THE BSPH IN BIOSTATISTICS AT THE UNIVERSITY OF NORTH CAROLINA
AT CHAPEL HILL

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ABSTRACT

In 1976 the Department of Biostatistics, School of Public Health, University of North Carolina at Chapel Hill initiated the nation's first undergraduate major in Biostatistics (BSPH). This communication reviews the origin, objectives, and content of the BSPH program. We also discuss recruitment strategies and admission requirements, as well as enrollment, academic performance, employment and continued education profiles of the BSPH graduates. In addition, we compare the requirements and content of the BSPH program with those of our Department's two master's programs and respond to five questions we are frequently asked about the BSPH program.

KEY WORDS: Undergraduate Education, Biostatistics, BSPH

INTRODUCTION

Dr. Barbara A. Bailar, Executive Director of the American Statistical Association (ASA), recently contacted the Chairs of Biostatistics and Statistics Departments to enlist their assistance with ASA's recruitment efforts (1992). Three of her comments are pertinent to this communication:

(1) "Reports from the National Research Council and other groups predict a critical shortage of faculty in statistics in a few years as the 'Sputnik-age' faculty begin to retire. I am writing to suggest that this may be an excellent opportunity to recruit bright graduates from other disciplines into graduate programs in statistics."

(2) "Besides an intensive recruiting effort for current seniors, you might consider efforts to reach juniors so that they could take additional mathematics courses during their senior year."

(3) "I have recently encouraged the Council of Sections Governing Board to consider using Sections to aid in such a graduate student recruiting effort. They are enthusiastically behind this effort."

We applaud Dr. Bailar's efforts to recruit students to graduate-level studies in (bio)statistics. However, we suggest that recruitment and training should not be restricted to graduate students since (bio)statisticians have been and continue to be educated at the undergraduate level. In addition, it is especially important that we increase our communication with high-school and undergraduate students, as well as with their counselors, in order to increase the public's awareness of statistics as an appealing undergraduate major and rewarding career. The Department of Biostatistics at the University of North Carolina at Chapel Hill (UNC-CH) has addressed these needs since 1976 by offering the first undergraduate major in Biostatistics which leads to the Bachelor of Science in Public Health (BSPH) degree (Turnbull, 1975, 1979, and 1989).

The author developed the BSPH in Biostatistics program and he has served as its Program Director since the inception of the program. This communication reviews the 16-year history of the program and discusses its origin, objectives, and content. We also present our recruitment strategies and admission requirements, as well as enrollment, academic performance, employment and continued

education profiles of the BSPH graduates. In addition, we compare the requirements and content of the BSPH program with those of our Department's two master's programs and respond to five questions we are frequently asked about the BSPH program.

ORIGIN OF THE PROGRAM

The BSPH program is one of five undergraduate programs currently offered by the School of Public Health at UNC-CH. Plans for the BSPH program were initiated in November of 1971 when a Study Commission on the Role of the School of Public Health reported that the greatest need for community health workers was at entry-level positions. This Commission and a 1973 Legislative Study Commission recommended that our School explore the feasibility of developing an undergraduate program. In 1975, under the leadership of Dean Bernard G. Greenberg, the School requested approval for an undergraduate program that would lead to the BSPH degree. This request was approved and undergraduates were admitted beginning in the Fall of 1976. Development of the BSPH program was enhanced by a five-year grant from the Bureau of Health Manpower (1976).

OBJECTIVES OF THE PROGRAM

The primary objective of the BSPH program is to prepare undergraduate students for entry-level statistical positions in health and health-related agencies. Two additional objectives are to prepare students for subsequent study at the graduate level and to acquaint students with the professional field of public health.

CONTENT OF THE PROGRAM

The BSPH program requires a broad academic base during the freshman and sophomore years followed by professional and departmental courses during the remaining two years. The University's required General College perspective and elective courses are taken during the freshman and sophomore years. Students are admitted to the BSPH program for the junior year and entering students have completed three calculus courses (through Calculus of Functions of Several Variables), Introduction to Programming (PASCAL), and an introductory biological science course.

