculty.

3. Title of the literature review and proposal.

The forms for reporting results of the preliminary doctoral examination are given beforehand to the Chair of the Doctoral Committee by the Registrar. The Registrar reserves a room and prepares a notice announcing the examination. This notice is sent to all faculty in the Department and to any committee members not in the Department of Biostatistics.

After the examination, the completed reporting forms should be returned to the Registrar. For any part of the preliminary oral examination, the student's Committee may award a PASS or FAIL, or a PASS subject to specified conditions (such as additional course work, or the passing of a special examination covering a specific topic). A student who fails a part of the preliminary oral examination is entitled to one re-examination, but not until at least 3 months have elapsed. Re-examination of the first part may be in writing, by request of the student. Appeals of Committee decisions may be made to the faculty of the Department through the Department Chair.

Doctoral Research

The research for the DrPH dissertation is a scientific and original project conducted by the student under supervision of the dissertation advisor or co-advisors. This research is expected to be of such scope, independence, and skillful presentation as to indicate that the candidate has acquired a mastery of the research methodology and its application, and has contributed new knowledge to this subject. The type of research expected is exemplified by that published in the *American Journal of*

Public Health, Journal of Clinical Epidemiology, American Journal of Epidemiology, and Statistics in Medicine.

Application for Graduation

Students must notify the Graduate School of their plan to graduate by applying to graduate through eGraduation Central no later than the deadline shown in the University Registrar's Calendar for the semester in which they expect to graduate. Applications should only be submitted when the student realistically intends to graduate that semester and are valid for one semester only. If a student does not graduate in the semester expected, s/he must submit another application for graduation in a future semester. The department registrar will also notify students via emai1 of deadlines. See appendix for link.

Final Oral Examination

When a date for the final oral examination is chosen, the candidate should notify the Registrar, who will reserve a room and prepare a notice which is sent to the Biostatistics faculty, to members of the Doctoral Committee, and to members of the statistical profession in the Triangle area. The candidate should provide the following:

1. date of the examination;
2. names of the committee members of the Doctoral Committee, with addresses for any committee members who are not on the Biostatistics faculty;
3. title of the dissertation;
4. one copy of the abstract;
5. any biographical data which the candidate wishes to have included in the notice.

At least two weeks after distributing copies of the final draft of the dissertation to members of the Committee, the candidate takes the final oral examination. This includes a public exposition and defense of the dissertation, presented as a seminar or colloquium, at which time the candidate answers questions regarding the dissertation that are raised by the Committee and others present. Immediately after the public meeting, the Committee members meet to conclude the examination, at which time they may also ask questions about other areas.

The Graduate School form for reporting the results of this examination is sent by the Registrar to the Doctoral Committee Chair prior to the examination; this form, after completion, is returned to the Registrar after the examination.

A STUDENT MUST BE REGISTERED FOR BIOS 994 FOR THREE (3) CREDIT HOURS IN ORDER TO TAKE THE FINAL ORAL EXAMINATION

POLICY ON ENROLLMENT

The policy on enrollment for Master's Paper/thesis/doctoral dissertation only is stated below.

"Students who have completed all course work and residency requirements for their graduate degree program and who are using University resources (including faculty time) to conduct their Master's

paper/thesis/doctoral dissertation research will be required to register and pay tuition for at least 3 hours of Master's paper/thesis/doctoral dissertation credit (992/993/994). As in the past, students must be registered in Master's paper/thesis/doctoral dissertation (992/993/994) for 3 hours during the semester in which they complete their graduate work or are scheduled to receive their degree."

"Students who are not using university resources may apply for a leave of absence. It should be emphasized, however, that students must be registered for at least 3 hours in order to receive a stipend, qualify for University Graduate Student Health Insurance, or maintain full-time student status for loan deferment or student visa status."

Please refer to the Graduate School Handbook link located in the appendix for additional information.

Electronic Theses and Dissertations Submission

Electronic Theses and Dissertations (ETDs) are a new initiative at UNC. ETDs provide students with digital publishing experience and an easier method for submission, plus the documents are much easier to search, retrieve and store than their paper versions. For more information on the benefits of ETDs, the process for changing to ETDs at UNC, how it affects you, to submit ETDs or search ETDs links, visit **http://gradschool.unc.edu/etdguide/subission.html**

Only the final document should be submitted after all relevant authorizations and department approvals are received. Once submitted, please patiently allow sufficient time for Graduate School staff to review the document for necessary format revisions. You will be notified if revisions are needed and/or if your document has been approved.

To submit click on Submit Electronic Thesis and Dissertations

One copy suitable for binding is presented to the Department of Biostatistics; this copy will be bound and placed in the Kuebler Library. Students are required to provide a PDF file of their dissertation. The student is responsible for ensuring that the electronic version can be converted correctly (i.e., for making sure that graphs, tables and equations are in the appropriate place and in the correct layout design). The Department will place the PDF file on a network server where it will be accessible by all network users. Additionally, if a request is made to the Department for a copy of the dissertation, the PDF file will be emailed to the requestor, provide a "Permission to Reproduce in PDF Format" (See below and in Appendix) consent form is on file with the Department. If the requestor has no email address, a hard copy will be mailed to the requestor.

DOCTOR OF PHILOSOPHY (PHD)

OBJECTIVES OF THE PROGRAM

The Doctor of Philosophy (PhD) program is designed to provide advanced, research-oriented training in theory and methodology to prepare individuals for academic careers or for research positions anywhere.

Upon satisfactory completion of this program the student will have:

1. demonstrated mastery of: (a) the theory of probability and statistical inference, by successfully passing the PhD Basic Written Examination in Biostatistics (Theory Exam), and (b) the application of said theory to solve a variety of applied statistical problems in the health sciences, by successfully passing the PhD Basic Written Examination in Biostatistics (Applications Exam) [Copies of past Basic Written Examinations are available from the Department];

2. learned advanced biostatistical techniques, including the ability to

    - design cost-effective surveys and experiments (including clinical trials) for collecting data on topics relevant to health, taking account of sampling error, measurement error, nonresponse, and other sources of bias and variability;

    - use advanced parametric and semiparametric extensions of the general linear model for the analysis of health data, including linear regression, mixed models, methods for categorical data, generalized linear (mixed) models, generalized estimating equations, survival analysis, and Bayesian methods;

    - discern when standard methods are not appropriate, when nonparametric methods based on randomization and ranks may be substituted, or when new methods must be developed;

    - estimate survival curves from time-to-event data which may involve censoring and time-dependent covariates, and test for differences among treatments and for the effects of covariates; and,

    - model population growth, spread of disease, and other biological phenomena using Markov chains, Poisson processes and extensions, epidemic models, branching processes, and other stochastic models of empirical processes;

3. used computers for research data management (applying a defensible standard of documentation, archiving, protection of confidentiality, and audit trail) and for the analysis of data with standard statistical program packages;

4. carried out independent methodological research, including the writing of a scholarly dissertation and publishing papers based on the dissertation in respected statistical journals;

5. gained successful practical experience in statistical consulting, including interaction with research workers in the health sciences, abstracting statistical aspects of substantive problems, and communicating the results to persons without specialized biostatistical training; if not outside academia, then this consulting experience can be obtained by serving in the Biometric Consulting Laboratory (BCL) or as a member of a university research project team;

6. taught basic statistical theory and applications effectively, not only to biostatistics majors, but also to other health science practitioners.

ADMISSIONS REQUIREMENTS

1. An appropriate prior Bachelor's or Master's degree in Statistics, Biostatistics, or in a closely related field.

2. Prior mathematics training at least including advanced calculus and linear algebra.

TIME/RESIDENCE REQUIREMENTS

Doctoral students are required to complete a minimum residence credit of four full semesters, at least two of the required four semesters of residence must be earned in contiguous (i.e., fall to spring or spring to fall) registration on this campus. All requirements for the degree must be completed within eight years of the time the student matriculated in the program. ***Please refer to the Graduate School Handbook located in the appendix for additional information***.

COURSE REQUIREMENTS

The Gillings School of Global Public Health requires a minimum of 18 semester hours of course work beyond the Master's degree for admission to candidacy and to dissertation and research courses. The Department of Biostatistics requirements are as indicated below. Requirements (A), (B), and (C) may be waived for students who have had previous training or experience deemed equivalent by the Director of Graduate Studies (DGS). Courses counted toward the School of Public Health requirements, or taken at UNC prior to entry into the program, may be included in (D) and (E). Students who finished their Master's degree at another institution must take or waive the courses indicated on the Master's Elsewhere Form (see Degree Checklist). This form should be completed at the beginning of the first semester of residence and should be approved by the advisor and DGS before submission to the Registrar.

Students who finished their Master's degree at another institution must successfully complete or waive the courses indicated on the Master's Elsewhere Form (see Degree Checklist). This form should be completed and approved by the advisor and DGS before submission to the Registrar.

A. Mathematics

1. Advanced Calculus

   The student must be prepared for BIOS 760 and BIOS 761. This requires working knowledge of advanced calculus equivalent to at least the level of MATH 521 at UNC-CH.

2. Linear Algebra

The student must be prepared for BIOS 762 and BIOS 763. This requires working knowledge of the material in MATH 416, 577, and 547 at UNC-CH.

B. Statistical Computing and Data Management

BIOS 511 is appropriate. This is self-enforcing, however, since the PhD Basic Written Examination (Applications Exam), and all non-service courses in BIOS, assume that students have mastered the topics covered therein.

C. Basic Statistics

The elements of probability, statistical inference, statistical analysis, sampling, and stochastic processes. Appropriate courses are: BIOS 660, BIOS 661, BIOS 662, and BIOS 663. Most of these courses are included in a typical MS program.

D. Advanced Statistics

1. Required Courses

   BIOS 760 and BIOS 761
   BIOS 762 and BIOS 763
   BIOS 767 and BIOS 780

2. Electives

   At least 12 semester hours. Acceptable courses include all those numbered at the 700-level in Biostatistics or in (Mathematical) Statistics at UNC-CH, and equivalent courses in Statistics at other institutions as approved by the Director of Graduate Studies (DGS). Requests to count 700-level courses in (Mathematical) Statistics toward this requirement are considered individually.

NOTE: BIOS 760, 761, 762, 763, 767 are typically taken during the second year of study and 780 is typically taken during the third year, following completion of BIOS 660, 661, 662, and 663 during the first year of study.

E. Supporting Program

A supporting program of at least 6 semester hours, including EPID 600 (or equivalent), is required. See Page 34 for details. The Supporting Program Proposal Form is to be used by the advisor to monitor the student's progress. The form requires approval by the student's advisor and the DGS before submission to the Registrar.

