The University of Georgia

University Council
Athens, Georgia 30602

January 13, 2011

UNIVERSITY CURRICULUM COMMITTEE – 2010-2011
Mr. David E. Shipley, Chair
Agricultural and Environmental Sciences - Dr. T. Dean Pringle
Arts and Sciences - Dr. Roxanne Eberle (Arts)
Dr. Rodney Mauricio (Sciences)
Business - Dr. James S. Linck
Ecology - Dr. James W. Porter
Education - Dr. Yvette Q. Getch
Environment and Design - Mr. Scott S. Weinberg
Family and Consumer Sciences - Dr. Jan M. Hathcote
Forestry and Natural Resources - Dr. Sarah F. Covert
Journalism and Mass Communication - Dr. Alison F. Alexander
Law – No representative
Pharmacy - Dr. Keith N. Herist
Public and International Affairs - Dr. Jerome S. Legge
Public Health – Dr. Marsha M. Black
Social Work - Dr. Stacey R. Kolomer
Veterinary Medicine - Dr. K. Paige Carmichael
Graduate School - Dr. Malcolm R. Adams
Undergraduate Student Representative – Mr. Stephen Thompson
Graduate Student Representative – Ms. Lauren Moret

Dear Colleagues:

The attached proposal for a new major in Epidemiology (Ph.D.) will be an agenda item for the January 19, 2011, Full University Curriculum Committee meeting.

Sincerely,

David E. Shipley, Chair
University Curriculum Committee

cc: Provost Jere W. Morehead
Dr. Laura D. Jolly

The University System of Georgia
New Program Proposal

Institution: The University of Georgia

Date: September 2010

College: College of Public Health

Department: Department of Epidemiology and Biostatistics

Degree: Doctor of Philosophy (Ph.D.), Epidemiology

Start Date: Fall 2011

Signatures:

Sept 29, 2010

John Vena, Ph.D.
Head, Department of Epidemiology and Biostatistics

Philip Williams, Ph.D.
Dean, College of Public Health

Maureen Grasso, Dean
Graduate School

Table of Contents

1. Program Abstract 3
2. Objectives of Program 3
3. Justification and Need of Program 4
4. Procedures to Develop Program 9
5. Curriculum 10
6. Inventory of Faculty 23
7. Programs in Other Institutions 27
8. Library Resources to Support Degrees 30
9. Facilities 32
10. Administration 34
11. Assessment 34
12. Accreditation 36
13. Affirmative Action Impact 37
14. Degree Inscription 37
15. Fiscal and Enrollment Impact, Budget 37
16. Bibliography 42
17. Appendices 43

1. Program Abstract

The Department of Epidemiology and Biostatistics in the College of Public Health proposes to develop a doctor of philosophy (Ph.D.) degree in Epidemiology. This new degree will build upon the already established and accredited Masters of Public Health (M.P.H.) degree and will complement the Doctor of Public Health (Dr.PH) degree. The new doctoral degree in Epidemiology is designed to train future leaders in the field, which will fulfill manpower needs at state, national and international levels. The proposed curricula will build expertise in research methodology so that graduates may create new knowledge about the distribution and determinants of diseases in human populations that can be used to shape future interventions and health policy.

2. Goals and Objectives of the Program

The goals of our proposed programs in Epidemiology are to:

1. Improve public health through the application of methods and approaches in Epidemiology
2. Create new knowledge in the field of Epidemiology, with a special emphasis on identifying emerging areas of enquiry, especially those that cross disciplinary boundaries
3. Translate new knowledge in Epidemiology so that it may be implemented and used to improve public health
4. Create the next generation of epidemiologists who can respond to the challenges in public health in the future, educate future students in the field, and provide service to the community
5. Serve the larger communities in which we live and work, by using our special skills and knowledge.

A Ph.D. program in Epidemiology is consistent with the “Strategic Visions for UGA in 2020” which call for the investment in research in the biomedical sciences and growth in the quality and number of graduate students. The overall mission of the University of Georgia as stated in the ‘Strategic Visions for UGA in 2020’ is to conserve and enhance the state’s and nation’s intellectual, cultural and environmental heritage. Furthermore, the University endorses full commitment to excellence in scholarship, teaching, and public service at the state, national, and international levels, while at the same time nurturing understanding and respect for cultural, ethnic, gender, and racial diversity.

The proposed Doctoral Program in Epidemiology in the Department of Epidemiology and Biostatistics in the College of Public Health will fully participate in this mission by educating and training the future public health leaders in the state, country and world. Moreover, the development of this doctoral program will enhance the University’s investment in research in the biomedical sciences and growth in the quality of graduate education.

3. Justification and Need of Program

Epidemiology is considered the basic science of Public Health. It is the study of the distribution and determinants of health in human or animal populations. As it is currently practiced, epidemiology has both descriptive and analytic elements. The descriptive aspect of Epidemiology provides information about the burden of disease or illness in a population and is determined through surveys and analysis of surveillance information. The analytic aspect of Epidemiology combines study design with powerful statistical methods to understand the cause of disease. Both areas of Epidemiology inform policy and evaluate effectiveness of policy decisions.

Over the past half century, Epidemiology has become a distinctive field that has a set of principles and competencies that are unique. The doctorate in Epidemiology (Ph.D. Epidemiology) provides in-depth knowledge in study design, statistical analysis of epidemiologic data, information technology, and current health conditions that affect public and individual health. The Ph.D. in Epidemiology will teach students how to become researchers and create new knowledge that addresses the main theoretical and practical problems facing the fields of Medicine and Public Health today. This training prepares graduates for academic and related professions that involve teaching and research as well as researchers for government public health agencies and the private sector such as consulting firms or biomedical and drug companies.

Outlined in this section is the justification and rationale for a new doctoral degree in Epidemiology. Among the many cogent reasons for creating this new degree at University of Georgia, one is of singular importance. At this time, no university in the University System of Georgia offers a doctoral degree in Epidemiology. In fact, in Georgia only Emory University offers such a degree. This lack of training creates a void in the state's ability to address medical and public health matters today and in the future. The proposed degree program will fill this void by training epidemiologists of the highest quality to work in and serve the public health needs of the state and country.

3.1 Value Added above MPH, DrPH

The content and expertise learned in a Ph.D. Epidemiology program differs substantively from the content of the Master of Public Health degree. Whereas the MPH degree requires knowledge and competence across a range of disciplines, including Epidemiology, it does not require the depth of knowledge or expertise in any content area that is expected in a doctoral degree. The Ph.D. in Epidemiology provides such depth. Although the MPH degree provides basic training in research methods in Epidemiology, the Ph.D. degree provides training in epidemiologic research methods and prepares the candidate to become a leader in the field and create new knowledge that will be essential to the field and will be vital to address state, regional,national, and international public health problems Finally, whereas the MPH degree introduces quantitative concepts, the Ph.D. in Epidemiology requires a firm grasp of the underlying theoretical and quantitative concepts of study design and statistical analysis.

The content and expertise in Epidemiology also differs from the doctorate in Public Health or the doctorate in Biostatistics. Whereas the Ph.D. in Epidemiology is a research degree that emphasizes training in research methodology in specific content

fields, the Dr. PH is an applied, professional degree that teaches how to conduct applied research and link theory with practice to solve problems in Public Health. The graduates with training in Epidemiology will seek careers as researchers and educators, whereas graduates with a Dr.PH usually seek careers as high-level administrators in teaching, policy making, and program evaluation. The field of Biostatistics also differs from Epidemiology in that its main focus is on the development of new quantitative methods to analyze biological and medical data.

3.2. Societal Need for Ph.D. Epidemiology

Georgia is the ninth largest state in the US with 9.5 million people that serves as the economic engine for the Southeast. Despite firm economic foundation, the state ranks 31st in chronic disease burden, 43rd in American's health rankings, and 42nd in health systems performance. Thus, there is tremendous local need to improve in public and personal health in Georgia. The health rankings are grim in multiple categories, such as cardiovascular deaths (40th), diabetes (41st), high blood pressure (42nd), infectious disease (46th), premature death (41st), infant mortality (42nd) and childhood obesity (48th). Additionally, Georgia's 30% African American population suffers with well-documented health disparities in cardiovascular disease, diabetes, kidney disease, cancer, stroke, and HIV/AIDS.

Despite public and private initiatives to improve public health in Georgia, data on the health status of Georgians confirms the need for continued efforts in this area. Not only is there is a high prevalence of chronic diseases such as obesity, cancer, diabetes, heart disease, stroke and asthma, but there is also a persistent problem with infectious diseases such as HIV, tuberculosis, influenza, among others. The prevalence of disease is not evenly distributed as there are dramatic health disparities among racial and ethnic groups within the state. Child and maternal health, as evidenced by infant mortality and low birth weights, is also of particular concern. As the population over 60 years of age (Baby Boomers) continues to grow, so do the age-related conditions and diseases.

Georgia has responded to these public health concerns with a number of new programs and initiatives. The Georgia Cancer Coalition's goal to find effective strategies for the prevention and treatment of cancer over the next decade is a major undertaking to promote the health of its citizens. The State's smoking prevention program, funded largely by Georgia's share of the tobacco settlement, provides both short- and long-term opportunities for research and service projects. Additionally, the Office of Women's Health was established in the Division of Community Health two years ago. And, in January of 2001, the Governor's Commission on Men's Health was established.

Population and Georgia Health Care Status. The changing demographics of Georgia result in new challenges for the state. These challenges are particularly acute in two areas: population growth, especially those over age 60, and rapid increase in the Hispanic population. According to the U.S. Census Bureau, in 2005 Georgia ranked 9th in population with 9,072,576 residents up from 8,186,453 in 2000 (estimate released December 22, 2005). Georgia has the sixth fastest growing population in the U. S., with an estimated increase of 150,000 people per year (GHA, 2005). One primary concern is

the aging of the population and the associated needs for health care. While the total population of Georgia is projected to grow 16% between 2000 and 2020, the population 65 and over is projected to grow 78% during the same period (HRSA, 2004). Having a high percentage of older adults whose demand for health care is high, combined with a shortage of public health professionals, places the people of Georgia at a disadvantage. The rise in the number of Hispanics who now reside in Georgia also necessitates special attention to the public health needs of this underserved population. Currently, over 500,000 people of Hispanic descent reside in Georgia.

Other factors such as poverty, low level of education, access to health care, all impact Georgia's demand for public health services. These serious health problems will only improve with an expanded commitment in the state to public health research, community-based health assessment and outreach. Improving the health status of its population will require a commitment from the state government to expand public health services, increase the number of public health professionals, and engage in large-scale public health research and education programs. Taking into consideration its rapidly growing population, its large portion of older adults, its poverty level, its lower levels of education, and its lagging health indicators, Georgia's need for public health professionals is high. And, given these population-level trends, this need will only continue to grow in the next few decades.

The very ability to assess the frequency of disease, to track trends over time, to determine underlying causes of illnesses, and to evaluate the effectiveness of programs depends on the skills and knowledge of Epidemiology. Thus, to have a robust public health work force, to collect accurate and reliable surveillance information, to plan and develop programs in public health with proper evaluation all require sophisticated understanding of Epidemiology. The University of Georgia's College of Public Health proposes to take leadership in creating a highly skilled and trained workforce in public health. The proposed program in Epidemiology at the Ph.D. level is designed to meet the future needs of the state.

3.3. Workforce Need and Academic Demand

The public health workforce in the nation, and in Georgia, may not be adequately prepared to meet current needs and face future challenges in health. According to a 2008 report from the Association of Schools of Public Health, a public health workforce shortage has grown steadily since 1980. It is estimated that 23% of the current workforce, or 110,000 people, will be eligible to retire within the next four years. In fact, today, there are 50,000 fewer public health workers in the US than in 1980. In Georgia, the same trends hold. The average age of the public health employee in Georgia is now 47 years, and almost 35% will retire by 2012. These losses are further accentuated with the steady population growth in the US and in Georgia. If these public health workers are not replaced by skilled professionals, then the nation's and state's infrastructure to deliver health care and disease prevention will be greatly diminished.

According to the American College of Epidemiology, in 2008, an estimated 4,800 epidemiologists were working in the U.S. Of these, 34% worked in state government excluding hospitals and education, 23% worked in local government, 13% worked in

public and private hospitals, 10% worked in colleges and universities, 6% worked in research and development, 4% worked in management and consulting services, and 3% were self-employed. It is projected that by 2018 there will be only 5,500 epidemiologists, a growth rate of less than 1.5% per year. Unless the number of epidemiologists entering the workforce from accredited programs increases in the next 10 years, there is likely to be a continued shortage of the highly trained scientists and public health professionals.

The work force in public health is largely supplied through the graduates of accredited schools of public health in the US. According to The Nation's Health, the official newspaper of the American Public Health Association, US public health schools supply between 80 and 85% of the nation's public health work force. To meet the needs of the future, these same schools will have to graduate three times the number of professionals. In Georgia, the ability to meet the future need is limited because there are only 3 schools of public health in the state (only 2 accredited), and only one offers the Ph.D. degree in Epidemiology. That program alone, located at Emory University, does not meet the need of MPH students graduating in the state of Georgia who desire to seek doctoral training in Epidemiology.

Leadership in public health must come from the most highly trained and skilled individuals. To this end, future leaders will emerge from the doctoral programs in Public Health, Epidemiology, and related fields. Given the unique role of the epidemiologists in the public health workforce, the nation and state will need a growing supply of well-trained skilled professionals in this field. The proposed doctoral program will contribute to the state and national efforts to produce a cadre of Ph.D. epidemiologists who can lead the public health research and academic programs, develop valid means of evaluation, provide surveillance data to key decision makers, and serve as experts in the community.

Epidemiology is currently a high demand field. Senior faculty in Epidemiology, both at UGA and other institutions, have found that most graduates of epidemiology programs move directly into their first professional job, unlike graduates from many basic science fields who enter post-doctoral fellowships for 3 to 5 years. This is because there are jobs awaiting these graduates at universities, federal health positions, local health departments, private industry, non-governmental organizations, and research organizations. Until the number of doctoral graduates in Epidemiology exceeds the current job market, the demand for these graduates will remain high. Given the shortages in public health workers and professionals, it will likely take years to meet current demand.

3.4 Level of Interest Surveys of Current Students and Alumni

At the recent national meeting of the American Public Health Association, students who visited the UGA College of Public Health informational booth often asked whether the College offered a doctoral training program in Epidemiology. These inquires confirmed a strong level of interest in doctoral training among student attendees to this national meeting.

To gauge the level of interest of current students and alumni of the College in a doctoral degree program in Epidemiology, we conducted a survey of current students (N = 63) and alumni (N = 27). Of the current students, nearly half (45%) were considering advanced training in public health or a related field, 27% were considering a Ph.D. in epidemiology. Nearly 80% of the student believed that the UGA College of Public Health should offer a Ph.D. in Epidemiology because it would boost the reputation of the College and enhance the educational environment in the College. Of the students interested in a Ph.D., many were still unsure about where they would apply, but some would definitely consider attending a doctoral program at UGA.

Of the 27 alumni of the College, about one-third indicated that they are considering doctoral training, though 30% were seriously considering the option. About 30% of the alumni would definitely consider a Ph.D. in Epidemiology, though a similar proportion were unsure whether they would pursue a doctoral degree in Epidemiology of another field. Like the current students, most (80%) believed that the College of Public Health should offer a Ph.D. in Epidemiology and that it would benefit the College in terms of educational environment and reputation. Of the alumni interested in a Ph.D. program, many were unsure about where they would obtain a doctoral degree, but some were inclined to apply to UGA.

Based on the results of this survey, current students and alumni of the College would be supportive of and interested in a doctoral program in Epidemiology at the UGA College of Public Health. With a growing graduate student body in the MPH program in the College, this would ensure a pool of potential applicants for the foreseeable future. Based on the interest expressed at the national public health meetings, students from other universities and states would also contribute to the candidate pool.

3.5. Public and Private Institutions offering Ph.D. Epidemiology

In Georgia, no state school currently offers a Ph.D. degree in Epidemiology. In the state, there is only one graduate program that offers a Ph.D. in Epidemiology and that program is at Emory University School of Public Health. In surrounding states, Ph.D. programs in Epidemiology at state universities may be found at the University of North Carolina at Chapel Hill School of Public Health, University of Tennessee College of Graduate Health Sciences, University of Miami School of Medicine, University of South Carolina's Arnold School of Public Health, University of Alabama, Birmingham, and University of Florida.

3.6. Reports from Advisory Committees and Consultants

The proposal was reviewed by Edward F. Fitzgerald, Ph.D., Professor and Chair, Department of Epidemiology and Biostatistics, School of Public Health, University at Albany, Statue University of New York, and Wilfried Karmaus, Ph.D., Graduate Director for Epidemiology, Department of Epidemiology and Biostatistics, Arnold School of Public Health, University of South Carolina. Dr. Fitzgerald concurred with the justification for the program and made specific suggestions that have been incorporated into the proposal. Dr. Karmaus has provided an alternative approach to teach the progression from basic to advanced topics in Epidemiology. We have retained the

sequence of proposed courses but have expanded the methods to be included in each course.

4. Procedures to Develop Program

The development of this Ph.D. program in Epidemiology is part of the strategic plan of the College of Public Health to build a national reputation in the field of Epidemiology. The program was developed in response to national documents (e.g., Healthy People 2000 and Health People 2010) that describe major health problems in the U.S. and establish objectives and priorities for solving these problems.

Establishing itself as a state and national leader in public health was a primary goal of the public health initiative at UGA. Following the creation and approval of a Masters in Public Health (MPH) in 2004, the University System of Georgia's Board of Regents approved the formation of the College of Public Health.

Since 2005, the College has implemented a successful campaign to recruit senior faculty to leadership positions in the College. One of the newly formed departments was the Department of Epidemiology and Biostatistics. Within 4 years of launching the College, this department has grown from just two faculty members to now eight full-time Epidemiology faculty members and six adjunct members within the University with expertise and training in Epidemiology. The department also has five faculty members in Biostatistics who provide teaching and research opportunities. These faculty are now engaged in teaching graduate level courses at the masters level and are developing federally funded research programs.

Beginning in the Fall 2008, the faculty began to consider the idea of developing a Ph.D. program in the College. During a departmental retreat, in the spring of 2009, Dr. Whalen, the chair of the curriculum committee in the department, was assigned the responsibility of developing the application. Specifically for this application, Dr. Whalen and his colleagues reviewed the current workforce needs in Epidemiology as published by the Centers for Disease Control and the American College of Epidemiology. Drs. Valeika and Robb conducted a survey of current MPH students and alumni of the MPH program to gauge the level of interest in a doctoral Epidemiology program. Through contacts in professional societies, three external readers were asked to read and comment on the proposed program. Finally, the proposed doctoral curriculum was developed and reviewed by the faculty in Epidemiology. Once all parties have contributed to the application, it was formally approved by the faculty, as indicated in the minutes of April 16 2010.

The approved program was then submitted the College Curriculum and Academic Affairs Committee for its review. Revisions and corrections were made following this review and a final version was approved on August 19, 2010 and sent to the College Dean.

5. Curriculum

The degree of Doctor of Philosophy in Epidemiology will be awarded in recognition of in-depth knowledge and a comprehensive understanding of the field of Epidemiology together with a demonstrated ability to perform independent research and to communicate clearly the results of such research. In this program, a student will acquire advanced knowledge and expertise in epidemiology by taking and passing a series of core and elective courses and by completing an independent research project under the direction of a faculty mentor. Advanced knowledge will be demonstrated by passing a written and oral comprehensive examination. Research expertise will be demonstrated through the successful completion and defense of a dissertation research project. As part of this requirement, students will form a dissertation committee, write and defend a dissertation prospectus (i.e., proposal) for the committee, complete the dissertation research project, and write and defend the final dissertation for the committee and other members of the academic community at the University. The student is guided through the experience by a research advisor (mentor) and Advisory Committee.

The proposed program requires 55 credits to complete the Ph.D. degree in Epidemiology. This program will include 30 credits of advanced coursework in Epidemiology and Biostatistics, 12 credits of approved electives, a minimum of 10 credits of dissertation research, and 3 credits of dissertation writing.

The Ph.D. Epidemiology degree will be granted in recognition of proficiency in research, breadth and soundness of scholarship, and thorough knowledge of field of Epidemiology, not upon completion of any definite amount of work prescribed in advance. Evidence of such achievement will be provided through the passing of written and oral comprehensive examinations and successful defense of a dissertation based upon a mentored research project.

5.1 Acceptance to the Program

An applicant may be admitted to the Ph.D. Epidemiology degree program upon certification by the major department that he or she is a person of proper attainment and promise, that appropriate courses may be adequately given, and that the student's research can be adequately supported and directed. Such admission must be to an authorized field and must be approved by the dean of the Graduate School.

Students may apply to this program with either a Bachelor’s or Master’s degree with specific prerequisites (Section 5.3.2). Regardless of the background, students must demonstrate strong quantitative skills, critical thinking, creativity, and a strong interest in Public Health, Epidemiology and research. Applications to the Ph.D. program will be reviewed by Departmental faculty and offers of acceptance made to qualified candidates. Admission will be based on evaluation of the applicant’s educational background and any work experience, past performance, and potential to provide leadership in the field of Epidemiology. Admission requirements will include:

- Official GRE test scores sent by the testing agency to the Graduate School. On a case-by-case basis, the MCAT may be substituted.

- Official transcripts from each institution attended (International applicants must submit official academic record and proof of degrees.)
- Completion of the College of Public Health's admissions questionnaire, personal statement and School of Public Health Application Service (SOPHAS) application
- Current resume or curriculum vitae
- Three letters of recommendation from former teachers, employers, or other individuals who are familiar with the applicant's potential to complete the rigorous requirements of the degree.
- International applicants must meet all requirements as determined by the Office for International Education at the University. All Graduate School International Education Requirements must be met.

5.2 Advisors and Advisory Committees

At the time admission to the Ph.D. program or during the semester of matriculation, the student will be assigned a Departmental academic advisor. This advisor will orient the student to the University, College and Department and assist the student in developing the Plan of Study. Once the student has developed an area of research interest, the student may select a Major Professor who will become the Research Advisor for the student's dissertation research. The selection must be mutually agreed upon by the student and major professor and approved by the departmental graduate coordinator and department head. The Research Advisor will assist the student in assembling the Advisory Committee and serve as the committee chair. The Research Advisor and Committee will provide advice regarding course selection, ensure the mastery of research skills, and provide a compelling research environment for the dissertation research.

The research advisor is the faculty member in the department who will mentor the pre-doctoral student in their Ph.D. dissertation. The research advisor therefore has the scientific and methodological expertise in the topic and area of the study proposed research. The research advisor is most directly responsible for the scientific content of the dissertation project and will be the primary resource for the student during the research project. The research advisor is expected to provide advice regarding course selection, mentorship in research conception, methods, performance, and ethics. The Research Advisor will provide a challenging research environment for the dissertation research, and will help the student build professional contacts in the field. This person determines when the student is ready to defend the proposal and final thesis.

Advisory Committee

Before the end of the first year of residence, a prospective candidate for the Ph.D. in Epidemiology and upon the recommendation of the departmental graduate coordinator, the dean of the Graduate School shall approve an Advisory Committee for the student. This Advisory Committee will consist of a minimum of three graduate faculty members from the Department of Epidemiology and Biostatistics and one member from outside the department. Adjunct faculty in the Department may serve in the same capacity as faculty members with a primary appointment but cannot serve as chair of the Advisory Committee. Adjunct faculty may serve as co-chairs of committees. Additional voting

members may be appointed to the committee, including no more than one non-UGA faculty, who must hold the terminal degree in their field of study. If there are more than three members, there must be greater than 50% graduate faculty representation. The committee will be recommended to the dean of the Graduate School by the graduate coordinator after the student has notified in writing the coordinator of the committee members.

The Advisory Committee is charged with planning the student's program of study, approving the program of study, arranging the comprehensive written and oral examinations, approving a subject for the dissertation, approving the dissertation prospectus, approving the completed dissertation, and approving the student's defense of his or her research. The committee should advise the student of required research skills and other requirements.

Departmental recommendations for the advisory committee, and any replacements, shall be determined by procedures approved by a majority of the graduate faculty of the department.

5.3.Course Requirements

5.3.1 Core and Cross-Cutting Competencies: Student Learning Objectives

The Department of Epidemiology and Biostatistics embraces the discipline-specific core competencies and cross-cutting/interdisciplinary competencies set forth by the Association of Schools of Public Health (Version 2.3, August 2006).

For Epidemiology there are 10 Core Competencies: 1) Identify key sources of data for epidemiologic purposes; 2) Identify the principles and limitations of public health screening programs; 3) Describe a public health problem in terms of magnitude, person, time, and place; 4) Explain the importance of epidemiology for informing scientific, ethical, economic, and political discussion of health issues; 5) Comprehend basic ethical and legal principles pertaining to the collection, maintenance, use, and dissemination of epidemiologic data; 6) Apply the basic terminology and definitions of epidemiology; 7) Calculate epidemiology measures; 8) Communicate epidemiologic information to professional and lay audiences; 9) Draw appropriate inferences from epidemiologic data; 10) Evaluate the strengths and limitations of epidemiologic reports.

In addition to these core competencies in epidemiology, there are a set of interdisciplinary and cross-cutting competencies that form the basis for the doctoral level training. These interdisciplinary competencies are: Communications and Informatics; Diversity and Culture; Leadership; Public Health Biology; Professionalism; Program Planning; Systems Thinking.

The following doctoral objectives are premised upon the student having successfully met all of the objectives of the MPH degree.

1. Understand the epidemiology of health outcomes and health promoting behaviors of public health importance and have a good working knowledge of one exposure or outcome or a broad category of outcomes.
2. Develop expertise in the full array of epidemiologic study designs, sampling approaches, and analytic techniques.
3. Extend the body of epidemiologic knowledge regarding disease etiology and/or methodological approaches and communicate these findings through publications and teaching.
4. Design and implement a research protocol aimed at testing an epidemiologic hypothesis that advances knowledge in the field, and analyze and interpret the data with dissemination of the results to the scientific community.
5. Teach basic epidemiologic concepts and methods at the master's level.
6. Prepare research grant proposals for peer review by national funding agencies.
7. Act as a consultant to researchers and other professionals who seek advice on epidemiologic designs and methods.

Overall competencies for the Ph.D. in Epidemiology are based on the workshop summary on doctoral education in epidemiology sponsored by the American College of Epidemiology and the Association of Schools of Public Health held in Baltimore, MD, December 9-11, 2002. Students are expected to become proficient in the following areas: descriptive epidemiology, biology (a human physiology equivalent with competence in the dissertation disease topic), basic knowledge of the leading public health problems and the history of the discipline, problem conceptualization, study design, data collection and monitoring, data management, data analysis, interpretation, communication, ethics, a substantive area of original research and project management.

5.3.2 Pre-Requisite Courses

All students entering the program must have taken courses at the undergraduate or graduate level in mathematics (including calculus) plus one or more courses in biology, biomedical sciences, or social sciences.

For students already holding an MPH degree, or a related degree (e.g., M.S. Epidemiology, M.S. Biostatistics, M.S.P.H.), the student must show proficiency in the content and material offered in the following basic courses taught in the College: Introduction to Epidemiology (EPID 7010), Epidemiologic Methods (EPID 7020), Introduction to Biostatistics (BIOS 7010), Linear Regression Analysis (BIOS 7020), and at least one other course in Epidemiology (e.g., chronic disease epidemiology, infectious disease epidemiology, environmental epidemiology). The student must complete these courses with a grade of B or higher, as indicated on their official transcript. For students admitted with only a Bachelor's degree a more detailed and lengthy course of study including the basic courses above must be completed as noted below. For students without an MPH degree, with a Master's or doctoral degree in a discipline other than Public Health or Epidemiology, or for students admitted from programs other than an accredited College of Public Health (or accredited MPH program), or for applicants with master's level training more than five years prior to

matriculation, a placement examination will be required at the time of entry into the program to assess the need for remedial coursework in the core courses in Epidemiology. These refresher course requirements will be taken as soon as possible during the student's program and will not be applied after the Plan of Study is developed. These courses will not count toward the Ph.D. degree but are taken in addition to the required hours for the degree. The departmental faculty also may require other extra courses on a case-by-case basis.

5.3.3 Program of Study

The doctoral student and academic advisor will develop a preliminary program of study to meet the requirements of the degree. This plan of study will be submitted to the graduate coordinator by the end of the student's first year of residence. The program of study will include all required courses, electives relevant to the student's interests, and dissertation courses. This program must include 16 or more hours of 8000- and 9000-level courses in addition to research, dissertation writing, and directed study. Doctoral research (9000), independent study courses, and dissertation writing (9300) may not be counted in these 16 hours. The program of study must carry a minimum of 30 hours of course work and three hours of dissertation writing (9300). In the course of completing these requirements, the student will fulfill the requirements as stipulated by the Graduate School (http://www.uga.edu/gradschool/academics/PhD_req.html).

A final program of study will be submitted to the graduate coordinator in the Department and the Graduate School before notification of the comprehensive examination. This program of study must be submitted on the proper form for approval by the graduate coordinator, and the dean of the Graduate School. The final program of study must show all graduate courses relevant to the doctoral program and not just courses satisfying the minimum degree requirement. Courses from the master's degree and courses taken at other universities should be listed in the "Relevant Master's or Other Graduate Degree Courses" section of the program of study form.

5.3.4 Coursework for Ph.D. Epidemiology

To complete the Ph.D. in Epidemiology the student will complete a total of 55 credits (Table 1) beyond the requirements of a master's degree. The student must complete 30 credit hours of core courses, 12 credit hours of elective courses, a minimum of 10 credit hours of

Table 1. Summary of credit hours required for Ph.D. in Epidemiology

Requirements	Course	Credit Hours
Core Courses	Table 2	30
EPID		15
BIOS		9
Seminar		3
Teaching Practicum		3
Elective Courses	Table 3	12
Dissertation Research	EPID 9000	10
Dissertation Writing	EPID 9300	3
Total		55

dissertation research (EPID 9000) and 3 credit hours of dissertation writing (EPID 9300). This program represents the minimum number of credits needed to graduate; a student may exceed this number of credit hours in a Plan of Study.

The required core coursework (Table 2) will strengthen the foundations in epidemiology and provide substantial depth in study design and analysis. It also includes at least three graduate level courses (9 credit hours) in biostatistics (Table 1).

Table 2. Required Core courses for Ph.D. in Epidemiology (total 30 credit hours)

Course	Credit Hours	Description
EPID 8010	3	Cohort Study Design, Implementation, and Analysis
EPID 8020	3	Case Control Designs, Implementation, and Analysis
EPID 7100	3	Seminar in Epidemiology (3 semesters)
EPID 8030	3	Teaching Practicum
EPID 8040	3	Clinical Trial Designs, Implementation, and Analysis
EPID 8050	3	Integrating Research Designs
EPID 7700	3	Biomedical Ethics and Research Integrity in Epidemiology
BIOS	9	At least three of the following*: Statistical Analysis of Clinical Trials (BIOS 8220) Survival Analysis (BIOS 6380) Categorical Data Analysis (BIOS 8110) Longitudinal Data Analysis (BIOS number to be assigned)
Total	30	

* As new Biostatistics courses are developed and offered, the list of selective courses will be expanded accordingly.

The program will include 12 credits of elective courses (Table 1) that will allow the student to pursue specialized interests and add depth or breadth to their experience. Students may choose from elective courses (Table 3) in specialty areas of Epidemiology or from courses outside of the Department, as long as the course is approved by the academic advisor and is included in the Plan of Study. As relevant courses are developed in the Department, College and University, they will be made available to the students for electives.

To complete the requirements for the degree, students must design, proposed, conduct, analyze, and defend a Ph.D. dissertation. The dissertation requires a minimum of 10 credit hours of dissertation research (EPID 9000) during which time the student conducts the study. Up to 5 credit hours of EPID 9000 may be taken before advancing to candidacy. The student must take at least 3 credit hours of dissertation writing (EPID 9300). The student must be registered in EPID 9300 in the semester of the final dissertation defense.