BSPH students take at least 60 credit hours during their junior and senior years, including a minimum of three electives outside of the School of Public Health. Our departmental and professional requirements have not changed since the inception of the BSPH program (although some courses have been renumbered). Students are required to take the following 13 courses (38 semester hours) during their junior and senior years:

(1)   19 hours of graduate-level Biostatistics:

Principles of Statistical Inference (3),

Introduction to Statistical Computing and Data Management (3),

Principles of Experimental Analysis (3),

Elements of Probability and Statistical Inference (3),

Introductory Applied Statistics (3),

Sample Survey Methodology (3), and

Field Observations in Biostatistics (1).

(2)   9 hours of upper-level undergraduate Mathematics:

Discrete Mathematics or Linear Algebra and Differential Equations (3),

Advanced Calculus or Mathematical Methods for the Physical Sciences (3), and

Matrix Theory or Linear Algebra (3).

(3)   3 hours of graduate-level Epidemiology:

> Principles of Epidemiology.

(4)   3 hours of undergraduate-level Environmental Science:

> Environmental Protection.

(5)   4 hours of undergraduate-level Biology:

> Ecology and Population Biology or Molecular Biology

Table 1 presents a typical program for the junior and senior years. One of the special features of the BSPH program is that students choose eight electives during their junior and senior years. These choices provide the faculty advisor ample opportunities to work with each student in order to tailor the program according to each student's abilities, interests, and career goals.

RECRUITMENT

Recruitment of quality students is essential in order to build and maintain a program which produces competent entry-level (bio)statisticians. We have observed that many undergraduates have limited knowledge of career opportunities in biostatistics and that they learn about our discipline only after arriving on campus. In fact, it is interesting to note that the previously intended majors of our BSPH students include: anthropology, applied science, biology, business, chemistry, computer science, mathematics, pharmacy, political science, psychology, and sociology.

Students learn about our program from currently enrolled students, fliers we distribute in selected mathematics courses, discussions with School of Public Health faculty, and by taking a course in our School. We have found, however, that word-of-mouth recruitment appears to be the most fruitful process since the quality of students already enrolled in or graduated from our BSPH program is our best resource. It seems there is no substitute for a satisfied customer.

A planned recruitment strategy is followed once a student indicates interest in our program. Prospective students are encouraged to schedule an informal interview with the Program Director

before applying for admission. During this interview we review the requirements of the program, discuss advising/mentoring roles of the faculty, determine areas of the student's interests regarding elective choices, review part-time employment experiences of former and currently enrolled students, and illustrate the employment and continued education histories of our graduates.

ADMISSION

Admission is competitive and application is typically made by the end of the Fall semester of the sophomore year; but, applications are accepted and admissions occur throughout the year. Admitted students have completed most of the University's General College perspective courses as well as each of our Department's prerequisites and they have earned a cumulative grade point average (GPA) of at least 2.5 on a four-point scale (A = 4.0, B = 3.0, C = 2.0, D = 1.0, and F = 0.0). An important component of our application process is that we require applicants to provide written responses to the following Statement of Goals questions:

(1) Why do you want to enter the BSPH program?

(2) Why have you selected this department for your major?

(3) When and how did you become interested in this major?

(4) What do you feel you have to offer this health profession?

(5) How is this program related to your projected career plans?

(6) What do you plan to do if you are not accepted into this program?

These queries require applicants to consider their personal and professional goals. Applicants frequently mention that our Statement of Goals requirement is a key selling point of the program since their previous academic experiences had not required that they think or write about such matters. This requirement also demonstrates that our program really is individualized and tailored to the interests and ability-levels of its students.

ENROLLMENT

The average Fall enrollment since 1976 is 12 students (see Figure 1). The largest enrollment occurred in 1983 when we had 20 students. Twelve students were enrolled in Fall 1992. The downward trend for 1984 through 1990 mimics the experience of other undergraduate mathematical science majors at UNC-CH. Fewer otherwise adequately prepared juniors chose the various mathematical science majors during this time period; also, informal discussions with colleagues throughout the nation suggest that our experience is typical of other locations.

Ninety-two percent (80/87) of enrolled students received their BSPH degree. Four students withdrew for medical reasons and did not return to the University. Three other students initially planned to double-major but subsequently decided to major only in their formerly intended fields (computer science, political science, and psychology) after one semester of enrollment in our program.