F. Practicum

a) BIOS 841
b) BIOS 843 (4 semesters (credits) are required)
. c) In addition, each PhD student may be required to grade up to 3 courses (up to 4 for a combined masters/doctoral program).

G. Dissertation Registration

All doctoral students must register for a minimum of 6 credit hours of dissertation work (BIOS 994).

H. Transfer of Credits

A doctoral student may request transfer up to 6 credit hours from another institution. Courses transferred are subject to examination at the time of the Doctoral Oral Examination. The Committee may recommend the transfer of both course and residence credit in its report to the Graduate School, which has the final responsibility for approving the transfer. Transferred credit does not relieve the student of the residence requirement of at least one academic year of continuous full-time study, or the equivalent, at UNC-CH. ***See the appendix for an example of the appropriate form.***

NOTE: This Department requires no "Research Skill" or "Language" as defined by the Graduate School. It may be beneficial to a student's program to take more computing or a foreign language (e.g., French may be desirable for a demography student). These individual arrangements are left to the students and their advisors.

DEGREE EXAMINATIONS AND DISSERTATION

Basic Written Examination

Each PhD student is required to pass the PhD Basic Written Examination (Theory Exam and Applications Exam). The PhD Basic Written Examination is usually taken at the end of the first or second year in the program depending on the student's prior obtained degree before entering the program. See Page 34 for details.

Doctoral Committee

In the Department of Biostatistics, the Doctoral Committee combines the functions of two committees as specified by the Graduate School: (1) the Doctoral Oral Examination Committee, and (2) the Dissertation Committee.

After the candidate has entered the final stage of planned course work, has chosen a topic for PhD dissertation research, and has been declared ready by the dissertation advisor, the student and advisor recommend the composition of the Doctoral Committee to the DGS for approval. The composition of each Doctoral Committee is to be approved in writing by both the chairperson of the Department and the DGS. An appropriate form to accommodate this approval process is available from the Departmental Registrar (see Appendix). This form will solicit information regarding the proposed dissertation topic. The student should first consult with the Registrar concerning completion of forms and acceptability of committee appointments.

No fewer than five persons shall constitute the Doctoral Committee. A majority of the members must be full members of the Graduate Faculty. Other members may be limited members of the Graduate Faculty or special appointees. The Committee must also include a representative of the supporting program.

Preliminary Doctoral Examinations

In the Department of Biostatistics, it is customary to combine the Doctoral Written Examination and the Doctoral Oral Examination specified by the Graduate School into a single Preliminary Oral Examination (or "Prelim", for short) with three parts:

1. The first part is concerned with the student's supporting program and the more advanced work taken for the major. [However, the member(s) of the Committee representing the supporting program may require instead that the candidate pass a written examination on the supporting program.] The result of this part is conveyed to the Graduate School on the appropriate Graduate School form**.**

2. The second part is the student's review of the literature for the proposed dissertation topic, on which the student will be questioned by the Committee. The result of this part is conveyed to the Graduate School on the appropriate Graduate School form.

As stated in the Graduate School Handbook, students should have fulfilled, or will have fulfilled by the end of the semester in which the preliminary oral examination is to be taken, all required course work and the minimum residence requirements for the doctorate.

NO DOCTORAL STUDENT IS ALLOWED TO TAK E THE DOCTORAL PRELIMINARY ORAL EXAMINATION UNTIL THEY HAVE PASSED ALL OF THE DOCTORAL BASIC WRITTEN EXAMINATIONS.

A STUDENT MUST BE REGISTERED FOR AT LEAST THREE (3) CREDIT HOURS OF BIOS 994 IN ORDER TO TAKE THE PRELIMINARY ORAL EXAMINATION.

In addition, no preliminary doctoral examination can be scheduled until the student has obtained some tangible research results as judged by the dissertation advisor.

The literature review and proposal to be considered at the preliminary oral examination must be submitted to the Doctoral Committee at least three weeks before the oral is scheduled. An appropriate maximum length for the literature review and proposal is about 40 pages.

At least two weeks before the examination, the student should provide the following information to the Registrar:

1. Date of the Preliminary Oral Examination.

2. Members of the Committee, and mailing addresses of any committee members not on the Biostatistics faculty.

3. Title of the literature review and proposal.

The forms for reporting results of the preliminary doctoral examinations are given beforehand to the Chair of the Doctoral Committee by the Registrar. The Registrar reserves a room and prepares a notice announcing the examination. This notice is sent to all faculty in the Department and to any committee members not in the Department of Biostatistics.

After the examination, the completed reporting forms should be returned to the Registrar. For any part of the preliminary oral examination the student's Committee may award a PASS or FAIL, or a PASS subject to specified conditions (such as additional course work, or the passing of a special examination covering a specific topic). A student who fails a part of the preliminary oral examination is entitled to one re-examination, but not until at least 3 months have elapsed. Re-examination of the first part may be in writing, by request of the student. Appeals of Committee decisions may be made to the faculty of the Department through the Department Chair.

Doctoral Research

The research for the PhD dissertation is a scientific and original project conducted by the student under supervision of the dissertation advisor or co-advisors. This research is expected to be of such scope, independence, and skillful presentation as to indicate that the candidate has acquired a mastery of the research methodology and its application, and has contributed new knowledge to this subject. Research for the PhD dissertation is expected to be of the type leading to articles in *Biometrics, Biometrika, Demography, the Journal of the American Statistical Association, the Annals of Statistics, American Journal of Human Genetics, and Genetic Epidemiology.*

Application for Graduation

Students must notify the Graduate School of their plan to graduate by applying to graduate through eGraduation Central no later than the deadline shown in the University Registrar's Calendar for the semester in which they expect to graduate. Applications should only be submitted when the student realistically intends to graduate that semester and are valid for one semester only. If a student does not graduate in the semester expected, s/he must submit another application for graduation in a future semester. The department registrar will also notify students via emai1 of deadlines. See appendix for link.

Final Oral Examination

When a date for the Final Oral Examination is chosen, the candidate should notify the Registrar, who will reserve a room and prepare a notice which is sent to the Biostatistics faculty, members of the Doctoral Committee, and to members of the statistical profession in the Triangle area. The candidate should provide the following:

1. date of the examination;
2. names of the members of the Doctoral Committee, with addresses for any committee members who are not on the Biostatistics faculty;
3. title of the dissertation;
4. one copy of the abstract;
5. any biographical data which the candidate wishes to have included in the notice.

At least two weeks after distributing copies of the final draft of the dissertation to members of the Committee, the candidate takes the Final Oral Examination. This includes a public exposition and defense of the dissertation, presented as a seminar or colloquium, at which time the candidate answers questions regarding the dissertation that are raised by the Committee and others present.

Immediately after the public meeting, the Committee members meet to conclude the examination, at which time they may also ask questions about other areas.

The Graduate School form for reporting the results of this examination is sent by the Registrar to the Doctoral Committee Chair prior to the examination; this form, after completion, is returned to the Registrar after the examination.

A STUDENT MUST BE REGISTERED FOR BIOS 994 FOR THREE (3) CREDIT HOURS IN ORDER TO TAKE THE FINAL ORAL EXAMINATION

POLICY ON ENROLLMENT

The policy on enrollment for Master's Paper/thesis/doctoral dissertation only is stated below.

"Students who have completed all course work and residency requirements for their graduate degree program and who are using University resources (including faculty time) to conduct their Master's paper/thesis/doctoral dissertation research will be required to register and pay tuition for at least 3 hours of Master's paper/thesis/doctoral dissertation credit (992/993/994). As in the past, students must be registered in Master's paper/thesis/doctoral dissertation (992/993/994) for 3 hours during the semester in which they complete their graduate work or are scheduled to receive their degree."

"Students who are not using university resources may apply for a leave of absence. It should be emphasized, however, that students must be registered for at least 3 hours in order to receive a stipend, qualify for University Graduate Student Health Insurance, or maintain full-time student status for loan deferment or student visa status."

Please refer to the Graduate School Handbook link located in the appendix for additional information.

Electronic Theses and Dissertations Submission

Electronic Theses and Dissertations (ETDs) are a new initiative at UNC. ETDs provide students with digital publishing experience and an easier method for submission, plus the documents are much easier to search, retrieve and store than their paper versions. For more information on the benefits of ETDs, the process for changing to ETDs at UNC, how it affects you, to submit ETDs or search ETDs links, visit **http://gradschool.unc.edu/etdguide/subission.html**

Only the final document should be submitted after all relevant authorizations and department approvals are received. Once submitted, please patiently allow sufficient time for Graduate School staff to review the document for necessary format revisions. You will be notified if revisions are needed and/or if your document has been approved.

To submit click on Submit Electronic Thesis and Dissertations

One copy suitable for binding is presented to the Department of Biostatistics; this copy will be bound and placed in the Kuebler Library. Student are required to provide a PDF file of their dissertation. The student is responsible for ensuring that the electronic version can be converted correctly (i.e., for making sure that graphs, tables and equations are in the appropriate place and in the correct layout design). The Department will place the PDF file on a network server where it will be accessible by all network users. Additionally, if a request is made to the Department for a copy of the dissertation, the PDF file will be emailed to the requestor, provided a "Permission to Reproduce in PDF Format" (See below and in Appendix) consent form is on file with the Department. If the requestor has no email address, a hard copy will be mailed to the requestor.

SUPPORTING PROGRAMS

The Department of Biostatistics requires a "supporting program" of at least 6 semester hours for the MS, 6 semester hours for the PhD, and 18 semester hours for the DrPH, in a field or fields of application. This supporting program typically includes EPID 600 or 710 (or equivalent)**.** A "field of application" is loosely defined as a discipline whose members might reasonably be expected to seek statistical consultation on occasion. (For the DrPH, the field of application must be relevant to Public Health.) Statistics, Mathematics, and Computer Science are excluded. A proposal involving a course in Operations Research is judged on its individual merits.

A supporting program is intended to be more flexible than a minor as defined by the Graduate School Handbook. For example,

1. The supporting program of students specializing in Demography may include demography-related BIOS courses (e.g. BIOS 670, 771, 777). These cannot then be counted toward BIOS elective requirements. For further details, consult the Director of Population Studies.

2. When a supporting program is split into more than one field of application, it need not have the exact hours in each field as specified by the Graduate School for a minor. However, the requirements of the Graduate School on splitting minors should serve as a strong guideline.

All supporting programs must be approved by the student's advisor in consultation with the appropriate faculty in the field(s) of the supporting program. A copy of the Supporting Program Proposal form (see Appendix) should be completed, approved by the DGS, and ultimately filed with the Registrar. Approval of subsequent course substitutions may be expedited by listing alternate courses with the proposed supporting program.