Table 3. Current Elective Courses offered through the College of Public Health for Ph.D. in Epidemiology. Twelve credits of electives are required to complete the degree*.

Course	Credit Hours	Description
EPID 8070	3	Environmental and Occupational Epidemiology
EPID 8100	3	Clinical Epidemiology
EPID 8200	3	Molecular Epidemiology
EPID 8250	3	Biomarkers
EPID 8300	3	Epidemiology of Aging
EPID 8410	3	Cancer Epidemiology
EPID 8515	3	Modeling of Infectious Diseases
EPID 8520	3	Food Safety Epidemiology
EPID 8540	3	Microbial Quantitative Risk Assessment
EPID 8540L	1	Microbial Quantitative Risk Assessment Laboratory
EPID 8600	3	Social Epidemiology
EPID 8610	3	Global Health
EPID 8900	3	Selected Topics in Epidemiology
EPID 8910	3	Special Problems in Epidemiology
EPID 9000	3	Dissertation Research
EPID 9005	3	Graduate Student Seminar
EPID 9300	3	Dissertation Writing

* This list of electives will expand and change with time as the faculty develop and offer new courses and when new faculty members develop their courses.

Students may transfer up to 9 credits to apply toward their degree in accordance with Graduate Student policy and procedures.

New Courses in Epidemiology for PhD Program

To meet the educational objectives of the doctoral program in Epidemiology, the Department has developed a five course series to meet the educational goals of the program. These courses will be taken during the first two years of the program before advancing to Candidacy. These courses will primarily focus on the development of advanced skills and provide doctoral students with the most advanced methodologic knowledge in the field.

EPID 8010 – Cohort Study Design, Implementation, and Analysis
This course provides a comprehensive and advanced presentation of the cohort study, with emphasis placed on cohort study design and cohort data analysis. The course will cover the conceptual framework underlying cohort studies, planning and conducting a cohort study, basic concepts of time, exposure and outcome, and methods in the analysis of survival and longitudinal data. Analytic methods covered in the course will include, but are not limited to: analysis of age, period, and cohort effects, analysis of incidence rates, analysis of repeated measures, and analysis of time-to-event data. The course will be taught through didactic lectures, analysis of datasets, homework problem sets, and group projects with presentations and written assignments. Prerequisites: Knowledge of at least one statistical analysis software, EPID 7010, EPID 7020, BIOS 7010, BIOS 7020.

EPID 8020 – Case-Control Design, Implementation, and Analysis
The course will focus on the family of case-control study designs and will provide a quantitative framework for the design, analysis, and interpretation of case-control studies. The course will teach theoretical and applied concepts including subject selection, exposure measurement, validity, reliability, sample size and power, effect modification, confounding, bias, risk assessment, matching, stratified data analysis, and logistic regression. The course will be taught through didactic lectures, analysis of datasets, homework problem sets, and group projects with presentations and written assignments. Prerequisites: Knowledge of at least one statistical analysis software, EPID 7010, EPID 7020, BIOS 7010, BIOS 7020.

EPID 8030. Teaching Practicum Requirement
Because one of the main goals of any Ph.D. program is to train the future educators in the field, the proposed program will include a teaching practicum. The teaching requirement is also included because it is often through teaching that the greatest depth of understanding comes. The purpose of this practicum will be to give advanced students the opportunity to teach basic concepts and principles under the guidance of an experienced instructor. Students taking this course will be required to develop the teaching materials for 5 classes during the course of the semester. These materials will include a syllabus, required and recommended readings, lecture notes, visual aids, and frequently asked questions with answers. The student will teach the designated classes in the presence of the course instructor. The student will also participate in developing the assignments and tests to assess the performance of students in the class.

EPID 8040 Randomized Clinical Trials: An Introduction
This course will present the basic concepts and principles of randomized clinical trials. Randomized clinical trials offer the highest quality of evidence for a new or alternative treatment or intervention. The course will cover major trial designs, such as phase I – III trials, community randomized trials, and equivalence trials. The course will cover practical issues around implementation the study and analysis of clinical trials. Topics include legal and ethical issues in the design; application of concepts of controls, masking, and randomization; steps required for quality data collection; monitoring for

evidence of adverse or beneficial treatment effects through interim analysis; elements of organizational structure; sample size calculations and data analysis procedures; and common mistakes. Students interested in the statistical analysis of clinical trials will proceed to take BIOS 8220. Prerequisites: Knowledge of at least one statistical analysis software, EPID 7010, EPID 7020, BIOS 7010, BIOS 7020.

EPID 8050 – Integrating Research Designs

The objective of this course is to synthesize content, design and analysis into a coherent research plan. The didactic portion of the course will cover causality in epidemiology, scientific method including hypothesis testing and interval estimation, sample size estimation, and sampling strategies. Through working groups and class presentations, students will develop research proposals in areas of interest. These proposals will be organized like a grant and include research goals, specific aims, rationale and justification, study design, analytic strategy, sample size, and an assessment of potential weaknesses and alternative approaches. The final proposal will be presented for each student and a written document evaluated by the class as if by a grant review committee. Pre-requisites: EPID 8010, EPID 8020, EPID 8030, EPID 8040.

EPID 9005 PhD Epidemiology Seminar

The Ph.D. Epidemiology Seminar series will address the practical and applied aspects of graduate training in Epidemiology. The objective of the seminar will be to provide direction in grant writing, manuscript writing, poster presentation, oral presentations, and report writing.

Sample Plan of Study

The following are two sample Plans of Study. The first illustrates a Plan of Study for a student who enters the program with an MPH degree (Table 4) and no need for remedial course work. The second illustrates a Plan of Study for a student entering with a Bachelor's degree (Table 5) or with need for remedial course work in Epidemiology.

Table 4. Sample program of study for Ph.D. Epidemiology for students entering with an MPH or equivalent degree and no remedial requirements (4 years)

Year	Fall Semester	Spring Semester
1	Cohort Study EPID 8010 (3) BIOS Selective (3) Seminar EPID 7100 (1) Ethics EPID 7700 (3)	Case Control EPID 8020 (3) Epidemiology Elective 1 (3) Seminar EPID 7100 (1) Teaching Practicum 8030 (3)
2	Integrating Designs EPID 8050 (3) BIOS Selective (3) Epidemiology Elective 2 (3) Epidemiology Elective 3 (3) Seminar EPID 7100 (1)	Epidemiology Elective 4 (3) BIOS Selective (3) Randomized Trials EPID 8040 (3)
3	Research EPID 9000 (6)	Research EPID 9000 (6)
4	Research EPID 9000 (3)	Dissertation Writing EPID 9300 (3)

Table 5. Sample program of study for Ph.D. Epidemiology for students entering with an Bachelors degree (5 years)

Year	Fall Semester	Spring Semester
1	Introduction to Epidemiology EPID 7010 Introduction to Biostatistics BIOS 7010 Seminar EPID 7100 (1) Topics in Biostatistics BIOS 8900	Epidemiology EPID 7020 Biostatistics BIOS 7020 Seminar EPID 7100 (1) Epidemiology Elective 1 (3)
2	Chronic Disease Epidemiology EPID 8400 Infectious Disease Epidemiology EPID 8500 Ethics EPID 7700 (3) Seminar EPID 7100 (1)	Case Control EPID 8020 (3) Randomized Trials EPID 8040 (3) BIOS Selective (3) Epidemiology Elective 2 (3) Seminar EPID 7100 (1)
3	Cohort Study EPID 8010 (3) Integrating Designs EPID 8050 (3) Epidemiology Elective 3 (3) BIOS Selective (3) Seminar EPID 7100 (1)	Epidemiology Elective 4 (3) BIOS Selective (3) Teaching Practicum 8030 (3)
4	Research EPID 9000 (6)	Research EPID 9000 (6)
5	Research EPID 9000 (3)	Dissertation Writing EPID 9300 (3) Graduation

5.4 Comprehensive Examination

The doctoral Qualifying Examination will be taken after completing the core doctoral level courses. The intent of the Qualifying Exam is to measure potential for doctoral research and to assess the student's basic technical and professional knowledge. The Qualifying Exam will consist of three parts. The first two parts will be written and the third oral. Part I will consist of an in-class multiple choice and short-answer test consisting of approximately 100 questions. Part II will consist of a one week long, take-home test in which the student will answer 4 essay questions. Part III will consist of an oral examination which will take place before (or at the time of) the Ph.D. Prospectus defense.

Students must pass all three parts to pass the entire examination and proceed to candidacy. The examination will be offered sequentially so that a student who fails one part may re-take that part of the examination before proceeding. If the student fails on two occasions on any one part, or more than one part, of the sequence of examinations, the student will be given a failing grade for the examination.

Students who fail this examination will be awarded a Masters Degree either in Public Health (if they do not already have this degree) or in Epidemiology. Students who choose to graduate with an MPH degree must complete any remaining required courses for that program. At the time of this submission, there is no M.S. Epidemiology degree

approved, but that application is forthcoming and should be approved by the time any Ph.D. candidates reach this stage in their program.

The Departmental faculty has the responsibility of scheduling and administering the Qualifying Examination. It is the responsibility of the student to get the approval of his/her academic advisor and notify the Graduate Coordinator in writing of his/her intent to take the examination at least one month prior to the examination.

A student must be registered for at least three credits during the semester in which the general examination is taken.

Qualifying Examination Part I

Part I of the General Examination will cover study design, research methods, statistical analysis of epidemiologic data, and other advanced topics. The examination will require a full understanding of the basic material taught in the pre-requisite courses (EPID 7010, EPID 7020, BIOS 7010, EPID 8500, EPID Chronic Diseases) but will focus on the advanced materials taught in the core courses outlined in Table 2.

Qualifying Examination Part II

Part II of the General Examination may only be taken after passing Part I. This part of the Qualifying Examination tests the student's ability to synthesize their knowledge of epidemiology and to deal with real-world medical and public health problems. Questions on this examination may cover all aspects of epidemiology, including questions on topics not specifically taught in the program. It is expected that students have acquired the skills to evaluate and respond to a broad range of epidemiologic problems - not just those topics covered by formal courses or problems within their discipline. Questions may cover, but not be limited to, the following areas: cardiovascular disease, cancer, infectious diseases, neuro-psychiatric disease, pharmaco-epidemiology, maternal child health, environmental epidemiology, international health, theoretical epidemiology. We expect the student to have comprehensive knowledge of study design, epidemiologic methods, and biostatistics including topics such as survey design, measurement, clinical trials, data analysis, and ethics. We also expect students to demonstrate the ability to integrate advanced epidemiologic content to create a cohesive document on questions relating to these topics. Part II will be a take home test, given over 1 week. Students will be given 7 to 8 questions; they will be required to write and submit answers to four of them.

Qualifying Examination, Oral

After passing parts I and II of the Qualifying Examination, the student will be required to complete an oral examination administered by the student's Advisory Committee. This oral examination will test the student's understanding of complex epidemiologic concepts and how they are applied to solve real-world problems. This part of the exam will be scheduled after the written exams and before the defense of the Ph.D. prospectus.

5.5 Admission to Candidacy

The student is responsible for initiating an application for admission to candidacy so that it is filed with the dean of the Graduate School within one semester of successfully defending the dissertation prospectus and at least one full semester before the date of graduation. This application is a certification by the Department of Epidemiology and Biostatistics that the student has demonstrated the ability to do acceptable graduate work in the chosen field of study and that:

- all prerequisites set as a condition to admission have been satisfactorily completed;
- research skills requirements have been met;
- the final program of study has been approved by the advisory committee, the graduate coordinator, and the dean of the Graduate School;
- an average of 3.0 (B) has been maintained on all graduate courses taken and on all completed courses on the program of study (no course with a grade below C may be placed on the final program of study);
- written and oral comprehensive examinations have been passed and reported to the Graduate School;
- the advisory committee, including any necessary changes in the membership, is confirmed and all its members have been notified of their appointment;
- a dissertation prospectus has been approved (if required for candidacy);
- the residence requirement has been met.

After admission to candidacy, a student must register for a minimum combined total of 10 hours of dissertation or other appropriate graduate credit during the completion of the degree program. The student must also meet all other deadlines for graduation in that semester.

Once a student has been admitted to candidacy, the department has an ethical responsibility to ensure that appropriate faculty mentorship is provided to the candidate for completion of the degree.

5.6 Ph.D. Dissertation Research and Defense

The Ph.D. dissertation consists of five distinct steps: selection of a research topic, writing and defending a research prospectus, performing the proposed research, and writing a dissertation document, and defending the Ph.D. dissertation. Each step is described briefly below. The Research Advisor and the Advisory Committee are responsible for guidance through these steps, supervision of research, and assessment of performance. .

Selecting a Research Topic

The spectrum of possible research projects is broad, and may consist of primary data collection or use of existing databases. The choice of research topic will be determined by the student's scientific interests, availability and content of research opportunities, availability of research funding, and the influence of her/his research advisor and Advisory Committee.

Defending Ph.D. Dissertation Prospectus
The Dissertation Prospectus is a proposal of the research that will be performed in partial fulfillment of the graduation requirements. In consultation with the Research Advisor and Committee, the student will identify an area of research and prepare a written proposal. This proposal will include research goals and aims, background and rationale, detailed description of methods proposed, and an analytic strategy. The prospectus must also include consideration of ethical issues involved in the research. Once the prospectus has been read and approved by the Advisory Committee, the student will notify the graduate coordinator of his or her plans to present the prospectus in a public setting. All the committee members must approve the final version of the proposal in writing.

Performing Research Project
Once the prospectus has been presented and approved, the student should complete the research under the supervision of the Research Advisor. The Research Advisor is responsible for mentoring the student through the steps and procedures of the research project. Other members of the Advisory Committee are engaged by the student as the need arises. In any case, the student should arrange to meet regularly (at least twice a year) with the Advisory Committee members during the conduct of the research project to provide an update on progress.

Dissertation Document
After the student has completed the proposed research project, the student must write and submit the Ph.D. dissertation to the Research Advisor for approval. Students are expected to write a dissertation that represents a significant contribution of new knowledge to the field. Specific dissertation requirements may be dictated by the Advisory Committee, including format and content. The dissertation document must contain an Introduction, Literature Review, description of methods, Results, Discussion and Conclusion. Whether the dissertation is formatted as a single document or multiple journal-style manuscripts will be left to the Advisory Committee. At least a portion of the dissertation must be suitable for publication.

The dissertation must be of sufficient scope and depth to meet the expectations of Advisory Committee. When the Research Advisor is satisfied with the completed dissertation, he or she will certify its approval and distribute copies of the dissertation to the remaining members of the Advisory Committee. The committee members must have three weeks to read and evaluate the completed dissertation. Written assent of the committee members (other than the major professor) will be required before a dissertation will be approved as ready for a final defense. No more than one dissenting vote may be allowed for the approval of the dissertation. If the advisory committee declines to approve the dissertation as ready for the final defense, the Research Advisor will notify the student and assist with further research and/or corrections.

Oral Dissertation Defense
Once the Advisory Committee has approved the dissertation, the Research Advisor will notify the student and schedule a final oral defense. The date and time of the oral defense will be set by the Research advisor and the committee members. The graduate

coordinator must notify the Graduate School at least two weeks prior to the defense. Subsequently, the Graduate School will announce the time and place of the defense of the dissertation to the University community.

The student must give an oral presentation that summarizes the major findings of the research project and respond to questions from the public audience and the committee members. The defense of the dissertation will be chaired by the student's Research Advisor and attended by all members of the Advisory Committee simultaneously for the entire examination period. It is open to all members of the University community.

To pass the dissertation defense, the Research Advisor must approve the defense and other committee members must agree to pass the student. One dissenting vote in the committee is allowed, as long as the dissenting vote is not cast by the Research Advisor. The committee will indicate approval in writing with signatures on all appropriate forms provided by the University.

Once the written dissertation has been approved by the advisory committee and the final oral examination has been passed, the dissertation must be submitted to the Graduate School for final approval no later than two weeks prior to graduation of the following semester. Dissertations which are not submitted by this deadline must be defended again and approved by the advisory committee before they will be considered by the Graduate School for final approval.

6. Inventory of Faculty

The Department of Epidemiology and Biostatistics has grown rapidly in the past two years and has recruited top-level faculty members at all ranks. The Epidemiology faculty includes experts in the fields of infectious disease epidemiology, cancer epidemiology, chronic disease epidemiology, mathematical modeling, and food security. The Biostatistics faculty has expertise in a broad base of statistical theory and practice with special expertise in survival analysis, categorical data analysis, longitudinal data analysis, data mining, among other important methods. The adjunct faculty provide expertise in global health, public health practice, food safety, exercise and disease, and zoonotic diseases.

There are 13 primary and 6 adjunct faculty members in the Department of Epidemiology and Biostatistics (Table 6.1). Of the 13 primary faculty, 8 specialize in Epidemiology and 5 in Biostatistics. There are 4 full professors, 1 associate professor, and 8 assistant professors. There is currently a search committee for an assistant professor in molecular epidemiology. This Department has the content expertise, experience, research productivity, and size to support a Ph.D. program in Epidemiology.

6.1. Faculty in the Department of Epidemiology and Biostatistics with rank, credentials, program role, including Adjunct faculty members.

Name	Rank	Credentials	Program Role
Mark Ebell	Associate Professor	M.D. 1987 M.S.	Teaching and Research Faculty
Robert Galen	Professor	M.D. 1970 M.P.H	Associate Dean Teaching and Research Faculty
Andreas Handel	Assistant Professor	Ph. D. 2004	Teaching and Research Faculty
James Oloya	Assistant Professor	D.V.M. 1992 Ph. D. 2006	Teaching and Research Faculty
Claire Robb	Assistant Professor	Ph. D. 2003 MPH 2003	Teaching and Research Faculty
Steven Valeika	Assistant Professor	D.V.M. 2001 Ph. D 2008	Teaching and Research Faculty
John E. Vena	Professor	Ph. D. 1980 M.S. 1976	Department Head
Christopher Whalen	Professor	M.D. 1984 M.S. Epidemiology 1992	Program Coordinator
Ming Zhang	Assistant Professor	Ph.D. Bioinformatics	Teaching and Research Faculty
Biostatistics Faculty			
Kevin Dobbin	Assistant Professor	Ph. D. 2001	Teaching Faculty and Research
Woncheol Jang	Assistant Professor	Ph. D. 2003	Teaching Faculty and Research
Stephen Rathbun	Professor	Ph. D. 1990	Teaching Faculty and Research
Xiao Song	Assistant Professor	Ph. D. 2002	Teaching Faculty and Research
Adjunct Faculty			
Claude Burnett	Adjunct Associate Professor	M.P.H. M.D.	Teaching Faculty
Al Langford	Adjunct Professor	M.D.	Teaching Faculty
Anil Mangla	Adjunct Assistant Professor	M.P.H. Ph. D.	Teaching Faculty
Michael Schmidt	Assistant Professor, Kinesiology,	Ph.D., 2005	Teaching and Research Faculty
David Stallnecht	Professor, College of	Ph.D.	Teaching and

	Veterinary Medicine		Research Faculty
Roy Berghaus	Assistant Professor, Department of Population Health College of Veterinary Medicine	D.V.M., 1994 Ph.D., 2006	Teaching and Research

The Epidemiology faculty in the Department is academically productive. Over the past five years, primary faculty members have published 120 articles in their respective fields. Many of these publications appeared in top level specialty journals in Epidemiology. Senior faculty members are recognized nationally and internationally, having been invited to present at 58 conferences or meetings.

The excellent level of scholarship has been supported by federally funded research and training grants to members of the Department. All members of the department are principal investigators or co-investigators on one or more grants. Total award amounts exceed $10 million. This funding will provide an excellent base to support pre-doctoral students in the program as well as access to current research projects directed by faculty.

6.2. Table of Scholarship and publication during past 5 years for Epidemiology and Biostatistics Faculty

Name	Articles	Book Chapters	Reports	Reviews/Editorials	Abstract Presentation	Invited Presentations
Mark Ebell	4	12	4	70	0	15
Robert Galen	3	3	0	1	2	27
Andreas Handel	18	1	0	0	4	9
James Oloya	17	1	0	2	0	4
Claire Robb	7	0	0	0	0	0
Steven Valeika	5	0	0	0	0	0
John Vena	31	0	0	1	18	5
Christopher Whalen	37	1	0	5	10	12
Biostatistics Faculty						
Woncheol Jang	8	1	0	22	-	13
Kevin Dobbin	7	1	1	35	-	7

Stephen Rathbun	8	2	0	35	-	6
Xiao Song	8	0	0	20	-	7

6.4 Current grant support for faculty in the Department of Epidemiology and Biostatistics

Primary Investigator	Title of Grant	Grant Agency and Number	Annual Costs	Total Amount of Grant	Number of Years Awarded
Mark Ebell	Using Physician Questions at the Point of care as a Needs Assessment for Continuing Education	2010-10222-0	$50,000	$50,000	1
Andreas Handel	Quantitative Studies of CD8 T-cell Dynamics	5K25AI072193			5
John Vena	Georgia Cancer Coalition	038505	$150,000	$750,000	5
John Vena (Co-Investigator)	Impact of Physical Activity on Stroke and Cognitive Function in Older Adults	NIH R01		$3,569,616	5
John Vena (Co-Investigator	The New York State Angler Cohort Study	NIH 1 R01 TS000077-01	$126,107		5
John Vena (Co-Investigator	Environmental Determinants of Pulmonary Disease: A New Approach to an Old Problem	1 KO EH000287-01	$138,889	$450,000	3
John Vena (Co-Investigator	Environmental Determinants of Systemic Lupus Erythematosus Among African Americans in Coastal Carolina and Georgia	NIH 1R21ES017934 – 01		$1,325,327	4
Woncheol Jang	Development of Software for Comparative/Quantiative Clinical Proteomics	2R42GM083525-02			1
Steven Valeika (Co-	Risk Analysis of Avian Influenza Infection from	(CDC)		$2,600,000	5

Investigator)	Recreational Exposures to Freshwater				
Christopher Whalen	AIDS International Research and Training Program	NIH TW00011	$278,000	$1,389,995	5
Christopher Whalen	Uganda HIV/TB COHRE Training Program	NIH TW06900	$233,773	$1.083,244	5
Christopher Whalen	HIV TB Therapeutic Trial	NIH AI 51219	$471,323	$2,356,616	7
Xiao Song	Statistical Designs for Marker Validation Studies in Treatment Elections	VA (IPA)	$24,012		2
Sangwook Kang	Survival Data Analysis with Application to Epidemiology	UGARF	$7,609	$7,609	1

6.5. Roles and Responsibilities in Proposed Program

The Head of the Department will appoint a Graduate Coordinator who will oversee the doctoral program. The primary faculty will both teach courses and act as the research mentors for doctoral students. The graduate coordinator will be responsible for approving plans of study, notifying the Graduate School when a student advances to candidacy, addressing curricular needs, and assigning research mentors. The graduate coordinator will keep the faculty informed about the progress of students at regular faculty meetings.

7. Programs in Other Institutions

The current program was developed by faculty who have completed doctoral training at or taught at multiple, top-tiered schools of public health or departments of Epidemiology and Biostatistics. Thus, the current proposal incorporates features of some of the most successful doctoral programs in Epidemiology adapted to the educational milieu in the College of Public Health at the University of Georgia. Below are three regional schools that offer a doctoral degree in Epidemiology and are considered excellent programs. For more complete descriptions of the programs, please refer to the Appendix.

7.1. University of North Carolina, Chapel Hill School of Public Health

Nancy Colvin, MS
Assistant to the Chair for Graduate Studies
Dept of Epidemiology
UNC-CH SPH
Chapel Hill NC 27599-7435
Ph: 919-966-7459
Fax: 919-966-4914

The development of an epidemiological perspective is essential to the conceptualization of problems and the application of knowledge. Graduates of the Department of Epidemiology are expected to have an appreciation of the origins and goals of epidemiology as the basic science of public health, and of its methods, capabilities, limitations, and contrasts with related fields. Students should understand basic etiologic and prevention principles which underlie problems in public health. Subjects that help build such an appreciation include the philosophy of science, the history of epidemiology, studies of the role of epidemiology in prevention of disease, evaluation of programs, the ethical aspects of defining research questions and methods, as well as basic biological, social, and physical sciences.

The PhD in Epidemiology is the academic doctoral degree. It is a research degree, centered around a major research project within a broad public health orientation and seeking to integrate related disciplines. The program averages three to five years following a master's or other advanced degree. Coursework and preliminary examinations normally require two years, with the remainder of the time devoted to the research and completion of the dissertation. The Department specifies degree requirements within a framework prescribed by the Graduate School.

Requirements include two semesters of teaching experience, a practicum in the field. The qualifying exam consists of two four hour tests, one in epidemiology methods, and the other in a substantive area that the student is majoring in (infectious, cardiovascular, molecular, cancer etc.). After completion of these requirements (roughly 2 years) the preliminary oral exam is given, where the student proposes their research plan. The purpose of the preliminary oral examination is to review a structured proposal of the student's doctoral research that includes its objectives, hypotheses, and work plan, submitted for formal approval by the doctoral dissertation committee.

The remainder of the time is spent completing the doctoral dissertation. The format at UNC is a two-manuscript dissertation. Before defending, one manuscript must be submitted to a peer reviewed journal. The other manuscript should be ready for submission, but need not yet be sent in. The final event is the doctoral defense. Following successful completion of the defense, the dissertation is submitted to the Graduate School for publication.

7.2. University of South Carolina Arnold School of Public Health

Wilfred Kormans, Ph.D.
Director of Graduate Studies, Epidemiology
800 Sumter Street
Columbia, SC 29208
P: 803-777-7666
F: 803-777-2524
E: epibios@sc.edu

Our department consists of two divisions representing the disciplines epidemiology and biostatistics, and offers master's and doctoral degrees in each. The major in

epidemiology is designed for students pursuing careers in the study of patterns of diseases, disabling conditions and other indicators of health in human populations. The field of epidemiology involves research into factors that influence human health states or events and evaluation of prevention and treatment interventions. Epidemiologists attempt to establish the causes of health problems by describing the genetic, biological, environmental, social and behavioral factors affecting illness and premature death as well as factors that contribute to health and well being. Descriptive and analytic techniques are used to gather information on disease occurrence, extend basic knowledge about the biologic, physical, mental and social processes affecting health, and develop effective disease control measures, and examine health services, treatments and intervention programs. The products of such inquiries also are used in the development of health programs and formulation of health policy. Epidemiologic studies often require innovative approaches to study design and exposure assessment in order to identify representative samples and to allow for assessment of the associations of various factors with development or progression of the disease or health condition of interest. Because of the important connection to the human condition, the discipline has an interest in ensuring adherence to ethical standards of practice with regard to persons' participation (both access to and right to refuse) in research as well as to the design, implementation, analysis, and reporting of epidemiologic investigations. Epidemiologists work closely with other public health practitioners, physicians, environmental health personnel, behavioral and basic scientists, microbiologists, demographers, biostatisticians, and administrators of health agencies.

The Master of Public Health (M.P.H.) degree is designed for experienced health professionals who wish to extend their analytic and investigative abilities and want to focus on application of epidemiologic skills in a public health setting. The Master of Science in Public Health (M.S.P.H.) degree is designed for those who wish to acquire skills necessary for doing research in public health and want to focus on development of basic research skills for the study of correlates and determinants of disease and other health conditions.

The Doctor of Philosophy (Ph.D.) is an advanced graduate degree for those who intend to pursue teaching and research careers. The major objective is to prepare an individual to pursue original epidemiologic investigation of diseases and develop novel methodological approaches. The Ph.D. in Epidemiology requires 54 credits beyond the masters degree. The Doctor of Public Health (Dr.P.H.) degree with concentration in Epidemiology and Biostatistics is an advanced degree for experienced health professionals. The major objectives are to prepare practicing professionals in the application of research methods and provide them with a broad knowledge base for solving public health problems.

7.3. University of Southern Florida

Heather G. Stockwell, ScD.
Department Chair & Professor, Epidemiology
Office: 2108, MDC 56
stockwel@health.usf.edu
Phone: (813)-974-4804

Fax: (813)-974-4719

The University of South Florida was founded in 1956 as the first public university established specifically to address the needs of Florida's rapidly emerging urban regions and serves more than 39,000 students. The USF College of Public Health was created 25 years ago to provide leadership for the Florida public health system through the development of academic programs and by serving as a resource for Florida public health officials. The department of Epidemiology and Biostatistics offers the MPH, MSPH and PhD degrees in both concentrations. At USF, the PhD Program in Epidemiology requires a minimum of 90 credit hours beyond the baccalaureate degree for the doctoral degree or a total of 50-57 credit hours beyond the masters degree including 18 hours in epidemiology and biostatistics. The remaining credits are made up of course electives, which may or may not be within the department and *a* minimum of 18 credits of dissertation. Coursework in other departments or colleges may be required by the individual's doctoral committee. In addition, the overall coursework must include 13 hours at the 7000 level and three doctoral level seminars.

Overall competencies for the PhD in Epidemiology are based on the workshop summary on doctoral education in epidemiology sponsored by the American College of Epidemiology and the Association of Schools of Public Health held in Baltimore, MD , December 9-11, 2002. Students are expected to become proficient in the following areas: descriptive epidemiology, biology (a human physiology equivalent with competence in the dissertation disease topic), basic knowledge of the leading public health problems and the history of the discipline, problem conceptualization, study design, data collection and monitoring, data management, data analysis, interpretation, communication, ethics, a substantive area of original research and project management.

Applicants seeking consideration to the doctoral program must possess the MPH, MSPH, or equivalent in an allied discipline. Those who hold other graduate degrees will be considered, but as a prerequisite, they must complete the Epidemiology and Biostatistics core courses, one additional core course, and other courses as required and approved by their advisor. Upon acceptance to the doctoral program in Public Health, each student shall sign a "letter of understanding" regarding the stages in the doctoral degree process:

a) Successful completion of required coursework;
b) Evidence of teaching proficiency;
c) Successful performance on the following;
   - Comprehensive examination for admission to doctoral candidacy and formation of the doctoral committee
   - Preparation of dissertation proposal and written and oral defense of this proposal;
   - Conduct of dissertation research activities and preparation of dissertation document
   - Formal and successful defense of dissertation

8. Library Resources for Epidemiology

8.1. Overview of Library Resources available at UGA

The University Libraries are the largest in the state (over 3.8 million volumes) and serves as the net lender for interlibrary loan. The University Libraries is a regional depository for the U.S. Superintendent of Documents and the U.S. Government Printing Office. It is an active member of the Association of Research Libraries, a nonprofit organization of 122 of the largest research libraries in the U.S. and Canada. In 2004, the University Libraries ranked 31st in total number of volumes held and 21st in total number of current serials owned.

Print Materials

The University of Georgia library system has excellent print resources, especially in the basic life sciences, medicine, public health, and agriculture. The UGA library recently ranked high in a survey of material held in medical sciences. This ranking can be attributed to the University's long-standing commitment ot teachin and research in the life sciences, pharmacy, nursing, and veterinary medicine. With the recent accreditation of the College of Public Health and the forthcoming medical school, the print resources will likely continue to develop.

Electronic Materials

The University of Georgia's library system is a national leader in offering electronic access to a wide range of electronic resources, including journal articles in full text. Through the Southeastern Research Libraries Consortium, the University subscribes to the Institute for Scientific Information's Web of Knowledge, whereby UGA students can access several searchable database products (e.g., Science Citation Index, Social Science Citation Index, and Arts and Humanities Citation Index*)* that include citations back to 1945*.* The Institute for Scientific Information also provides analytical tools, such as Journal Citation Reports. The statewide GALILEO system provides access to hundreds of databases, including: CABI, Agricola, BIOSIS, Biological and Agricultural Index, MEDLINE, PsychInfo, Sport DISCO, Chemical Abstracts SciFinder Scholar, and Cambridge Scientific Abstracts, which taps more specialized databases such as Animal Behavior, Bioengineering, Calcium and Calcified Tissue, Entomology, Genetics, Human Genome, Immunology, Microbiology, Neuroscience, Nucleic Acids, Oncogenes and Growth Factors, Pollution, Risk, Toxicology, and TOXLINE. The Libraries also subscribe to most of the JSTOR backfiles that provide online access to scanned journals back to their first volumes.