Ninety-one percent of our graduates (73/80) are white and 76% are female. We are pleased that at least half of our graduates are female; but, we are frustrated that such a small percentage is nonwhite. All but two of the 12 students enrolled for 1992-3 are female and only one is non-white (Asian).

PERFORMANCE

The average verbal and quantitative SAT scores for our graduates are 520 and 606, respectively. The average pre-program GPA for the 80 BSPH graduates is 2.97 (approximately a "B") and the average cumulative GPA at graduation is 2.93. We are especially pleased with our graduates' performance since they take 15 credit hours per semester and almost all of them were also employed part-time during the academic year.

The average GPAs earned by our graduates in the required master's-level biostatistics courses are:

Principles of Statistical Inference	3.11
Introduction to Statistical Computing and Data Management	3.26
Principles of Experimental Analysis	2.83
Elements of Probability and Statistical Inference	2.97
Introductory Applied Statistics	2.73
Sample Survey Methodology	2.93

These averages range from a minimum of 2.73 (B-) to a maximum of 3.26 (B+) and reflect our overall satisfaction with the performance of our graduates in the required master's-level biostatistics courses.

Graduates of the BSPH program have completed the prerequisite coursework to be considered for admission to our Department's two master's programs. In addition, the BSPH program provides a firm academic base for graduate study which is not restricted to biostatistics.

Table 2 shows that 35 percent (28/80) of our graduates immediately enrolled in graduate programs and 64 percent (18/28) of them continued their studies in our Department. Current information regarding subsequent educational experiences for our graduates reveals that 65 percent (52/80) undertook graduate education sometime after receiving their BSPH degree and 21 percent (17/80) continued with doctoral training. To date, 32 BSPH graduates pursued our master's and seven of them continued with doctoral studies in our Department. In addition, 18 graduates obtained master's-level training and ten pursued doctoral studies elsewhere. The other master's-level training includes five in statistics; two in the armed services, business, and computer science; and one in audiology, biostatistics, education, epidemiology, health sciences, mathematics, and theology. The other doctoral studies includes four in medicine; two in business and epidemiology; and one in biomathematics and statistics.

EMPLOYMENT

Biostatisticians often work in collaboration with persons from other disciplines by developing or applying statistical techniques in order to define and study biological and social problems. As such, employment possibilities for biostatisticians are diverse and numerous-- especially in North Carolina's Research Triangle Park area. Table 2 shows that sixty-five percent (52/80) of our graduates accepted full-time employment immediately after they completed their BSPH degree. They obtained entry-level statistical, mathematical, and/or computer-oriented positions. Twenty-five graduates worked in private research or service industries, 20 in universities, (14 at UNC-CH), 6 in pharmaceutical firms, and one in the federal government.

Current information regarding 106 places of full-time employment for our 80 graduates is given in Table 3. Seventy-seven percent (82/106) of the positions are located in North Carolina (21 in Chapel Hill and 40 in North Carolina's Research Triangle Park), 22 in other parts of the United States, and 2 in other countries.

An important feature of our BSPH program is that we encourage BSPH students to work part-time during the academic year, and if possible, during the summer of their junior year. Seventy-eight percent (62/80) of the BSPH graduates participated in the Department's research or service projects and all but three of our current students have worked part-time with our faculty and their research/service colleagues. We have found that such employment has given the BSPH students valuable experiences with state-of-the-art analytical methods, data management technologies, and opportunities to collaborate in the interpretation and reporting of research/service findings.

BSPH students benefit from the wide spectrum of research and service interests of the faculty. For instance, the Department's Biometric Consulting Laboratory (BCL) has employed many BSPH students and they have gained valuable experiences through their participation in consultations, data analyses, and data management services for our BCL's research and service projects which involved

many health science disciplines, both on and off-campus. We are especially pleased that several of our students' part-time work experiences have resulted in published articles and presentations at professional meetings. Also, employers of the BSPH graduates continue to inform us that the part-time work experience facet of our program provides students with excellent entry-level professional credentials for the workplace.