Alternative to Supporting Program.

A student may elect to do a formal minor instead of a supporting program. Students choosing to do so should consult the current Graduate School catalogue for requirements.

Representation of Supporting Program (or minor) on Doctoral Committee.

The Doctoral Committee must include at least one member from the area of the supporting program or minor.

DEPARTMENT-WIDE WRITTEN EXAMINATIONS

INTRODUCTORY STATEMENT

The MPH and MS Written Examinations are the Master's Written Examinations for students in the Master's programs; they satisfy the Graduate School's requirement that every Master's candidate must pass a comprehensive examination covering all course work done for the degree. All Master's candidates are required to pass these examinations by the deadline established by the Graduate School for the commencement at which they expect to receive the degree.

The Doctoral Basic Written Examinations serve as intra-departmental qualifying examinations for students in the PhD and DrPH programs. PhD students are required to take both a Theory Exam (in-class, in two sessions on two days) and an Applications Exam (take home). DrPH students are required to take an Applications Exam (take-home). These intra-departmental written qualifying examinations are different from the Doctoral Written Examination required by the Graduate School.

The MPH examination is usually offered in April or May, and the MS examination usually in August. The Doctoral Basic Written Examinations (PhD and DrPH) are usually offered in August. The exact dates of these MPH, MS, PhD, and DrPH examinations are set by the faculty, upon the recommendation of the Examinations Committee, after consultation with student representatives. See ***http://www.sph.unc.edu/bios/exams_2048_2046.html*** for exam dates.

Rules on the maximum number of years to pass the Basic Written Examinations

1. **Doctoral students**

   a. **Timing of exams**

      i. **Doctoral students admitted directly to doctoral programs** Doctoral students are expected to take the Basic Written Examination right after they finish the required core courses, which is typically after their 1st or 2nd year in the program. In all cases, they are required to have *taken all* required PhD or DrPH Basic Written Examinations by the end of the 3rd year after they started in the doctoral program. In addition, they must *pass all required PhD or DrPH Basic Written Examinations* by the end of the 4th year/beginning of the 5th year in the program.

      ii. **Doctoral students proceeding from the Master's programs** Doctoral students who proceeded from the Masters programs are *expected* to take the Basic Written Examinations at the end of the 1st year started as a doctoral student, and they are *required to have taken all* required PhD or DrPH Basic Written Examinations by the end of the 2nd year after they started in the doctoral program. They are required to pass all PhD or DrPH Basic Written Examinations by the end of the 3rd year/the beginning of the 4th year in the doctoral program.

   b. **Priority funding based on exam status**

      i. Any doctoral student must pass the Basic Written Examinations by the end of the 3rd year or the beginning of the 4th year in order to receive priority for funding. No student should receive more than four years of funding without passing all Basic Written Examinations for his or her program.

      ii. In addition, the preliminary oral examination should be passed within 4 years of starting in the doctoral program to ensure priority funding status.

      iii. No student will receive departmental funding after the completion of the sixth year of doctoral study.

c. **Special considerations**
   i. Part time students are allowed to have an extra year for these deadlines if requested.
   ii. Medical leave of absence or other approved leave of absence will stop the clock for these deadlines/guidelines.
   iii. For students who entered the program prior to Fall 2007, their clock starts in Fall 2007

2. Master's students

a. **Timing of exams**
   i. Master's students are expected to take the Master's Written Examinations right after they finish the required core courses, which is typically after their first year in the program. They are required to have taken the Master's Written Examinations by the end of the 2nd year after starting in theMaster's program. They are also required to pass the Masters Written Examination by the end of the 3rd year/beginning of the 4th year in the program.

b. **Priority funding based on exam status**
   i. No Master's student will receive funding after three years of study in the Master's program without passing the Master's Written Examinations.

c. **Special considerations**
   i. Part time students are allowed to have an extra year for these deadlines if requested.
   ii. Medical leave of absence or other approved leave of absence will stop the clock for these deadlines/guidelines.
   iii. For students who entered the program prior to Fall 2007, their clock starts in Fall 2007

FORMAT AND SCHEDULING

Each examination (except MPH and DrPH) is composed of two parts: Theory and Applications. The number of questions to be answered in each part depends on the degree program, as follows:

MPH: 3 Questions out of 4
(One day, take-home, open-book)

	Theory Exam	**Applications Exam**
MS:	3 Questions out of 4 (6 hours, in-class, closed book)*	3 Questions out of 4 (6 hours, in-class, open book)**
PhD:	2 Questions out of 3, Day 1 (4 hours) 2 Questions out of 3, Day 2 (4 hours) (in-class, closed book)	4 Questions out of 5 (5 days, take-home, open-book)***
DrPH:	(not required)	4 Questions out of 5 (5 days, take-home, open-book)***

**For the MS* Theory *exam*, distribution tables, numerical and mathematical, will be provided when needed. S*tudents can bring ONE 8"*11" sheet of paper ("study guide") with HAND-WRITTEN not*es in Blue Ink on only ONE SIDE. *These specifications of the study guide will be strictly enforced. Study guides not satisfying these specifications will not be allowed in the exam room.* Calculators will be provided - students are not allowed to use their own calculators. Computers and web browsers in any shape or form are not allowed.

**You may only bring a few text and reference BOOKS to the MS Applications exam. No other materials are permitted.

***An answer to a question must not exceed 8 typewritten (300 words per page with font no smaller than 12 pt) pages, including tables and figures.

NOTE: Candidates whose native language is not English are not allowed extra time on department-wide examinations. This condition may be waived for individual candidates at the discretion of the Department Chair upon petition by the student at least one week prior to the examination. Students who plan to take any of the exams need to sign up with the Registrar.

GRADING OF DEPARTMENT-WIDE WRITTEN EXAMINATIONS

The Examinations Committees prepare and conducts all department-wide written examinations, and handles arrangements for their grading.

Papers are coded so that the graders are unaware of the students' identities. Each student is given a grade of Pass or Fail.

A team of two graders is appointed for each question. Where possible, all graders are members of the Department of Biostatistics and of the Graduate Faculty, and no individual serves on more than one team for the same examination. (Theory and Applications exams count separately in this context.) For their question, the members of the grading team will independently assign a grade. Their joint report may include comments on serious shortcomings in a student's answer.

The student’s answer to an individual question is marked independently by each of the two graders on a scale of 0 to 25. The mark awarded reflects the effective proportion of a question correctly answered. The two graders agree beforehand on the maximum marks possible for various components of the question, and, after grading, attempt to clear up any major discrepancies in their respective marks.

On the basis of a student's total score on a paper, the Examinations Committee recommends to the faculty whether the student has passed, failed, or passed conditionally. In the last case, the condition is specified together with a time limit. All final decisions are by vote of the faculty.

Examination papers are not identified as to author until after the verdicts of Pass and Fail have been rendered.

The Chair of the Examinations Committee notifies all students by letter of the faculty's evaluation of their papers. Advisors are free also to notify advisees of the results. Actual numerical scores are not released to the students.

A student whose performance was not of the standard required may be re-examined at the next regularly scheduled examination, or at an earlier date set by the Examinations Committee. One re-examination is permitted automatically.

Rules for Offering MS Re-Exams in Jan/Feb

The purpose for offering the MS re-exams in Jan/Feb of a particular year is to provide the students an opportunity to satisfy the MS degree requirements for subsequent May or August graduation during that year. Students who are eligible for taking the re-exams are those who are in the terminal MS degree program, will have finished all the course requirements and the Master's paper for May or August graduation, but have failed exactly one part of the two-part MS Written Examination in the previous year.

To be eligible for taking the re-examination, students (i) must have failed exactly one part of the MS Written Examination; (ii) are not admitted to a doctoral program in Biostatistics; and (iii) must have completed at least 1 full year of residency in the BIOS graduate program.

Taking the re-examination is counted as 1 attempt to pass the MS Written Examination. Students who did not pass the MS Written Examination are not obligated to take the re-examination in Jan/Feb if they prefer to take the next regularly scheduled MS Written Examination.

AVAILABILITY OF OLD EXAMS

All recent and old examinations are available on the following web site:
http://www.bios.unc.edu/distrib/exam/Copies of exams can also be obtained from Tania Osborn.

TOPICS COVERED ON THE MPH AND MS WRITTEN EXAMINATIONS

The questions in each part of the written examination for the MS degree in Biostatistics may cover topics in the following courses:

BIOS 511	Introduction to Statistical Computing and Data Management
BIOS 660,661	Probability and Statistical Inference
BIOS 662	Intermediate Statistical Methods
BIOS 663	Intermediate Linear Models

The questions in each part of the written examination for the MPH degree in Biostatistics may cover topics in the following courses:

BIOS 511	Introduction to Statistical Computing and Data Management
BIOS 550, 663 (or equivalent)	Basic Elements of Probability and Statistical Inference
BIOS 662	Intermediate Statistical Methods
BIOS 664	Sample Survey Methodology

Note that some basic topics from BIOS 662 may be included even though this course is not specifically required in the MPH program.

TOPICS COVERED ON THE DOCTORAL BASIC WRITTEN EXAMINATIONS

The PhD Theory Exam covers theoretical aspects of statistics at the level and content of the following courses:

BIOS 760, 761, 762, 763, and relevant prerequisites.

The PhD Applications Exam covers applied aspects of statistics at the level and content of the following courses:

BIOS 762, 763, 767 and relevant prerequisites.

The DrPH Applications Exam covers applied aspects of statistics at the level and content of the following courses:

BIOS 762, 767, and relevant prerequisites.

HONOR CODE - WORKING INDEPENDENTLY

In the performance of laboratory and homework assignments, the student may use all available sources of information and assistance. These include directions and suggestions by the instructor and course assistants, and **(IF PERMITTED)** consultations with other students. However, the final assembly and writing up of the report on an assignment are to be completely in the individual student's words.

Completely individual work is expected on both in-class and take-home examinations, without discussion among students and others after the examination has been distributed.

In accordance with the University's Honor Code, the submission of any homework report or test paper by a student implies a pledge of originality of the authorship. It is the student's responsibility to seek clarification from the appropriate faculty member in case of any question as to whether particular behavior might be perceived as an Honor Code violation. Evidence of violations will be reported directly to the Office of Student Affairs.

INSTRUCTORS MAY MODIFY THIS POLICY AS APPROPRIATE FOR THEIR COURSES BY WRITTEN NOTIFICATION TO THEIR STUDENTS.