Online access to full text journals and serials is provided by in-house subscriptions (e.g., Elsevier's Science Direct) and through a consortium of libraries, including Emory, Georgia Tech, Georgia State, and the Medical College of Georgia. In addition to almost 1,000 Elsevier titles, the University Libraries currently subscribe to most titles published by Academic Press, BioOne, Marcel Dekker, Springer Verlag, John Wiley, Kluwer, Blackswell Science, Lippincott/Williams & Wilkins and Cell Press. Electronic access to full text serials and reference sources includes all titles published by Annual Reviews, Inc. The Libraries also subscribe to hundreds of other titles through Lexis/Nexis, EBSCO, and Periodicals Abstracts. In 2005, the Libraries added *Science*, *Nature and*

New England Journal of Medicine online. As of 2005, a full listing of more than 31,000 electronic journals was available via the Electronic Journal Locator hyperlink on the UGA Libraries homepage.

Other full text electronic resources available on GALILEO include: *AHFS Drug Information, CRC Handbook of Chemistry and Physics, DSM IV-TR, Encyclopedia of Human Nutrition, Encyclopedia of Food Microbiology, Encyclopedia of Immunology, Encyclopedia of Virology, The Prokaryotes, Stedman's Medical Dictionary, and USP/DI Drug Information.* The UGA Science Library has approximately 750,000 volumes and is open to the public. Library hours vary by department; the reference desk is staffed with a professional librarian or paraprofessional and the libraries are open approximately 16 hours per day.

Human Resources

Lucy M. Rowland, M.S., M.L.S., is the Head of the Science Collections and Research Facilities at UGA, as well as the Head of the Library at the College of Veterinary Medicine. She holds a B.S. in zoology (chemistry minor), a M.S. in microbiology, and a master of library science. In addition to postgraduate coursework in medical microbiology, she has been a diagnostic and research microbiologist in field and clinical settings. The author or co-author of numerous articles, she has over 25 years experience as a medical and life sciences librarian. Ms. Rowland is the Libraries' faculty liaison to the College of Veterinary Medicine and has been a faculty member in the College since 1980. The Science Library provides reference assistance, interlibrary loan, and circulation services. The reference staff has six to eight full or part-time professional librarians and three paraprofessionals. A limited number of study carrels for graduate students who are actively writing a thesis or dissertation are available at the Science Library through the Circulation Department.

8.2. Specialized Library Resources for Epidemiology

The UGA library system provide ready access to the leading journals in the field of Epidemiology. There are four specialty journals that publish original research, editorials, tutorials, and letters in Epidemiology. These include the *American Journal of Epidemiology*, *Epidemiology*, the *Annals of Epidemiology*, the *International Journal of Epidemiology.* In addition to these journals, there are a number of sub-specialty journals in Epidemiology, such as *Journal of Clinical Epidemiology*, *Journal of Epidemiology and Community Health*, *Infection Control and Hospital Epidemiology, Journal of Cancer Epidemiology*, among others. All of these resources are available electronically and may be readily accessed through the UGA library system.

Apart from these journals, epidemiologist often publish in more general medical and scientific journals such as *Science*, the *New England Journal of Medicine*, the *Journal of the American Medical Association* (JAMA), the *Lancet*, to name a few. These publications are also available through the library system.

9. Facilities

9.1. Office and Workspace

Coverdell Center for Biomedical and Health Sciences

The Department of Epidemiology is located in the Coverdell Center for Biomedical and Health Sciences, Brooks Avenue, Athens, GA, 30602. The Department of Epidemiology occupies eight private offices for its eight full-time faculty members. Each office is furnished with a desk, chair, bookshelf, and file cabinet. The Department personnel, students and fellows also occupy desk space in common areas adjacent to faculty offices. These workspaces (cubicles) can accommodate five staff and students. The Department administration is located adjacent to the Department Head and is shared space with other departments in the College of Public Health.

Future Site of the Department of Epidemiology and Biostatistics – the Naval Supply School

Currently, the space in the Department is limited and more office and workspace will be needed to accommodate the growth of the Ph.D. program. As part of the University's master plan to develop the U.S. Navy Supply School into a Health Sciences campus, the Department of Epidemiology and Biostatistics will move to the Miller Building located at the Navy Supply School. This is a two-story building that will accommodate all current faculty, provide space for students, fellows, and research assistants. It will also include a computer laboratory, classrooms and a lecture room. The current plans are to move into this building within the next year.

9.2. Equipment

The department of Epidemiology and Biostatistics is part of the College of Public Health. The College of Public Health has its own Information Technology department consisting of a Systems Administrator and a full time support technician, dedicated to serving the computing needs of CPH Faculty, students and staff. Students have access to several college-wide computer laboratories, which provide a full range of statistical and modeling software to support classroom and independent research activities. The college has three computer labs, one in the Environmental Health Science building with 12 computers, one in the Coverdell Building with 11 computers and a projector for use as a teaching lab, and one mobile Macintosh lab consisting of 20 MacBooks on a mobile cart for use in instruction (although other uses will be considered by request). Additional student computer labs are located elsewhere on campus where CPH students' classes are held (e.g., Ramsey Center, Aderhold, Student Learning Center). A wide array of software is available, including statistical packages, analytical programs and word processing packages. Software in CPH student labs includes MPNCalc, ArcGIS, SigmaPlot, SAS, and SPSS, Matlab, MiniTab, STATA, R, JMP, EpInfo, EpiData, Acslx Lite as well as standard programs such as Acrobat Pro, EndNote, Microsoft Office, Firefox, SSH and FTP programs and a variety of media software. Each graduate student is given storage space on the College Server that may be accessed from any college computer. The College receives a portion of Student Technology Fee funding each year, which serves to support technology services for students enrolled in College degree programs.

To support graduate student research, faculty and students working with them have access to the University-wide computing resources called the Research Computing Center (RCC). Several faculty members of the department are members of UGA's Bioinformatics Institute, who have priority to use a Linux cluster which include 20 dual-processor single-core nodes, AMD Opteron, 2GB RAM/core and 28 dual-processor quad-core nodes, Intel Xeon, 2GB RAM/core (IOB). Presently, the existing UGA Bioinformatics Core consists of a SGI Altix with 16 processors, an IBM p655 with 32, 8-CPU nodes (256 CPU cores) and a Linux cluster with 187 nodes (310 CPU cores). The cluster uses Platform LSF queuing system software. The joint computing power can be estimated to be around 5 Tflops.

We do not expect to have IT needs for the Ph.D. Epidemiology program beyond what is currently available in our department and college.

10. Administration

Policies and procedures of the University of Georgia Graduate School will govern the administration of the program and the Dean of the Graduate School will certify the compliance by individual students with regard to the requirements for admission and graduation.

The program will be administered using the current organizational structures of the Department. The Department of Epidemiology is one of four departments in the College of Public Health. It is directed by a Head, who is responsible for promoting the teaching and research, and for administrating in the department. The Head of the department delegates curriculum affairs to the departmental Epidemiology Curriculum Committee. This committee is chaired by a senior faculty member in the department and its membership includes two other faculty members. The chair of the Curriculum Committee is the Graduate Coordinator for Epidemiology students and will be responsible for all communications with the University's Graduate School. These communications will include but not be limited to announcements about the defense of dissertation prospectus, final defense, advancement to candidacy. In the case of a student dismissal or probation, the Graduate Coordinator will also work with the Curriculum and Academic Affairs Committee of the College according to guidelines established by the University and Graduate School.

11. Program Assessment

11.1 Student Assessment

Performance of the entire program is reflected in the individual performance of students accepted into the Ph.D. Epidemiology program. The milestones for individual learning are: 1) completion of required and elective coursework; 2) the doctoral qualifying examination; 3) completion of a teaching practicum; 4) doctoral dissertation defense; 5) degree completion and attrition; 6) time to degree completion. The student's academic advisor will monitor the successful completion of each milestone Completion of required and elective courses will require a B average or better with no single course grade

below B-. Before advancing to candidacy, the student must pass the comprehensive examination at a 70% level. The teaching practicum will be evaluated by the academic advisor, or a designated surrogate, and must meet the standards of the department. The advisory committee will evaluate the doctoral defense and dissertation and decide whether it meets the standards of the department. Through bi-annual formal meetings, and any ad hoc meetings, the academic advisor will provide feedback to students about their performance in the program. If a student fails to meet the performance standards at these milestones, the Graduate Committee will review the case and make recommendations about remedial study or dismissal from the program.

11.2 Program Assessment

The quality of the Ph.D. Epidemiology program will be assessed on a continual basis by faculty, students and alumni, the College, and accrediting bodies. Records for program review will be kept by the Department Head.

11.2.1 Faculty Assessments

The faculty in the Department of Epidemiology and Biostatistics will be the group with the most direct and frequent evaluation of the program. The faculty will review performance measures relating to student admission, performance once in the program, quality and appropriateness of the curriculum offered. The Director of Admissions in the department will monitor and report to the faculty about the number of applicants per year, the number (percent) accepted, the quality of accepted candidates as measured by the grade point average (GPA) and other standardized test scores. Student assessment will be performed by the academic advisors as described in Section 11.1 Student Assessments. The curriculum committee and Epidemiology faculty will review the course offerings on an annual basis to be sure that they meet the changing needs for knowledge and information in the field.

In terms of outcomes, the program will enumerate the number of graduates per year and cumulatively. It will also monitor degree completion, the time to degree completion for each student and in aggregate. One way to evaluate the quality of a program is to determine positions obtained after graduation. To this end, we will maintain relevant written materials and develop a database of Ph.D. graduates from our program that includes date and year of graduation, degree completion, attrition, dissertation topic, position(s) obtained during the first 10 years after graduation, and any awards or prizes. Another aspect of evaluation will include scientific contributions to the field of Epidemiology. During a student's training, we will track the number of scientific manuscripts, presentations at local, national and international meetings. After graduation, we will track scientific contributions through publications with annual web databases searches (e.g., using PubMed).

11.2.2 Student and Alumni Assessments

Student assessments will form a critical part of the evaluation of the overall program. Student assessments will comprise two different evaluations. After each course, students are required to complete and submit anonymously course evaluations. These course evaluations are collated and submitted to the faculty member(s), departmental

chair, and the administrative office of the College. At annual performance reviews, the head of department reviews the student evaluations with the faculty members and provides feedback for improving teaching performance the next year. In addition, faculty may use the open ended responses by students to gauge their performance and identify areas for improvement. Students will also be given the opportunity to assess the program upon graduation to determine whether the learning objectives of the program have been met. These exit surveys will identify perceived strengths and weaknesses of the faculty, courses, research opportunities, mentoring, teaching, and career advice and direction.

Often the full breadth and depth of an education cannot be fully appreciated until after students enter the workforce when they can evaluate how well their education in the department prepared them. To this end, a survey will be sent to recent graduates (within one year of graduation) and to alumni after three years. The survey of recent graduates will focus on the transition from student to professional life and how well the program prepared the student. The three-year survey will assess whether the program provided the necessary skills to be successful in the workforce. The results of these surveys will be collated and reported to the department head and faculty.

11.2.3 College of Public Health Assessments

The faculty credentials will be evaluated annually by the department Head using criteria set forth by the Council on Education in Public Health. These evaluations include assessment of teaching, research, and service.

In an effort to develop and maintain the highest standards of instruction, the Department conducts peer-reviewed teaching evaluations each year. At least once a year, a colleague within the department (or college) attends one class of another faculty member and evaluates the content, style, and effectiveness of teaching. These standardized and written reports are included as part of the annual review of faculty. The department head can make recommendations about any deficiency in teaching.

11.2.4 External Assessments

We propose an external review of the Ph.D. program after its first three years and then every five years thereafter. The initial review will be done to assess whether the program is meeting its stated educational goals; subsequent reviews will be scheduled regularly to precede College accreditation by two years. CEPH accreditation occurs every 5 years of masters level education. The review will be conducted by epidemiologist in good standing in the field. A written evaluation will be given to the Head of Department and Dean of College.

12. Accreditation

The Council on Education for Public Health (CEPH) is the only independent agency recognized by the U.S. Department of Education to accredit schools of public health and certain public health programs offered in settings other than schools of public health. Accreditation by CEPH reflects achievement of academic program excellence, and it is

required in order to be fully recognized as a member of the Association of Schools of Public Health (ASPH). In June 2009, the College of Public Health was fully accredited by the Council on Education for Public Health and now becomes the 41st accredited college of public health in the country and the only accredited college of public health within the University System of Georgia.

Although the Ph.D. in Epidemiology was not part of the initial accreditation process, the doctoral degree will be included during the next accreditation of the College in 5 years. The CEPH accreditation criteria focus specifically on the master's degree education with no specific guidelines for doctoral degrees. The sole reference by CEPH to doctoral education is that an accredited school of public health must offer at least three doctoral degree programs that relate to public health. In this regard, the Ph.D. Epidemiology will add a fourth doctorate degree to be offered by the College. In addition, CEPH stipulates that at least five full-time faculty with proper training must be within a department offering a doctoral degree. The current application also meets that requirement.

Apart from CEPH, there is no formal body that accredits Ph.D. programs in Epidemiology. The Department includes, however, faculty who are members of national scientific organizations in Epidemiology that determine the direction of the field. Thus, the faculty is in touch with the training and educational requirements to keep current in Epidemiology.

13. Affirmative Action Impact

Healthy People 2010 underscores the importance of focusing significant public health efforts to improve the health and quality of life of underserved populations. Currently, UGA's College of Public Health possesses affiliations with state-wide infrastructures that will allow it to focus on minority health care issues and minority professionals.

A large portion of recruitment efforts will focus on enrolling minority students (e.g., African-Americans, Hispanics, Asians, and Native Americans) and will stress the significant role they have the potential to play as future public health leaders. Faculty and enrolled student representatives will visit targeted campuses in the Southeast in an effort to recruit students from minority gender and race groups. In addition, promotional brochures will be mailed to southeastern schools with substantial minority student populations. Such schools might include: Schools in the Atlanta University Center, Georgia State, Armstrong Atlantic State, Fort Valley, Mercer University, University of Alabama, University of South Carolina, University of North Carolina, and Tulane University. Promotional materials will also be sent to regional public health agencies, such as the Centers for Disease Control and Prevention, Georgia Department of Human Resources, Georgia's state and regional district public health offices, and non-profit agencies (e.g., American Cancer Society). Finally, UGA representatives will use carefully tailored recruitment messages to actively promote its doctoral degree programs at relevant conferences and conventions. In particular, promotional efforts will target the American Public Health Association's national convention and significant minority health-focused state/regional conventions.

14. Degree Inscription

Doctor of Philosophy

15. Fiscal and Enrollment Impact, Budget

Enrollment Projections

According to the student and alumni survey (section 3.4), there will likely be demand for the Ph.D. in Epidemiology. Approximately 25 - 30% of each entering class of students in the MPH program will pursue a doctoral degree in epidemiology. Thus, as the enrollment in the MPH Epidemiology increases from about 30 per class to 60 per class, we expect to see the number of applicants from within our program increase from 5 to 15. In addition, as this will be the only publically offered Ph.D. degree in Epidemiology, it will likely attract applicants from around the state and region, thereby expanding the applicant pool. We expect to have a large and competitive pool of applicants for our degree program.

The number of students in the program at any one time will depend on the size of the primary faculty in the department and funding resources available to support students. We project that each senior research faculty member can support one or two doctoral students at any one time; junior faculty may support fewer, depending on experience and funding. Given the current mix of senior and junior faculty, the Department would be able to provide academic and educational support for 5 – 10 doctoral students total at this time. Because the program is new, we plan to phase in the number of students over the first three years.

Doctoral Student Support

Doctoral students in the department will be supported through research grants or training grants. Although scholarships may become available in the future, no departmental or College resources are available to support study tuition at this time. As the federal, state and private grant portfolio grows in the department, a stable base of tuition and stipend support will be developed. Furthermore, when there is a critical mass of federally funded research programs in the department, we will submit an institutional training grant (T32 at NIH) to support pre-doctoral students. The department currently supports stipends for 15 students, 4 doctoral (Dr.P.H.) and 11 MPH students.

In general, faculty members with active research programs will be the major professors for our doctoral students. These faculty members will support student through the federally funded research grants, if permitted, or through formal training grants awarded to the college. The number of students that can be accepted each year will be determined, in part, by the funding base available to the faculty members.

Budgetary Considerations

We expect to enroll 4 students in the first year of the program and then 6 over the following 2 years for a total of 10 students accepted by the third year. The proposed program does not require any new faculty to meet its educational or research needs.

With the primary and adjunct faculty, there is a wide array expertise to teach the current and new courses. The doctoral students will be hired as graduate assistance and receive a partial salary with fringe benefits, including tuition support. There are no start-up costs to the program. There are recurrent supplies and classroom technologies that will be needed to train the students.

Revenue for the program will come in the form of tuition and federal funding. The current research portfolio can support 5 students at this time; as further research grants are obtained, the department will employ new doctoral students. Based on our projections of enrollment and revenue, we expect that the program will be cost neutral after 3 years.

I. ENROLLMENT PROJECTIONS			**FY 2011**	**FY 2012**	**FY 2013**
A.	Student Majors				
	1.	Shifted from other programs (per yr)	4	0	0
	2.	New to institution (per yr)	0	3	3
	3.	Total New Students Enrolled in program (per yr)	0	3	6
Total Majors (enrolled)			4	7	10
B.	Course sections satisfying program requirements				
1.		Previously existing	5	6	4
2.		New	3	2	0
Total Program Course Sections			8	8	4
C. Estimated Credit Hours generated by those courses					
1.		Existing enrollments *(students X credit hours X courses)*	96	96	168
2.		New Enrollments *(students X credit hours X courses)*	0	72	72
Total Credit Hours			96	168	240
D.	Degrees awarded		0	0	0

II. Costs			**EFT**	**Dollars**	**EFT**	**Dollars**	**EFT**	**Dollars**
A.	Personnel reassigned or existing positions							
	1.	Faculty						
	2.	Part-time Faculty						
	3.	Grad. Assistants						
	4.	Administrators						
	5.	Support Staff						
	6.	Fringe Benefits (26%)						
	7.	Other personnel costs						
Total Existing Personnel Costs[1]			0	0	0	0	0	0
B.	Personnel new positions							
	1.	Faculty						
	2.	Part-time Faculty						
	3.	Grad. Assistants[2] *(Presuming maximum of 49.999%)*	4 x .49999%	$69,089	7 x .49999%	$120,906	10 x .49999%	$172,723.00
	4.	Administrators						
	5.	Support Staff						
	6.	Fringe Benefits (5% for grad. assistants)	4 x .49999%	$3,454	7 x .49999%	$6,045	10 x .49999%	$8,636
	7.	Other personnel costs						
Total New Personnel Costs			4	$72,543	7	$126,951	10	$181,359

C.	Start-up Costs (one-time expenses)		1st Year	2nd Year	3rd Year
	1.	Library/learning resources			

	2.	Equipment			
	3.	Other (_____)			
D.	Physical Facilities: construction or major renovation				
		Total One - Time Costs	0	0	0

E. Operating Costs (recurring costs - base budget)			
1. Supplies/Expenses	$600	$650	$700
2. Travel			
3. Equipment (classroom technologies)	$1200	$1200	$1200
4. Library/learning resources			
5. Other			
Total Recurring Costs	$1800	$1850	$1900
Grand Total Costs	$76,143	$130651	$183259
III. Revenue Sources			
A. Source of Fund			
1. Reallocation of existing funds			
2. New student workload	5	8	10
3. New tuition (Includes full and part-time) *(presuming 12 hours per term, Fall and Spring using Spring 2010 rates from University Bursa: tuition - $4133/semester for 12 uniy)*	$33,064	$57,128	$82,660
4. Federal funds[2]	$76,143	$130651	$183,259
5. Other grants			
6. Student fees ($1000/student)	$5000.00	$6000.00	$10,000.00
7. Other (_____)			

Subtotal	$114,207	$193,779	$275,919
New State Allocation Requested			
Grand Total Revenues	$114,207	$193,779	$275,919
B. Nature of funds			
1. Base budget			
2. One-time funds			
GRAND TOTAL REVENUES	$114,207	$193,779	$275,919

NOTES
[1]No impact is anticipated regarding existing personnel costs to implement this degree program. Current faculty and staff are sufficient to support the degree program without adversely affecting other instruction, research or public service.
[2]The Department of Epidemiology & Biostatistics anticipates offering all PhD students graduate research assistantships through extramural grant funds. State funds are not anticipated to support any PhD students.

16. Bibliography

Association of Schools of Public Health. Confronting the Public Health Workforce Crisis. 2008. http://www.asph.org/UserFiles/WorkforceShortage2010Final.pdf Accessed 1 June 2010.

DeVol R, Bedroussian A. An Unhealth America: The Economic Burden of Chronic Diseases. Milken Institute Review. 2007.

Lichtveld M, Boulton M, Lemmings J, Gale J. From Competencies to Capacity: Assessing the National Epidemiology Workforce. Public Health Reports. 2008 (Suppl. 1); 123: 128 – 135.

Facing the Future. The Nation's Health. 2008 (May).

Public Health Epidemiology: Capacity at a Crossroads. Council of State and Territorial Epidemiologists. www.cste.org. Accessed June 1, 2010.

2006 National Assessment of Epidemiologic Capacity: Findings and Recommendations. Council of State and Territorial Epidemiologists. www.cste.org Accessed June 1 2010.

Workforce Development Initiative (2007). Council of State and Territorial Epidemiologists. www.cste.org. Accessed June 1 2010.

17. Appendices

Confronting the Public Health Workforce Crisis

Association of Schools of Public Health, Confronting the Public Health Workforce Crisis. ASPH, www.asph.org, December 2008.

Competencies For Doctoral Programs in Epidemiology

Samet J, Stoto M, Arcari C. Workshop on Doctoral Education in Epidemiology. Baltimore, MD, December 9 – 11, 2002.

Calhoun JG, Ramiah K, Weist E, Shortell SM. Development of a Core Competency Model for the Master of Public Health Degree.

ASPH Policy Brief

Confronting the Public Health Workforce Crisis

EXECUTIVE SUMMARY

The current public health workforce is inadequate to meet the health needs of the U.S. and global population – and worsening worker shortages will reach crisis proportions in the coming years. Fewer workers, drawing on diminished resources to meet the needs of more people, mean Americans are likely to be at grave risk unless measures are taken immediately to rebuild the workforce.

In this paper, the Association of Schools of Public Health (ASPH), which represents the 41 Council on Education for Public Health (CEPH) accredited schools of public health in North America, offers recommendations for building a diverse public health workforce prepared to meet future challenges.

The Looming Workforce Crisis

- By 2020, the nation will be facing a shortfall of more than 250,000 public health workers, according to ASPH estimates. Shortages of public health physicians, public health nurses, epidemiologists, health care educators, and administrators are anticipated.
- The public health workforce is diminishing over time even as the U.S. population increases. In 2000, the total workforce was 448,000, or 50,000 less than in 1980.
- More than 100,000 government public health workers – approximately one-quarter of the current public sector workforce – will be eligible to retire by 2012.
- Over the next 11 years, schools of public health would have to train three times the current number of graduates to meet projected needs.

Key Recommendations for Action

- Increase federal funding to support public health professional education. Federal funds should be available to:
  - Provide financial support to students pursuing public health graduate training through loan repayment and forgiveness programs, training and service obligation grants, and fellowships.
  - Strengthen practice experiences for public health students.
  - Promote a more diverse public health workforce by offering financial incentives and training opportunities to underrepresented minorities and to students focused on reducing racial and ethnic health disparities.

ASPH • 1101 15th Street, NW • Suite 910 • Washington, D.C. 20005
Tel: (202) 296-1099 • Fax: (202) 296-1252 • Email: info@asph.org • Web: www.asph.org

- Build public health education capacity, enabling schools of public health to:
  - Enroll and train more graduate students.
  - Develop competencies and curriculum in emerging areas of public health practice.
  - Expand joint degrees and other opportunities for cross-disciplinary training.
  - Significantly increase public health research training in population health, primary prevention, and community-based and public health systems.
  - Expand undergraduate public health education.
  - Develop opportunities for the public health workforce to engage in lifelong learning through short courses, certificate programs, distance learning, and other opportunities.
- Provide grants to state health departments to promote worker training.
- Establish a U.S. Global Health Service to coordinate U.S. efforts to build a workforce prepared to meet international needs.
- Institutionalize a process for periodic enumeration of the public health workforce in order to identify current and future needs.

About ASPH: These recommendations reflect the consensus of the Association of Schools of Public Health (www.asph.org), which represents the 41 Council on Education for Public Health (CEPH) accredited schools of public health in North America. A critical national resource, the nation's Schools of Public Health educate the next generation of public health leaders; conduct cutting-edge research; and translate knowledge into public health policy and practice. They currently enroll 22,000 students, produce more than 7,300 graduates a year, and employ 9,600 faculty.

ASPH is committed to collaborating with the public health practice community, governmental agencies, academic medicine, non-profit organizations, and business groups. This policy paper is part of a series exploring the nation's public health priorities.

ASPH • 1101 15th Street, NW • Suite 910 • Washington, D.C. 20005
Tel: (202) 296-1099 • Fax: (202) 296-1252 • Email: info@asph.org • Web: www.asph.org

ASPH Policy Brief

Confronting the Public Health Workforce Crisis

Background

Dramatic public health advances in the 20th century have helped to increase the average lifespan of U.S. residents by more than 30 years and to improve quality of life around the world. Vaccinations, control of infectious diseases, safer workplaces, motor vehicle safety, an improved food supply, strategies to protect the health of mothers and babies, and the recognition of tobacco as a health hazard are among the great public health achievements of the past century, according to the Centers for Disease Control and Prevention.[1]

The public health workforce has made all of this possible through practice, service, and research.[2]

These multidisciplinary professionals:

- Include clinicians and health program administrators, educators, planners, and policy analysts, occupational and environmental health specialists, and economists, epidemiologists, and biostatisticians.
- Work in diverse public and private settings, including public health agencies at every level of government, community-based service organizations, academic and research institutions, hospitals, health plans and medical groups, and private companies.
- Serve many functions, including health surveillance and protection, wellness promotion, planning and regulating, and organizing, delivering, and evaluating health services.

In an era of daunting public health challenges, when we face threats that know no geographic boundaries, adequately trained U.S. public health workforce must be prepared to:

- Confront emerging communicable diseases (e.g., Ebola virus and avian influenza).
- Meet environmental challenges (e.g., food insecurity and climate change).
- Tackle chronic disease (e.g., the myriad health consequences of tobacco use and obesity).
- Assist communities in preparing for emergencies (e.g., natural disasters and biological and chemical attacks).
- Advocate for policies designed to promote health (e.g., increasing access to care and reducing health disparities).
- Promote an emphasis on public education, and disease prevention and wellness.
- Conduct research and build evidence for interventions that work.

ASPH • 1101 15th Street, NW • Suite 910 • Washington, D.C. 20005
Tel: (202) 296-1099 • Fax: (202) 296-1252 • Email: info@asph.org • Web: www.asph.org

Given the increasing complexity of public health science, meeting these challenges means training many more specialists in the many sub-disciplines of public health. As well, the availability and capacity of a global public health workforce needs to be significantly expanded.

Forecast

While widely acknowledged, the extent of the public health workforce shortage remains imprecise, reflecting inconsistent enumeration and the absence of a systematic effort to assess national needs.[3,4,5] Nonetheless, it is clear that public health professionals have been forced to do more with fewer people, and that needs are growing dramatically.

In 2000, there were 50,000 fewer public health employees than in 1980.[6,7] Technological advances may to some extent mitigate the impact of the decrease in the public health workforce, but this trend clearly cannot continue without drastically compromising the public's health.

The workforce ratio in 1980 – 220 public health workers for every 100,000 U.S. residents – may underestimate the ideal, but it provides a useful benchmark.[3] Given population increases, a total of 600,000 public health workers would have been necessary in 2000 to maintain the workforce ratio that existed two decades earlier. Instead, we came up short by 150,000 people.

Going forward, the gap is even more alarming. In 2020, a public health workforce of more than 700,000 will be necessary to achieve the 220:100,000 ratio. That creates a need for some 250,000 more workers than are available today.

Public Health Workforce to U.S. Population Ratios

Year	U.S. Population[8]	Ratio of the Public Health Workforce to U.S. Population	Public Health Workforce
1980	226,542,199	220 per 100,000	500,000[6]
2000	281,421,906	158 per 100,000	448,254[7]
Projected Need			
2020	*324,927,000*	*220 per 100,000*	*714,839*

Many sources have documented current workforce shortfalls in specific fields:

- More than half the U.S. states responding to a survey by the Association of State and Territorial Health Officials reported a lack of qualified employees to fill emergency preparedness needs.[9]
- The Institute of Medicine reports a shortage of 10,000 public health physicians, or twice the number now in practice.[10] Other reports have forecast shortages among public health nurses, epidemiologists, health care educators, and administrators.

ASPH • 1101 15th Street, NW • Suite 910 • Washington, D.C. 20005
Tel: (202) 296-1099 • Fax: (202) 296-1252 • Email: info@asph.org • Web: www.asph.org

Moreover, there are demonstrated racial and ethnic disparities, and significant geographic gaps, in the public health workforce. As the Sullivan Commission on Diversity in the Healthcare Workforce states:[11]

> *"Today's physicians, nurses, and dentists have too little resemblance to the diverse populations they serve, leaving many Americans feeling excluded by a system that seems distant and uncaring. The fact that the nation's health professions have not kept pace with changing demographics may be an even greater cause of disparities in health access and outcomes than the persistent lack of health insurance for tens of millions of Americans."*

Public health workforce shortages are even more critical in much of the developing world. For example, sub-Saharan Africa has 11% of the world's population and 24% of the global burden of disease – yet it commands less than 1% of the world's health expenditures.[12]

The World Health Organization has said there is a "major mismatch" between population needs and the available public health workforce in terms of overall numbers, relevant training, practical competencies, and sufficient diversity to serve all individuals and communities.[13]

Retirement. By 2012, more than 100,000 U.S. public health workers in government – approximately one-quarter of an estimated 450,000-person workforce – will be eligible to retire.

Level	Percent Eligible to Retire by 2012	Percent of Total Workforce(6)	Total Workforce	Number Eligible to Retire
Federal	44[14]	19	450,000	37,620
State	29[12, 15]	33	450,000	43.065
Local	19[16]	34	450,000	29,070
Total Eligible to Retire				**109,755**

The retirement status of public health professionals in the private sector is unavailable.

ASPH • 1101 15th Street, NW • Suite 910 • Washington, D.C. 20005
Tel: (202) 296-1099 • Fax: (202) 296-1252 • Email: info@asph.org • Web: www.asph.org

The Response

Recognizing the urgency of the need, ASPH recommends the following measures to expand the public health workforce:

Increase federal funding for public health education. Federal financial support for public health professional education has been steadily eroding since 1980, and is woefully inadequate, according to the Institute of Medicine.[17]

Public resources can be used to:

- **Attract students to public health graduate training** and retain them as they pursue their degrees. Mechanisms include training grants, loan repayment and forgiveness programs, service obligation grants, and fellowship programs. ASPH supports passage of the "Public Health Preparedness Workforce Development Act," which would support educational loan repayment for students pursuing a degree in public health in exchange for service in a state, local, or tribal health department.[18]
- **Improve practice experiences for public health students**, which enhances their training while offering a resource to support the mission of health-related organizations. Opportunities exist to increase both the number and type of organizations that serve as sites for practice rotations.
- **Promote a more diverse public health workforce.** Studies show that increasing the number of health professionals from racial and ethnic groups with poor health indicators will help to reduce health disparities.
  - The National Institutes of Health should establish a loan forgiveness program and other financial incentives to attract underrepresented populations to public health.
  - The NIH Center for Minority Health and Health Disparities and other funding agencies should create opportunities for post-doctoral studies and other training targeted at minorities.
  - Targeted financial support should be available to all public health graduate students who focus on disparities.