COMPARISON OF OUR BACHELOR'S AND MASTER'S PROGRAMS

The BSPH program for the junior and senior years requires seven master's-level biostatistics courses, one master's-level epidemiology course, three upper-level undergraduate mathematics courses, undergraduate courses in biology and environmental protection, as well as eight elective courses (three of which must be taken outside of the School of Public Health). Our 16-year experience with the BSPH program reveals that its graduates have an excellent foundation for either of our Department's master's programs (MPH and MS).

Since our Department offers 52 courses, BSPH graduates who proceed to either of our master's programs do not exhaust the Department's course offerings. In fact, since the BSPH graduates have completed several of the master's requirements as part of their BSPH program they have the flexibility to explore elective coursework in their master's programs and they deepen and broaden their statistical and other subject-matter expertise.

The MPH program serves as the Department's professional master's program; as such it is less demanding in the sense that its mathematical prerequisites and theoretical content is not as demanding as those for the BSPH and MS programs. The primary focus of the MPH program is to provide training in the broad field of public health and to impart specialized knowledge of the field of applied biostatistics.

Table 4 shows that the mathematics prerequisites for admission to the BSPH program are more demanding than those for the MPH program since admission to the BSPH program requires two

courses on the calculus of functions of one variable as well as a course on the calculus of functions of several variables. In addition, the BSPH program includes the mathematics and computing, probability and mathematical statistics, and biostatistical applications courses which are required for the MPH degree.

The BSPH program does not include the following MPH requirements:

(1)   at least one year of prior relevant full-time work experience,

(2)   two professional biostatistics courses (the Department's master's-level seminar and apprenticeship in consulting),

(3)   a supporting program which consists of three non-biostatistics courses in public health,

(4)   written comprehensive examinations in theory and applications, and

(5)   master's paper or thesis.

The BSPH program includes the prerequisite mathematics courses as well as advanced calculus and matrix theory courses which are useful, but not required, for admission to the MS degree. The BSPH program requires five courses which are also required by the MS program (ie., statistical computing and data management, introductory applied statistics, sample survey methodology, field observations in biostatistics, and introduction to epidemiology). The BSPH program does not include the following MS requirements:

(1)   two intermediate-level probability and mathematical statistics courses,

(2)   four intermediate-level biostatistical applications courses (usually analysis of categorical data, linear models, and 2 other courses),

(3)   two professional biostatistics courses (the consulting courses listed above for the MPH),

(4)   a supporting program of six additional hours of non-biostatistics courses (students usually choose epidemiology),

(5)   written comprehensive examinations in theory and applications, and

(6)   master's paper or thesis.

FIVE FREQUENTLY ASKED QUESTIONS ABOUT THE BSPH PROGRAM

This section addresses five questions which are often asked about our BSPH program. In 1988 our School reported the results of a ten-year self-study of its five BSPH programs-- the other four programs are Environmental Sciences and Engineering, Health Policy and Administration, Health Behavior and Health Education, and Nutrition. The self-study addressed the first three questions.

#1. Does our graduate faculty have negative opinions regarding having undergraduates in their graduate-level courses?

Since our BSPH program requires eight graduate-level courses we recognize that the presence of both graduate and undergraduate students in a course contributes to the diversity of backgrounds with which the instructor must contend. The issue of teaching courses with both types of students was addressed by profiling the perceptions of the instructors for these courses. A four-item, self-administered questionnaire was sent to the principal instructor for 60 of the School's required or elective courses for which 20% or more of the students were undergraduates. Fifty of the questionnaires were returned. Table 5 presents the questions and the findings for the Biostatistics Instructors. These data show that a majority of the instructors have similar expectations for graduate and undergraduate students, use comparable criteria to evaluate the performance of each group, note that each group performs similarly, and find their classroom behavior to be about the same.

#2. Are the Program Director and Staff opportunity costs reasonable?

The self-study reported that the staff costs in managing our School's undergraduate program are in line with the FTE (full time equivalent) contributions of the program. In terms of assessing the opportunity costs of the Program Director's role with respect to faculty research, the self-study showed that most of the Program Directors were not involved in substantial research projects; hence, the self-study concluded that the time spent on directing the programs

did not seriously detract from the research of the Program Directors.