Statement of the UNC honor pledge:

"In recognition of and in the spirit of the honor code, I certify that I have neither given nor received aid on this examination and that I will report all Honor Code violations observed by me."

MASTER'S PAPERS

GENERAL

Each MPH or MS candidate is required to register for BIOS 992, and thereby earn at least three hours of credit for writing a Master's Paper, as a substitute for a Master's Thesis. A Master's Paper need not follow the formatting guidelines of the Graduate School. (As an exception**,** an MS candidate may elect to write a Master's Thesis in accordance with the regulations of the Graduate School and should therefore register for BIOS 993. In this instance, please follow the graduate school guidelines for thesis and dissertations. See Page 45.

An MPH Paper should show some synthesis of knowledge, and advance or contribute to the field of Public Health. It must be approved by a Paper Advisor who is a member of the Biostatistics Graduate Faculty; or, if the Advisor is not such a member, then there must also be a Reader who is.

An MS Paper may describe in detail the analysis of data or it may consist of a theoretical exposition of a methodological topic in Biostatistics or Statistics. It must be approved by a Paper Advisor and a Reader, at least one of whom is a member of the Biostatistics Graduate faculty.

All candidates must make oral presentations of their Master's Papers, with the exception that those candidates who have permanently left the Triangle area may petition for exemption by letter to the Director of Graduate Studies. If the paper is not presented orally, then an extra Reader is required.

As required by the Department, the Paper must also be submitted in a suitable written format. The original (its title page signed by the Advisor, by any required Reader(s), and by the Director of Master's Paper Day if presented orally) goes to the Registrar for binding and placement in the Departmental Archives. Both the original copy (submitted on 100% rag bond paper) and an electronic copy (in PDF format) must be turned into the Registrar.

To indicate successful completion of the Master's Paper Project, a "Substitute of Master's Thesis" form is completed and submitted to the Graduate School when the Master's Paper is received by the Registrar.

GUIDELINES FOR THE WRITTEN FORMAT

Margins: All copies must have uniform margins, as follows: the first page of the text and all first pages of chapters should have margins of two inches at the top, one and one- half inches at the left and one inch at the right and bottom. All other pages should have margins of one inch at the top, bottom, and right, and one and one-quarter inches at the left. The margins are checked carefully at the time the Paper is submitted and any pages not meeting these specifications will be rejected and must be retyped. Charts, graphs, tables, etc., must meet these margin specifications. This requirement may necessitate photographic reduction.

Spacing: Text must be double-spaced, except for quotations (including material of four lines or more, which should be single-spaced and should not be enclosed in quotation marks). Quotations of four or more lines should be indented four spaces on each line. Each paragraph throughout the text should be indented eight spaces.

Title Page: See the samples on the pages following these guidelines.

Table of Contents: When appropriate, a table of contents should be drawn up and should follow the title page. On it should be listed the chapter headings with large Roman numerals, the bibliography, and the appendix, if any, with the page numbers at which these divisions begin. A foreword, introduction, or appropriate opening quotation is permissible.

First Page: The title of the Paper should be repeated in capitals, centered, and placed two inches below the top of the page. Three spaces below the title should appear the word "by", and three spaces below this the author's full name in the same manner as the title page. The text, or the first subtitle, should begin five spaces below the author's name. Subtitles should be positioned consistently throughout the entire Paper.

Pagination: Small Roman numerals should be used to number the introductory pages, with the title page, which is the first of these, bearing no number. Arabic numerals should be used to number the pages of the text. The first page of the text should be left unnumbered. On all other pages, the page number should be placed in the upper right-hand corner on the margin line at the right. The top line of the text should begin three spaces below this.

Appendix: Supporting documents and elaborated material may be presented in appendices. The first appendix should be placed at the end of the text and should begin a new page. The word "APPENDIX" should be followed by the Roman numeral I, if there is to be more than one. The title explaining the appendix should be placed five spaces below this. Subsequent appendices should be started on new pages, using the same format and the appropriate numeral and descriptive title. Page numbers should be given in Arabic numerals and should continue the numbering of the text.

References: References should be in accordance with the style sheet of the American Statistical Association. Any recent issue of that journal, or the *Journal of the American Statistical Association*, will exemplify the style.

Condition of Copy: The Department requires each student to assume full responsibility for the correctness in content and form of all copies of the Paper. All copies must be clear and legible; all copies must be proofread. The student is responsible for having pages in proper order before submitting the Paper. BEFORE REPRODUCING the Paper, the student should give the manuscript to the Registrar to check for completeness, margins, spacing, uniformity of type, and other format requirements.

Methods of Reproduction: Papers may be reproduced by Xeroxing. All copies must be on 100% cotton content paper, 20 pound weight, 8 1/2" x 11" size, which is available at Student Stores and most copy centers. Pages that have been reproduced will be accepted only if they have clear dark print.

Refer to the Graduate School's "Guide to Thesis and Dissertations" for more detailed information.

GUIDELINES FOR THE ORAL PRESENTATION OF MASTER'S PAPERS

Oral presentations will ordinarily take place as part of the Faculty-Student Seminar Series, normally during the noon hour on Fridays. Students should contact the Seminar Committee Chair near the beginning of the semester in which they desire to present, in order to schedule their presentation and arrange the details. Presentations will be expected to take 15 to 20 minutes, with 5 to 10 minutes allowed for questions. The Master's Paper does not need to be in final form at the time of the oral presentation. The general public is invited, and especially all Department faculty and students; the Advisor and Reader(s) are expected to attend if at all possible.

Here are some suggestions you may find useful:

- Time: Stick to the time allotted, i.e. 15-20 minutes total. Plan for 15-18 minutes, allowing the remainder for questions.
- Size: Ensure that your overheads can be read from the back of the room. Use a large font, enlarge text on a photocopier, or write very clearly.
- Length: Use short phrases, not full sentences, on your overheads.
- Space: Don't crowd your overheads; leave plenty of space to make your text, tables and figures stand out.
- Content: Don't feel obligated to present every detail of the work you've done -- you can't do that anyhow in 15-20 minutes.
- Background: Present an overview of the problem (3-5 minutes).
- Body: Describe the methods you used and state the reasons for using them. Explain your procedures but don't try to provide a tutorial (8-10 minutes).
- Conclusions: Summarize your findings and discuss the implications (3-5 minutes).
- Extras: Bring extra overheads in case they are needed to clarify points or to help answer questions.
- At most 20 overheads are needed for the presentation, plus 10 extras.
- Practice, Practice, Practice: Try to rehearse in front of people (students, faculty, or your advisor). Try to practice at least once.

You may find the following references helpful:

Freeman DH, Gonzalez ME, Hoaglin DC, Kilss BA (1983): Presenting statistical papers. American Statistician, 37: 106-110.

ASA (1991): Guidelines for meeting participants: Chairs, speakers, discussants, poster authors. ASA, Alexandria, VA, 1-8.

TITLE OF MPH PAPER

by

Student Name

A paper submitted to the faculty
of the University of North Carolina
in partial fulfillment of the requirements
for the degree of Master of Public Health
in the Department of Biostatistics

Chapel Hill

(DATE)

Approved by:

_____
Advisor

Oral Presentation on: (DATE)

_____
Chair of Seminar Committee

TITLE OF MS PAPER

by

Student Name

A paper submitted to the faculty
of the University of North Carolina
in partial fulfillment of the requirements
for the degree of Master of Science
in the Department of Biostatistics

Chapel Hill

(DATE)

Approved by:

_____
Advisor

_____
Reader

Oral Presentation on: (date)

_____
Chair of Seminar Committee

GUIDELINES FOR THE WRITTEN FORMAT DOCTORAL DISSERTATION

The Graduate School Thesis and Dissertation Guide
Visit: *http://www.gradschool.unc.edu/etdguide/* to access detailed instructions.

Introduction

Please read this manual carefully before preparing your thesis/dissertation. Staff in the Enrolled Student Office of The Graduate School is available to assist you in preparing and submitting your thesis/dissertation. You are encouraged to call the office at (919) 962-6313 (last names A-G) or (919) 962-6316 (last names H-Z) or stop by Bynum Hall if you have questions about these guidelines.

This Guide is not meant to be an exhaustive manual. For specific questions of style, consult the most recent edition of the style manual used in your disciplinary field (e.g., Kate L. Turabian, *A Manual for Writers of Term Papers, Theses, and Dissertations*; *The MLA Style Manual*; and the *American Psychological Association (APA) Style Manual*). When using a style manual, follow the specifications for published documents, but do not include typesetting notations often used when submitting manuscripts to a publisher. Microsoft Word offers online assistance: Word 2007 training courses.

If there is a discrepancy between a style manual and this guide, the regulations set forth in this Graduate School guide take precedence. **Please do not use another thesis/dissertation as a model for your work since a particular style or example in a previous year may not meet current guidelines.** Also, certain commonly used software packages may require format modifications in order to comply with Graduate School guidelines.

POLICIES FOR CHANGING DEGREE PROGRAMS

Two requests for action by the Graduate Admissions Committee are described:

1) Proceeding from a Master's to a Doctoral Program; and, 2) Switching Between the Two Masters Programs or Between the Two Doctoral Programs.

REQUESTS TO PROCEED FROM A MASTER'S TO A DOCTORAL PROGRAM

A departmental Master's student interested in continuing to a doctoral program should discuss these plans with his/her advisor. In particular, MPH students interested in proceeding to a doctoral program should seek advice early about any supplementary mathematics and biostatistics coursework needed (e.g., BIOS 660, 661, 662, 663, 667 and 680) and their prerequisites. Applicants to the DrPH program must have at least 12 months of acceptable full-time experience in public health, or have plans for completion of such experience, by the time of the proposed admission. To apply, students must provide a one-page statement of purpose that explains what they expect to gain from this doctoral training. In addition, each such student is to request his/her advisor to provide a letter of support for such doctoral training. Comments on research promise (perhaps as shown by plans for, or progress on, the Master's paper) will be especially valuable. Students can apply for admission to a doctoral program at any time, but they should send the application materials to the Chair of the Graduate Admissions Committee.

Requests for approval to proceed to a doctoral program are subject to review and recommendation by the Graduate Admissions Committee, which seeks information about the applicant from the advisor, instructors of BIOS 660, 661, 662, 663, 667, 680 and other 500-level BIOS courses, and the Examinations Committee. The Departmental Chair reviews the Admissions Committee's recommendation for each student to proceed to a doctoral program, and with concurrence, notifies each such student that a positive recommendation will be sent forward to the Graduate School for approval after all relevant requirements have been completed.