Build capacity in schools of public health. Graduate education remains the gold-standard for training public health professionals. Forty accredited schools of public health train over 85 percent of public health graduates from accredited schools and programs (most of the rest graduate from public health programs within other schools, such as medical schools). To meet the predicted need for an additional 250,000 trained public health workers by 2020, schools of public health will need a threefold increase in the number of students they graduate over the next 11 years.

That means expanding capacity. Many public health schools now lack the resources to manage larger class sizes and states have cut their funds, forcing them to turn away qualified applicants. New federal resources for accredited public health schools are essential, as is enhanced student recruitment.

A number of new schools of public health are being formed, or are under consideration. This will increase the public health workforce, although new ventures are usually more expensive on a per-student basis than adding capacity as a marginal cost to existing school infrastructure.

ASPH • 1101 15th Street, NW • Suite 910 • Washington, D.C. 20005
Tel: (202) 296-1099 • Fax: (202) 296-1252 • Email: info@asph.org • Web: www.asph.org

Public health schools need funding to:

- **Expand their capacity to enroll and train degree-seeking graduate students.**
- **Develop competencies and curriculum in emerging areas of public health practice.**
- **Offer joint degrees and other opportunities for cross-disciplinary training**. Public health training can be combined with training in medicine, veterinary medicine, dentistry, nursing, law, business, public administration, public policy, and social work, among other fields. The interconnectedness of these fields is illustrated by the fact that 75% of emerging diseases are zoonotic (highlighting the link between veterinary medicine and public health).[19] Support for greatly expanding HRSA training grants and graduate medical education are among the mechanisms to increase the number of students who pursue joint degrees.
- **Expand undergraduate public health education** in order to introduce more students to the field.
- **Promote training of the public health workforce through short courses, certificate programs, distance learning, and other opportunities for lifelong learning.** Targeted programs are needed to meet the needs of credentialed public health professionals, undertrained and noncredentialed public health workers, and other workers engaged in public health activities.
- **Significantly increase public health research training** in population health, primary prevention, and community-based and public health systems, among other areas**.** Particular emphasis should be placed on transdisciplinary research programs at the Agency for Healthcare Research and Quality, the Centers for Disease Control and Prevention, and the National Institutes of Health, which fund most research training at schools of public health.

Provide grants to state health departments to promote worker training. At present, most health departments have very limited training budgets, and federal funding in this arena has been waning. Grants to state health departments can be used to support working professionals who wish to pursue MPH degrees, public health certificates, and other training, and to promote credentialing.

Ensure that all primary, secondary, and post-secondary schools offer public health-related curricula. This is fundamental to giving all Americans a basic understanding of public health and the importance of prevention in health care.

Create a U.S. Global Health Service. Given the crippling shortages within the international public health workforce, the federal government should establish a U.S. Global Health Service that would serve as an umbrella organization for a Global Health Service Corps, health workforce needs assessment, fellowship and loan repayment programs, a twinning program, and an information clearinghouse.[20] These programs would be designed to strengthen the international expertise of the U.S. public health workforce, as well as to prepare workers from other countries to provide public health services.

Fund efforts to collect data about the public health workforce. The federal Health Resources and Services Administration (HRSA) last conducted an enumeration of the public health workforce in 2000; the enumeration prior to that was completed in 1980.[6,7] Public health needs a legislative mandate to collect data regularly and to study workforce issues under the guidance of a federal agency.

ASPH • 1101 15th Street, NW • Suite 910 • Washington, D.C. 20005
Tel: (202) 296-1099 • Fax: (202) 296-1252 • Email: info@asph.org • Web: www.asph.org

Better demographic data about the workforce would help to identify shortages and surpluses, track trends over time, and forecast future needs. Improved public health enumeration data would also be useful in guiding student decisionmaking about which aspects of public health to pursue, ensuring a better balance between workforce supply and demand.

Effective public health depends on a workforce of sufficient size and training to meet both expected and unanticipated needs. A shortage of crisis proportions looms, and the opportunity to address it should be seized now.

ASPH • 1101 15th Street, NW • Suite 910 • Washington, D.C. 20005
Tel: (202) 296-1099 • Fax: (202) 296-1252 • Email: info@asph.org • Web: www.asph.org

References

[1] Ten Great Public Health Achievements – United States, 1900-1999. *Morbidity and Mortality Weekly Report* April 2, 1999:48 (12);241-3.

[2] Health Sciences Committee. Public Health Education and the University of California. Oakland, CA: University of California; 2004

[3] Gebbie KM, Turnock BJ. The public health workforce 2006: New challenges. Health Affairs 2006;25(4):923-933.

[4] Institute of Medicine, National Academy of Sciences. Who will keep the public healthy? Educating Public Health Professionals for the 21st Century. Washington, DC: National Academy Press; 2003

[5] Rahn DA, Wartman SA. For the health-care workforce, a critical prognosis. The Chronicle of Higher Education 2007.

[6] Health Resources and Services Administration. Public health personnel in the United States 1980: Second report to Congress. In: U.S. Department of Health and Human Services, editor. Washington, DC: U.S. Public Health Service; 1982.

[7] National Center for Health Workforce Information and Analysis, Center for Health Policy at the Columbia University School of Nursing, Bureau of Health Professions. The Public Health Workforce Enumeration 2000. In: Health Resources and Services Administration, editor. Washington, DC: Health Resources and Services Administration; 2000.

[8] U.S. Census Bureau 2008.

[9] Association of State and Territorial Health Officials. State Public Health Employee Worker Shortage Report: A Civil Service Recruitment and Retention Crisis. Washington, DC; 2004.

[10] Institute of Medicine, National Academy of Sciences. Training physicians for public health careers. Washington, DC; 2007.

[11] Sullivan Commission on Diversity in the Healthcare Workforce. Missing Persons: Minorities in the Health Professions. Washington, DC; 2004.

[12] World Health Organization. Taking Stock: Health Worker Shortages and the Response to AIDS; 2006.

[13] World Health Organization. Working Together for Health: World Health Report 2006. Geneva, Switzerland; 2006.

[14] Partnership for Public Service. Homeland Insecurity: Building the Expertise to Defend America from Bioterrorism. Washington, DC; 2003.

[15]Association of State and Territorial Health Officials. ASTHO 2007 State Public Health Survey. In. Washington, DC; 2007.

[16] National Association of County and City Health Officials. 2005 National Profile of Local Health Departments. Washington, DC; 2006.

[17] Institute of Medicine, National Academy of Sciences. The Future of Public's Health in the 21st Century. Washington, DC: National Academy Press; 2003.

[18] Unenacted bill: Public Health Preparedness Workforce Development Act of 2008, S.1882 and Public Health Preparedness Workforce Development Act of 2007, H.R. 5496 , 110th Cong. (2008).

[19] Centers for Public Health Preparedness. Centers for Public Health Preparedness Collaborative Group Report on Veterinary Preparedness. Washington, DC: Association of Schools of Public Health; 2006.

[20] Institute of Medicine, National Academy of Sciences. Healers Abroad: Americans Responding to the Human Resource Crisis in HIV/AIDS. Washington, DC; 2005.

ASPH • 1101 15th Street, NW • Suite 910 • Washington, D.C. 20005
Tel: (202) 296-1099 • Fax: (202) 296-1252 • Email: info@asph.org • Web: www.asph.org

WORKSHOP SUMMARY

A WORKSHOP ON DOCTORAL EDUCATION IN EPIDEMIOLOGY SPONSORED BY THE AMERICAN COLLEGE OF EPIDEMIOLOGY AND THE ASSOCIATION OF SCHOOLS OF PUBLIC HEALTH

Baltimore, Maryland
December 9-11, 2002

Editors:
Jon Samet, MD, MS - Bloomberg School of Public Health, Johns Hopkins University
Michael Stoto, PhD - RAND
Christine Arcari, PhD, MPH - Population Health Sciences, University of Wisconsin-Madison

Together, the American College of Epidemiology (ACE) and the Association of Schools of Public Health (ASPH) planned and conducted a workshop on doctoral education on December 9-11, 2002, with participation from many institutions granting doctoral degrees in epidemiology and from a variety of institutions for whom doctoral-trained epidemiologists are key staff members.

The workshop was developed through an extensive planning process involving the ACE, the ASPH, the sponsoring organizations, and a steering committee established for the workshop. Input was obtained broadly as the meeting was planned, including holding a session at the annual meeting of the ASPH at the American Public Health Association 2001 annual meeting in Atlanta, GA. Additionally, background materials were gathered for the workshop, including an assessment of the curricula offered at various schools of public health and other doctoral-degree planning programs.

The workshop began with a set of orientating presentations that included a data review of doctoral education and panels representing the academic, public private and student perspectives. Workshop participants divided up in to working groups to address a set of critical themes and to prepare the reports that comprise the body of this report. The five working groups were: 1) core competencies in doctoral-level epidemiologic training, 2) scientific foundations for epidemiologists: doctoral training, 3) specialization in epidemiology vs. general training, 4) competencies for public health practice and 5) epidemiology and bioterrorism.

The overall goal of the workshop was to improve doctoral education in epidemiology by fostering communication on curriculum content and to identify the competencies to be gained by graduate students in epidemiology, regardless of future career paths. The specific workshop goals were to:

1. Provide a picture of the current state of doctoral education in epidemiology, including the number, scope, and academic housing of the doctoral programs;

2. Develop a set of core competencies in the following broad areas, with input from both educators and employers, to be achieved by graduates of doctoral programs:
    - General epidemiologic methodology,
    - Communication and application of epidemiologic evidence, and
    - Strategies for life-long learning

3. Develop perspectives on critical issues in doctoral education including:
    - The interface of epidemiology and biostatistics,
    - The need for education in primary data collection and the related skills,
    - The requisite biological foundation for doctoral students in epidemiology,
    - The consequences of specialization for doctoral education,
    - The broadening scope of epidemiologic inquiry and the necessary background for training in social epidemiology and other multidisciplinary research areas, and

- The need for education in the analysis of large-scale, national databases.

In addition to the stated goals of the workshop, two related activities were carried out in conjunction with the workshop. As part of the ACE's efforts to respond to the events of September 11th, one working group addressed the education and training needs in epidemiology related to bioterrorism and in collaboration with the National Center for Health Statistics, a pre-workshop meeting focused on the need, content, and format of educational activities aimed at doctoral-level epidemiologists in regard to the analysis of national survey data gathered by the Center.

There was also the expectation of a wider range of outcomes from this workshop, including continued interaction among the doctoral programs and a process to achieve this interaction; competency-driven changes in educational programs; development of new educational materials to address gaps; and identification of continuing professional education needs.

Workshop participants were unanimous in viewing this workshop as a starting point in a needed process of discussion of doctoral education in epidemiology. The partnership of the ACE with the ASPH and its member schools, other degree-granting schools, and the broader set of organizations for whom epidemiologists are essential proved to be a sound framework for planning and carrying out the workshop.

The working groups produced materials that should be valuable for existing doctoral programs and those that may be initiated by new schools of public health and other graduate schools. There was a clear lesson from the workshop as to the magnitude of the task taken on by the workshop participants. While much was accomplished over the nearly two days of the workshop, the reports set an even larger agenda for continued discussion and planning than was present at the workshop's start. The reports of the working groups follow and a list of participants in the working groups is included as an Appendix to this report.

Work Group 1: Core Competencies in Doctoral-Level Epidemiological Training

This group addressed *Core Competencies*, defined as skills or activities that all students at the doctoral level should be able to do well. These are considered essential skills. In addition to specific courses, other approaches to assist students in acquiring core competencies are listed, including seminars, practica, supervised self-study, and other methods. Additional competencies that were not considered as core are noted at the end of the report. This listing might be used to assess the adequacy of current training or as a resource for the development of a doctoral training program.

The group identified two qualitatively different levels of competency (**A** and **B**), as listed below:

A. *Students are able to conduct each of these activities or to have at their command specific types of information that they can use in solving problems.*

B. *Students have a working knowledge of the principles of these techniques/issues but are not necessarily competent to conduct such activities without additional training or consultation.*

Core Competencies: General Skills and Knowledge		
Domain	**Skill Level**	**Competency**
Descriptive Epidemiology	**A**	• Produce the descriptive epidemiology of a given condition, including case definition, calculation of the primary measures of disease morbidity and mortality, and appropriate comparisons by person, place and time. • List the strengths and limitations of descriptive studies. • Identify data from existing national and international sources.
Biology	**A**	• Complete course work or equivalent in human physiology and pathophysiology, with special competence in the disease addressed in the student's dissertation.
Basic knowledge of the leading public health problems and the history of the discipline	**B**	• Identify major chronic and infectious diseases, their general pathophysiology, descriptive epidemiology and risk factors. • Identify leading causes of death. • Understand the general history of the development of epidemiology, including the major epidemiological studies of selected diseases. • Know the principles of screening and of surveillance systems, including understand the concepts of validity and reliability of screening tests and be able to calculate associated measures and know the types of surveillance systems and approaches used in disease surveillance. • Understand the global, cultural, and social context of health problems and how these influence the conduct, interpretation, and dissemination of research and intervention studies.

Core Competencies: Research		
Domain	**Skill Level**	**Competency**
Problem Conceptualization	**A**	• Search the literature. • Review and critically evaluate the literature (be familiar with different approaches to reviewing and synthesizing the literature: Skill Level: B/working knowledge as opposed to prior experience. • Synthesize available information. • Identify meaningful gaps in knowledge. • Formulate an original and key hypothesis or statement of the research problem.
Study Design	**A**	• Design a study using any of the main study designs (including clinical trials and community trials: Skill Level: B/working knowledge as opposed to prior experience). • Understand the advantages and limitations of each design for addressing specific problems, as well as the practical aspects of their uses, including trade-offs. This understanding will be reflected in selecting the most appropriate and efficient design for a designated problem. • Calculate the requisite sample size. • Identify and minimize sources of bias; describe both the direction and magnitude of the bias and the effect of potential biases on the measures of association. • Use basic population sampling methods.
Data Collection and Monitoring	**A**	• Use methods of measurement – design data collection forms assessing both exposures and outcomes; determine the validity of the instrument; identify the presence and magnitude of measurement error; adjust for measurement error when appropriate data are available. • Monitor the conduct and progress of data collection; develop, implement and assess quality control measures.
Data Management	A	• Create data files appropriate for analysis; carry out the steps needed to create new variables, clean the data sets, etc.

Core Competencies: Research		
Domain	**Skill Level**	**Competency**
Data Analysis	**A**	• Use statistical computer packages to calculate and display descriptive statistics, analyze categorical data, and perform multivariable regression, survival analysis, and longitudinal analysis. • Examine data for the presence of confounding and interaction (effect modification), identify their presence, and manage them appropriately.
Interpretation	**A**	• Interpret the research results, make appropriate inferences based on results, and recognize the implications of the research results; (also see 2.d. above – Study design).
Communication	**A**	• Communicate research results orally and in writing to both scientists and non-scientists (includes preparation of a manuscript suitable for publication in a scientific journal and presentation of research proposals). • Present research data in both tabular and figure forms.
Ethics	**A**	• Understand the concepts of human subjects protections and confidentiality, and awareness of particular issues relevant to the study of specific populations. • Apply this understanding as evidenced in the design and conduct of their research.
Substantive area	**A**	• Demonstrate mastery of a substantive area, including knowledge and application of that knowledge in conducting original research related to a specific topic (Note that some programs require a minor outside epi/biostat).

Additional Competencies: recommended items that do not qualify as core competencies

- Exposures to a wide range of employment options and epidemiologic applications.
- Training in leadership and management skills, and interdisciplinary team work.
- Experience working with large datasets.
- Teaching opportunities.
- Budget experience.
- Approaches to teaching "life-long" learning, which could include modeling from the faculty – e.g., a small group of students works with a faculty member who is starting research in a new area in order to gain an understanding of the research process.
- Experience with primary data collection. Linkage of large datasets may sometimes be acceptable, but analysis of a completed, clean dataset would not normally be accepted for this requirement. Examples of primary data collection experiences are listed below; working within the confines of a single dissertation experience, a doctoral student may be unable to gain experience in all of these elements of epidemiological research, but they should be familiar with general approaches to each of the items and points for quality control measures to reduce errors:
  - Development and testing of study protocols
  - Staff training and certification
  - Subject recruitment
  - Questionnaire design and pretesting
  - Interviewing
  - Working with the community to implement research
  - Coding
  - Medical or other records abstraction
  - Designing and implementing quality control activities
  - Biospecimen collection
  - Laboratory analysis
  - Environmental, occupational or personal exposure monitoring
  - Collection of measurements on study participants

Work Group 2: Scientific Foundations for Epidemiologists: Doctoral Training

This group addressed the question of the extent of the scientific foundation needed for epidemiologists. The scope of epidemiological research is broad, potentially dealing with an array of scientific and public health questions that extend from the molecular to the population levels. The methods of epidemiology also demand quantitative skills, and increasingly elegant but mathematically sophisticated biostatistical methods have become fundamental to the analysis of epidemiological data. Epidemiologists also need a sufficient understanding of the broad aspects of populations who are under investigation and of the ethical, privacy, and other concerns that arise in the conduct of research. The group's report covers three facets of doctoral training in epidemiology, relevant to either PhD or DrPH candidates: prerequisites, core science requirements, and elective courses.

1. Prerequisites for Doctoral Training

Strong quantitative skills and capabilities are essential prerequisites for all epidemiology students; good quantitative scores on the GREs or in undergraduate training seem to indicate adequate backgrounds and capabilities in this area. Important and potentially relevant domains of knowledge, although not considered required of every student entering a doctoral program, are calculus, demography, laboratory sciences, and possibly other specific fields in the biomedical sciences, such as molecular biology, genetics/genomics, immunology, microbiology, pharmacology, and toxicology. With regard to these diverse areas of biomedical sciences, often themselves a focus for doctoral education, students may need a high level of training before entering a program in epidemiology, which may not be able to provide sufficient in-depth training across all relevant areas. For example, a student intending to address the molecular genetics of cancer would typically need to enter the doctoral program with an established foundation in molecular and cellular biology and possibly genetics.

Programs tend not to set minimum requirements for mathematical or statistical backgrounds. However, calculus and possibly linear algebra can be seen as useful background and the concepts of calculus can be viewed as essential to a basic understanding of many analytic methods and issues. Prior courses in calculus might be viewed as a possible prerequisite for acceptance into the doctoral program. Arguments can also be made for its utility but not its essentiality for graduation. Nonetheless, concepts of mathematics, including calculus, are fundamental to the methods of epidemiology, and all students should have a clear understanding of mathematical principles and scientific thinking before entering a doctoral program.

Specific technical expertise in laboratory techniques may be needed for some epidemiology subspecialties, such as molecular, nutritional, or infectious disease epidemiology, but such expertise is not an essential skill for all students. Many of the concepts critical in laboratory practice, including sensitivity, specificity, reliability, and validity are important not only for laboratory assays, but for measurement of any epidemiologic variable, including questionnaires, examination procedures, or an environmental characteristic. Those students who are likely to carry out laboratory-based research and even to direct laboratories would generally benefit from advanced training in the area of interest, unless such training is explicit to the training program that they are entering.

2. Core Science Requirements

Three key fundamental areas important to the doctoral education of epidemiologists should be considered for a core science curriculum. These include: the *scientific method and approach*, *basic human biology and pathophysiology*, and the *social-behavioral-cultural sciences (or socio-behavioral sciences)*, described below. Training should take place in these three main areas early in the doctoral student's training, as an understanding of basic biology and the social sciences are critical to the development of plausible hypotheses and logical, well-designed studies.

- The *scientific method and approach* includes the philosophy and methods of scientific inquiry and logic, especially probabilistic logic. Didactic training in this area can be considered essential for students to carry out epidemiologic research; all training and skills development in epidemiologic and biostatistical methods require this fundamental understanding. Every student needs to think logically and probabilistically.

- A solid understanding of *biology* -- and especially *pathophysiology* -- is critical, as there are various pathologic processes, some of which are common to many diseases. Understanding these common processes across diseases and studying their pathways for a variety of diseases may provide fresh insights. Although some students begin their epidemiology training with little or no prior education in biology, many enter doctoral training with medical, veterinary, or other health sciences or biology – related degrees or backgrounds, and faculties for some epidemiologic specialties such as nutritional or molecular epidemiology may require more grounding in the biological sciences. A minimum skill set and understanding in this area for those without such backgrounds would be a course in *pathophysiology*, defined as the study of basic physiology and how aberrations in normal physiology result in disease. One approach for providing access to such a course is to establish a provision for reciprocal "service" from medical schools for the courses provided by epidemiology and biostatistics departments for medical students. Fundamental scientific areas can be taught to students through courses, seminars, and distance education; however, direct mentoring and guidance of students is one of the most important and effective mechanisms.

- A fundamental understanding of the *social-behavioral-cultural sciences* -- psychology, anthropology, sociology, group dynamics, ethnicity and disease, and related disciplines presented with a public health perspective (similar to many MPH program offerings) -- are integral to the successful conduct of observational studies and to the practice of epidemiology. Research on the determinants of community health, including the role and consequences of poverty, and its specific components—study design, participant identification and enrollment, questionnaire design, and informed consent construction are strengthened by a broad foundation that covers these domains. While epidemiologists cannot be expected to gain expertise in all of these areas, they should have an appreciation of the relevance of these disciplines and should be able to assemble appropriately multidisciplinary teams, as needed, and to foster exchange among the team members. One of the core requirements for all MPH programs is in the social-behavioral-cultural sciences and meeting this requirement could serve to satisfy the minimal training requirement for epidemiology doctoral students as well.

3. Elective Courses in the Sciences

Essential core scientific areas are distinct from dissertation-based, or content-specific, training in the sciences. In-depth study of a specialty area is critical to training, but the specific courses will vary from student to student. A number of approaches are used in epidemiology training programs to assist students in selecting these courses, ranging from informal (advice from faculty on the students' dissertation committee, to faculty subgroups within the epidemiology department), to formal (departmentally established criteria for specialty training). The group is concerned, however, that early overspecialization will too quickly narrow the training focus and perhaps limit emphasis on a broad foundation and reduce the commitment to career-long learning in epidemiology generally.

The value of experience of as many aspects of epidemiologic research, either through dissertation work or brief externships or practical rotations, needs emphasis. Students need to understand field research and the experience of study participants at the first-hand level. They should be exposed to the workings of a field study and understand the interplay between participants and researchers, perhaps by actually collecting data in the field or by serving as "mock" study participants. They should understand how biological samples are obtained from participants in the field. Participating in these activities can lead to a better understanding of people's experiences in epidemiological research, and foster more sensitive and informed identification of issues, ranging from enrollment and obtaining informed consent to data quality from questionnaires and biological assays.

For those students without a medical background, doctoral programs may be limited in the capacity to provide training and experiences that will build a first-hand and complete understanding of particular diseases or health problems. Although students cannot voluntarily experience being a patient with a specific disease, they can spend time with patients and their families through mechanisms such as "shadowing" clinicians, or engaging in discussions with patients. Of necessity, such interactions are limited in scope, but they can provide a key complement to scientific literature, adding a human picture of disease and perhaps reinforcing the need for intervention to prevent disease. Students may also benefit from observing particular technologies, e.g., mammography, or particular settings, e.g., health maintenance organizations, which are the focus of their research.

There are many other areas relevant to epidemiologic research where complete training is not possible but more limited experiences may be valuable. These include laboratory rotations to gain an understanding of some of the major assays that may be used in a research project and an appreciation of the potential sources of error in the measurements. Students may also need to learn more about computer databases for handling the large amounts of data generated by some of the new methodologies, e.g., microarrays, and by large-scale epidemiological research more generally.

Other issues

- Epidemiology is moving in many different directions, and epidemiologists throughout their career will need to grow and learn; they need to be able to adapt frequently to new circumstances in the field and the environment. Continuous learning situations for both faculty and students can benefit both groups, through role reversal, one-to-one interactions, and more open communication.

- Students need to be exposed early in their doctoral training to the many career paths that they can take and the skill sets that these different paths may require.

- Fundamental scientific areas can be taught to students through several modalities, including courses, seminars, and distance education; however, direct mentoring and guidance of students is one of the most important and effective mechanisms.

- Students should not need to be closely tied to the subject matter and approaches of the faculty at a particular institution. Faculty should feel comfortable in arranging for students to receive some types of specific training in other schools if that school has special strengths in the student's area.

- Of note are the restrictions on NIH epidemiology training grants that can make it very difficult for some students to participate, such as students who wish to work part-time. Also, stipends/salaries are extremely low. Training programs could benefit students by providing support for research carried out by students.

Work Group 3: Specialization in Epidemiology vs. General Training

This group addressed the challenge posed by the increasing specialization within epidemiology. Recent decades have seen the continued differentiation of the field with multiple new branches that are defined by methods (e.g., genetic epidemiology), exposures (e.g., environmental epidemiology), and outcomes (e.g., cardiovascular epidemiology), as well as other descriptors. Increasingly, doctoral programs are fragmented as specialty areas proliferate, each with their own training needs. This group offers its reports as a series of critical questions along with answers.

1. What is *specialization*?

Specialization is the in-depth study of either a particular disease, e.g., cancer, perinatology or cardiovascular disease, or particular exposures, e.g., environmental, infectious, or occupational; or the concentrated study of particular domains such as clinical or pharmacological epidemiology. The increased knowledge base in all specialties makes it imperative that many epidemiologists are educated in specialized epidemiology programs. To achieve academic advancement, epidemiologists working on university faculties will need to be at the cutting edge of specific areas of scholarship and are among those most likely to follow specialized epidemiology careers.

2. Should there be a general epidemiology degree?

We recognize that all doctoral students, including those in a specialized program, should receive general epidemiology training; however, a strong need exists for generalist training at the doctoral level in epidemiology. A generalist doctoral degree, although not completely defined, should include a high level of methodology training and preparation for a career in a broad range of epidemiology topics. For example, private industry, state health departments, or nonprofit research organizations could hire such graduates. Training for public health careers should not be considered as a generalist career path, as some public health workers may function in specifically designated areas such as Maternal and Child Health Departments.

3. When should specialization begin in doctoral education?

Training in core competencies should typically occur during the first two years and should take priority over specialization during this time. However, specialization can begin at any time during a doctoral program and would typically dominate the later phase of training, including the thesis requirement. In addition, some testing of specialty topics would normally be expected as part of the competency examination for admission to PhD candidacy.

4. Is there a core of knowledge and skills in epidemiology that should be held by all doctoral students, regardless of specialization?

Yes. In addition to those listed by the two groups on competencies, doctoral students should have training in advanced methods of longitudinal analysis, repeated measures, nonparametric statistics, and clinical trials. Also critical are project and fiscal management training, sampling, data management and documentation, and protocol development.

5. What is the need for epidemiologists in various areas of specialization? Do we know? How are the schools of public health setting their targets?

The extent of the need for specialist epidemiologists in the various areas is unknown. Determination of this data would be a useful exercise for the ACE, as there are no firm data on how schools of public health set their targets for training in particular areas. Possibilities include available faculty expertise, available training funds, and some projections about what is important or needed based on student demand. This kind of information is not routinely gathered, and it could be useful in

conjunction with a systematic investigation of the marketplace for doctoral level epidemiologists. This would include a review of postings of epidemiology jobs, as well as appropriate jobs that may not be specifically listed for epidemiologists. Career tracking of recent graduates may already be available from the schools of public health, other degree-granting institutions, and professional organizations and would assist with understanding the demands of the marketplace.

6. How can or should tracks for general epidemiology be developed and maintained?

Doctoral programs need to provide a strong foundation in all the core competencies of epidemiology for all doctoral students. Elective courses provide the opportunity for students to either continue the generalist approach through a variety of choices or to specialize through focus on a specific area of epidemiology. The DrPH may be one option for this kind of track but schools of public health may seek to create public health practice DrPH degrees as one form of specialization.

Work Group 4: Competencies for Public Health Practice

This group was charged with considering epidemiology and public health practice. Of course, public health practice has long been a domain for problem-solving using epidemiological approaches. With the substantial growth of research within academic and other institutions, however, there is increasing divergence of the research and practice communities within the field of epidemiology. In training institutions, the PhD degree has been "research-oriented" while the DrPH degree has been "practice-oriented."

The group considered the key question in this regard: *Is the DrPH distinct from the PhD?* While in most schools, there are recognizable differences in DrPH (practice) and PhD (academic) degrees; there is also substantial overlap. A number of schools of public health have either recently reviewed or are reviewing the DrPH and PhD degrees and the differences between them. The trend is toward making the degrees distinctive; with the DrPH designed for those intending to work as public health professionals; its associated training program and dissertation would focus on public health practice. There is also a lack of distinction between the two degrees in the job market. This lack of distinction raises a number of the questions:

- Is public health practice really separate from research?
- What are core competencies of public health practice for all epidemiologists?
- What is the philosophy of public health?
- Is translational research a way to instill the idea of the big picture?
- Is it necessary to understand the role of epidemiology in public health versus being a public health practitioner?

The use of a post-doctoral training mechanism might offer one approach to strengthening offerings in public health practice at schools of public health. To accommodate the training for a given career direction, schools of public health might consider making post doctoral training in public health practice more widely available. The Epidemic Intelligence Service is an example for public health practice. The ASPH should explore academic-public health agency partnerships to develop additional postdoctoral training in public health settings, with some slots specifically directed to those in mid-career. Post-graduate specialty training can also serve as a mode to enhance doctoral training.

Suggested core competencies covering general training issues
• Synthesizing, e.g., via meta analysis, conducting a systemic review, drawing a conceptual model
• Possessing a breadth of experiences of challenges to develop the ability to move to new problems
• Participating in a mentored research experience
• Writing of a major report, usually a dissertation
• Designing an instrument
• Conducting a sensitivity analysis
• Critiquing epidemiologic research constructively

Minimal training for all doctoral students in public health practice
• Assessing the health of the community using epidemiologic methods. • Having familiarity with the principles of prevention, intervention, and evaluation • Working effectively on multidisciplinary teams (scientists, non-scientists and stakeholders) • Understanding public health ethics • Developing a cultural competence • Conceptualizing and synthesizing public health problems

Recommended experiences and skills for a public health practitioner
• Possessing all of the skills required for completion of an MPH • Applying epidemiologic process in a public health emergency • Understanding public health ethics, e.g., small number analysis • Understanding public health law and jurisdiction, including IRB considerations • Possessing knowledge of disease surveillance at the population level • Participating in outbreak investigation • Participating in community participatory research • Having proficiency in oral and written communication with the public, media, and policy makers • Understanding public health perspective • Participating in public health practice that provides direction and focus. • Having the ability to describe the implications of epidemiologic research for public health policy and the consumer • Understanding the broad perspectives of disciplines relevant to public health interventions, e.g., behavioral sciences, economic theory • Possessing a knowledge of program evaluation

Work Group 5: Epidemiology and Bioterrorism

This group focused on the preparation of epidemiologists for public health practice. The public health system in the United States is a critical component of the nation's ability to respond to terrorist attacks. Within this system, epidemiologists play a key role in detecting possible terrorist attacks, analyzing sketchy information to identify the likely agent and source of exposure, and managing response activities such as emergency immunization and quarantine.

Although no definitive numbers were available at the workshop, it was clear that there has been a sudden surge in the demand for epidemiologists following the events in the autumn of 2001. Many states responded to new federal funding opportunities by hiring epidemiologists for state and regional positions. Although many of the individuals being hired into these positions are not expected to have doctoral or even masters level training, there are a number of implications for doctoral training.

First, schools of public health and other programs that train epidemiologists must be involved in training those who will fill "epidemiologist" positions at the state and local level. This training should focus on applied epidemiology in a public health practice setting, something that is not the focus on many current epidemiology-training programs. Specific approaches could involve life-long learning, in-service education, train the trainer, distance education, and certificate or topical training. In order to appropriately train epidemiologists and other public health professionals, a modular approach may be necessary. This would assume that basic information on bioterrorism and health security/public health preparedness be incorporated into all training programs in public health and epidemiology. Beyond this, doctoral-level epidemiologists would have to be prepared to train staff of state and local public health departments, and to serve as experts and leaders in infectious disease epidemiology and control strategies.