#3.　What is the instructional time/effort impact?

A considerable number of the School's full-time faculty are either teaching courses that are exclusively made up of undergraduates or which involve at least 20% of class enrollments. This may be the major cost of our undergraduate program. For instance, the Biostatistics courses include not only our required departmental courses, but also two of the required core courses for the School's other four BSPH programs and each of the School's master's-level programs.

#4.　Are the undergraduates swamped by the larger number of graduate students and do the graduate students intimidate them?

Our Department has produced 80 undergraduate, 464 master's, and 186 doctoral degrees through August of 1992. The enrollment for Fall 1992 was 137 students-- 12 undergraduate, 66 master's (24 MPH and 42 MS), and 59 doctoral (42 PhD and 17 DrPH) students. Table 6 shows Fall head counts for our undergraduate, master's, and doctoral students for 1987 through 1992. It is clear that the undergraduates have been and continue to be vastly outnumbered by the graduate students.

Also, we have noted that some new undergraduates, that is the juniors, initially tend to be intimidated by the graduate students since they realize that they will compete with them, especially during their senior year. Frankly, such feelings are understandable and they generally help to motivate the undergraduates to achieve at a higher level than they have previously attempted. In order to try to allay such intimidation, we encourage the BSPH students to work part-time with our faculty and their research/service colleagues. To date, 78% of the BSPH graduates have worked side-by-side with both our graduate students and faculty during their junior and senior years.

Another feature of our BSPH program which helps to assimilate the BSPH students into the mainstream of the Department is that we require both undergraduate and graduate students to take BIOS 191 (Field Observations in Biostatistics) during the last Fall semester of

coursework. This course involves site visits to the statistical units of six non-academic service and/or research agencies in North Carolina's Research Triangle Park Area. These visits provide introductions to the environments and professional activities of many of our former undergraduate, master's, doctoral, and postdoctoral students. The students enjoy this course and they report that these visits frequently serve as students' first face-to-face taste of biostatistics in the "real world" and all students, especially the undergraduates, observe that they can be employed by and have an important role in the statistical activities of such agencies.

#5. What is the main advantage of your BSPH program?

Our undergraduate students are brought into contact with an analytical health science discipline and coursework which is not experienced by other undergraduate students. Students who enjoy the applied aspects of mathematics and computer science, and who have an interest in health and health-related problems are encouraged to consider biostatistics as an undergraduate major and future profession.

SUMMARY

Our profession cannot "let George to do it" a la the Quantitative Literacy Project and/or the Annenburg videotape series, even though these are valuable activities. Rather, we suggest that colleges and universities marshal or develop resources to initiate an undergraduate program in (bio)statistics and hence apply the power of statistical thinking, methods, and action to their professional areas of expertise as has been done by the Department of Biostatistics at the University of North Carolina at Chapel Hill.

ACKNOWLEDGEMENTS

REFERENCES

"Bachelor of Science in Public Health Degree Program," Bureau of Health Manpower, Allied Health Special Project Grant, D12AH00928, 1976-82.

Bailar, BA, Personal Communication, February 3, 1992, Memorandum to the Chairs of Departments of Biostatistics and Statistics via her role as the Executive Director of the American Statistical Association.

Turnbull, CD, "Training Health Statisticians at The University of North Carolina at Chapel Hill," Invited Paper, Presented at the Annual Meetings of the American Public Health Association, Chicago, IL, 1975.

Turnbull, CD, "New Undergraduate Program at UNC-CH: The BSPH," Invited Paper, Presented at the Annual Meetings of the American Public Health Association, New York, NY, 1979.

Turnbull, CD, "UNC-CH's BSPH Program in Biostatistics: Its History, Requirements and Graduates," Invited Session, Presented at the Annual Meetings of the American Statistical Association, Washington, DC, 1989.