NOTE: A graduate student in the UNC-CH Department of Biostatistics will not be permitted to take any of the Department's Basic Doctoral Written Examinations until that student has been **FORMALLY ADMITTED** into a doctoral program in the UNC Department of Biostatistics. Such formal admission must come from the Department's Admissions Committee.

REQUESTS TO SWITCH BETWEEN MASTER'S PROGRAMS OR DOCTORAL PROGRAMS

Each Master's admission and each doctoral admission is made for graduate study in a specific program (Master's: MS or MPH; doctoral: PhD or DrPH) by the Graduate Admissions Committee after careful consideration of the applicant's qualifications, experience, and requested program.

Each student wishing to switch between the two Master's programs or between the two doctoral programs should confer with his/her advisor. If the advisor agrees with the rationale for switching Master's (or doctoral) programs, the student should send the Director of Graduate Admissions a memorandum, through his/her advisor, requesting the change and explaining the reason for it. In addition, a completed checklist for the new Master's (or doctoral) program, and its accompanying supporting program, should be attached to describe how and when the prerequisites and requirements for the desired Master's (or doctoral) program have been or will be satisfied.

Such a request is subject to review by the Graduate Admissions Committee. If the student has received one or more grades lower than P or has failed any departmental examination required by the current degree program, a critical review can be expected since the integrity of the Master's (or doctoral) programs must be maintained. Approval of the request is forwarded for final action by the Graduate School.

Note: Students seeking to switch from the DrPH to the PhD program will not be permitted to take the Theory Exam of the PhD Doctoral Basic Written Examination until formal admission to the PhD program has been granted.

INSTRUCTIONAL ASSISTANTS

DEFINITIONS

Instructional Assistant (IA) include:

- Grading Assistant (GA). These are paid assistants (graders) or students who must satisfy the requirement as part of their training grant who do not teach.
- Teaching Assistant (TA). These include students formally enrolled in BIOS 850 and graduates of BIOS 850.

DUTIES AND COMPENSATION OF IAs

In what follows, the designation Instructional Assistant (IA) refers to either a Grading Assistant (GA) or a Teaching Assistant (TA). The TA designation refers to students who are taking BIOS 850 for credit in a particular semester. Without exception, TA positions are only available for service courses (e.g., BIOS 600 and BIOS 545) in the UNC Dept. of Biostatistics. If there are more TA's than service courses require, they may petition the Director of Graduate Studies to TA for other non-service BIOS courses. See Page 48 for more details.

Assignment of GA's is as follows, BIOS classes having between 5 and 25 enrolled students will be permitted to have exactly one IA; BIOS classes having between 26 and 50 enrolled students will be permitted to have exactly two IAs; and, BIOS classes having over 50 enrolled students will be permitted to have exactly three IAs.

GAs that are not on a training grant will be compensated for their services. TAs will not be compensated for their services since they are receiving academic credit for BIOS 850. Decisions concerning the amount of compensation per course for GAs in any academic year will be made by the Chair of the UNC Department of Biostatistics prior to the start of the academic year.

BIOS student supported as a predoctoral trainee by a Federally-funded training grant in the UNC Dept. of Biostatistics will be required to serve without compensation as a GA for one course in each academic year in which that student receives training grant support.

Duties of GAs (graders)

The two primary duties of GAs are:

1. Grading of examination questions requiring no subjective judgment (e.g., multiple-choice type) and of homework problems (whether subjective or objective). Policies on work turned in late, turnaround time for grading, and the like, should be negotiated between instructors and GAs in advance.

2. Holding office hours for up to 2 hours per week, during which time students, on a one-on-one basis, may receive further help as necessary. The time for office hours should be negotiated by instructors and GAs in advance. GAs are responsible for securing a suitable place for office hours through the Registrar.

3. The GA should not be spending more than 15 hours per week in their GA duties. **NOTE:** Other duties of benefit to the course (e.g., copying, dataset management, maintaining class records) may be assigned to GAs when it is not convenient to use staff personnel instead. However, any such duties are to be at most incidental to the primary duties. Note also that Departmental policy does not permit GAs to grade subjective examinations, and GAs are never required to teach classes or give lectures.

OBJECTIVES

By serving as GAs, BIOS students:

a. are stimulated to review and consolidate their knowledge;
b. receive a useful introduction to teaching activities, with which most will become involved as part of their careers;
c. acquire skill in communicating with members of other disciplines, which is essential for effectiveness as a biostatistician;
d. provide faculty with opportunities to observe their performance, which aid in evaluating the student and in writing effective and convincing recommendations.

DUTIES OF TAs

While the complete duties of a TA will necessarily vary depending on the particular faculty member and course, TAs are usually required to perform the following:

1. Conduct weekly laboratory or review sessions. While much of the time spent in the laboratory may be devoted to answering questions arising from the instructor's lectures, homework, or examinations, the TA may be expected to prepare a brief review lecture or demonstration.

2. Meet with the instructor each week, prior to the laboratory session, to ensure that the TA understands the level and emphasis of the current lecture materials and homework assignments.

3. Present one or two regular class lectures during the semester, with the instructor observing and evaluating.

Subject to the limitation on time requirements stated below, the TA may additionally be required by the instructor to perform some or all of the following duties:

4. Maintain computer-based data files for homework and examination problems.

5. Assist in preparation of class materials such as handouts.

6. Assist in the preparation of homework and/or examinations, including solution guides.

7. Attend the instructor's lectures and/or personally do the assigned homework.

8. Read, and/or discuss with the instructor, material on statistical pedagogy. (TAs enrolled in BIOS 850)

Time Requirements

TAs must pre-register for 3 hours of BIOS 850. A student can receive credit for BIOS 850 only once. This translates into 9 hours of work per week on average. TAs may not be expected to work more than an average of 15 hours per week during the semester. The instructor should be notified as soon as it appears that these time restrictions may be exceeded. All doctoral students are REQUIRED to register for BIOS 850 within two years of starting their program.

Resolution of Problems

If TAs cannot resolve problems involving these guidelines with the instructor, they should contact the Director of Graduate Studies. All TAs are strongly encouraged to submit an evaluation of their experiences to the DGS at the end of the semester so that these guidelines may be monitored more effectively.

QUALIFICATIONS OF IAs

IAs must be given responsibilities that commensurate with their qualifications.

a. All IAs must be enrolled graduate students, and in "good academic standing" (which implies that their academic performance represents reasonable progress toward the degree and warrants continuation in the program).

b. All IAs must have taken the courses in which they assist, or equivalent courses, except for elementary service courses.

c. All TAs must have demonstrated oral proficiency in English, as approved by the instructors of the courses in which they are to assist. Those TAs whose native language is not English must have passed the ETS Test of Spoken English (TSE) or some other formal screening test approved by the University.

SUPERVISION AND MENTORING OF IAs

IAs must be properly supervised and mentored in their roles.

GAs:

1. The instructor should review and discuss this section of the AIM with the GA prior to the start of the semester.

2. The instructor must provide the GA with at least a rough sketch of acceptable answers for all homework exercises and must also provide instructions regarding how to distribute points among the assigned questions.

3. The instructor should meet with the GA as needed so that the GA is informed about such matters as: progress through the course's text, which parts of the course (i.e., topics) typically require emphasis/explanations in the GA's individual help sessions, coverage of homework assignments, and dates for assigned homework and examinations.

TAs:

1. The instructor should review and discuss this section of the AIM with the TA prior to the start of the semester.

2. The instructor should meet with the TA each week so that the TA is informed about such matters as: progress through the course's text, which parts of the course (i.e., topics) typically require emphasis/explanations in the TA's weekly review and individual help sessions, coverage of homework assignments, and dates for assigned homework and examinations. In addition, the instructor should discuss at least the general outline of what is to be covered by the TA in the review/laboratory session so that the TA can provide additional explanations/details regarding what was covered in lectures.

3. The TA will ordinarily be required to give one or two of the general lectures during the semester, with the instructor observing and evaluating. In addition, the TA and the instructor should consider the desirability of having the TA's weekly help session observed at least once during the semester in order to assess further the TA's overall progress in teaching.

4. The TA experience may be enriched by bringing the TAs together at the end of the semester to facilitate discussions among them and the faculty in order to share their experiences and to offer suggestions about how to improve the TA process.

EVALUATION OF IAs

IAs must be fairly evaluated, with public recognition when performance is outstanding.

a. The instructor of a class with one or more IAs is expected to survey the class near the end of the semester, as part of the course evaluation, about the quality of the supplemental instruction and assistance provided to the students by the IA. The results of the survey should be communicated to the IAs and reported to the DGS.

b. A student Excellence in Teaching Award may be given to TAs to recognize truly exceptional performance.

ASSIGNMENT OF IAs

IAs must be assigned in accordance with procedures that are open, reasonable, and fair.

a. The Registrar's Office, in conjunction with faculty input, makes all IA assignments for the entire academic year. Non-service courses are not guaranteed to be assigned an IA unless 5 or more students are enrolled for credit. As general guidelines, BIOS classes having between 5 and 25 enrolled students will be permitted to have exactly one IA; BIOS classes having between 26 and 50 enrolled students will be permitted to have exactly two IAs; and, BIOS classes having over 50 enrolled students will be permitted to have exactly three IAs. Any petition by a BIOS faculty member for extra IAs should be submitted in writing to the Director of Graduate Studies, who will then review the petition with the Departmental Chair.

b. If more students request enrollment in BIOS 850 than are required by the service courses, these additional TAs may be assigned to non-service courses. If there are still too many requests, then priority will be given to students who need BIOS 850 to satisfy degree requirements. Within this group, the more advanced students will be given priority. Other TAs will be assigned only to service courses, when there is an insufficient number of TAs enrolled in BIOS 850 to cover them. Service courses are defined as those for which the primary audience is non-BIOS majors; currently, these are BIOS courses numbered 600 and below.

c. For courses that require both GAs and TAs, TAs will always be given priority in being offered the position.

DEPARTMENTAL LIBRARY AND PUBLICATIONS

Kuebler Library

McGavran-Greenberg Room 3102 is named the Roy R. Kuebler Jr. Conference Room & Library in honor of the late Professor Kuebler (1911-1990), who was Deputy Chair of the Department for many years, and was known as a distinguished teacher of statistics. Here are housed two parts of the Departmental Library: the Archives and the Journal Collection. The Archives include Master's Papers and Doctoral Dissertations from the Department (including some early ones by students who were considered "ours" before we had a formal major in Biostatistics); these are bound in black with gold imprinting. There are also bound volumes of the Department's Annual Reports, minutes of Departmental Meetings, and the collected papers of three of its illustrious faculty members: Professors Bernard Greenberg, Regina Elandt-Johnson, and Mindel Sheps. The Journal Collection includes current issues, and many back issues of the most important scientific journals for biostatisticians. A far more extensive collection is maintained by the Brauer Library in Phillips Hall. Also, back issues of several statistical journals are available on the web at *www.jstor.org*. The Kuebler Library is available as a reading room except when conferences are in progress. The materials in the Archives and Journal Collection are not to be removed except briefly for copying, unless by express permission of the Department Librarian.