Second, schools of public health and other training programs should increase their emphasis on practical aspects of public health practice, including surveillance. Epidemiology is regarded as the core science of public health and the fundamental basis for public health practice. As such, academic research must be balanced by efforts to translate scientific results to improved public health practice. This will require more faculty members who are knowledgeable about bioterrorism, emerging diseases, and public health practice. Financial resources will also be needed to support students and faculty, to develop new teaching material, and to reach out to others.

Third, doctoral trained epidemiologists are still needed in public health practice, especially at the state level. Although masters level epidemiologists are sufficient for many roles, the fast pace of scientific growth in epidemiology and infectious diseases makes a doctoral degree necessary at least in leadership positions in state health departments.

Workshop participants also noted the many opportunities for research using health department data, and suggested more collaboration between state health departments and schools of public health on research and training. Programs to bring public health faculty and students into health departments are one way to expose faculty to the challenges of public health practice.

Some have noted that other more traditional health concerns were responsible for far more morbidity, mortality, and health care expenditures, and expressed concern that the new interest in bioterrorism would distort priorities in epidemiologic research and training. More positively, perhaps the new attention to bioterrorism will lead to a rebalance in epidemiology, building up areas such as infectious disease epidemiology and surveillance methodology that have been relatively neglected in recent years without reducing effort in other areas. Development of "dual use" capability in epidemiology, in which surveillance and other activities serve both terrorism and more traditional public health purposes, can also lead to positive results. Workshop participants felt that it was better to have epidemiologists at the table in considering these policy issues than for them to be absent, and that perhaps the new interest in the field could lead epidemiologists to reconsider their priorities and activities, including emphases in doctoral education which is the focus of the workshop.

Skills are needed for epidemiologists working at the state and local level on bioterrorism
• Biological and clinical aspects of bioterrorism agents/emerging infections • Surveillance, detection, investigation, and infectious disease control – Clinical diagnosis – Laboratory skills – Statistics – Outbreak investigations, including forensic epidemiology and coordination with law enforcement – Screening and mass prophylaxis • Information technology • Communication with providers and the public • Exposure assessment • Environmental remediation • Risk management and communication • Epidemiologic modeling • Mental health • Evidence-based medicine • Ethical behavior in the conduct of public health research and practice • Health services administration – Integration of surveillance with regular practice – Mobilizing mass immunization and prophylaxis – System planning

Appendix: List of Work Group Participants

Work Group 1: Core Competencies in Doctoral-Level Epidemiological Training

Linda Cowan, PhD
(Co-chair)
College of Public Health
University of Oklahoma

Meir Stampfer, MD, DrPH
(Co-chair)
Harvard School of Public Health
Harvard University

Felicia Allen-Ramey, PhD, MPH
Merck & Company, Inc.

Amy Borenstein Graves, PhD, MPH
College of Public Health
University of South Florida

Elizabeth Chrischilles, PhD, MS
College of Public Health
University of Iowa

Sean Cleary, PhD, MPH
School of Public Health & Health Sciences
George Washington University

Deborah del Junco, PhD
School of Rural Public Health
Texas A&M University Systems Health Science Center

Carolyn Drews-Botsch, PhD
Rollins School of Public Health
Emory University

Lisa Fredman, PhD
School of Public Health
Boston University

Ellen Funkhouser, DrPH
School of Public Health
University of Alabama at Birmingham

Sylvia Furner, PhD, MPH
School of Public Health
University of Illinois at Chicago

Steve Goodman, PhD, MD, MHS
Bloomberg School of Public Health
Johns Hopkins University

Marty Kanarek, PhD
Population Health Sciences
University of Wisconsin-Madison

Sheryl Kelsey, PhD
Graduate School of Public Health
University of Pittsburgh

Patricia Langenberg, PhD
University of Maryland, Baltimore

Paul Muntner, PhD
School of Public Health & Tropical Medicine
Tulane University

Philip Nasca, PhD
School of Public Health
University of Massachusetts-Amherst

Cruz Nazario, PhD, MS
Graduate School of Public Health
University of Puerto Rico

Mia Papas, MS
Bloomberg School of Public Health
Johns Hopkins University

William True, PhD, MPH
School of Public Health
Saint Louis University

Work Group 2: Scientific Foundations for Epidemiologists: Doctoral Training

Deborah Winn, PhD
(Co-chair)
National Center Institute
National Institutes of Health

Demetrius Albanes, MD
(Co-chair)
National Cancer Institute
National Institutes of Health

Kristin Anderson, PhD, MPH
School of Public Health
University of Minnesota

Sean Hennessy, PharmD, PhD
Center for Clinical Epidemiology & BioStatistics
University Of Pennsylvania School of Medicine

John Hokanson, PhD
Department of Preventive Medicine
University of Colorado

Michael Lebowitz, PhD
College of Public Health
University of Arizona

Charles Poole, ScD, MPH
School of Public Health
University of North Carolina - Chapel Hill

Alfred Rimm, PhD
Medical School
Case Western Reserve University

Stephen Schwartz, PhD, MPH
School of Public Health
University of Washington

Sherry Selevan, PhD
U.S. Environmental Protection Agency

Gregg Wilkinson, PhD
School of Public Health
University of North Texas Health Science Center

Zuo-Feng Zhang, MD, PhD
School of Public Health
University of California at Los Angeles

Work Group 3: Specialization in Epidemiology vs. General Training

Michael Bracken, PhD
(Co-chair)
School of Public Health
Yale University

Mary Haan, MD, DrPH
(Co-chair)
School of Public Health
University of Michigan

Toni Alterman, PhD
NIOSH
Centers for Disease Control & Prevention

Christine Arcari, PhD, MPH
Population Health Sciences
University of Wisconsin-Madison

Rebecca Fuhrer, PhD
McGill University Faculty of Medicine

Terri Madison, PhD, MPH
STATPROBE, Inc.

Richard Shaffer, PhD, MPH
School of Public Health
San Diego State University

Sheila Weiss, PhD
School of Pharmacy
University of Maryland, Baltimore

Work Group 4: Competencies for Public Health Practice

Betsy Foxman, PhD
(Co-chair)
Center for Molecular and Clinical Epidemiology of Infectious Diseases
University of Michigan

Art Reingold, MD
(Co-chair)
School of Public Health
University of California at Berkeley

C. Perry Brown, DrPH
Florida A&M University

Patricia Hartge, ScD
National Cancer Institute
National Institutes of Health

Merry Holliday-Hanson, PhD, MS
California Department of Health Services

Scott Kellerman, MD, MPH
Epidemiology Program Office
Centers for Disease Control & Prevention

Kristian Lindsted, PhD
School of Public Health
Loma Linda University

Polly Marchbanks, PhD
Centers for Disease Control & Prevention

Robert McKeown, PhD
Norman J. Arnold School of Public Health
University of South Carolina

Ann Stueve, PhD
Mailman School of Public Health
Columbia University

Robert Weinzimer
National Center for Health Statistics
Centers for Disease Control & Prevention

Work Group 5: Epidemiology and Bioterrorism

Maureen Lichtveld, MD, MPH
(Co-chair)
PHPPO
Centers for Disease Control and Prevention

Michael Stoto, PhD
(Co-chair)
RAND

Kitaw Demissie, MD, PhD
School of Public Health
UMDNJ

Elin Gursky, ScD
ANSER Institute for Homeland Security

John Herbold, PhD, MPH
University of Texas Health Science Center

Rosanne McTyre, PhD
The Weinberg Group, Inc.

Curtis Patton, PhD
School of Public Health
Yale University

Dennis Perrotta, PhD, CIC
State Epidemiologist
Texas Department of Health

Epidemiology Core Competencies for Master of Public Health Students

Michael Moser, MD, MPH, FACPM[a]
Kalpana Ramiah, MSc, MPH, CHES[b]
Michel Ibrahim, MD, PhD[c]

SYNOPSIS

Competency-based education for public health professionals has been recommended by the Institute of Medicine. The Association of Schools of Public Health has developed a set of academic core competencies that it recommends that all Master of Public Health (MPH) students should possess prior to graduation. This article discusses the processes and reasoning used by the workgroup that prepared the epidemiology subset of MPH core competencies that appear in the association's 2006 report. These academic core competencies are complementary to but distinct from the specialist competencies that students should develop in their major field. The authors emphasize the importance of ongoing refinement of the core competency model with participation from both public health academics and public health practitioners.

[a]Akron Health Department, Akron, OH; Northeastern Ohio Universities College of Medicine, Rootstown, OH

[b]Formerly with Educational Programs, Association of Schools of Public Health, Washington, DC

[c]Department of Epidemiology, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD

Address correspondence to: Michael Moser, MD, MPH, FACPM, Morley Health Center, Akron Health Department, 177 S. Broadway, Ste. 215, Akron, OH 44308; tel. 330-375-2960; fax 330-375-2154; e-mail <MoserMi@ci.akron.oh.us>.

In the 2002 report, "Who Will Keep the Public Healthy? Educating Public Health Professionals for the 21st Century,"[11] the Institute of Medicine recommended that public health education should be competency-based. Competency assessment has become a common way to measure performance in both academic and practice settings. A competency is defined as a "complex combination of knowledge, skills, and abilities demonstrated by organization members that is critical to the effective and efficient function of the organization."[2] In 2001, the Council on Linkages Between Academia and Public Health Practice (COL) disseminated a competency model for public health practitioners.[3] COL's competency model was framed as a set of workforce competencies, designed for public health professionals/practitioners already working in the field. Previous works in competency development have explained the difference between a workforce competency and an academic competency.[4] The Council on Education for Public Health (CEPH) now explicitly requires schools of public health and public health degree programs seeking accreditation to have clearly stated competencies that guide the development of their educational programs.[5,6]

This article reviews the background and processes involved in the preparation of the epidemiology portion of a set of Master of Public Health (MPH) core competencies, which were developed by the Association of Schools of Public Health (ASPH) to facilitate further implementation of competency-based programs in graduate public health education.[7]

THE ASPH MPH CORE COMPETENCY DEVELOPMENT PROJECT

In 2004, ASPH launched an initiative under the auspices of its Education Committee (Chair, Stephen Shortell, PhD) to develop an academic competency model for master's-level education in public health. The MPH Core Competency Development Project was a response to a number of forces, including: expansion of both the opportunities and challenges for graduates of MPH programs; recognition of the advantages conferred by competency-based approaches in other academic fields; increased emphasis on accountability in higher education; and recommendations from key national organizations.

For the purposes of the MPH Core Competency Development Project, the core competencies were defined as a unique set of applied knowledge, skills, and other attributes (KSOs), grounded in theory and evidence, that every MPH student should possess upon graduation. The MPH Core Competency Development Project was completed in August 2006, with approval from the ASPH Board, for 119 core competencies arrayed in 12 domains. The core competency domains fall into two categories. There are five domains that address the five traditional core areas of knowledge (Biostatistics, Environmental Health Sciences, Epidemiology, Health Policy and Management, and Social and Behavioral Sciences) currently required for MPH degrees offered by programs and schools accredited by CEPH, and seven interdisciplinary, cross-cutting domains (Communication and Informatics, Diversity and Culture, Leadership, Professionalism, Program Planning, Public Health Biology, and Systems Thinking) that were considered essential for contemporary public health practice. The relationship between traditional core domains and the interdisciplinary, cross-cutting domains is illustrated in Figure 1. A full description of the MPH Core Competency Development Project is available through ASPH.[7]

THE CORE COMPETENCY WORKGROUPS

Twelve workgroups aligned with the five traditional domains and seven interdisciplinary domains were convened in two phases of the project. All workgroups were asked to follow the same procedures, which are described later in this article. Workgroup members were nominated to the project by a school of public health dean or public health partner organization (the American Public Health Association, Association of State and Territorial Health Officials, or National Association of County and City Health Officials). From these nominees, chairs and cochairs for each workgroup were appointed by ASPH project leaders. The workgroup chairs were then asked to identify, from the nominees, a group of approximately 10 content specialists to serve as members of the core workgroup for their domain. Additional nominees were invited to serve on resource groups, utilized to obtain additional input and provide a second level of review for draft lists of domain competencies. The workgroups were assisted by a competency consultant—Judith Calhoun, PhD, University of Michigan School of Public Health. ASPH provided staff support for the workgroups.

Michel Ibrahim, MD, PhD (Johns Hopkins Bloomberg School of Public Health) and Michael Moser, MD, MPH (Akron Health Department and Northeastern Ohio Universities College of Medicine) were designated cochairs for the Epidemiology workgroup. The members of the Epidemiology Core Workgroup and the Epidemiology Resource Group are listed, with affiliations, in Figure 2.

Charge to the Epidemiology Workgroup

The Epidemiology Workgroup was charged with developing a consensus list of eight to 10 epidemiology competencies that every MPH graduate should possess upon graduation. Early in this workgroup's process, members recognized that a central concept in its deliberation was the distinction that these competencies were to be required of *every* MPH student upon graduation, regardless of background, specialization, or intended career direction. This distinction was critical throughout the deliberations of the Epidemiology Workgroup. While the focus of this workgroup was epidemiology, the members recognized that the purpose was not to define the competencies possessed by an epidemiology major or by a practicing epidemiologist. The question that framed their discussions was, "What epidemiology competencies are needed by every MPH graduate for effective public health practice and lifelong learning, whatever form or focus their public health practice may take?"

Figure 1. Association of Schools of Public Health core competencies graphic model

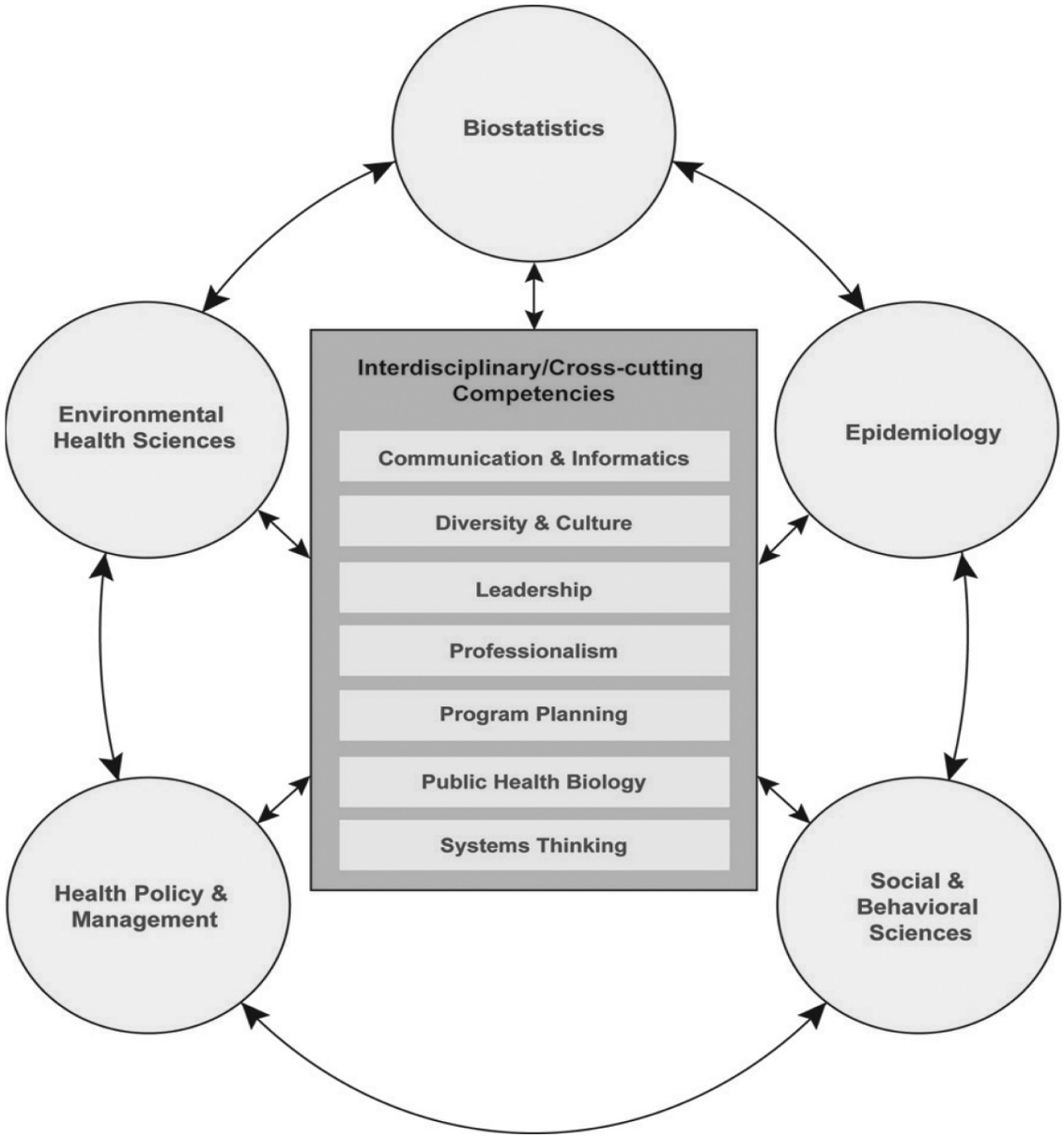


Figure 2. Epidemiology Workgroup

Epidemiology Core Workgroup Members

Dr. Michel Ibrahim, Johns Hopkins Bloomberg School of Public Health
Dr. Michael Moser, Akron Health Department and Northeastern Ohio Universities College of Medicine
Dr. Kristin Anderson, University of Minnesota School of Public Health
Dr. Erin Bell, University at Albany SUNY School of Public Health
Dr. James Gale, University of Washington School of Public Health and Community Medicine
Dr. Dan Herman, Columbia University Mailman School of Public Health
Dr. Paul Muntner, Tulane University School of Public Health and Tropical Medicine
Dr. Arthur Reingold, University of California at Berkeley School of Public Health
Dr. Heather Stockwell, University of South Florida College of Public Health

Epidemiology Resource Group Members

Dr. Anne Aschengrau, Boston University School of Public Health
Dr. Zhao Chen, University of Arizona, Mel and Enid Zuckerman College of Public Health
Dr. E. Francis (Fran) Cook, Harvard School of Public Health
Dr. Roberta McKean-Cowdin, University of Southern California
Dr. Robert Dubrow, Yale University School of Public Health
Ms. Jo Ann Glad, Allegheny County Health Department
Dr. Arden Handler, University of Illinois at Chicago School of Public Health
Dr. Carol Hogue, Emory University Rollins School of Public Health
Ms. Elissa Laitin, Arlington County Public Health Division
Dr. Michael Lebowitz, University of Arizona, Mel and Enid Zuckerman College of Public Health
Dr. Philip Nasca, University of Massachusetts School of Public Health and Health Services
Dr. George Rhoads, University of Medicine and Dentistry of New Jersey School of Public Health
Dr. Russell Rycheck, University of Pittsburgh Graduate School of Public Health
Dr. Victor Schoenbach, University of North Carolina at Chapel Hill School of Public Health
Dr. Evelyn Talbott, University of Pittsburgh Graduate School of Public Health
Dr. John Vena, University of South Carolina Arnold School of Public Health
Dr. Paul Visintainer, New York Medical College School of Public Health

The Epidemiology Workgroup process

While recognizing that it was not developing competencies for practicing epidemiologists and was not empowered to define the entire discipline of epidemiology, the Epidemiology Workgroup did feel that it needed to have a working definition of epidemiology for the purposes of this project. After discussion, the following working definition was accepted: "Epidemiology is the study of patterns of disease and injury in human populations and the application of this study to the control of health problems."

In the belief that others before them had likely considered the question of epidemiology competencies, and wanting to learn from this prior work, the workgroup chairs directed the ASPH staff assigned to the workgroup to identify, review, and summarize all previous compilations of epidemiology competencies. ASPH staff collected this information via Web searches, surveys of the core and expanded resource workgroups, and reviews of CEPH accreditation self-evaluation reports.

Staff also contacted other organizations involved in public health competency development, including the Council on Linkages Between Academia and Public Health Practice, the Northwest Center for Public Health Practice, and the Public Health Prevention Service at the Centers for Disease Control and Prevention (CDC). The results of this search were compiled in a comprehensive listing (the megalist) that contained more than 400 epidemiology-related competency statements. Staff also prepared digests of the search results, which arrayed the epidemiology-related competency statements in categories. A complete list of all epidemiology competency statements considered by the workgroup for this vetting process is available at http://www.asph.org/UserFiles/Master%20Comp.xls. A list of the resources examined by staff to prepare this list is available at http://www.asph.org/document.cfm?page=935.

ASPH staff coordinated workgroup meetings by telephone conference calls at prearranged times using a commercial hosting firm to provide the telecommunications bridge. At its initial meeting, the core workgroup reviewed its charge and agreed on a general process for undertaking the project. Workgroup members began by reviewing the lists of epidemiology

competency statements assembled by staff and submitting any additional competency statements that seemed warranted. All subsequent nominated statements were added to the megalist.

Staff then set up an Internet-based survey tool to refine the megalist. Members used a nominal group technique—modified Delphi process—for this and succeeding selection rounds. Respondents considered each candidate competency and responded in a structured fashion. The options for these responses varied slightly in each of the Delphi rounds and are summarized in Figure 3.

After the first Delphi round, the Epidemiology Workgroup found itself with 24 competency statements that had obtained widespread support and moved into the next stage. Core workgroup members met by conference call to discuss the results of Delphi #1. Each candidate competency was considered individually and efforts were made to clarify ambiguous language. The group was asked to give careful consideration to the possibility of absence from the competency list of any epidemiology competency that might be important for successful public health practice. Clearly redundant statements were combined. A criterion for selection introduced during the second round of discussion and reiterated throughout the remainder of the epidemiology competency selection process was, "Is this competency measurable?"

From these discussions and associated e-mail exchanges, the cochairs developed a refined list of candidates for the second Delphi round. For the second Delphi, both the core workgroup and the expanded resource workgroup were asked to participate. Participation from the Epidemiology Workgroup was high in all Delphi rounds, averaging 91% (Table).

After the second Delphi round, the workgroup reached consensus on a list of 15 epidemiology core competency candidates. The subsequent discussion among members of the core workgroup brought under more intense scrutiny the rationale for required acquisition of epidemiology competencies by *all* MPH graduates. In this context, the core workgroup considered the many occupational settings in which MPH graduates might find employment. The group's consensus was that it is necessary for MPH graduates to possess core epidemiology competencies to prepare them to appropriately and effectively assemble and/or interpret information about health and disease in human populations. Knowledge of information and programs developed using epidemiologic methods and insights was recognized as important in public health practice, but possession of such content knowledge by every MPH graduate was considered secondary in priority to fundamental skills in population data acquisition and interpretation.

The language of each candidate competency was repeatedly examined for clarity. Members discarded competencies for which a feasible mechanism could not be proposed to evaluate student success upon acquisition. Bloom's taxonomy for educational objectives and assessment[8–10] was utilized as a core resource for the entire MPH Core Competency Development project. The Epidemiology Workgroup's cochairs worked with the project consultant to assure that the final epidemiology MPH core competencies were written to be consistent with Bloom's taxonomy.

With the assistance of the project consultant, the workgroup examined the complexity and character of the candidate competencies, striving for a mix of competencies that addressed needs for basic knowledge, higher-level analysis and interpretation, and affective elements. The group did not feel that any of the core competencies for the epidemiology domain involved the development of motor (sometimes referred to as technical) skills.

The third Delphi round conducted among the core

Figure 3. Criteria for acceptance of each competency in the modified Delphi surveys

Pre-Delphi voting (only for SBS workgroup)	*Delphi Round 1*	*Delphi Round 2*	*Delphi Round 3*
1. Yes 2. No 3. Maybe	1. Accept 2. Accept with changes 3. Reject 4. Consider an alternative as noted below 5. If "accept with changes," how should it be reworded?	1. Accept 2. Reject 3. Accept with changes 4. If "accept with changes," how should it be reworded?	1. Accept 2. Reject 3. Final comments (use the box for comments)

NOTE: In all three rounds of each survey, respondents had the opportunity to provide input by using a General Comments section.
SBS = social and behavioral sciences

Table. Epidemiology Workgroup Delphi processes summary

Steps		Delphi 1		Delphi 2		Delphi 3		Final list	
Workgroups	Initial action	Number of competencies	Response rate (percent)	Number of competencies	Response rate (percent)	Number of competencies	Response rate (percent)	Discipline-specific competencies	Cross-cutting competencies
Epidemiology	Staff developed megalist containing more than 400 competencies, followed by cochairs' review	24	100	15	92	11	81	10	2

workgroup produced a consensus list of 11 epidemiology core competencies. The cochairs then facilitated a final set of discussions to achieve the prespecified target of 10 epidemiology core competencies. In addition, the workgroup made a strong recommendation that two competencies not included on their final list be considered for inclusion in a cross-cutting competency category.

RECOMMENDATIONS OF THE EPIDEMIOLOGY WORKGROUP

The epidemiology core competencies for all MPH graduates recommended by the Epidemiology Workgroup are listed in Figure 4. In addition, the workgroup strongly recommended to the Education Committee that one or more cross-cutting competency domains be established and that the following cross-cutting competencies be included:

Upon graduation, a student with an MPH should be able to:

1. Interact appropriately and sensitively with people from diverse backgrounds, including but not limited to diversity of culture, age, gender, education, race, ethnicity, lifestyle, profession, and socioeconomic status.
2. Understand the need for lifelong learning to remain a master of public health.

Figure 4. Epidemiology core competencies for all Master of Public Health (MPH) graduates

Upon graduation, a student with an MPH should be able to:

1. Identify key sources of data for epidemiologic purposes.
2. Identify the principles and limitations of public health screening programs.
3. Describe a public health problem in terms of magnitude, people, time, and place.
4. Explain the importance of epidemiology for informing scientific, ethical, economic, and political discussion of health issues.
5. Comprehend basic ethical and legal principles pertaining to the collection, maintenance, use, and dissemination of epidemiologic data.
6. Apply the basic terminology and definitions of epidemiology.
7. Calculate basic epidemiology measures.
8. Communicate epidemiologic information to lay and professional audiences.
9. Draw appropriate inferences from epidemiologic data.
10. Evaluate the strengths and limitations of epidemiologic reports.

EXTERNAL CONSULTATION

During its deliberations, the Epidemiology Workgroup sought to communicate with key academic and practice constituencies. The workgroup cochairs and ASPH staff conferred by telephone with the CDC point of contact for the CDC/Council of State and Territorial Epidemiologists (CSTE) project on Competencies for Applied Epidemiologists in Governmental Public Health Agencies (AECs)[11] to verify that the two projects would not be redundant. Two members of the ASPH Epidemiology Core Competencies Workgroup were also participants in the AECs project. The ASPH epidemiology MPH core competencies were conceived as academic competencies to provide a foundation for future public health practice in any field, while the CDC/CSTE AECs were developed as practice competencies for people working as epidemiologists.

Staff shared information with the CDC/CSTE project during the ASPH workgroup's vetting and selection process, while the candidate lists of competencies were being developed, and as the criteria used for selection of core competencies were selected. Staff circulated the list of core MPH competencies recommended by the Epidemiology Workgroup widely among public

health academics and other stakeholders, with requests for comments. When comments were received, the cochairs reviewed them to determine if they raised issues that had not been addressed during workgroup deliberations. Staff then prepared responses to each questioner. Within ASPH, staff circulated the competency recommendations for review among both faculty and leadership groups prior to adoption by the ASPH Board.

CONCLUSIONS

It is timely and appropriate that academic institutions offering a program of study leading to the MPH degree give consideration to use of a competency model for this professional degree. At this time, whether and to what extent MPH degree granting institutions adopt such a model is the decision of each institution and its faculty. The MPH Core Competencies matrix developed by ASPH outlines a comprehensive set of core competencies for MPH graduates that should be a valuable reference for any institution and faculty choosing to pursue a competency approach to graduate public health education.

The 26 members of the Epidemiology Workgroup were able to bring a broad range of insight from academic and practice settings to the competency selection process. The consensus list of 10 epidemiology core competencies that the workgroup produced is a credit to the collective knowledge and wisdom of the workgroup members. It has been reviewed and endorsed by a wide range of professional organizations and individuals, without significant objection. But it is important to remember that any listing of competencies, whether academic or practice-focused, involves some degree of selection and compromise if the listing is to be of practical value.

The list of epidemiology core competencies proposed by the Epidemiology Workgroup and adopted as part of the ASPH MPH Core Competencies matrix is not a canonical document. It can and should continue to be closely examined and critiqued. As schools of public health and other academic institutions work to incorporate core competencies into MPH curricula, it is probable that issues will emerge that were not apparent during the initial core competency project. This is particularly likely as faculty explore integrated implementation of core competencies, both in traditional domains and the new cross-cutting areas.

The epidemiology core competencies outlined in version 2.3 of the ASPH MPH Core Competencies must not be viewed as static dicta, but rather as a starting point for discussion and academic exploration. A sincere commitment to competency-based education will involve challenges and a lot of work. It has the potential to transform both the content and the form of MPH education. It was the goal of the Epidemiology Workgroup to provide a useful benchmark for institutions and faculties that choose to undertake this challenge.

The authors wish to thank the other members of the Epidemiology Core Workgroup: Kristin Anderson, Erin Bell, James Gale, Dan Herman, Paul Muntner, Arthur Reingold, and Heather Stockwell for the time, wisdom, and insight that they contributed to the competency development process. The members of the Epidemiology Resource Group—Anne Aschengrau, Zhao Chen, Fran Cook, Roberta McKean-Cowdin, Robert Dubrow, Jo Ann Glad, Arden Handler, Carol Hogue, Elissa Laitin, Michael Lebowitz, Philip Nasca, George Rhoads, Russell Rycheck, Victor Schoenbach, Evelyn Talbott, John Vena, and Paul Visintainer—provided critical input and validation without which the workgroup deliberations would have been incomplete.

Finally, the authors acknowledge the superb and dedicated support from the project consultant, Dr. Judith Calhoun, and staff at the Association of Schools of Public Health (ASPH), in particular Dr. Harrison Spencer and Ms. Elizabeth Weist.

This project was supported under a cooperative agreement from the Centers for Disease Control and Prevention (CDC) through the ASPH Grant #U36/CCU300430-23/24.

The contents of this article are solely the responsibility of the authors and do not necessarily represent the official views of CDC. For more information on the ASPH MPH Core Competency Model, please contact: Elizabeth Weist, MA, MPH, Association of Schools of Public Health, 1101 15th St. NW, Ste. 910, Washington, DC 20005; e-mail <eweist@asph.org>.