TABLE 1.   TYPICAL BSPH PROGRAM FOR THE JUNIOR AND SENIOR YEARS

JUNIOR YEAR:

FALL	BIOS 110	Principles of Statistical Inference. 3. Craig D. Turnbull's notes.
	BIOS 111	Introduction to Statistical Computing and Data Management. 3. SAS User's Guide: Basics. SAS.
	MATH 81	Discrete Mathematics (or MATH 83: Linear Algebra and Differential Equations). 3.
	Elective *	
	Elective	
SPRING	BIOS 145	Principles of Experimental Analysis. 3. Applied Regression Analysis and other Multivariate Methods. Kleinbaum and Kupper.
	MATH 121	Advanced Calculus (or MATH 108: Mathematical Methods for the Physical Sciences). 3.
	EPID 160	Principles of Epidemiology. 3.
	Elective	
	Elective	

SENIOR YEAR:

FALL	BIOS 150	Elements of Probability and Statistical Inference. 3. Mathematical Statistics with Applications. Mendenhall, Scheaffer, and Wackerly.
	BIOS 191	Field Observations in Biostatistics. 1.
	MATH 147	Matrix Theory (or MATH 116: Linear Algebra). 3.
	BIOL 54	Ecology and Population Biology (or BIOL 53: Molecular Biology and Genetics). 4.
	Elective	
	Elective	
SPRING	BIOS 162	Introductory Applied Statistics. 3. Dana E. Quade's notes.
	BIOS 164	Sample Survey Methodology. 3. Survey Sampling. Kish.
	ENVR 51	Environmental Protection. 3.
	Elective	
	Elective	

* Electives are chosen by the student after consultation with the advisor.

TABLE 2. FIRST POSITION TAKEN BY THE 80 BSPH GRADUATES

CONTINUED STUDIES: BIOS @ UNC-CH   18

                    All other: 10

Medicine	3-- 2 @ UNC-CH	
Officer training	2	
Business	1	
Education	1	
Epidemiology	1	
Health Services	1	
Mathematics	1	

EMPLOYMENT:

Federal Government	1	
Pharmaceutical firms	6	
Universities	20-- 14 @ UNC-CH	
Other industries:	25	

Chapel Hill	7
Durham	3
Greensboro	2
Raleigh	1
Research Triangle Park:	5
Other	7

TOTAL   80

TABLE 3.   PLACE OF FULL-TIME EMPLOYMENT FOR THE BSPH GRADUATES

PLACE		NUMBER OF GRADUATES
NORTH CAROLINA: (n = 82)		
Apex:	Apex High School	1
Cary:	SAS Institute	2
Chapel Hill:	Carolina Population Center	4
	Frank Porter Graham Child Dev. Center	5
	Highway Safety Research Center	1
	Nationwide Insurance	1
	Private Consultant	2
	Profile Associates	1
UNC-CH:	Biostatistics Department	6
	School of Medicine	1
Charlotte:	EDS Corporation	1
Durham:	Blue Cross/Blue Shield	2
	Clindar Pharmaceuticals	1
	Personal Research, Inc.	1
	School of Medicine, Duke Univ.	3
Greensboro:	MARC, Inc.	2
Greenville:	School of Medicine, East Carolina Univ.	1
Raleigh:	NCNB	1
	First Investors Corporation	1
	General Electric Mortage Ins. Corp.	1
	State Center for Health Statistics	1
Research Triangle Park:	Burroughs Wellcome Company	6
	Chemical Industry Inst. of Technology	1
	Family Health International/CRI	5
	Glaxo Pharmaceuticals	6
	NIEHS	1
	Northern Telecom	1
	Northrop Corporation	2
	Program Resources	1
	Quintiles, Inc.	8
	Research Triangle Institute	9
Winston-Salem:	First Union Mortgage Corporation	1
	School of Medicine, Bowman-Grey	2

TABLE 3. (continued)

OTHER PARTS OF THE UNITED STATES: (n = 22)