Students' Reference Collection

This collection is located in Suite 3107. It contains about 300 items, including elementary and advanced texts, dictionaries, books of tables, and computer manuals; a listing is posted on the side of the bookcase. Recent copies of miscellaneous statistical journals are also shelved at this location. The *Encyclopedia of Statistical Sciences* and the *Encyclopedia of Biostatistic* are recent gifts from the Biostatistics Section of the SPH Alumni Association. Checking out of materials is allowed: just sign and date the card in the book, and put the card in the box provided. When you return the item, cross your name off the card, put the card back in the book, and reshelve the book. By action at the Department Meeting of 12 January 1994, the time limit for checkouts is seven (7) days; seven-day renewals are allowed, but the student must re-sign each time. Reserved books are not allowed to be checked out.

Book Register

The Biostatistics Book Register is a computerized catalog of all books and journal volumes belonging to the Department of Biostatistics. Updates and the addition of new members ceased in 2000. Dr. Quade served as the forwarding librarian with his retirement in 1998. This catalog is maintained as the text dataset O:\BIOSLIB\REGISTER. For example, suppose it is desirable to get a listing of all Departmental books and journals (including duplicates) with the character string WEIBULL as part of the author name(s) or of the title. A search using the string WEIBULL produces

700013-Y Weibull	Some Aspects o .. Inference w .. Sample Survey
900217-L Chang	91MPH: Using Weibull Distribution
902484-L Feaganes	93DrPH: Unobservable Heterogeneity in Weibull & ..

Characters 1-6 are an ID. Characters 7-8 indicate location: "-S" is the Student's Reference Collection, "-J" the Journal Collection, "-L" the Archives, and in most other cases they will be the initials of the faculty member who has the book "on extended loan".

The second field (characters 10-28) gives the author(s) for a book, or the year and volume number for a journal. In the title field (characters 30-80), "=2" indicates "Second (or Revised) Edition", while ":2" (as in the example above) would indicate "Part 2" or "Volume 2", and so on. A few common words are consistently abbreviated: e.g., and → &, for → 4, of → o, with → w.

BIOSTATISTICS COURSES

600 PRINCIPLES OF STATISTICAL INFERENCE (3). Prerequisite, knowledge of basic descriptive statistics. Major topics include elementary probability theory, probability distributions, estimation, tests of hypotheses, chi-squared procedures, regression, and correlation. Fall and spring. Long, Hamer, Monaco, Bowling

610 BIOSTATISTICS FOR LABORATORY SCIENTISTS (3). Prerequisite, elementary calculus. Introduces the basic concepts and methods of statistics, focusing on applications in the experimental biological sciences. Not offered 2009-10.

511 INTRODUCTION TO STATISTICAL COMPUTING AND DATA MANAGEMENT (4). Prerequisite, previous or concurrent course in applied statistics or permission of the instructor. Introduction to use of computers to process and analyze data, concepts and techniques of research data management, and use of statistical programming packages and interpretation. Focus is on the use of SAS for data management, with an introduction to use of SAS for reporting and analysis. Fall. Roggenkamp

540 PROBLEMS IN BIOSTATISTICS (1 or more). Prerequisites to be arranged with the faculty in each case. A course for students of public health who wish to make a study of some special problem in the statistics of the life sciences and public health. Fall, spring, and summer.

541 QUANTITATIVE METHODS FOR HEALTH CARE PROFESSIONALS I (4). Prerequisite, permission of instructor. Course is designed to meet the needs of health care professionals who need to be able to critically appraise the design and analysis of medical and health care studies and intend to pursue academic research careers. Basics of statistical inference, analysis of variance, multiple regression, categorical data analysis, and an introduction to logistic regression and survival analysis. Emphasis is on applied data analysis of major health care studies. Fall. Garrett

542 QUANTITATIVE METHODS FOR HEALTH CARE PROFESSIONALS II (4). Prerequisites, BIOS 541 and permission of instructor. Continuation of BIOS 541; main emphasis is on logistic regression; other topics include exploratory data analysis and survival analysis. Spring. Garrett

545 PRINCIPLES OF EXPERIMENTAL ANALYSIS (3). Prerequisites, BIOS 600 or equivalent; a basic familiarity with a statistical software package (preferably SAS) that has the capacity to do multiple linear regression analysis; permission of the instructor except for majors in School of Public Health. Continuation of Biostatistics 110; the analysis of experimental and observational data, including multiple regression, and analysis of variance and covariance. Spring. Truong.

550 BASIC ELEMENTS OF PROBABILITY AND STATISTICAL INFERENCE I (GNET 150) (4). Prerequisite, MATH 232 or equivalent. Fundamentals of probability, discrete and continuous distributions; functions of random variables; descriptive statistics; fundamentals of statistical inference, including estimation and hypothesis testing. Fall. Truong.

613 DATA MANAGEMENT IN CLINICAL AND PUBLIC HEALTH RESEARCH (3). Prerequisite, Familiarity with basic health research designs (e.g., BIOS 664 or 668, EPID 726 or 733, MHCH 713, INSL 780, or equivalent) or permission of the instructor. This course introduces theoretical and practical aspects of data management architecture, processes and applications in clinical and public health research. Spring.

660 PROBABILITY AND STATISTICAL INFERENCE I (3). Prerequisite, MATH 233 or equivalent. Introduction to probability; discrete and continuous random variables; expectation theory; bivariate and multivariate distribution theory; regression and correlation; linear functions of random variables; theory of sampling; introduction to estimation and hypothesis testing. Fall. Kupper

661 PROBABILITY AND STATISTICAL INFERENCE II (3). Prerequisite, BIOS 660. Distribution of functions of random variables; Helmert transformation theory; central limit theorem and other asymptotic theory; estimation theory; maximum likelihood methods; hypothesis testing; power; Neyman-Pearson Theorem, likelihood ratio, score, and Wald tests; noncentral distributions. Spring. Qaqish

662 INTERMEDIATE STATISTICAL METHODS (4). Corequisites, BIOS 511, 550, or equivalents. Principles of study design, descriptive statistics, and sampling from finite and infinite populations, with particular attention to inferences about location and scale for one, two, or k sample situations. Both distribution-free and parametric approaches are considered. Gaussian, binomial, and Poisson models, one-way and two-way contingency tables, as well as related measures of association, are treated. Fall. Couper

663 INTERMEDIATE LINEAR MODELS (4). Prerequisite, BIOS 662 or equivalent. Matrix-based treatment of regression, one-way and two-way ANOVA, and ANCOVA, emphasizing the general linear model and hypothesis, as well as diagnostics and model building. The course begins with a review of matrix algebra, and it concludes with some treatment of statistical power for the linear model and with binary response regression methods. Spring. Sun

664 SAMPLE SURVEY METHODOLOGY (4). Prerequisite, BIOS 550 or equivalent or permission of the instructor. Fundamental principles and methods of sampling populations, with primary attention given to simple random sampling, stratified sampling, and cluster sampling. Also, the calculation of sample weights, dealing with sources of nonsampling error, and analysis of data from complex sample designs are covered. Practical experience in sampling is provided by student participation in the design, execution, and analysis of a sampling project. Spring. Kalsbeek

665 ANALYSIS OF CATEGORICAL DATA (3). Prerequisites, BIOS 550, 662, and 663 or equivalent. Introduction to the analysis of categorized data: rates, ratios, and proportions; relative risk and odds ratio; Cochran-Mantel-Haenszel procedure; survivorship and life table methods; linear models for categorical data. Applications in demography, epidemiology, and medicine. Fall. Koch and Schwartz

666 APPLIED MULTIVARIATE ANALYSIS (3). Prerequisite, BIOS 663 or equivalent. Application of multivariate techniques, with emphasis on the use of computer programs. Multivariate analysis of variance, multivariate multiple regression, weighted least squares, principal component analysis, canonical correlation and related techniques. Not offered 2009-10.

667 APPLIED LONGITUDINAL DATA ANALYSIS (3). Prerequisite: analysis of variance and (multiple) linear regression at the level of Bios 545 and/or Bios 663. Familiarity with matrix algebra is also useful. Univariate and multivariate repeated measures analysis of variance, general linear model for longitudinal data, linear mixed model, generalized linear and population-averaged models for non-normal responses. Estimation and inference, maximum and restricted maximum likelihood, fixed and random effects, balanced and unbalanced data. Fall. Edwards

668 DESIGN OF PUBLIC HEALTH STUDIES (3). Prerequisites, BIOS 511, 545, 550, or equivalents. Statistical concepts in basic public health study designs: cross-sectional, case-control, prospective, and experimental (including clinical trials). Validity, measurement of response, sample size determination, matching and random allocation methods. Not offered 2009-10.

670 DEMOGRAPHIC TECHNIQUES I (3). Source and interpretation of demographic data; rates and ratios, standardization, complete and abridged life tables; estimation and projection of fertility, mortality, migration, and population composition. Fall. Suchindran, Bilsborrow.

680 INTRODUCTORY SURVIVORSHIP ANALYSIS (3). Prerequisite, BIOS 661 or permission of the instructor. Introduction to concepts and techniques used in the analysis of time to event data, including censoring, hazard rates, estimation of survival curves, regression techniques, applications to clinical trials. Spring. Hudgens

691 FIELD OBSERVATIONS IN BIOSTATISTICS (1). Field visits to, and evaluation of, major nonacademic biostatistical programs in the Research Triangle area. (Field fee $25.). Fall Monaco

700 RESEARCH SKILLS IN BIOSTATISTICS (1). Prerequisites, either completion of BIOS 760 and 761 (or 758), 762, 763, an d767 or successful passing grade on either doctoral qualifying examination in biostatistics. This course will introduce doctoral students in biostatistics to research skills necessary for writing a dissertation and for a career in research. Fall. Herring

735 STATISTICAL COMPUTING - BASIC PRINCIPLES AND APPLICATIONS (3). Prerequisites, BIOS 661; familiarity with at least one computer system and with either a computer language (C, FORTRAN, etc.) or a computer package (SAS, SPSS, etc.). Basic theory and application of computing as a tool in statistical research and practice. Topics include: algorithms and data structures, linear and nonlinear systems, function approximation, numerical integration, the EM algorithm, simulation, and document preparation. Not offered 2009-10.