REFERENCES

1. Gebbie K, Rosenstock L, Hernandez LM, editors. Who will keep the public healthy? Educating public health professionals for the 21st century. Board on Health Promotion and Disease Prevention, Institute of Medicine. Washington: National Academies Press; 2003.
2. Nelson JC, Essien JD, Loudermilk R, Cohen D. The public health competency handbook: optimizing individual and organizational performance for the public's health. Gaithersburg (MD): Aspen Publishers; 1997.
3. Council on Linkages Between Academia and Public Health Practice. Core competencies for public health professionals [cited 2007 Jun 13]. Available from: URL: http://www.phf.org/competencies.htm
4. Gebbie KM. Competency-to-curriculum toolkit: developing curricula for public health workers. 2002. Columbia University School of Nursing Center for Health Policy and Association of Teachers of Preventive Medicine. Revised October 2004 [cited 2007 Jun 13]. Available from: URL: http://www.nursing.hs.columbia.edu/research/ResCenters/chphsr/pdf/toolkit.pdf
5. Council on Education for Public Health. Accreditation criteria: schools of public health. Amended June 2005 [cited 2006 Oct 30]. Available from: URL: http://www.ceph.org/files/public/SPH-Criteria-2005.SO5.pdf
6. Council on Education for Public Health. Accreditation criteria: public health programs. Amended June 2005 [cited 2006 Oct 30]. Available from: URL: http://www.ceph.org/files/public/PHP-Criteria-2005.SO5.pdf
7. Association of Schools of Public Health. ASPH Education Committee: master's degree in public health core competency development

project, version 2.3. 2006 [cited 2007 Jun 13]. Available from: URL: http://www.asph.org/userfiles/Version2.3.pdf
8. Association of Schools of Public Health Education Committee. Core MPH competency model development project, workgroup reference guidebook. Washington: ASPH; 2004. Calhoun J, Document 6, Taxonomies of Educational Outcomes.
9. Bloom BS, Engelhart MD, Hill W, Furst EJ, Krathwohl DR. Taxonomy of educational objectives: the classification of educational goals, handbook I: cognitive domain. New York: Longman; 1956.
10. Krathwohl DR, Bloom BS, Masia BB. Taxonomy of educational objectives: the classification of educational goals, handbook II: affective domain. New York: Longman; 1964.
11. Centers for Disease Control and Prevention (US) and Council of State and Territorial Epidemiologists. Competencies for applied epidemiologists in governmental public health agencies (AECs) [cited 2007 Oct 17]. Available from: URL: http://www.cdc.gov/od/owcd/cdd/aec or http://www.cste.org/competencies .asp

Letters of Review

Edward F. Fitzgerald, Ph.D., Professor and Chair, Department of Epidemiology and Biostatistics, School of Public Health, University at Albany, Statue University of New York

Wilfried Karmaus, Ph.D., Graduate Director for Epidemiology, Department of Epidemiology and Biostatistics, Arnold School of Public Health, University of South Carolina.

UNIVERSITY AT ALBANY
State University of New York

Department of Epidemiology and Biostatistics
School of Public Health

A joint venture with the
New York State Department of Health

May 5, 2010

John E. Vena, PhD
Head, Department of Epidemiology and Biostatistics
College of Public Health
University of Georgia
132 A Paul D. Coverall Center
Athens, GA 30602

Dear John:

I am pleased to review and comment on your proposed PhD program in epidemiology at the University of Georgia. We have had a similar program here at the University at Albany for over 10 years, so I have some experience in this area.

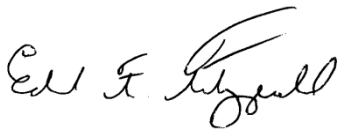
There clearly is a great need for more doctoral level epidemiologists in Georgia and across the USA to help address critical public issues such as climate change, health disparities, and aging. Your list of required courses will provide the students with a strong basis in epidemiological and biostatistical methods. The comprehensive examination is a three part assessment that will ensure that the students have mastered the material at the doctoral level and are ready for their culminating experience, the dissertation. Most importantly, I believe that your faculty have the ability to successfully train and mentor doctoral students, given their strong records in research. .

I have several questions, suggestions or recommendations. For example, will part-time study and credit transfers from other institutions be allowed? What happens if a student fails the comprehensive examination twice – will he or she be dismissed? Is there a research tool requirement such as proficiency in SAS or R? It would useful to outline the program of study for a student with only a bachelor's degree to identify what remedial courses he or she must take. Many programs are now allowing students to submit dissertations that consist of three or more interrelated and publishable papers – will this format be permitted? It is not clear whether the comprehensive examination will test

knowledge of a particular content area relevant to the dissertation, e.g. cancer, environmental, or infectious disease epidemiology, in addition to general methods. Finally, although the list of elective courses is reasonably broad, it does lack courses in some important content areas such a cardiovascular disease and diabetes epidemiology. The lack of coursework and by extension faculty expertise in these areas will necessarily restrict the topics that students may choose for dissertations.

In general, however, I believe that your proposal is an excellent and rigorous plan that will produce well trained and competent graduates.

Sincerely,



Edward F. Fitzgerald, PhD
Professor and Chair

One University Place, Room 130
Rensselaer, NY 12144-3456
PH: 518-402-0372 FX: 518-402-0380

Subject:RE: any comments on UGA Epid Doctoral

Date: Mon, 7 Jun 2010 16:12:25 -0400

From: KARMAUS, WILFRIED <KARMAUS@mailbox.sc.edu>

Graduate Director for Epidemiology, Department of Epidemiology and Biostatistics, Arnold School of Public Health, University of South Carolina, Health Sciences 304A, 800 Sumter Street, Columbia, SC, 29208, 803-777-9814

To: John Vena <jvena@uga.edu>

Hallo John:
I am sorry for the delay.

I looked at it but then it lost my attention.

I have it at home.

My advice is not to block the epidemiology in
- cross-sectional,
- case-control and
- cohort studies

but to revisit the different approaches again and again in different settings.
Such as EPI701, EPID741, and EPID800.

For instance, you may consider a case-crossover design as case-control, but it is also a repeated measurement design.
Hence, I would use
- basic designs: prevalence, incidence,
- intermediate designs: linear, logistic, survival, Poisson - here you still keep the concept of incidence,prevalence etc.
- advanced designs: repeated measurement, mixed models, path analyses
- here you change the idea of incidence and prevalence and use transitions, changes, etc. instead.

I believe, that these three different layers with repeated but more and more advanced concepts are better, than one block with case-control in which you have to cover all basic and the advanced stuff (case-crossover, case-only etc.).

Hope this helps.
Wilfried

Curriculum Vitae from Departmental Faculty

BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.
Follow this format for each person. **DO NOT EXCEED FOUR PAGES.**

NAME	POSITION TITLE
EBELL, MARK H.	Co-Director, Institute for Evidence-Based Health Professions Education Associate Professor, Epidemiology and Biostatistics
eRA COMMONS USER NAME mebell	

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	YEAR(s)	FIELD OF STUDY
Kalamazoo College, Kalamazoo, MI	BA	1983	Biology
University of Michigan Medical School, Ann Arbor, MI	MD	1987	Medicine
University of Michigan Hospitals, Ann Arbor, MI	--	1990	Family Medicine residency
University of Michigan School of Public Health, Ann Arbor, MI	MS	1995	Clinical Research Design and Statistical Analysis

A. Personal statement

The goal of the proposed research is to learn when most patients feel that cardiopulmonary resuscitation is futile, and when they feel it is likely to be of benefit. We will accomplish this using focus groups and surveys of elderly persons and physicians. Then, we will develop and validate a series of decision support models using different methodologies, and test them in a group of community dwelling elderly. I feel that I am ideally positioned to lead this research team, having done extensive research on patient and physician attitudes and behavior regarding CPR and do-not resuscitate orders. I have also developed and validated decision support tools using multivariate models, point scores, and artificial neural networks. My colleague Anne Glass is an expert in qualitative methods and Woncheol Jang and expert in biostatistics, including multivariate analysis, classification and regression trees, random forests, and data mining in general. Furthermore, we are ideally situated in a growing and accredited College of Public Health.

B. Positions and Honors.

List in chronological order previous positions, concluding with your present position. List any honors. Include present membership on any Federal Government public advisory committee.

Positions

1992 – 1996	Assistant Professor, Dept of Family Medicine, Wayne State University, Detroit, Michigan
1996 – 2000	Associate Professor, Dept of Family Practice, Michigan State Univ., East Lansing, MI
1998 – 2006	Co-Founder, InfoPOEM Inc. (sold to John Wiley and Sons in 2006)
2000 – 2008	Patient care, Athens Primary Care, Athens, GA
2000 – 2002	Editor, *The Journal of Family Practice,* Dowden Publishing Company
2002 – Present	Deputy Editor, *American Family Physician*
2006 – Present	Editor-in-Chief, *Essential Evidence* medical reference, John Wiley and Sons.
2007 – 2009	Assistant to the Provost, University of Georgia (development of medical campus)
2009 – Present	Member, Healthcare Technology and Decision Support study section, AHRQ
2009 – Present	Associate Professor, Dept of Epidemiology and Biostatistics, College of Public Health, UGA

Honors

1994 – Present	Selected, “Best Doctors in America”
1996	Alpha Omega Alpha medical honorary society, Beta Chapter of Michigan

1997	Distinguished Presentation, NAPCRG 25th Annual Meeting, Houston, TX
1998 – 2002	Robert Wood Johnson Generalists Scholars Award
1999	Teacher / Scholar Award, Michigan State University
2002 – Present	Selected, "Who's Who in America"
2004	Early Distinguished Career Achievement Award, University of Michigan Alumni Society

C. Selected peer-reviewed publications

Original research relevant to the current research proposal (selected from 39 original research studies and over 160 other peer reviewed publications and 7 books)

1. **Ebell MH**, Smith MA, Seifert KG, Polsinelli K. The do-not-resuscitate order: outpatient experience and decision-making preferences. J Fam Pract. 1990 Dec;31(6):630-4; discussion 635-6.
2. **Ebell MH**, Doukas DJ, Smith MA. The do-not-resuscitate order: a comparison of physician and patient preferences and decision-making. Am J Med. 1991 Sep;91(3):255-60.
3. **Ebell MH**. Prearrest predictors of survival following in-hospital cardiopulmonary resuscitation: a meta-analysis. J Fam Pract. 1992 May;34(5):551-8.
4. **Ebell MH**, Preston PS. The effect of the APACHE II score and selected clinical variables on survival following cardiopulmonary resuscitation. Fam Med. 1993 Mar;25(3):191-6.
5. **Ebell MH**. Artificial neural networks for predicting failure to survive following in-hospital cardiopulmonary resuscitation. J Fam Pract. 1993 Mar;36(3):297-303.
6. **Ebell MH**, Kruse JA. A proposed model for the cost of cardiopulmonary resuscitation. Med Care 1994;32(6):640-9.
7. O'Keeffe S, **Ebell MH**. Prediction of failure to survive following in-hospital cardiopulmonary resuscitation: comparison of two predictive instruments. Resuscitation. 1994 Jul;28(1):21-5.
8. **Ebell MH**. When everything is too much. Quantitative approaches to the issue of futility. Arch Fam Med. 1995 Apr;4(4):352-6.
9. **Ebell MH**, Smith M, Kruse JA, Drader-Wilcox J, Novak J. Effect of race on survival following in-hospital cardiopulmonary resuscitation. J Fam Pract. 1995 Jun;40(6):571-7.
10. **Ebell MH**, Bergus GR, Warbasse L, Bloomer R. The inability of physicians to predict the outcome of in-hospital resuscitation. J Gen Intern Med. 1996 Jan;11(1):16-22.
11. **Ebell MH**, Kruse JA, Smith M, Novak J, Drader-Wilcox J. Failure of three decision rules to predict the outcome of in-hospital cardiopulmonary resuscitation. Med Decis Making. 1997 Apr-Jun;17(2):171-7.
12. **Ebell MH**, Becker LA, Barry HC, Hagen M. Survival after in-hospital cardiopulmonary resuscitation. A meta-analysis. J Gen Intern Med. 1998 Dec;13(12):805-16.
13. Dosh SA, Hickner JM, Mainous AG 3rd, **Ebell MH**. Predictors of antibiotic prescribing for nonspecific upper respiratory infections, acute bronchitis, and acute sinusitis. An UPRNet study. Upper Peninsula Research Network. J Fam Pract. 2000 May;49(5):407-14.
14. **Ebell MH**, Flewelling D, Flynn CA. A systematic review of troponin T and I for diagnosing acute myocardial infarction. J Fam Pract. 2000 Jun;49(6):550-6. Review.
15. **Ebell MH**, Smith MA, Barry HC, Ives K, Carey M. The rational clinical examination. Does this patient have strep throat? JAMA. 2000 Dec 13;284(22):2912-8.

D. Research Support

Current support

2009-2010 Principal Investigator
Physician's Institute for Excellence in Medicine
Using physician questions as a needs assessment for continuing education.
8/31/2009 to 8/31/2010 ($50,000)

Pending support

2010-2015 Co-Investigator (10% FTE)
Geriatric Education Center for the State of Georgia
7/1/2010 – 6/30/2015 ($2,000,000)

2010-2015 Co-Investigator (15% FTE)
PERLC Center for Health Management and Mass Destruction Defense
7/1/2010 – 6/30/2015 ($4,500,000)

NAME	POSITION TITLE
Robert S. Galen	Professor and Senior Associate Dean

EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE (IF APPLICABLE)	YEAR(S)	FIELD OF STUDY
Boston University	AB	1970	Pre-Med
Boston University School of Medicine	MD	1970	Medicine
Columbia University School of Public Health	MPH	1972	Epidemiology
Columbia Presbyterian Medical Center	Residency	1974	Pathology

RESEARCH AND PROFESSIONAL EXPERIENCE:

Professional Positions:

1974–1976 Director, Clinical Chemistry, Metpath Laboratories, Hackensack, N.J.
1974–1976 Assistant Professor, Clinical Pathology, Columbia University College of Physicians and Surgeons, New York City, New York
1976–1982 Associate Director, Clinical Laboratories, Overlook Hospital, Summit, New Jersey
Associate Professor, Clinical Pathology, Columbia University College of Physicians and Surgeons, New York City, New York
1982–1987 Chairman, Department of Biochemistry, Cleveland Clinic Foundation, Cleveland, OH
1988–1993 Associate Professor, Epidemiology and Biostatistics, School of Medicine, Case Western Reserve University, Cleveland, Ohio
1992–1995 Chairman of the Board, Abaxis, Inc. Sunnyvale, California
1994–2001 Co-founder and Medical Director, LXN Corporation, San Diego, California
1999–2001 Co-founder and Medical Director, HealthSentry.net, Mentor, Ohio
2002-2005 Professor, College of Pharmacy, University of Georgia
2005-2007 Professor of Epidemiology and Interim Head, Dept. Health Administration, Biostatistics, and Epidemiology
College of Public Health, University of Georgia, Athens, Georgia
2007-present Senior Associate Dean, College of Public Health, University of Georgia.

Professional Memberships: (selected)

1977–1986 Member, Council of Clinical Chemistry, American Society of Clinical Pathologists, Chairman, 1982-1986
1977–1986 Member, Committee on World Standards, World Association of Societies of Pathology
1983–1986 Course Director, Annual Review in Clinical Chemistry, A.S.C.P.
1984–1986 Chairman, NCCLS Area Committee on General Laboratory Practices
1982–1984 Director, Standards Laboratory, College of American Pathologists

Honors:

1983–present Fellow, National Academy of Clinical Biochemistry
1985–present Fellow, American Society of Clinical Pathologists

Editorial Board Positions: (selected)

1978–1983 Human Pathology
1978–1984 Medical Editor, Diagnostic Medicine
1978–1985 Consulting Editor, Clinical Laboratory Reference
1977–1986 LAB
1986–1987 American Journal of Clinical Pathology
1986–1987 Laboratory Medicine
1985–2007 Computers in Biology and Medicine

Selected publications (from over 100):

Evans MI, Krantz DA, Hallahan TW, Galen RS. Meta-analysis of first trimester Down syndrome screening studies: free beta-human chorionic gonadotropin significantly outperforms intact human chorionic gonadotropin in a multimarker protocol. Am J Obstet Gynecol. 2007 Mar;196(3):198-205.

Vigersky RA, Hanson E, McDonough E, Rapp T, Pajak J, Galen RS. A wireless diabetes management and communication system. Diabetes Technol Ther. 2003;5(4):695-702.

Weiss SM, Galen RS, Tadepalli PV. Maximizing the Predictive Value of Production Rules. Artif. Intell. 1990, 45: 47-71.

Galen RS. Predictive value of immunodiagnostic cancer tests. Immunol Ser. 1990;53:3-11.

Hu SL, Haimes YY, Galen RS. Optimal selection of a battery of tests: a multiobjective optimization methodology. Med Decis Making. 1988 Jan-Mar;8(1):19-32.

Van Lente F, McHugh AM, Galen RS. Changes in serum CK-MB mass after coronary artery bypass surgery. Clin Biochem. 1987 Oct;20(5):333-7.

Van Lente F, Castellani W, Chou D, Matzen RN, Galen RS. Application of the EXPERT consultation system to accelerated laboratory testing and interpretation. Clin Chem. 1986 Sep;32(9):1719-25.

Pippenger CE, Megargle RG, Galen RS. The robots are coming. MLO Med Lab Obs. 1985 Feb;17(2):30-8.

Marchand A, Van Lente F, Galen RS. The assessment of laboratory tests in the diagnosis of acute appendicitis. Am J Clin Pathol. 1983 Sep;80(3):369-74.

Galen RS. Application of the predictive value model in the analysis of test effectiveness. Clin Lab Med. 1982 Dec;2(4):685-99.

Galen RS. The normal range: a concept in transition. Arch Pathol Lab Med. 1977 Nov;101(11):561-5.

Galen RS, Forman D. Enzyme immunoassay of serum thyroxine with the “Autochemist” multichannel analyzer.Clin Chem. 1977 Jan;23(1):119-21.

Galen RS. When is a tumor marker a laboratory test? Ann Clin Lab Sci. 1977 Jan-Feb;7(1):51-6.

Krieg AF, Gambino R, Galen RS. Why are clinical laboratory tests performed? When are they valid? JAMA. 1975 Jul 7;233(1):76-8.

Galen RS, Reiffel JA, Gambino R. Diagnosis of acute myocardial infarction. Relative efficiency of serum enzyme and isoenzyme measurements. JAMA. 1975 Apr 14;232(2):145-7.

Galen RS. The enzyme diagnosis of myocardial infarction.Hum Pathol. 1975 Mar;6(2):141-55.

Galen RS. Multiphasic screening and biochemical profiles: state of the art, 1975. Prog Clin Pathol. 1975;6:83-110.

Galen RS, Gambino SR. Isoenzymes of CPK and LDH in myocardial infarction and certain other diseases. Pathobiol Annu. 1975;5:283-315.

Galen RS, Gambino SR Beyond Normality—The Predictive Value and Efficiency of Medical Diagnoses. John Wiley, 1975 pp237

PATENTS:

GALEN RS, BURD JF, HOBLITZELL T, NEYER G. DECEMBER 9, 1997. COMBINED ASSAY FOR CURRENT

GLUCOSE LEVEL AND INTERMEDIATE OR LONG TERM GLYCEMIC CONTROL. US PAT. 5695949.

GALEN RS, BURD JF, HOBLITZELL T, NEYER G. FEBRUARY 22, 2000. APPARATUS FOR COMBINED ASSAY FOR CURRENT GLUCOSE LEVEL AND INTERMEDIATE OR LONG-TERM GLYCEMIC CONTROL. US PAT. 6027692.

GALEN RS, BURD JF, HOBLITZELL T, NEYER G. DECEMBER 30, 2003. APPARATUS FOR COMBINED ASSAY FOR CURRENT GLUCOSE LEVEL AND INTERMEDIATE OR LONG-TERM GLYCEMIC CONTROL. US PAT. 6670192.

GALEN RS, BURD JF, HOBLITZELL T, NEYER G. OCTOBER 25, 2005. COMBINED ASSAY FOR CURRENT GLUCOSE LEVEL AND INTERMEDIATE OR LONG-TERM GLYCEMIC CONTROL. US PAT. 6958129.

BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors.
Follow this format for each person. **DO NOT EXCEED FOUR PAGES.**

NAME	POSITION TITLE
Andreas Handel	Assistant Professor
eRA COMMONS USER NAME (credential, e.g., agency login) ahandel	

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	MM/YY	FIELD OF STUDY
University of Stuttgart, Stuttgart, Germany	B.S. (equivalent)	10/96-07/99	Physics
Georgia Institute of Technology, Atlanta, GA	Ph.D.	08/99-07/04	Physics
Emory University, Atlanta, GA	Postdoc	08/04-12/08	Theoretical Biology

A. Personal Statement

I have experience in mathematical and computational modeling of biological systems in general and of influenza infection dynamics and immunology in particular. Several of my recent studies are based on the tight integration of data and mathematical models as proposed in the grant. I also have experience in mentoring students and Postdocs; I currently have several in my group.

B. Positions and Honors

2004-2008 Postdoctoral Researcher, Department of Biology, Emory University, Atlanta, GA
2009-Present Assistant Professor, Department of Epidemiology & Biostatistics,
Member, Institute of Bioinformatics,
Member, Faculty of Infectious Diseases, University of Georgia

C. Selected peer-reviewed Publications (from a total of 18)

Five most relevant publications for the current application (in chronological order)

Andreas Handel, Ira M. Longini Jr., Rustom Antia (2007) "Neuraminidase Inhibitor Resistance in Influenza: Assessing the Danger of its Generation and Spread", PLoS Computational Biology 3 (12): e240. PMCID: PMC2134965

Andreas Handel, Andrew Yates, Sergei S. Pilyugin, Rustom Antia (2007) "Gap junction-mediated antigen transport in immune responses", Trends in Immunology 28, No. 11, 463-466. PMID: 17951108

Andreas Handel and Rustom Antia (2008) "A Simple Mathematical Model Helps To Explain the Immunodominance of CD8 T Cells in Influenza A Virus Infections", Journal of Virology 82 (16), 7768-7772. PMCID: PMC2519595

Andreas Handel, Andrew Yates, Sergei S. Pilyugin, Rustom Antia (2009) "Sharing the burden: Antigen transport and firebreaks in immune responses", Journal of the Royal Society Interface 6, 447-454. PMCID: PMC2659692

Andreas Handel, Ira M. Longini Jr., Rustom Antia (2010) “Towards a quantitative understanding of the within-host dynamics of influenza A infections”, Journal of the Royal Society Interface 7, 35-47. PMID: 19474085

Additional recent publications (in chronological order)

Cecile Viboud, Theresa Tam, Douglas Fleming, **Andreas Handel**, Mark A. Miller, Lone Simonsen (2006) "Transmissibility and mortality impact of epidemic and pandemic influenza, with emphasis on the unusually deadly 1951 epidemic", Vaccine 24, 6701. PMID: 16806596

Andreas Handel, Roland R. Regoes, Rustom Antia (2006) "The Role of Compensatory Mutations in the Emergence of Drug Resistance", PLoS Computational Biology 2(10): e137. PMCID: PMC1599768

Andreas Handel, Ira M. Longini Jr., Rustom Antia (2007) "What is the best control strategy for multiple infectious disease outbreaks?", Proceedings of the Royal Society B 274, 833-837. PMCID: PMC2093965

Daniel E. Rozen, Michelle G. J. L. Habets, **Andreas Handel**, J. Arjan G. M. de Visser (2008) "Heterogeneous Adaptive Trajectories of Small Populations on Complex Fitness Landscapes", PLoS One 3 (3): e1715. PMCID: PMC2248617

Andreas Handel and Matthew Bennett (2008) "Surviving the bottleneck: Transmission mutants and the evolution of microbial populations", Genetics 180 (4). PMCID: PMC2600951

Andreas Handel, Elisa Margolis, Bruce R Levin (2009), “Exploring the role of the immune response in preventing antibiotic resistance”, Journal of Theoretical Biology 256 (4), 655-662. PMID: 19056402

Andreas Handel and Daniel E. Rozen (2009), “The impact of population size on the evolution of asexual microbes on smooth versus rugged fitness landscapes”, BMC Evolutionary Biology 9:236. PMCID: PMC2753573

Andreas Handel, Ira M. Longini Jr., Rustom Antia (2009) " Antiviral resistance and the control of pandemic influenza: The roles of stochasticity, evolution and model details", Journal of Theoretical Biology 256 (1), 117-125. PMCID: PMC2624577

Andreas Handel, Ira M. Longini Jr., Rustom Antia (2009), “Intervention strategies for an influenza pandemic taking into account secondary bacterial infections”, Epidemics 1, 185-195, NIHMS ID 150315

D. Research Support

5K25AI072193, NIH/NIAID (Handel PI) Project period: 05/01/07 - 04/30/12

Quantitative studies of CD8 T-cell dynamics

The goal of this study is to obtain a quantitative understanding of the dynamics of CD8 T-cells after viral infections and how these dynamics depend on antigen and other stimuli.

BIOGRAPHICAL SKETCH

Provide the following information for the Senior/key personnel and other significant contributors in the order listed on Form Page 2.
Follow this format for each person. **DO NOT EXCEED FOUR PAGES.**

NAME	POSITION TITLE
James Oloya	Assistant Professor
eRA COMMONS USER NAME (credential, e.g., agency login) joloya	

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	MM/YY	FIELD OF STUDY
Postdoctoral fellow, North Dakota State Univ.	Post doc	2007-2008	Food safety risk assesment
Norwegian School of Vet Science, Oslo, Norway	Ph.D	Dec/ 2006	Epidemiology and Veterinary Public Health
Makerere University	MSc Vet Med.	Jan/1999	Veterinary Epidemiology
Makerere University	DVM	1992	Veterinary Medicine

B. Positions Held:

- Assistant Professor, Department of Epidemiology and Biostatistics, University of Georgia, Athens GA 2008 - todate
- Postdoctoral Research fellow, North Dakota State University, 2006-2008
- Senior Lecturer – Veterinary Public Health, Dept of Veterinary Public health and Preventive Medicine, Makerere University- 2007-2008
- Lecturer – Veterinary Public Health and Preventive Medicine - 1999-2007
- Assistant Lecturer – Veterinary Public Health and Preventive Medicine - 1994-to 1999.
- Teaching Assistant – Veterinary Public Health and Preventive Medicine - 1992-to 1994.

C: **Professional membership:**

- Society for Veterinary Epidemiology and Preventive Medicine
- Uganda Veterinary Association
- Collaborative Research in Environmental Toxicology and Zoonotic Diseases: a South-North Veterinary Network- Funded by the Norwegian Council for higher education.

C. <u>Publications in refereed Journals</u>

1. Ebot S. Tabe, James Oloya, Dawn Doetkott and Margret Khaitsa: Characterization of Multi drug resistant salmonella enteric subsp. enteric Serovar Typhimurium var. Copenhagen and Typhimurium Isolated from feedlot cattle. *Food Protection trends* 2010, Vol 30, No.5 pages 273-279.
2. Oloya J, Doetkott D, Khaitsa ML: Antimicrobial drug resistance and molecular characterization of Salmonella isolated from domestic animals, humans, and meat products. *Foodborne Pathog Dis* 2009, 6(3):273-284.

3. Tabe ES, Oloya J, Doetkott DK, Bauer ML, Gibbs PS, Khaitsa ML: Comparative effect of direct-fed microbials on fecal shedding of Escherichia coli O157:H7 and Salmonella in naturally infected feedlot cattle. *J Food Prot* 2008, 71(3):539-544
4. Khaitsa ML, Oloya J, Doetkott D, Kegode R: Antimicrobial resistance and association with class 1 integrons in Escherichia coli isolated from turkey meat products. *J Food Prot* 2008, 71(8):1679-1684
5. Oloya J, Theis M, Doetkott D, Dyer N, Gibbs P, Khaitsa ML: Evaluation of Salmonella occurrence in domestic animals and humans in North Dakota (2000-2005). *Foodborne Pathog Dis* 2007, 4(4):551-563.
6. Muller B, Hilty M, Berg S, Garcia-Pelayo MC, Dale J, Boschiroli ML, Cadmus S, Ngandolo BN, Godreuil S, Diguimbaye-Djaibe C, Oloya J*, et al*: African 1, an epidemiologically important clonal complex of Mycobacterium bovis dominant in Mali, Nigeria, Cameroon, and Chad. *J Bacteriol* 2009, 191(6):1951-1960.
7. Clovice Kankya AM, Susan Olet, Musso Munyeme, Demelash Biffa, John Prof Opuda-Asibo, Eystein Skjerve and James Oloya: Factors associated with pastoral community knowledge and occurrence of mycobacterial infections in Human-Animal Interface areas of Nakasongola and Mubende districts, Uganda. *BMC Public Health* 2010, Accepted for publication.
8. Inangolet FO, Biffa D, Opuda-Asibo J, Oloya J, Skjerve E: Distribution and intensity of Echinococcus granulosus infections in dogs in Moroto District, Uganda. *Trop Anim Health Prod* 2010.
9. Biffa D, Skjerve E, Oloya J, Bogale A, Abebe F, Dahle U, Bohlin J, Djonne B: Molecular characterization of Mycobacterium bovis isolates from Ethiopian cattle. *BMC Vet Res* 2010, 6:28.
10. 7. Demelash B, Inangolet F, Oloya J, Asseged B, Badaso M, Yilkal A, Skjerve E: Prevalence of bovine tuberculosis in Ethiopian slaughter cattle based on post-mortem examination. *Trop Anim Health Prod* 2009, 41(5):755-765..
11. 9. Oloya J, Opuda-Asibo J, Kazwala R, Demelash AB, Skjerve E, Lund A, Johansen TB, Djonne B: Mycobacteria causing human cervical lymphadenitis in pastoral communities in the Karamoja region of Uganda. *Epidemiol Infect* 2008, 136(5):636-643.
12. Inangolet FO, Demelash B, Oloya J, Opuda-Asibo J, Skjerve E: A cross-sectional study of bovine tuberculosis in the transhumant and agro-pastoral cattle herds in the border areas of Katakwi and Moroto districts, Uganda. *Trop Anim Health Prod* 2008, 40(7):501-508.
13. Oloya J, Muma JB, Opuda-Asibo J, Djonne B, Kazwala R, Skjerve E: Risk factors for herd-level bovine-tuberculosis seropositivity in transhumant cattle in Uganda. *Prev Vet Med* 2007, 80(4):318-329.
14. Oloya J, Kazwala R, Lund A, Opuda-Asibo J, Demelash B, Skjerve E, Johansen TB, Djonne B: Characterisation of mycobacteria isolated from slaughter cattle in pastoral regions of Uganda. *BMC Microbiol* 2007, 7:95.
15. Muma JB, Toft N, Oloya J, Lund A, Nielsen K, Samui K, Skjerve E: Evaluation of three serological tests for brucellosis in naturally infected cattle using latent class analysis. *Vet Microbiol* 2007, 125(1-2):187-192.
16. Muma JB, Samui KL, Oloya J, Munyeme M, Skjerve E: Risk factors for brucellosis in indigenous cattle reared in livestock-wildlife interface areas of Zambia. *Prev Vet Med* 2007, 80(4):306-317.
17. Oloya J, Opuda-Asibo J, Djonne B, Muma JB, Matope G, Kazwala R, Skjerve E: Responses to tuberculin among Zebu cattle in the transhumance regions of Karamoja and Nakasongola district of Uganda. *Trop Anim Health Prod* 2006, 38(4):275-283.
18. Muma JB, Samui KL, Siamudaala VM, Oloya J, Matop G, Omer MK, Munyeme M, Mubita C, Skjerve E: Prevalence of antibodies to Brucella spp. and individual risk factors of infection in traditional cattle, goats and sheep reared in livestock-wildlife interface areas of Zambia. *Trop Anim Health Prod* 2006, 38(3):195-206.

BIOGRAPHICAL SKETCH

Provide the following information for the key personnel and other significant contributors in the order listed on Form Page 2.
Follow this format for each person. **DO NOT EXCEED FOUR PAGES.**

NAME	POSITION TITLE
Robb, Claire	Assistant Professor
eRA COMMONS USER NAME ROBBCL	

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, and include*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	YEAR(s)	FIELD OF STUDY
Mount Union College, Alliance, OH	BA	1967	English
University of South Florida	MPH	2003	Epidemiology
University of South Florida	PH.D.	2003	Aging Studies

A. Positions and Honors

Positions and Employment

1998-2002	Research Assistant, Department of Gerontology, University of South Florida
1998-1999	Project Manager, Sun City Center Mental Health Care Survey
2000 -	Phase III Project Manager, Hospice Caregiver Bereavement Study, Department of Gerontology. (Training and supervision of interviewer)
2001-2002	Research Assistant, Florida Policy Exchange Center, University of South Florida
2001-8/2003	Instructor, Department of Gerontology, University of South Florida
2002-2003	Project Manager, Charlotte County Healthy Aging Study 5-Year Follow-up
2002-2003	Project Manager, NIA Pilot Grant Study "Quality of Life in Older Breast Cancer Survivors", Award #1R03AG21210-01
8/2003-5/2003	Visiting Assistant Professor, Department of Psychology, University of North Carolina at Wilmington, Wilmington, NC
5/2004-4/2006	Instructor, School of Aging Studies, University of South Florida, Tampa, Florida
8/2004-8/2006	Post Doctoral Fellow, H. Lee Moffitt Cancer Center and Research Institute, Tampa, Florida.
7/2006-Present	Assistant Professor, College of Public Health, The University of Georgia
2008-Present	Georgia Cancer Coalition Distinguished Scholar

B. Selected Peer-Reviewed Publications

Robb, C., Chen, H., & Haley, W.E. (2002) Ageism in mental health and health care: A critical review. *Journal of Clinical Geropsychology, 8,* 1-12.