Alabama:	Birmingham:	Comprehensive Cancer Center	1
District of Columbia:		ACEMENICS	1
		Asso. of American Medical Colleges	1
		Census Bureau	1
		FDA	1
Florida:	Jacksonville:	Prudential Life Insurance Company	1
	Tallahassee:	EDS Corporation	1
Georgia:	Atlanta:	NCR Corporation	1
Hawaii:	Honolulu:	Cancer Research Center, Univ. of Hawaii	1
Maryland:	Bethesda:	NIAID	1
		NINDS	1
Massachusetts:	Cambridge:	Harvard University	1
Michigan:	Detroit:	School of Medicine, Wayne State	1
Missouri:	Kansas City:	Lee Jeans Company	1
New Jersey:	Woodbridge:	Merck, Sharpe and Dohme	1
	Roseland:	Prudential Life Insurance Company	1
Oklahoma:	Enid:	Private Insurance Company	1
Pennsylvania:	West Point:	Merck, Sharpe and Dohme	1
Virginia:	Charlottesville:	Pharmaceutical Research Assoc	2
		School of Medicine	1
West Virginia:	Morgantown:	NIOHA	1

OTHER THAN THE UNITED STATES OF AMERICA: (n = 2)

Indonesia:	Hotel Mandarin Oriental	1
Israel:	Hadassa School of Public Health	1

TABLE 4. NUMBER OF COURSES REQUIRED FOR ADMISSION TO (in parentheses) OR COMPLETION OF THE BSPH, MPH, AND MS DEGREES

	BSPH	MPH	MS
UNDERGRADUATE-LEVEL METHEMATICS AND COMPUTING:			
Calculus of Functions of One Variable I and II	(2)	(2)	(2)
Calculus of Functions of Several Variables	(1)		(1)
Introduction to Programming	(1)		
Linear Algebra and Differential Equations	1		(1)
SENIOR/GRADUATE-LEVEL MATHEMATICS AND COMPUTING:			
Advanced Calculus I (or Math for Physical Sciences)	1		
Matrix Theory (or Linear Algebra)	1		
Statistical Computing and Data Management	1	1	1
SENIOR/GRADUATE-LEVEL MATHEMATICAL STATISTICS:			
Principles of Statistical Inference (non-calculus)	1		
Probability and Statistical Inference	1	1	2
BIOSTATISTICAL APPLICATIONS:			
Principles of Experimental Analysis	1	1	
Introductory Applied Statistics	1	1 or	1
Analysis of Categorical Data		1	1
Sample Survey Methodology	1	1	1
Electives			3
PRACTICUM:			
Field Observations in Biostatistics	1	1	1
Seminar and Apprenticeship in Consulting		2	2
SUPPORTING PROGRAM:			
Introduction to Epidemiology	1	1	1
Environmental Protection	1		
Biology (Molecular/Genetics or Ecology/Population)	1		
Electives in Public Health		3	
Electives in Public Health or Elsewhere			2

Notes: The MPH also requires a year of relevant full-time experience for admission. The MPH and MS also require written comprehensive examinations and a master's paper/thesis.

TABLE 5. SURVEY OF PRINCIPAL INSTRUCTORS FOR REQUIRED AND SELECTED COURSES, SCHOOL OF PUBLIC HEALTH SELF-STUDY OF BSPH PROGRAMS, UNC-CH, 1988

#1: Do you have separate performance expectations of graduate and undergraduate students taking this course?

#2: Do you have separate criteria for evaluating the performance of graduate and undergraduate students taking this course?

#3: Have the undergraduate students taking this course generally performed better, worse, or about the same as the graduate students?

#4: Is the classroom demeanor of undergraduate students markedly different from graduate students in this course?

		Number	Percent
Question #1:	Yes	2	18
	No	9	82
	Not answered	0	0
Question #2:	Yes	2	18
	No	9	82
	Not answered	0	0
Question #3:	Better	0	0
	Worse	3	27
	About the same	7	64
	Not answered	1	9
Question #4:	Yes	2	18
	No	9	82
	Not answered	0	0

TABLE 6. FALL HEADCOUNTS FOR BACHELOR'S, MASTER'S, AND DOCTORAL
BIOSTATISTICS MAJORS, UNC-CH, 1987-1992

DEGREE PROGRAM	FALL HEAD COUNT						TOTAL	
	YEAR							
	87	88	89	90	91	92	Number	Percent
BACHELOR'S	13	12	9	8	14	12	68	10
MASTER'S	50	55	67	63	61	66	362	51
DOCTORAL	40	38	43	45	55	59	280	39
TOTAL	103	105	119	116	130	137	710	100

FIGURE 1. BSPH FALL ENROLLMENT, UNC-CH, 1976-1992