740 SPECIALIZED METHODS IN HEALTH STATISTICS (1 or more). Prerequisite, permission of the instructor. Statistical theory applied to special problem areas of timely importance in the life sciences and public health. Lectures, seminars, and/or laboratory work, according to the nature of the special area under study. Fall, spring, and summer.

752 DESIGN AND ANALYSIS OF CLINICAL TRIALS (3) Prerequisites, BIOS 660, and 661 or permission of the instructor. Description: This course will introduce the methods used in clinical trials. Topics include dose-finding trials, allocation to treatments in randomized trials, sample size calculation, interim monitoring, and non-inferiority trials. Fall. Ivanova, LaVange

756 INTRODUCTION TO NONPARAMETRIC STATISTICS (STAT 171) (3). Prerequisite, BIOS 661 or equivalent. Theory and application of nonparametric methods for various problems in statistical analysis. Includes procedures based on randomization, ranks, and U-statistics. A knowledge of elementary computer programming is assumed. Spring. Sen.

758 ADVANCED STATISTICAL METHODS IN BIOMETRIC AND PUBLIC HEALTH (4) Prerequisites, BIOS 660 and 661 or equivalents. Description: A non-measure theoretic introduction to probability theory, random elements, statistics, and stochastic processes. Random walks, Markov chains, Poisson processes and martingales. Exponential family of densities, finite Sample distributions and the need for large sample methods. Basic properties of statistical estimators, Cramer-Rao bound and the Rao-Blackwell theorem. Stochastic convergence and central limit theorems. Slutsky's theorem, transformation of variables and statistics, and variance stabilization. Neyman-Pearson fundamental lemma and finite sample hypothesis testing. Introduction to large sample inference methods. Likelihood ratio, Rao's score, and Wald tests. Statistical inference for categorical data and regression models. Resampling plans. Elements of Bayes methods. Inference in bioassay, dosimetry and environmental studies. Fall. Sen

759 APPLIED TIME SERIES ANALYSIS (3). Prerequisites, BIOS 661 and 663 or equivalents, and permission of the instructor. Topics include correlograms, periodograms, fast Fourier transforms, power spectra, cross-spectra, coherences, ARMA and transfer-function models, spectral-domain regression. Real and simulated data sets are discussed and analyzed using popular computer software packages. Not offered 2009-10.

760 ADVANCED PROBABILITY AND STATISTICAL INFERENCE I (4). Prerequisite, BIOS 661 or permission of the instructor. Measure space, sigma-field, Lebesgue measure, measureable functions, integration, Fubini-Tonelli theorem, Radon-Nikodym theorem, probability measure, conditional probability, independence, distribution functions, characteristic functions, exponential families, convergence almost surely, convergence in probability, convergence in distribution, Borel-Cantelli leema, strong law of large numbers, central limit theorem, the Cramer-Wold device, delta method, U-statistics, martingale central limit theorem. Least squares estimation, uniformly minimal variance and unbiased estimation, estimating functions, maximum likelihood estimation, Cramer-Rao lower bound, information bounds, LeCam’s lemmas, consistency, asymptotic efficiency, expectation-maximization algorithm, nonparametric maximum likelihood estimation. Fall. Kosorok.

761 ADVANCED PROBABILITY AND STATISTICAL INFERENCE II (4). Prerequisite, BIOS 760 or permission of the instructor. Description: Elementary decision theory, utility, admissibility, minimax rules, loss functions, Bayesian decision theory, likelihood ratio, Wald, and score tests, Neyman-Pearson tests, UMP and unbiased tests, rank tests, contiguity theory, confidence sets, parametric and nonparametric bootstrap methods, jackknife and cross-validation, asymptotic properties of resampling methods. Elements of Stochastic processes, including Poisson process, renewal theory, discrete-time Markov chains, continuous-time Markov chains, Martingales, and Brownian motion. Spring. Fine.

762 THEORY OF LINEAR MODELS (4). Prerequisites, BIOS 661 and 663, MATH 547, MATH 416 or 577. Theory and methods for continuous responses. Topics include matrix theory, the multivariate normal distribution, multivariate quadratic forms, estimability, reparameterization, linear restrictions and splines, estimation theory, weighted least squares, multivariate tests of linear hypotheses, multiple comparisons, confidence regions, prediction intervals, statistical power, mixed models, transformations and diagnostics, growth curve models, dose-response models, missing data. Fall. Zhou.

763 GENERALIZED LINEAR MODEL THEORY AND APPLICATIONS (4). Prerequisite, permission of instructor if non-Bios major. Introduction to the theory and applications of generalized linear models, quasi-likelihoods, and generalized estimating equations. Topics include logistic regression, over-dispersion, Poisson regression, log-linear models, conditional likelihoods, multivariate regression models, generalized mixed models, and regression diagnostics. Spring. Zhu.

764 ADVANCED SURVEY SAMPLING METHODS (3). Prerequisite, BIOS 664 or equivalent. Continuation of Biostatistics 664 for advanced students: stratification, special designs, multistage sampling, cost studies, nonsampling errors, complex survey designs, employing auxiliary information, and other miscellaneous topics. Fall. Kalsbeek.

765 MODELS AND METHODOLOGY IN CATEGORICAL DATA (3). Prerequisites, BIOS 661, 663, 665, or equivalents. Theory and application of methods for categorical data including maximum likelihood, estimating equations and chi-square methods for large samples, and exact inference for small samples. Fall. Preisser.

767 LONGITUDINAL DATA ANALYSIS (4). Prerequisite, BIOS 762. Presents modern approaches to the analysis of longitudinal data. Topics include linear mixed effects models, generalized linear models for correlated data (including generalized estimating equations), computational issues and methods for fitting models, and dropout or other missing data. Spring. Herring.

771 DEMOGRAPHIC TECHNIQUES II (3). Prerequisites, BIOS 670 and integral calculus. Life table techniques; methods of analysis when data are deficient; population projection methods; interrelations among demographic variables; migration analysis; uses of population models. Not offered 2009-10.

772 STATISTICAL ANALYSIS OF MRI IMAGES (3). Prerequisite, BIOS 761, 762 and 763. This course reviews major statistical methods for the analysis of MRI data and its applications in various studies. Not offered 2009-10.

773 STATISTICAL ANALYSIS WITH MISSING DATA (3). Prerequisite BIOS 761 and 762. This course will examine fundamental concepts in missing data, including classifications of missing data, missing covariate and/or response data in linear models, generalized linear models, models for longitudinal data, and survival models. Several missing data methodologies will be discussed including maximum likelihood methods, multiple imputation, fully Bayesian methods and weighted estimating equations. Applications in the biomedical sciences will be presented in detail and several cases studies will be examined. Software packages for analyzing missing data include WinBUSG, SAS and R. Not offered 2009-10.

777 MATHEMATICAL MODELS IN DEMOGRAPHY (3). Prerequisite, permission of the instructor. A detailed presentation of natality models, including necessary mathematical methods, and applications; deterministic and stochastic models for population growth, migration. Not offered 2009-10.

779 BAYESIAN STATISTICS (4). Prerequisite, BIOS 262 or equivalent. Description: This course examines basic aspects of the Bayesian paradigm including Bayes' theorem, the likelihood principle, prior distributions, posterior distributions, and predictive distributions. General topics include Bayesian analysis of linear models, generalized linear models, random effects models, spatial models, and survival models. Additional topics include informative prior elicitation, model comparisons, Bayesian diagnostic methods, and variable subset selection. Markov chain Monte Carlo methods for computations are discussed in detail. Bayesian methods for the design and analysis of clinical trials will be examined. Fall Ibrahim.

780 THEORY AND METHODS FOR SURVIVAL ANALYSIS (3). Prerequisites, BIOS 760 and 761 or permission of the instructor. Counting process-martingale theory, Kaplan-Meier estimator, weighted log-rank statistics, Cox proportional hazards model, nonproportional hazards models, multivariate failure time data. Spring. Lin.

781 STATISTICAL METHODS IN HUMAN GENETICS (GNET 281) (3). Prerequisites, BIOS 661 and 663 or permission of the instructor. An introduction to statistical procedures in human genetics, Hardy-Weinberg equilibrium, linkage analysis (including use of genetic software packages), linkage disequilibrium and allelic association. Fall. Wright.

783 STATISTICAL METHODS IN QUANTITATIVE GENETICS (3). Prerequisites, BIOS 661 and 663 or permission of the instructor. An introduction to the statistical basis of variation in quantitative traits, with focus on experimental crosses and decomposition of trait variation, linkage map construction, statistical methodologies and computer software for mapping quantitative trait loci. Issues involving whole-genome analysis will be highlighted. Spring Zou.

784 INTRODUCTION TO COMPUTATIONAL BIOLOGY (3). Prerequisites, BIOS 661 and 663, or permission of the instructor. Description: molecular biology, the construction of physical and genomic maps, cloning, sequence assembly, sequence analysis, DNA-RNA protein sequence alignment, sequence patterns, hidden Markov models, matching statistics and the Poisson approximation, discovery of functional motifs via likelihood and Monte Carlo Bayesian approaches, modeling secondary structure, computational algorithms, statistical software, applications to cancer. Not offered 2009-10.

785 STATISTICAL METHODS FOR DNA MICROARRAY DATA (3). Prerequisites, BIOS 661 and 663, or permission of the instructor. Description: Clustering algorithms, classification techniques, statistical techniques for analyzing multivariate data, analysis of high dimensional data, parametric and semiparametric models for DNA microarray data, measurement error models, Bayesian methods for analyzing microarray data, statistical software for analyzing microarray data, sample size determination in microarray studies, applications to cancer. Fall Wright.

791 EMPIRICAL PROCESSES AND SEMIPARAMETRIC INFERENCE (3). Prerequisites: BIOS 761 or consent of instructor. Description: Theory and applications of empirical process methods to semiparametric estimation and inference for statistical models with both finite and infinite dimensional parameters. Topics include the bootstrap, Z-estimators, M-estimators, semiparametric efficiency. Spring. Kosorok.

841 PRINCIPLES OF STATISTICAL CONSULTING (3). Prerequisites, BIOS 545 or equivalent and permission of the instructor except for majors in the department. An introduction to the statistical consulting process, emphasizing its nontechnical aspects. Spring. Bangdiwala and LaVange.

842 PRACTICE IN STATISTICAL CONSULTING (3). Prerequisites, BIOS 511, 545, 550, 841, or equivalents, and permission of the instructor. Under supervision of a faculty member, the student interacts with research workers in the health sciences, learning to abstract the statistical aspects of substantive problems, to provide appropriate technical assistance, and to communicate statistical results. Fall, spring, and summer.