Robb, C., Haley, W.E., Becker, M.A., Polivka, L.A., and Chwa, H. (2003). Attitudes towards mental health care in younger and older adults: Similarities and differences. *Aging and Mental Health, 7,* 142-152.

Robb C, Haley WE, Balducci L, Extermann M, Perkins EA, Small BJ, et al. Impact of breast cancer survivorship on quality of life in older women. *Crit Rev Oncol Hematol* 2007;62(1):84-91

Perkins EA, Small BJ, Balducci L, Extermann M, **Robb C**, Haley WE. Individual differences in well-being in older breast cancer survivors. *Crit Rev Oncol Hematol* 2007;62(1):74-83.

Robb, C., Small, B.J., and Haley, W.E. (2008). Gender differences in coping with functional disability in self and spouse in older married couples: The role of personality and social resources. *Aging and Mental Health* 12:4,423-33

Robb, C., Boulware, D., Overcash, J., and Extermann (2009). Patterns of care and survival in cancer patients with cognitive impairment. *Crit Rev Oncol Hematol* (in press)

C. Research Support

Principal Investigator, *Health and personal resources in older cancer patients undergoing chemotherapy*, Award # NIH 1 R03 CA126376-01, September, 2006, by the National Cancer Institute, 9/2006-Present.(currently under no-cost extension)

Georgia Cancer Coalition Distinguished Cancer Scholar Award

BIOGRAPHICAL SKETCH

Provide the following information for the key personnel and other significant contributors in the order listed on Form Page 2.
Follow this format for each person. **DO NOT EXCEED FOUR PAGES.**

NAME	POSITION TITLE
Steven Valeika	Assistant Professor of Epidemiology
eRA COMMONS USER NAME (credential, e.g., agency login)	

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	YEAR(s)	FIELD OF STUDY
Vanderbilt University, Nashville TN	B.S.	1992	Biology
University of Georgia, College of Veterinary Medicine, Athens GA	D.V.M.	1996	Veterinary Medicine
University of North Carolina School of Public Health, Chapel Hill NC	Ph.D.	2008	Epidemiology

Please refer to the application instructions in order to complete sections A, B, and C of the Biographical Sketch.

A. **Role**

Will be a co-investigator on this study. He is interested in ecology of infectious diseases. Has experience in developing and analyzing social networks of infectious diseases. Will develop data collection forms, organize data and analyze the social network data. Will contribute to the analysis of dta, writing of manuscripts and presentations. He will devote % effort in academic and summer months to this project.,

B. Positions and Honors

Positions and Employment

2001-2002 Intern in Small Animal Medicine and Surgery, NC State College of Veterinary Medicine
2002-2006 Part time emergency veterinarian, NC State
2007-2008 Temporary Assistant Professor of Epidemiology, UGA College of Public Health
2008 - Assistant Professor of Epidemiology, UGA College of Public Health

Honors

Kenan Fellow, University of North Carolina School of Public Health

C. Publications

1. Brown, JD, Stallknecht DE, Valeika, S, Swayne, DE. *Suceptibility of Wood Ducks to H5N1 Highly Pathogenic Avian Influenza Virus.* Journal of Wildlife Diseases. 43(4), 2007, pp 660-667

2. Lloyd, A.L., Valeika, S., Cintron-Arias, A. (2006). *Epidemic Dynamics on Small World Networks.* In: Modeling the Dynamics of Human Disease: Emerging Paradigms and Challenges. AMS Contemporary Mathematics Series. A. Gumel, C. Castillo-Chavez, D. P. Clemence, and R.E. Mickens, eds

3. Lloyd, A.L. & Valeika, S. (2006). *Network Models in Epidemiology: An Overview.* In : Complex Population Dynamics: Nonlinear Modeling in Ecology, Epidemiology and Genetics, B. Blasius, J. Kurths and L. Stone, eds. World Scientific

4. Takahashi, R, Valeika SR, Glass KW. *A Simple Method of Plasmid Transformation of Escherichia coli by Rapid Freezing.* BIOTECHNIQUES. 13: (5) 712-715. November 1002

D. Support

Completed

Center for AIDS Research, University of North Carolina Chapel Hill 2004-2008
Development of Mathematical Models to Study HIV Transmission

BIOGRAPHICAL SKETCH

Provide the following information for the key personnel and other significant contributors in the order listed on Form Page 2.
Follow this format for each person. **DO NOT EXCEED FOUR PAGES.**

NAME	POSITION TITLE
John E. Vena	Professor and Head
eRA COMMONS USER NAME (credential, e.g., agency login) JohnVena	

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	YEAR(s)	FIELD OF STUDY
Saint Bonaventure University, New York	B.S.	1975	Biology
State university of New York at Buffalo, NY	M.S.	1976	Nat Sci/Epidemiology
State University of new York at Buffalo, NY	Ph.D.	1980	Epidemiology

A. Positions and Honors.

Positions and Employment

1994-2003 Professor, Department of Social and Preventive Medicine, School of Medicine, SUNYAB, Buffalo, NY

2003-2008 Professor and Chair, Department of Epidemiology and Biostatistics, Arnold School of Public Health, University of South Carolina, Columbia, SC

2008- University of Georgia Foundation Professor in Public Health and Head, Department of Epidemiology and Biostatistics, College of Public Health, University of Georgia, Athens, GA

Other Experience and Professional Memberships

2006-2009 American Public Health Association (1978-present); Section Council
2003-2006 International Society for Environmental Epidemiology Councilor
1978- Society for Epidemiologic Research
1989- International Society for Environmental Epidemiology
1989- International Epidemiological Association
1998- American College of Epidemiology, Fellow
2007- American Epidemiologic Society, Fellow

Honors

1975 Magna Cum Laude, St. Bonaventure University, St. Bonaventure, NY
1997 Senior International Fellow, Fogarty International Center, NIH

B. Selected peer-reviewed publications (in chronological order).

1. **Vena JE,** Graham S, Zielezny M, Swanson M, Barnes RE, Nolan J: Lifetime occupational exercise and colon cancer. Am J Epidemiol 122(3):357-65, 1985.
2. **Vena** JE, Bona JR, Byers T, Middleton E, Swanson M, Graham S: The relationship between allergy related diseases and cancer: An inverse association. Am J Epidemiol 122(1):66-74, 1985.
3. **Vena** JE, Byers T, Cookfair D, Swanson M: Occupation and lung cancer risk: An analysis by histologic subtypes. Cancer 56:910-917, August 15, 1985.
4. **Vena** JE, Graham S, Zielezny M, Brasure J, Swanson M: Occupational exercise and risk of cancer. Am J Clin Nutr (Supplement) 45(1):318-327, 1987.
5. Violanti JM, **Vena** JE, Marshall JR: Disease risk and mortality among police officers: New evidence and contributing factors. J Pol Sci Adm 14(1):17-23, 1986.
6. **Vena** JE, Violanti JM, Marshall JR, Fiedler RC: Mortality of a municipal worker cohort: III. Police officers. Am J Ind Med 10(4):383-97, 1986.
7. Violanti JM, **Vena** JE, Marshall JR, Petralia S. A comparative evaluation of police suicide rate validity. Suicide Life Threat Behav 26(1):79-85, 1996.
8. Violanti JM, **Vena** JE, Marshall JR. Suicides, homicides, and accidental death: A comparative risk assessment of police officers and municipal workers. Am J Ind Med 30(1):99-104, 1996.
9. Violanti JE, **Vena** JE, Petralia S. Mortality of a police cohort: 1950-1990. Am J Ind Med 33:366-373, 1998.

10. Violanti JM, Burchfiel CM, Miller DB, Andrew ME, Dorn J, Wactawski-Wende J, Beighley CM, Pierino K, Joseph PN, **Vena JE**, Sharp DS, Trevisan M. The Buffalo Cardio-Metabolic Occupational Police Stress (BCOPS) pilot study: methods and participant characteristics.Ann Epidemiol. 2006 Feb;16(2):148-56.
11. **Vena JE**, Graham S, Zielezny M, Brasure J, Swanson M: Occupational exercise and risk of cancer. Am J Clin Nutr (Supplement) 45(1):318-327, 1987.
12. Graham S, Hellmann R, Marshall J, Freudenheim J, **Vena JE**, Swanson M, Zielezny M, Nemoto T, Raimondo T: The nutritional epidemiology of postmenopausal breast cancer in Western New York. Am J Epidemiol 134:552-66, 1991.
13. **Vena JE**, Hayes D, Ziegler S: Physical activity and cancer: Review of Findings and Methodological Issues. In: Geriatric Oncology. L. Balducci, W. Ershler, G. Lyman (eds). J.B. Lippencott, Philadelphia, PA, 1991.
14. Olson SH, Trevisan M, Marshall JR, Graham S, Zielezny M, **Vena JE**, Laughlin R, Freudenheim JL. Body mass index, weight gain and risk risk of endometrial cancer. Nutr Cancer 23(2):141-149, 1995.
15. Mendola P, Freudenheim JL, Marshall JR, Graham S. Hellmann R, **Vena JE**. Zielezny M: Dietary correlates of fat intake. Nutr Cancer 23:161-169, 1995.
16. Gorey KM, **Vena** JE. The association of near poverty status with cancer incidence among black and white adults. J Comm Hlth 20(4):359-366, 1995.
17. Ambrosone CB, Freudenheim JL, Marshall JR, Graham S, **Vena JE**, et al. The association of polymorphic *N*-Acetyltransferase (*N*AT2) with breast cancer risk. Cancer Prev 768:250-252, 1995.
18. **Vena JE**, Buck GM, Kostyniak P, Mendola P, Fitzgerald E, Sever L, Freudenheim J, Greizerstein H, Zielezny M, McReynolds J, Olson J. The New York angler cohort study: Exposure characterization and reproductive developmental health. Tox & Indus Hlth 12(3/4), 1996.
19. Ambrosone CB, Freudenheim JL, Graham S, Marshall JR, **Vena, JE**, Brasure JR, Michalek AM, Laughlin R, Nemoto T, Gillenwater KA, Shields PG. Cigarette smoking, N-acetyltransferase 2 genetic polymorphisms, and breast cancer risk. JAMA 276(18):1494-1501, 1996.
20. Freudenheim JL, Marshall JR, **Vena JE**, Laughlin R, Brasure JR, Swanson MK, Nemoto T, Graham S. Premenopausal breast cancer risk and intake of vegetables, fruits, and related nutrients. JNCI 88(6):340-348, 1996.
21. Olson SH, **Vena JE**, Dorn JP, Marshall JR, Zielezny M, Laughlin R, Graham S. Exercise, occupational activity and risk of endometrial cancer. Ann Epidemiol 7(1):46-53, 1997.
22. **Vena JE**, Boffetta P, Becher H, et al. Exposure to dioxin and nonneoplastic mortality in the expanded IARC international cohort study of phenoxy herbicide and chlorophenol production workers and sprayers. Environ Hlth Perspect 106:645-653, 1998.
23. Moysich KB, Ambrosone CB, **Vena JE**, Shields PG, Mendola P, Kostyniak P, Greizerstein H, Graham S, Marshall JR, Schisterman EF, Freudenheim JL. Environmental organochlorine exposure and postmenopausal breast cancer risk. Cancer Epidemiol, Biomarkers & Prev 7:181-188, 1998.
24. Dorn J, **Vena JE**. Commentary: The risk of endometrial cancer increased with decreasing levels of physical activity at work. Evidenced-Based Obstet and Gynecol 1:120-121, 1999.
25. Dorn JP, Cerney FJ, Epstein LH, Naughton J, **Vena JE**, Winkelstein Jr W, Schisterman E, Trevisan M: Work and leisure time physical activity and mortality in men and women from a general population sample. Ann Epidemiol 9:366-373, 1999.
26. Freudenheim JL, Ambrosone CB, Moysich KB, **Vena** JE, Graham S, Marshall JR, Muti P, Laughlin R, Nemoto T, Harty LC, Crits GA, Chan AWK, Shields P. Alcohol dehydrogenase 3 genotype modification of the association of alcohol consumption with breast cancer risk. Cancer Causes and Control 10:369-377, 1999.
27. Moysich KB, Shields PG, Freudenheim JL, Schisterman EF, **Vena JE**, Kostyniak P, Greizerstein H, Marshall JR, Graham S, Ambrosone CB. Polychlorinated biphenyls, cytochrome P4501A1 polymorphism, and postmenopausal breast cancer risk. Cancer Epi, Biomarkers, & Prev 8:41-44, 1999.
28. Petralia SA, **Vena JE**, Freudenheim JL, Dosemeci M, Michalek A, Goldberg MS, Brasure J, Graham S. Risk of premenopausal breast cancer in association with occupational exposure to polycyclic aromatic hydrocarbons and benzene. Scand J Work Environ Health 25(3):215-221, 1999.
29. Freudenheim JL, Ambrosone CB, Moysich KB, **Vena JE**, Graham S, Marshall JR, Muti P, Laughlin R, Nemoto T, Harty LC, Crits GA, Chan AWK, Shields P. Alcohol dehydrogenase 3 genotype modification of the association of alcohol consumption with breast cancer risk. Cancer Causes and Control 10:369-377, 1999.

30. **Vena JE**, Weiner JM. Innovative multidisciplinary research in environmental epidemiology: The challenges and needs. Int J Occup Med and Environ Hlth 12(4)353-70, 1999.
31. Dorn J, **Vena JE**, Brasure J, Freudenheim J, Graham S. Lifetime Physical Activity and Breast Cancer Risk in Pre- and Postmenopausal Women. Med. & Sci in Sports & Exer. 35(2):278-285, February 2003.
32. Bonner MR, Han D, Nie J, Rogerson P, **Vena JE**, Vito D, Muti P, Trevisan M, Nemoto T, Edge S, Freudenheim JL. Breast cancer risk and exposure in early life to polycyclic aromatic hydrocarbons using total suspended particulates as a proxy measure. Cancer Epidemiol Biomarkers Prev. Jan;14(1):53-60, 2005.
33. Han D, Rogerson PA, Bonner MR, Nie J, **Vena JE**, Muti P, Trevisan M and Freudenheim Jl. Assessing spatio-temporal variability of risk surfaces using residential history data in a case control study of breast cancer. International Journal of Health Geographics (IJHG) 4:9, 2005.
34. Tennis M, Krishnan S, Bonner M, Ambrosone CB, **Vena JE**, Moysich K, Swede H,McCann S, Hall P, Shields PG, Freudenheim JL. p53 Mutation analysis in breast tumors by a DNA microarray method. Cancer Epidemiol Biomarkers Prev. Jan;15(1):80-5, 2006.
35. **Vena JE** Cancer Prevention in South Carolina: Will you Join the Cause? Jr South Carolina Medical Assoc. 2006 Aug. 102: 175.
36. NieJ, Beyea J, Bonner MR, Han D, **Vena JE**, Rogerson P, Dominica Vito D, Muti P, Trevisan M, Edge SB, Freudenheim JL. Exposure to Traffic Emissions throughout Life and Risk of Breast Cancer:The Western New York Exposures and Breast Cancer (WEB) Study. Cancer Causes & Control. 2007, Vol. 18 (9), 947-955.
37. Tumiel-Berhalter LM, Vena J, Crespo C, McLaughlin-Diaz V. Strategies for Building Research Capacity in a Community-Based Participatory Research Program Serving a Predominately Puerto Rican Community. Progress in Community Health Partnerships: Research, Education, and Action. 2007. 1(1):89-98.
38. Stepanova E, Karmaus W, Naboka M, Vdovenko V, Mousseau T, Shestopalov VM, **Vena J**, Svendsen E, Underhill D, Pastides H. Exposure from the Chernobyl accident had adverse effects on erythrocytes, leukocytes, and, platelets in children in the Narodichesky region,Ukraine. Environmental Hlth 2008
39. Hooker SP, Sui X, Colabianchi N, **Vena JE**, Laditka J, LaMonte MJ,Blair SN. Cardiorespiratory Fitness as a Predictor of Fatal and Nonfatal Stroke Events in Asymptomatic Women and Men. Stroke 39:2008 DOI: 10.1161/STROKEAHA.107.495275
40. Buck Louis G.M., Dmochowski J., Lynch C, Kostyniak P. McGuinness B.M; **Vena JE**. Polychlorinated biphenyl serum concentrations, lifestyle and time-to-pregnancy. Human Reproduction 24 (2): 451-458 FEB 2009; DOI: 10.1093/humrep/den373
41. Bloom MS, Buck Louis GM, Schisterman EF, Kostyniak PJ, **Vena JE**. *Changes in maternal serum chlorinated pesticide and metabolite concentrations across critical windows of human reproduction and development*. Environmental Research, 109 (1): 93-100 JAN 2009.
42. Spliethoff H, Bloom M, **Vena J,** Sorce J, Aldous K, Eadon G. *Exploratory assessment of sport-caught fish consumption and polybrominated diphenyl ether measures in New York State anglers*. Environmental Research, 108(3): 340-347, 2008.
43. Bloom M**,** Spliethoff, H, **Vena J,** Eadon, G. *Environmental exposure to polybrominated diphenyl ethers and thyroid function among New York anglers*. Environmental Toxicology and Pharmacology, 25(3): 86-392, 2008.
44. Brasky,TM Matthew R. Bonner, Joan Dorn, James R. Marhsall, **John E. Vena**, John R. Brasure, Jo L. Freudenheim. Tonsillectomy and Breast Cancer Risk in the Western New York Diet Study. Cancer Causes and Control 20 (3): 369-374 APR 2009
45. Bloom MS, Kannan K, Spliethoff HM, Tao L, Aldous K, **Vena JE**. *Exploratory assessment of perfluorinated alkyl acid concentrations and thyroid function among New York State anglers*. Physiology and Behavior. In Press
46. Svendsen ER, Whittle N, Wright L, McKeown RE, Sprayberry K, Heim M, Caldwell R, Gibson JJ, **Vena J**. GRACE: Public Health Recovery Methods following an Environmental Disaster Archives of Environmental and Occupational Health (In Press).
47. Bloom, M. S., Kannan, K., Spliethoff, H. M., Tao, L., Aldous, K. M. and Vena, J. E. A preliminary study of temporal differences in serum concentrations of perfluoroalkyl acids, among New York anglers, in the absence of known changes in manufacturing practices',Toxicological & Environmental Chemistry,91:7,1387 — 1397, 2009 To link to this Article: DOI: 10.1080/02772240802590301

B. Research Support

ACTIVE

NIH R01 (Dr. Steven Hooker, PI)
NINDS, NIA, NHLBI. Total: $3,569,616 .18 academic
9/30/2008 – 09/29/2013 .06 summer
Impact of Physical Activity on Stroke and Cognitive Function in Older Adults
Co-Investigator

1 R01 TS000077-01 CDC/ATSDR (Matthew Bonner ,PI)
Co-Investigator: John E. Vena, 0.6 CM, Consultant
09/30/07 - 09/29/2012
Direct Costs year 1: $126,107
The New York State Angler Cohort Study – Long term follow-up for Chronic Disease.
This proposed study builds on the large New York State Angler Cohort that has been surveyed, with data analyzed in 1991 and 1997. These previous studies provide baseline information concerning health status and provide the opportunity to follow the long-term health consequences of this population. This population was recruited and is well characterized from the previous studies. Few cohorts have been followed for the extensive amount of time required for the development of chronic health endpoints, such as cancer, so this cohort is an important resource. The proposed study addresses the important issue of the long-term health effects of consuming contaminated fish from Lake Ontario.

1 K01 EH000287-01 CDC (Erik Svendsen, PI)
John Vena, Primary Mentor and Co-investigator 1.20 CM
Training Award - No salary for Mentor
09/30/2007 – 09/29/2010
Total: $450,000, $150,000/ year for 3 years**.** Direct Costs year 1: $138,889
Environmental Determinants of Pulmonary Disease: A new approach to an old problem
Dr. Svendsen's research strategy is to leverage his current joint position to harness the capabilities for collaborative and multidisciplinary community-based participatory research (CBPR) within South Carolina communities with disparities in pulmonary health outcomes there are three short-term objectives: 1. to better identify additional communities with disparities in pulmonary disease 2. to establish better mechanisms for building partnerships and coalitions within South Carolina communities with disparities in pulmonary disease 3. to integrate his research strategy into an existing community with disparities in pulmonary health as an exemplary community.

038505 Georgia Cancer Coalition (Vena John E, PI)
Distinguished Scholar Award 1.8 academic
07/01/2009 – 06/30/2014 .60 summer
Total: $750,000,$150,000 per year
This award allows Dr. Vena to develop a research program in Cancer Epidemiology Prevention and Control.

1R21ES017934 - 01 (Kamen, Diane, PI) 10/01/2009 - 09/30/2013 0.23 academic
Co-investigator NIH/NIEHS $1,325,327 Subaward to UGA $46,295 0.08 summer
Environmental Determinants of Systemic Lupus Erythematosus (SLE) Among African Americans in Coastal Carolina and Georgia

BIOGRAPHICAL SKETCH

Provide the following information for the key personnel and other significant contributors in the order listed on Form Page 2.
Follow this format for each person. **DO NOT EXCEED FOUR PAGES.**

NAME	POSITION TITLE
Christopher C. Whalen, M.D., M.S.	Professor of Epidemiology and Biostatistics
eRA COMMONS USER NAME cwhalen	

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	YEAR(s)	FIELD OF STUDY
Stanford University	A.B.	1978	English
Case Western Reserve University	M.D.	1984	Medicine
Case Western Reserve University	M.S.	1992	Epidemiology & Biostatistics

A. Personal Statement

As a physician-epidemiologist I am interested in reducing the suffering and mortality associated with infectious diseases, especially tuberculosis and HIV infection. I am committed to working in the regions of the world that are most afflicted by these diseases so my research and clinical activities focus on Sub-Saharan Africa. My main research activities endeavor to improve current methods and strategies for tuberculosis control and to improve clinical care for tuberculosis among HIV-infected persons. An equal part of my work involves building capacity for research, teaching and clinical care in Africa. I am committed to training future leaders in science and public health in Africa and providing them to equipment, workforce, and infrastructure to be successful.

B. Positions and Honors

Professional Appointments:

1990 – 1998	Assistant Professor Medicine, Case Western Reserve University
1994 – 1998	Assistant Professor of Epidemiology and Medicine, Case Western Reserve University
1998 – 2005	Associate Professor of Epidemiology and Biostatistics, Case Western Reserve University
1999	Tenure, Department of Epidemiology and Biostatistics, Case Western Reserve University
2002 – 2008	Head, Division of Epidemiology, Department of Epidemiology and Biostatistics, Case Western Reserve University School of Medicine
2005 – 2008	Professor of Epidemiology and Biostatistics, Case Western Reserve University
2008 – Present	Adjunct Professor of Epidemiology and Biostatistics, Case Western Reserve University
2008 – Present	Professor (with tenure), Department of Epidemiology and Biostatistics, College of Public Health, University of Georgia

Honors:

1984 Alpha Omega Alpha; 1991 Junior Faculty Research Award in for Society of General Internal Medicine; 1998 John S. Diekhoff Award for Distinguished Graduate Teaching, Case Western Reserve University; 2002 Invited plenary speaker, Tuberculosis and HIV Co-Infection Symposium, 9th Conference on Retroviruses and Opportunistic Infections, Seattle, WA; 2004 Invited speaker, Emmanuel Wolinsky Symposium; 2004 Elected to American Epidemiological Society; 2008 Teacher of the Year Award, Department of Epidemiology and Biostatistics, Case; 2009 Invited Speaker, George Naff Annual Lecture, Case Western Reserve University.

Professional Service:

1999 – 2003 Microbiology and Infectious Disease Review Committee, Division of Microbiology and Infectious Diseases, National Institutes for Allergy and Infectious Diseases; 2000 Consultant, Vaccines for HIV/AIDS, Malaria, and Tuberculosis: Addressing the Presidential Challenge; 2001 - 2007 Special Emphasis Panels for the Fogarty International Center, Division of AIDS, and Division of Microbiology and Infectious Diseases; 2005 – 2009 AIDS Review Committee, NIAID, National Institutes of Health, Bethesda, MD.

C. Selected peer-reviewed publications (Total publications: 113; †-student or fellow of Dr. Whalen)

Relevant to the current application

1. Guwatudde D†, Nakakeeto M, Jones-Lopez EC, Maganda A†, Chiunda A, Mugerwa RD, Ellner JJ, Bukenya G, Whalen CC. Tuberculosis in Household Contacts of Infectious Cases in Kampala, Uganda. Am J Epidemiology 2003; 158: 887 - 898.

2. Guwatudde D†, Debanne SM, Diaz M, King C, Whalen CC. A re-examination of the potential impact of preventive therapy on the public health problem of tuberculosis in contemporary sub-Saharan Africa. Preventive Medicine, 2004; 39(5): 1036 – 1046.
3. Sekandi JN†, Neuhauser D, Smyth K, Whalen CC. Active case finding of undetected tuberculosis among chronic coughers in a slum setting in Kampala, Uganda. Int J Tuberc Lung Dis 2009; 13 (4): 508 – 513.
4. Kiwannuka N†, Robb M, Laeyendecker O, Kigozi G, Wabwire-Mangen F, Makumbi FE, Nalugoda F, Kagaayi J, Eller M, Eller LA, Serwadda D, Sewankambo NK, Reynolds SJ, Quinn TC, Gray RH, Wawer MJ, Whalen CC. HIV-1 viral subtype differences in the rate of CD4+ T-cell decline among HIV seroincident antiretroviral naïve persons in Rakai Districr, Uganda. JAIDS 2010 (Epub ahead of print).
5. Mupere E†, Zalwango S†, Chiunda A, Okwera A, Mugerwa R, Whalen CC. Body composition among HIV-seropositive and HIV-seronegative adult patients with pulmonary tuberculosis in Uganda. Ann Epidemiol 2010; 20 (3): 210 – 216.

Other publications relevant to the application:

1. Whalen C, Horsburgh CR Jr., Hom D, Lahart C, Simberkoff M, Ellner J. Accelerated course of human immunodeficiency virus infection after tuberculosis. Am J Resp and Crit Care Med. 1995; 151:129-135.
2. Wallis RS, Nsubuga P. Whalen CC, Mugerwa RD, Oette D, Jackson JL, Johnson JJ, Ellner JJ. Pentoxifylline in HIV-l-seropositive tuberculosis: a randomized controlled trial. J Infect Dis 1996; 174: 727 – 733
3. Whalen CC, Nsubuga P, Okwera A, Johnson JL, Hom DL, Michael N, Mugerwa RD, Ellner JJ. Impact of pulmonary tuberculosis on survival of HIV-infected Ugandan adults. AIDS 2000; 14:1219 – 1228.
4. Toossi Z, Mayanja-Kizza H†, Hirsch CS, Edmonds KL, Spalingher T, Hom DL, Aung H, Ellner JJ, Whalen CC. Impact of tuberculosis on human immunodeficiency virus-1 disease. Clin Exp Immunol, 2001; 123: 233 – 238.
5. Guwatudde D†, Zalwango S, Kamya MR, Debanne SM, Diaz MI, Okwera A, Mugerwa RD, King C, Whalen CC. Burden of tuberculosis in Kampala, Uganda. Bull WHO, 2003; 81: 799-805.
6. Mayanja-Kizza H†, Jones-Lopez E†, Okwera A, Wallis RS, Ellner JJ, Mugerwa RD, Whalen CC. Immunoadjuvant therapy for HIV-associated tuberculosis with prednisolone: a phase II clinical trial in Uganda. JID 2005;191: 856 – 65.
7. Whalen CC, Chiunda A, Zalwango S, Maganda A, Nshuti L, Okwera A, Hirsch C, Peters P, Jones-Lopez E, Boom WH, Mugerwa RD. Risk Factors for Acute *M. tuberculosis* Infection in Household Contacts in Kampala, Uganda. Am J Trop Med Hyg. 2006; 75: 55 - 61.
8. Srikantiah P, Walsimbi MN, Kayanja HK, Mayanja-Kizza H, Mugerwa RD, Lin R, Chalebois ED, Boom WH, Whalen CC, Havlir DV. Early virological response of zidovudine/lamivudine abacavir for patients co-infected with HIV and tuberculosis in Uganda. AIDS 2007; 21: 1972 – 1974.
9. Stein CM†, Zalwango S, Chiunda AB, Millard C, Leonitev DV, Horvath AL, Cartier KC, Chervenak K, Boom WH, Elston RC, Mugerwa RD, Whalen CC*, Iyengar SK*. Linkage and association analysis of candidate genes for TB and TNFα cytokine expression: evidence for association with IFNGR1, IL-10, and TNF receptor 1 genes. Hum Genet 2007; 121: 633 – 673. (*share senior authorship).
10. Stein CM†, Zalwango S, Malone LL, Woo S, Mayanja-Kizza H, Mugerwa RD, Leontiev DV, Thompson CL, Cartier KC, Elston RC, Iyengar SK, Boom WH, Whalen CC. Genome scan of M. tuberculosis infection and disease in Ugandans. PLoS ONE 2008; 3 (12): e4094.
11. Mahan CS, Walusimbi M, Johnson DF, Lancioni C, Charebois, Baseke J, Chervenak KA, Mugerwa RD, Havlir DV, Mayanjan-Kizza H, Whalen CC, Boom WH. Tuberculosis treatment in HIV-infected Ugandans with CD4 Counts > 350 cells/mm3 reduces immune activation with no effect on HIV load or CD4 count. PLoS ONE 2010; 5(2): e9138. doi:10.1371/journal.pone.0009138
12. Mugwanya K†, Baeten J, Nakku-Joloba E, Katabira E, Celum C, Whalen CC. Knowledge and attitudes concerning male circumcision for HIV-1 prevention among heterosexual HIV-1 sero-discordant couples in Kampala, Uganda. AIDS and Behavior 2010, in press.
13. Chamie G, Charlebois ED, Srikantiah P, Walusimbi-Nanteza M, Mugerwa RD, Mayanja-Kizza H, Okwera Alphonse, Whalen CC, Havlir DV. My tuberculosis micrbiologic and clinical treatment outcomes in a randomized trial of immediate vs CD4+ initiated antiretroviral therapy in HIV-infected adults with high CD4+ T cell counts. Clin Infect Dis 2010; 51: 359 – 362.

D. Research Support.

Active Research Grants

AIDS International Training and Research Program (PI: Whalen CC; 9/87 – 5/13; TW – 00011, Fogarty International Center, National Institutes of Health) The goal of this training program is to train foreign scientists from developing countries to perform research in the areas of HIV/AIDS and tuberculosis.

International Clinical, Operational, and Health Services Research on TB and AIDS (PI: Whalen CC; 6/04 – 5/09; TW – 006900-01, Fogarty International Center, National Institutes of Health) The goal of this research and training program is to provide training through active research programs relating to clinical, operational, and health services research on tuberculosis or HIV in Uganda.

Punctuated Antiretroviral Therapy (PI: Whalen CC; AI AI51219, 2003 – 2010) This is a randomized clinical trial of HIV-infected tuberculosis patients with CD4+ T cell counts > 350 cells/μL to determine whether a short, 6-month, punctuated course of antiretroviral therapy during tuberculosis therapy will slow the progression of HIV infection as measured by the decline in CD4+ cell count.