843 SEMINAR IN BIOSTATISTICS (1). Fall and spring. Staff.

844 LEADERSHIP IN BIOSTATISTICS (3). Prerequisites, BIOS 841. Using lectures and group exercises, students are taught where and how biostatisticians can offer leadership in both academic and non-academic public health settings. Not offered 2009-10.

850 TRAINING IN STATISTICAL TEACHING IN THE HEALTH SCIENCES (2 or more). Prerequisite, a minimum of one year of graduate work in statistics. Principles of statistical pedagogy. Students assist with teaching elementary statistics to students in the health sciences. Students work under the supervision of the faculty, with whom they have regular discussions of methods, content, and evaluation of performance. Fall, spring, and summer.

889 RESEARCH SEMINAR IN BIOSTATISTICS (1-3). Prerequisite, permission of the instructor. Seminar on new research developments in selected biostatistical topics. Fall and spring.

990 RESEARCH IN BIOSTATISTICS (2 or more). Individual arrangements may be made by the advanced student to spend part or all of his or her time in supervised investigation of selected problems in statistics. Fall, spring, and summer.

992 MASTER'S PAPER (3 or more). Fall, spring, and summer.

993 MASTER'S THESIS (3 or more). Fall, spring, and summer.

994 DOCTORAL DISSERTATION (Minimum of 3). Fall, spring, and summer.

SPECIAL INTERESTS OF CURRENT BIOSTATISTICS FACULTY

Shrikant I. Bangdiwala	Research Professor PhD 1980 - University of North Carolina at Chapel Hill	Nonparametric Methods, Clinical Trials Methodology, Reliability, and and Validity, Injury Prevention
Richard E. Bilsborrow	Research Professor PhD 1968 - University of Michigan	Economic Demography, Demography, Population and Environment, Data Collection
Jianwen Cai	Professor and Associate Chair PhD 1992 - University of Washington at Seattle	Survival Analysis and Regression Models, Clinical Trials, Analysis of Correlated Responses
Diane Catellier	Research Associate Professor PhD 1998 - University of North Carolina at Chapel Hill	Linear Models, Missing Data, Clinical Trials
Lloyd E. Chambless	Research Professor PhD 1979 - University of North Carolina at Chapel Hill	Clinical Trials, Measurement Error Models
Haitao Chu	Research Associate Professor PhD 2003 – Emory University	Statistical Methods in Epidemiology, Statistical Methods for the Design and Analysis of Bio-Markers with Detection Limits, Missing Data Analysis, Applications Using Bayes and Empirical Bayes Methods, Statistical Genetics
David John Couper	Research Associate Professor PhD 1994 - University of Washington	Epidemiological Methods, Longitudinal Data, Data Quality
Lloyd J. Edwards	Associate Professor PhD 1990 - University of North Carolina at Chapel Hill	Longitudinal Data Analysis, Measurement Error Models, Clinical Trials
Regina Elandt-Johnson	Professor Emeritus PhD 1955 - Agricultural University Poznan, Poland	Research in Statistical Theory and Methodology, Statistical Genetics
James E. Grizzle	Professor Emeritus PhD 1960 - North Carolina State College	Design and Analysis of Surveys, Clinical Trials
Robert Hamer	Research Professor PhD 1979 – University of North Carolina at Chapel Hill (Joint with Psychiatry)	Linear Models, Mixed Models, Clinical Trails
Ronald Helms	Professor Emeritus PhD 1969 – North Carolina State University	Research Data Management, Analysis of Incomplete and/or Irregular Longitudinal Data
Amy H. Herring	Associate Professor ScD 2000 - Harvard University	Missing data problems, Complex exposure-response relationships, Reproductive and Environmental Epidemiology
Michael G. Hudgens	Research Associate Professor PhD 2000 – Emory University	Nonparametric estimation, causal inference, group testing, infectious diseases
Joseph G. Ibrahim	Alumni Distinguished Professor PhD 1988 – University of Minnesota	Bayesian Inference, Missing Data Problems, Survival Analysis, Generalized Linear Models

Anastasia Ivanova	Associate Professor PhD 1992 - St. Petersburg State University, Russia PhD 1998 - University of Maryland	Clinical Trials Design, Sequential Design of Binary Response Experiments, Ethics in Biomedical Studies, Statistical Methodology in Biostatistics
William D. Kalsbeek	Professor PhD 1973 - University of Michigan	Sample Design, Survey Analysis, Nonsampling Errors
Alan F. Karr	Professor (Joint with Statistics) PhD 1973 - Northwestern University	Inference for Stochastic Processes, Image Analysis
Gary G. Koch	Professor PhD 1968 - University of North Carolina at Chapel Hill	Categorical Data Analysis, Nonparametric Methods
Michael R. Kosorok	Professor and Chair (Joint with Statistics) PhD 1991 - University of Washington	Empirical Processes, Semiparametric Inference, Monte Carlo Methods
Pei-Fen Kuan	Research Assistant Professor PhD 2009 – University of Wisconsin, Madison	Statistical Genetics
Lawrence L. Kupper	Alumni Distinguished Professor PhD 1970 - University of North Carolina at Chapel Hill	Regression Analysis, Statistical Applications in Epidemiology and in Environmental Health
Ethan M. Lange	Research Assistant Professor **(**Joint with Dept. of Genetics) PhD 2001 – University of Michigan	Genetics
Lisa M. LaVange	Professor of the Practice PhD 1983 – University of North Carolina at Chapel Hill	Clinical Trials
Yun Li	Assistant Professor (Joint with Dept. of Genetics) PhD 2009 – University of Michigan	Genetics
Danyu Lin	Dennis Gillings Distinguished Professor PhD 1989 – University of Michigan	Survival Analysis, Design and Analysis of Medical Studies, Longitudinal Data Analysis, Statistical Analysis
Jane H. Monaco	Clinical Assistant Professor DrPH 2003 – University of North Carolina at Chapel Hill	Survival Analysis, Statistics Education
James S. Marron	Amos Hawley Distinguished Professor PhD 1982 – University of California at Los Angeles (Joint with Statistics)	Smoothing Methods for Curve Estimation
Keith E. Muller	Professor Emeritus PhD 1981 - University of North Carolina at Chapel Hill	Linear Models, Experimental Design for Environmental Research
Andrew B. Nobel	Professor PhD 1992 – Stanford University (Joint with Statistics)	Statistical Analysis of Gene Expression data Analysis and simulation of internet traffic Pattern recognition and machine learning Data Mining
John S. Preisser, Jr	Research Professor PhD 1995 - University of North Carolina at Chapel Hill	Categorical Data, Longitudinal Data Analysis

Bahjat Qaqish	Associate Professor PhD 1990 - Johns Hopkins University	Generalized Linear Models, Correlated Discrete Data, Survival Analysis, Statistical Computing, Statistical Methods in Epidemiology
Dana Quade	Professor Emeritus PhD 1960 - University of North Carolina at Chapel Hill	Nonparametric Methods
Katherine J. Roggenkamp	Research Instructor MAT 1984 – University of North Carolina at Chapel Hill MA 1986 – University of North Carolina at Chapel Hill	Statistical Computing
Todd A. Schwartz	Research Assistant Professor DrPH 2004 – University of North Carolina at Chapel Hill	Mixed Models, GEE, Categorical Data analysis, Clinical Trials
Pranab K. Sen	Cary Boshamer Distinguished Professor (Joint with Statistics) PhD 1962 Calcutta University	Nonparametric Multivariate Analysis, Large Sample Theory, Sequential Methods, Survival Analysis, Stochastic Processes
Richard L. Smith	Mark L. Reed Distinguished Professor PhD 1979 – Cornell University (Joint with Statistics)	spatial statistics, time series analysis, extreme value theory and Bayesian statistics
Paul W. Stewart	Research Associate Professor PhD 1981 - University of North Carolina at Chapel Hill	Linear Models, Incomplete or Censored Longitudinal Data, Pediatric Research, and Pulmonary Research
Chirayath M. Suchindran	Professor PhD 1972 - University of North Carolina at Chapel Hill	Statistical Demography
Wei Sun	Assistant Professor PhD 2007 – University of California at Los Angeles	eQTL studies, tiling array data analysis, statistical genetics, dimension reduction, multiple testing
Michael J. Symons	Professor Emeritus PhD 1969 – University of Michigan	Bayesian Inference, Survival Analysis Applications
Kinh N. Truong	Professor PhD 1985 - University of California at Berkeley	Extended Linear Models, Functional Modeling, Hazard Regression, Time Series, Neuro Modeling, and Biochemical Epidemiology
Craig Turnbull	Professor Emeritus PhD 1971 - University of North Carolina at Chapel Hill	Public Health Statistics, Applied Research in Perinatal Outcomes and Behavioral Sciences
Bradley H. Wells	Professor Emeritus PhD 1959 - University of North Carolina at Chapel Hill	Population Statistics, Demographic Methods
Fred A. Wright	Professor PhD 1994 - University of Chicago	Statistical Genetics
Michael C. Wu	Assistant Professor PhD 2009 – Harvard University	Statistical Genetics
Donglin Zeng	Associate Professor PhD 2001 – University of Michigan	High dimensional data, Survival Analysis

Haibo Zhou	Professor PhD 1992 - University of Washington	Missing/auxiliary Data, Survival Analysis, Human Fertility, Statistical Methods in Epidemiology, Toxicology Risk Assessment
Hongtu Zhu	Associate Professor PhD 2000 – The Chinese University of Hong Kong	Imaging Statistics, Latent Variable Models
Fei Zou	Associate Professor PhD 2001 – University of Wisconsin-Madison	Statistical Genetics

LISTS OF IMPORTANT WEB SITES

- University Registrar (links to calendars, courses, residency, etc)
  http://regweb.unc.edu/index.php

- Calendars Fall 2009 and Spring 2010
  http://regweb.unc.edu/calendars/index.php

- UNC Academic Calendars
  http://regweb.unc.edu/calendars/index.php

- Degree Deadlines
  http://gradschool.unc.edu/dates.html

- UNC Graduate School
  http://www.gradschool.unc.edu

- eGraduation
  http://cfx.research.unc.edu/grad_appOnline/

- Graduate School Forms
  (To obtain a copy of these forms please visit
  http://www.gradschool.unc.edu/forms.html - OR - stop by the office of the registrar).

- Graduate School Handbook
  http://www.gradschool.unc.edu/guidebooks.html

- Departmental Committees and Members for 2009 - 2010
  http://www.sph.unc.edu/bios/departmental_committees_2420_2466.html