Community-Based Case Finding of TN-HIV Patients in Kampala, Uganda (PI: Whalen CC; Doris Duke Charitable Foundation, 2007 – 2009) This is an observational study that compares the effectiveness of two different strategies for active case finding of patients with HIV-associated tuberculosis.

The Tuberculosis Research Unit (PI: Boom WH, Co-investigator: Whalen CC; 2007 - 2014; AI 95383, Division of Microbiology and Infectious Diseases, National Institutes of Health) The Tuberculosis Research Unit is a multidisciplinary research contract to study novel methods for tuberculosis control. The TBRU has four major research programs in epidemiology, clinical trials, immunology, and microbiology, and three core activities including a specimen repository, a study coordinating center, and an administrative core..

Completed Grants (within past 3 years)**:**

Determination of infection with multiple strains of Mycobacterium tuberculosis in adults with active pulmonary tuberculosis in Kampala. Uganda. Howard Hughes Medical Institute (PI – Whalen CC). This is a research training fellowship for a medical student Katherine Dickman.

Genetic Determinants of Tumor Necrosis Factor-alpha Expression to M. tuberculosis (PI: Whalen CC; 6/2003 – 6/2004; STERIS Corporation grant). In household contacts of active tuberculosis, we determined TNF □ expression in response to M. tuberculosis antigens in a whole blood cytokine assay.

Impact of Tuberculosis on HIV Infection in Uganda: Corticosteroid adjuvant therapy in HIV-associated TB (PI: Whalen CC; 3/93 – 8/06; AI-32414, National Institute of Allergy and Infectious Disease, National Institutes of Health). This project was developed to evaluate the impact of tuberculosis on the natural history of HIV in Africa.

BIOGRAPHICAL SKETCH

Provide the following information for the key personnel and other significant contributors in the order listed on Form Page 2.
Follow this format for each person. **DO NOT EXCEED TWO PAGES.**

NAME	POSITION TITLE
MING ZHANG	Assistant Professor
eRA COMMONS USER NAME MINGZH	

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, and **include postdoctoral training**.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	YEAR(s)	FIELD OF STUDY
Shandong Normal University, P.R.China	BS	1992-1996	Biological Sciences
Shandong Normal University, P.R.China	MS	1996-1999	Molecular & Cellular Biology
Georgia Institute of Technology, USA	MS	2000-2001	Bioinformatics
University of Göttingen, Germany	PhD	2003-2007	Bioinformatics (HIV Molecular Evolution)
Los Alamos National Laboratory, USA	Postdoc Fellow	2007-2010	Computational Biology (Viral Molecular Epidemiology and Evolution)

A. Positions and honors

(1) Positions

05/2001- 07/2002 Bioinformatics Intern (ORISE Postgraduate Fellow). CDC, USA.
07/2002-10/2007 Bioinformatician and Web Developer (Graduate Research Assistant). Los Alamos HIV Sequence Database group, Los Alamos National Laboratory, USA.
07/2003- 08/2007 Research Assistant. Department of Bioinformatics, Institute of Microbiology and Genetics, University of Göttingen, Germany.
11/2007-10/2010 Postdoctoral Research Associate. Theoretical Biology & Biophysics (T-6), Los Alamos National Laboratory, USA.
04/2008-10/2010 Postdoctoral Fellow. Center for Nonlinear Studies, Los Alamos National Laboratory (LANL), USA.
11/2010- Assistant Professor. Department of Epidemiology and Biostatistics, University of Georgia, USA.

(2) Selected awards and honors

2001-2002 CDC ORISE Postgraduate Fellowship. CDC, USA.
2004 Merit-based Travel Grant. 13th AIDS Vaccine International Conference, Switzerland.
2007 James H. Nakano Citation Award. U.S. CDC, USA.
2007 Nominated for Secretary of Health Distinguished Service Award. DHHS/CDC. USA.
2007 Nominated for Charles C. Shepard Award. U.S. CDC, USA.
2007 PhD graduated with *Summa cum Laude*. University of Göttingen, Germany.
2008 CNLS Postdoctoral Fellowship. Los Alamos National Laboratory, USA.
2010 Keystone Symposium HIV Research Fellowship. Keystone Symposia HIV Conference, USA.
2010 Young Investigator Award. International Conference on Retroviruses and Opportunistic Infections. USA.

B. Selected peer-reviewed publications (in chronological order, limit: 10 papers) (selected from 22 peer-reviewed publications)

1. **M. Zhang***, B. Foley, A. Schultz, J. Macke, I. Bulla, M. Stanke, B. Morgenstern, B. Korber, T. Leitner. The role of recombination in the emergency of a complex and dynamic HIV epidemic. ***Retroviology***. 7:25. 2010.
2. M. Faghihi, **M. Zhang**, J. Huang, F. Modarresi, G. Laurent, C. Wahlestedt. Evidence for Natural Antisense Transcript-Mediated Inhibition of MicroRNA Function. ***Genome Biology.*** In press. 2010.

3. Schultz, **M. Zhang**, I. Bulla, T. Leitner, B. Korber, M. Morgenster, M. Stanke. 2009. Improving the reliability of jpHMM recombination predictions on HIV. ***Nucleic Acids Research***. 37: W647-51. 2009.
4. J. Xie, **M. Zhang**, T. Zhou, X. Hua, L. Tang, W. Wu. 2007.Sno/scaRNAbase: a curated database for small nucleolar RNAs and cajal body-specific RNAs. ***Nucleic Acids Research***. 35:D183-D187.
5. **M. Zhang**, A. Schultz, C. Calef, C. Kuiken, T. Leitner, B. Korber, B. Morgenstern, M. Stanke. 2006. JpHMM at GOBICS: a web server to detect genomic recombinations in HIV-1. ***Nucleic Acids Research***. 34: W463-5.
6. Schultz, **M. Zhang**, T. Leitner, C. Kuiken, B. Korber, B. Morgenstern, M. Stanke. 2006. A jumping profile Hidden Markov Model and applications to recombination sites in HIV and HCV genomes. ***BMC Bioinformatics***. 7:265.
7. J. Esposito, S. Sammons, M. Frace, J. Osborne, M. Rasmussen, **M. Zhang**, D. Govil, I. Damon, R. Kline, M. Laker, Y. Li, G. Smith, H. Meyer, J. LeDuc, R. Wohlhueter. 2006. Genome sequence diversity and clues to the evolution of variola virus. ***Science***. 313(5788):807-12.
8. **M. Zhang**, A. Schultz, B. Morgenstern, M. Stanke, B. Korber, T. Leitner. Greater HIV Genome Diversities Inferred From Re-subtyping of HIV Database Sequences. 2005. ***Proceedings of German Conference on Bioinformatics (Discovery Notes)***. pp 5-7.
9. **M. Zhang**, K. Wilbe, N. Wolfe, B. Gaschen, J. Carr, T. Leitner. HIV-1 CRF13-cpx revisited: identification of a new sequence from Cameroon and signal for sub-subtype J2. 2005. ***AIDS Research and Human Retroviruses***. 21(11):955-960.
10. **M. Zhang**, B. Gaschen, W. Blay, B. Foley, N. Haigwood , C. Kuiken, B. Korber. 2004. Tracking global patterns of N-linked glycosylation site variation in highly variable viral glycoproteins: HIV, SIV, and HCV envelopes, and influenza hemagglutinin. ***Glycobiology***. 14 (12): 1229-1246.

Relevant Authored Software

(1) Developed biological software

- Antisense Explorer: genome-wide screening for disease-specific cis- natural antisenses.
- jpHMM: A hidden Mokov model-based HIV subtyping tool. Be rated as one of the top 3 HIV subtyping tools in the world (evaluated by independent research group in UK).
- N-glyco: for tracking N-linked glycosylation sites in protein sequences.
- Tree-entropy: Phylogenetic information based sequence variety evaluation.
- Window-BLAST: for fast detecting HIV contaminations and recombinants.
- Frequent contributions to many other computing programs for sequence analyses purposes.

(2) Developed biological databases

- Los Alamos HIV and HCV sequence databases (www.hiv.lanl.gov and www.hcv.lanl.gov. USA)
- Sno/scaRNA database for small nucleolar RNAs and cajal body-specific RNAs (http://gene.fudan.sh.cn/snoRNAbase.nsf. State Key Laboratory of Genetic Engineering, Fudan University, China)
- CDC smallpox sequence database (CDC in-house database. USA)
- Algae strain collection database (Dept. of Botany in-house database, University of Göttingen, Germany)

C. Research Support

- Grant/Project #: X9M6/3000 Category "Computational Biology and Bio-inspire", 2008-2010
  Title: "Aberrant Human *cis*- Natural Antisense Transcripts".
  Sponsor: Los Alamos National Laboratory
  Overall goals: To investigate human *cis*-natural antisense transcripts under disease conditions.
  Role: Independent Researcher
- Grant/Project #: NIH-DOE Agreement Project Y1-AI-8309, 2008-2014
  Title: "HIV Databases and Analysis".
  Sponsor: NIH and DOE
  Overall goals: To investigate genetic diversity of HIV strains
  Role: Postdoctoral Researcher

BIOGRAPHICAL SKETCH

Provide the following information for the key personnel and other significant contributors.
Follow this format for each person. **DO NOT EXCEED FOUR PAGES.**

NAME Dobbin, Kevin Kelly	POSITION TITLE Assistant Professor of Biostatistics
eRA COMMONS USER NAME Dobbinke	

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	YEAR(s)	FIELD OF STUDY
St. John's College, Santa Fe, NM	B.A.	1987	Great Books Program
University of Colorado, Boulder, CO	B.A.	1996	Mathematics
University of Minnesota, Twin Cities, MN	Ph.D.	2001	Statistics

A. Positions and Honors.

Positions and Employment

2001-2002 Post-doc, National Cancer Institute, National Institutes of Health, Bethesda, MD
2002-2008 Mathematical Statistician, National Cancer Institute, National Institutes of Health, Bethesda, MD
2009- Assistant Professor of Biostatistics, College of Public Health, University of Georgia
2009- Distinguished Cancer Scholar, Georgia Cancer Coalition

Other Experience and Professional Memberships

1999-2001 Research Assistant, Minnesota Epilepsy Group, P.A., St. Paul
2001- Member, American Statistical Association
2001- Member, International Biometric Society Eastern North American Region
2009- Member, Biomedical and Health Science Institute, University of Georgia
2009- Member, Institute of Bioinformatics, University of Georgia]
2009- Associate Editor, Biometrics

Honors

1995-1996 J. Tour Scholarship in Mathematics, College of Arts and Sciences, University of Colorado
1999-2001 Scholarship, College of Liberal Arts, University of Minnesota
2000 Student Paper Travel Award, International Biometric Society, Eastern North American Region
2001-2002 Cancer Research Training Award, National Institutes of Health

B. Selected peer-reviewed publications (in chronological order).

Peer-reviewed Journal Articles

1. **Dobbin, K.** and Simon, R. (2002) Comparison of Microarray Designs for Class Comparison and Class Discovery. Bioinformatics, 18: 1438-1445.
2. Simon, R., Radmacher, M. and **Dobbin, K.** (2002) Design of Studies Using DNA Microarrays. Genetic Epidemiology, 23: 21-36.
3. Simon, R., Radmacher, M., **Dobbin, K.** and McShane, L. (2003) Pitfalls in the Use of DNA Microarray Data for Diagnostic and Prognostic Classification. Journal of the National Cancer Institute, 95: 14-18.
4. **Dobbin, K.**, Shih, J., and Simon, R. (2003) Statistical Design of Reverse Dye Microarrays. Bioinformatics, 19: 803-810.
5. **Dobbin, K.** and Louis, T. (2003) Accommodating Stochastic Departures from Percentile Invariance in Causal Models. Journal of the Royal Statistical Society, Series B, 65: 837-849.

6. Simon, R. and **Dobbin, K.** (2003) Experimental Design of DNA Microarray Experiments. Biotechniques, March Supplement: 16-21.
7. **Dobbin, K.**, Shih, J. and Simon, R. (2003) Questions and Answers on Design of Dual-label Microarrays for Identifying Differentially Expressed Genes. Journal of the National Cancer Institute, 95: 1362-1369.
8. **Dobbin, K.** and Simon, R. (2005) Sample Size Determination in Microarray Experiments for Class Comparison and Prognostic Classification. Biostatistics, 6: 27-38.
9. **Dobbin, K.**, Beer, D.G., Meyerson, M., Yeatman, T., Gerald, W., Jacobson, J., Conley, B., Buetow, K., Heiskanen, M., Simon, R., Minna, J., Girard, L., Misek, D., Taylor, J., Hanash, S., Naoki, K., Hayes, D. N., Ladd-Acosta, C., Enkemann, S., Viale, A., Giordano, T. (2005) Inter-laboratory comparability study of cancer gene expression analysis using oligonucleotide microarrays. Clinical Cancer Research, 11: 565-72.
10. **Dobbin, K.K.**, Kawasaki, E.S., Petersen, D.W., and Simon, R.M. (2005) Characterizing dye bias in microarray experiments. Bioinformatics, 21: 2430-2437
11. **Dobbin, K.K.**, Shih, J.H. and Simon, R.M. (2005) Comment on`Evaluation of the gene-specific dye bias in cDNA microarray experiments'. Bioinformatics, 21, 2803-2804.
12. **Dobbin, K.K.** and Simon, R.M. (2007) Sample size planning for developing classifiers using high dimensional DNA microarray data. Biostatistics, 8: 101-117.
13. Kajdacsy-Balla A, Geynisman JM, Macias V, Setty S, Nanaji NM, Berman JJ, **Dobbin K**, Melamed J, Kong X, Bosland M, Orenstein J, Bayerl J, Becich MJ, Dhir R, Datta MW and the Cooperative Prostate Cancer Tissue Resource (2007) Practical Aspects of Planning, Building and Interpreting Tissue Microarrays: The Cooperative Prostate Cancer Tissue Resource Experience. Journal of Molecular Histology, 38: 113-21.
14. **Dobbin, K.K.**, Zhao, Y. and Simon, R.M. (2008) How large a training set is needed to develop a classifier? Clinical Cancer Research, 14: 108-114.
15. Director's Challenge Consortium for the molecular evaluation of lung adenocarcinoma (2008) Gene expression-based survival prediction in lung adenocarcinoma: a multi-site, blinded validation study. Nature Medicine. 14(8): 822-7.
16. **Dobbin, K.K.** (2009) A method for constructing a confidence bound for the actual error rate of a prediction rule in high dimensions. Biostatistics, 10: 282-296.
17. Dancey J.E., **Dobbin K.K.**, Grever M.R. Groshen S., Jessup J.M., Koehler M., Shankar L.K. Stadler W.M., True L.D., Gravel A. on behalf of the Biomarker Task Force of the NCI Investigational Drug Steering Committee (2010) Guidelines for the development and incorporation of biomarker studies in early clinical trials of novel agents. Clinical Cancer Research, 16: 1745-55.
18. Harvey R.C., Mullighan C.G., Chen I, Wharton W., Mikhail F.M., Carroll A.J., Kang H., Liu W., **Dobbin K.K.,** Smith M.A., Carroll W.L., Davidas, M., Bowman W.P., Camitta B., Reaman G.H., Hunger S.P., Downing J.R., Willman C.L. (2010) Rearrangement of CRLF2 is associated with mutation of JAK kinases, alteration of IKZF1, Hispanic/Latino ethnicity and a poor outcome in pediatric B-progenitor acute lymphoblastic leukemia. Blood, 115(26): 5312-21.

C. Research Support

Ongoing Research Support

Georgia Cancer Coalition, "Georgia Cancer Coalition Distinguished Scholar," 7/1/2009-6/29/2014. Principal Investigator.

Completed Research Support

BIOGRAPHICAL SKETCH

Provide the following information for the key personnel in the order listed on Form Page 2.
Follow this format for each person. **DO NOT EXCEED FOUR PAGES.**

NAME	POSITION TITLE
Jang, Woncheol	Assistant Professor

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	YEAR(s)	FIELD OF STUDY
Seoul National University	B.S.	1991	Computer Science & Statistics
Seoul National University	M.S.	1993	Statistics
Texas A&M University	M.S.	1998	Statistics
Carnegie Mellon University	Ph.D.	2003	Statistics
Carnegie Mellon University	Postdoc	2004	Statistics

A. Positions and Honors.

Positions and Employment

2007 – present	Assistant Professor, Department of Epidemiology Biostatistics, and Epidemiology, College of Public Health, University of Georgia
2007 – present	Full member, Institute of Bioinformatics, University of Georgia
2006 -- 2007	Assistant Professor, Department of Health Administration, Biostatistics and Epidemiology, College of Public Health, University of Georgia
2006	New Research Fellow, Astrostatistics Program, Statistical and Applied Mathematical Science Institute
2004 – 2006	Visiting Assistant Professor, Institute of Decision Sciences and Statistics, Duke University
2003 – 2004	Postdoctoral Research Associate, Department of Statistics, Carnegie Mellon University
1998 – 2003	Teaching and Research Assistant, Department of Statistics, Carnegie Mellon University
1996 – 1998	Teaching and Research Assistant, Department of Statistics, Texas A&M University

Professional Memberships

American Statistical Association
Institute of Mathematical Statistics
International Society for Bayesian Analysis

Honors

2008	NSF Young Researcher Travel Award, University of Florida Tenth Annual Winter Workshop: Bayesian Model Selection and Objective Methods.
2006	NSF Young Researcher Travel Award, University of Florida Eight Annual Winter Workshop: Frontiers oof Theoretical Statistics
2005	IMS Laha Travel Award, Joint Statistical Meetings
2005	Travel Award, The Fifth International Workshop on Objective Bayes Workshop
2005	NSF Young Research Travel Award, University of Florida Seventh Annual Winter Workshop: Longitudinal Data Analysis.

2004 NSF Young Research Travel Award, University of Florida Sixth Annual Winter Workshop: Data Mining, Statistical Learning and Bioinformatics.
2002 Student Travel Award, Workshop on Developments and Challengers in Mixture Models, Bump Hunting and Measurement Error Models

B. Selected peer-reviewed publications (in chronological order).

Journal Papers

1. **Jang, W.** and Lim, J. (In Press) Discussion of "Maximum likelihood of a multidimensional log-concave density" by Cule, Samworth and Stewart, *Journal of the Royal Statistical Society, Series B*, To appear.
2. Loh, J. M. and **Jang, W.** (2010) Estimating a cosmological mass bias parameter with bootstrap bandwidth selection. *Journal of the Royal Statistical Society, Series C*, To appear.
3. **Jang, W**. and Loh, J. M. (2010) Density estimation for grouped data with application to transect sampling. *Annals of Applied Statistics*, 4 893-915.
4. Kim, Y., Kim, B. and **Jang, W.** (2010) Asymptotic properties of the maximum likelihood estimation for the proportional harzards model. *Journal of Multivariate Analysis* 101 1339-1351
5. Jang, W. and Lim, J. (2009) A numerical study of PQL estimation biases in generalized linear mixed models under heterogeneity of random effects. Communication in Statistics – Simulation and Computation. In Press.
6. **Jang W**. (2006) Density estimation and clustering in astronomical sky surveys. *Computational Statistics & Data Analysis* 2006:50:760-774
7. Jung, S.-H and **Jang W**. How accurately can we control the FDR in analyzing microarray data? *Bioinformatics* 2006:22:1730-1736
8. Choi B, **Jang W**, Salama G. Spatially discordant voltage alternans cause wavebreaks in ventricular fibrillation. *Heart Rhythm* 2007:4:1057-1068
9. **Jang W.** and Hendry M. Cluster analysis for massive datasets in astronomy. *Statistics and Computing* 2007:17:253-262

Book Chapters and Abstract

1. **Jang W**. Comments on Analyzing Data from astronomical surveys: issues and directions by Tom Loredo. In *Statistics Challenges in Modern Astronomy IV*. San Francisco: Astronomical Society of the Pacific, 2007.
2. Choi B. **Jang, W**, Salama, C. Patterns f wave break locations in ventricular fubrillation. *Heart Rhythm* 2 S216-S216, 2005
3. **Jang W**. Nonparametric density estimation and galaxy clustering, In *Statistical Challenges in Astronomy* 443-445 New York: Springer, 2003
4. **Jang W**, Miller C, Connolly A, Scheider J, Genovese C, Nichol B, Moore A ,Wasserman L. Nonparametric inference in astrophysics. , In *Statistical Challenges in Astronomy* 221-235 New York: Springer, 2003

C. Research Support.

Small Business Technology Transfer Grant (Biostatistician) 7/1/09-6/30/11
National Institute of Health
Development of Software for Comparative/Quantitative Clinical Proteomics

Faculty Research Grant UJ-013 (PI) 1/1/08-12/31/08
University of Georgia Research Foundation
Functional Data Analysis with Application to Bioinformatics

BIOGRAPHICAL SKETCH

Provide the following information for the key personnel and other significant contributors in the order listed on Form Page 2.
Follow this format for each person. **DO NOT EXCEED FOUR PAGES.**

NAME	POSITION TITLE
Rathbun, Stephen L.	Associate Professor Biostatistics
eRA COMMONS USER NAME slrathbun	

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)*

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	YEAR(s)	FIELD OF STUDY
Florida State University	BS	1976	Biology
Florida State University	MS	1980	Biology
Iowa State University	MS	1987	Statistics
Iowa State University	Ph.D.	1990	Statistics

NOTE: The Biographical Sketch may not exceed four pages. Items A and B (together) may not exceed two of the four-page limit. Follow the formats and instructions on the attached sample.

A. Positions and Honors. List in chronological order previous positions, concluding with your present position. List any honors. Include present membership on any Federal Government public advisory committee.

Positions and Employment

2005-present Associate Professor of Biostatistics, University of Georgia
2007-2008 Interim Head, Department of Epidemiology and Biostatistics, University of Georgia
2001-2005 Associate Professor of Statistics, Pennsylvania State University
1996-2001 Associate Professor of Statistics, University of Georgia
1990-1996 Assistant Professor of Statistics, University of Georgia

Other Experience and Professional Memberships

2005-present Managing Editor, *Environmental and Ecological Statistics*
2005-2007 Representative of the Eastern North American Region/Western North American Region of the Biometric Society to the American Association for the Advancement of Science Section on Geology and Geography
1999-2001 Member, Statistical Review Panel, Florida Marine Research Institute
1997-2001 Director, Statistical Consulting Center, University of Georgia
1996-1999 Member, Regional Advisory Board, Eastern North American Region of the International Biometric Society
1994-1996 Member, American Statistical Association Committee on Environmental Monitoring and Assessment Program
1991-1992 Member, Estuarine Review Group for the Environmental Monitoring and Assessment Program

B. Selected peer-reviewed publications (in chronological order).

James, F.C., and S. Rathbun. 1981. Rarefaction, relative abundance, and diversity of avian communities. *The Auk* 98, 785-800.

Karlin, A.A., S.I. Guttman, and S.L. Rathbun. 1984. Spatial autocorrelation analysis of heterozygosity and geographic distribution in populations of *Desmognathus fuscus* (Amphibia: Plethodontidae). *Copeia* 1984, 341-354.

Platt, W.J., G.W. Evans, and S.L. Rathbun. 1988. The population dynamics of a long-lived conifer (*Pinus palustris*). *The American Naturalist* 131, 491-525.

Rathbun, S.L., and Cressie, N. 1994. Asymptotic properties of estimators for the parameters of spatial inhomogeneous Poisson point processes. *Advances in Applied Probability* 26, 122-154.

Rathbun, S.L., and Cressie, N. 1994. A space-time survival point process for a longleaf pine forest in southern Georgia. *Journal of the American Statistical Association* 89, 1164-1174.

Rathbun, S.L. 1996. Estimation of Poisson intensity using partially observed concomitant variables. *Biometrics* 52, 226-242.

Rathbun, S.L. 1996. Asymptotic properties of the maximum likelihood estimator for spatio-temporal point processes. *Journal of Statistical Planning and Inference* 51, 55-74.

Conroy, M.J., Anderson, J.E., Rathbun, S.L., and Krementz, D.G. 1996. Statistical inference on patch-specific survival and movement rates from marked animals. *Journal of Ecological and Environmental Statistics* 3, 99-118.

Rathbun, S.L. 1998. Spatial modeling in irregularly shaped regions: kriging estuaries. *Environmetrics* 9, 109-129.

Burke, V.J., Rathbun, S.L., Bodie, J.R., and Gibbons, J.W. 1998. Predation of turtle nests in a heterogeneous landscape -- a test of density effects. *Oikos* 83, 3-11.

Ettema, C.H., Coleman, D.C., Vellidis, G., Lowrance, R., and Rathbun, S. 1998. Spatiotemporal distributions of bacterivorous nematodes and soil resources in a restored riprarian wetland. *Ecology* 79, 2721-2734.

Olsen, A.R., Sedransk, J., Edwards, D. Gotway, C.A. Rathbun, S., Reckhow, K., and Young, L. 1999. Statistical issues for monitoring ecological and natural resources in the United States. *Environmental Monitoring and Assessment* 54, 1-45.

Ettema, C.H., Rathbun, S.L., and Coleman, D.C. 2000. On spatiotemporal patchiness and the coexistence of five species of Chronogaster (Nematoda: Chronogasteridae) in a riprarian wetland. *Oecologia* 125, 444-452.

Calvert, C.A., Jacobs, G.J. Smith, D.D., Rathbun, S.L., and Pickus, C.W. 2000. Association between results of ambulatory electrocardiography and development of cardiomyopathy during long-term follow-up of Doberman Pinschers. *Journal of the American Veterinary Medical Association* 216, 34-39.

Singleton, D.R., Furlong, M.A., Rathbun, S., and Whitman, W.B. 2001. Quantitative comparisons of 16S rDNA sequence libraries from environmental samples. *Applied and Environmental Microbiology* 67, 4374-4376.

Bacchus, S.T., Archibald, D.D., Brook, G.A., Britton, K.O., Haines, B.L., Rathbun, S.L., and Madden, M. 2003. Near-infrared spectroscopy of a hydroecological indicator: new tool for determining sustainable yield for Floridan aquifer system. *Hydrological Processes* 17, 1785-1809.

Zhao, D., Borders, B., Wilson, M., and Rathbun, S.L. 2006. Modeling neighborhood effects on the growth and survvival of individual trees in a natural temperate species-rich forest. *Ecological Modelling* 196, 90-102.

Rathbun, S.L., and Fei, S. 2006. A Spatial Zero-Inflated Poisson Regression Model for Oak Regeneration. *Environmental and Ecological Statistics* 13, 409-426.

Rathbun, S.L., and Black, B. 2006. Modeling and Spatial Prediction of Pre-Settlement Patterns of Forest Distribution using Witness Tree Data. *Environmental and Ecological Statistics* 13, 427-448.

Rathbun, S.L. 2006. Spatial Prediction with Left-Censored Observations. *Journal of Agricultural, Biological, and Environmental Statistics* 11, 317-336.

Rathbun, S.L., Shiffman, S., and Gwaltney, C. 2007. Modeling the effects of partially observed covariates on Poisson process intensity. *Biometrika* **94,** 153-165.

Pearce, J.L., Rathbun, S.L., Aguilar-Villalobos, M., and Naeher, L.P. (2009). Characterizing the spatiotemporal variability of PM_{2.5} in Cusco, Peru using kriging with external drift. *Atmospheric Environment* **43**, 2060-2069.

C. Research Support.

Stephen Rathbun

ACTIVE

SES-0720195 (Rathbun PI) 9/1/07 - 8/31/10 2.00 Calendar
National Science Foundation 236,240.00
A Probability-Sampling Framework for Modeling the Impact of Time-Varying Covariates on Event History Data.

The purpose of this project is to develop the theoretical foundations for a new probability-sampling framework for modeling the impact of time-varying covariates on event history and lifetime data, and to develop new an innovative point process models for event history data. The proposed framework may be implemented in any situation where the estimating equations involve the integration of some function of covariates over time, space or space-time, and has applications not only in event-history data, but also spatial point process modeling in ecology and spatial epidemiology.

1RO1DA024687-01 (Rathbun, PI) 4/1/08 – 3/31/11 3.00 Calendar
NIH 336,899.00
Probability-Sampling Framework for Modeling the Impact of Time-Varying Covariates: Ecological Momentary Assessment of Smoking.

The purpose of this project is to develop a probability-based framework for modeling data from an ecological momentary assessment of smoking. The specific aims are to: 1. Develop models for the post-lapse pattern of cigarettes in the naturalistic EMA study, and pattern of ad-lib smoking, lifetimes to lapse following a designated quit date, and post-lapse pattern of cigarettes in the EMA study of the efficacy of the nicotine patch, supported by a probability-based framework for statistical inference and taking into account temporal dependence among smoking events. 2. Develop a model for variation among subjects with respect to effects of time-varying covariates and time of day, from which clusters of subjects showing similar smoking behaviors may be identified. 3. Construct models in which the hazard of smoking a cigarette at a given instant in time depends not only on the current values of time-varying covariates, but also on an integrated function of past values of those covariates.

BIOGRAPHICAL SKETCH

Provide the following information for the key personnel and other significant contributors in the order listed on Form Page 2.
Follow this format for each person. **DO NOT EXCEED FOUR PAGES.**

NAME	POSITION TITLE
Song, Xiao	Assistant Professor of Biostatistics
eRA COMMONS USER NAME (credential, e.g., agency login) XIAOSONG	

EDUCATION/TRAINING (Begin with baccalaureate or other initial professional education, such as nursing, and include postdoctoral training.)

INSTITUTION AND LOCATION	DEGREE (if applicable)	YEAR(s)	FIELD OF STUDY
Peking University	B.S.	1992	Mathematics
Peking University	M.S.	1995	Mathematics
North Carolina State University	M.S.	2000	Statistics
North Carolina State University	Ph.D.	2002	Statistics

A. Personal Statement

B. Positions and Honors.

Positions and Employment

1993-1994 Teaching Assistant, Department of Mathematics, Peking University
1995-1998 Computer Software Engineer, Institute of Computer Science & Technology, Peking University
1998-2000 Teaching Assistant, Department of Statistics, North Carolina State University
2000-2002 Research Assistant, Department of Statistics, North Carolina State University
2002-2006 Research Assistant Professor, Department of Biostatistics, University of Washington
2004-2006 Joint Assistant Member, Fred Hutchinson Cancer Research Center
2006- Assistant Professor, Department of Epidemiology and Biostatistics, University of Georgia

Honors

1991 Jiu-Zhang Mathematics Prize, highest honor in Department of Mathematics, Peking University
2001 ASA Biopharmaceutical Section Student Paper Award.
2001 Gertrude M. Cox Outstanding Academic Achievement Award Fellow, Department of Statistics, North Carolina State University.
2001-2002 Merck Foundation Fellowship, Department of Statistics, North Carolina State University.

C. Selected peer-reviewed publications

1. Song X, Davidian M, and Tsiatis AA. An estimator for the proportional hazards model with multiple longitudinal covariates measured with error. *Biostatistics* 3:511-528, 2002.
2. Song X, Davidian M, and Tsiatis AA. A semiparametric likelihood approach to joint modeling of longitudinal and time-to-event data. *Biometrics* 58:742-753, 2002.
3. Shlipak MG., Stehman-Breen C, Fried LF., Song X., Siscovick D, Fried LP, Psaty BM and Newman AB. The presence of frailty in elderly persons with chronic renal insufficiency. *American Journal of Kidney Disease* 43(5): 861-867, 2004.
4. Song X. and Pepe, MS. Evaluating markers for selecting a patient's treatment. *Biometrics* 60, 874-883, 2004.
5. Song X and Zhou, X-H. A Marginal Model Approach for Analysis of Multi-reader Multi-test Receiver Operating Characteristic (ROC) Data. *Biostatistics* 6 : 303-312, 2005.
6. Song X and Huang Y. On corrected score approach for proportional hazards model with covariate measurement error. *Biometrics* 61, 702-714, 2005.
7. Song X and Huang Y. A corrected pseudo-score approach for additive hazards model with longitudinal covariates measured with error*., Lifetime Data Analysis* 12, 97-110, 2006.

8. Ma S, Song X and Huang, J. Regularized binormal ROC method in disease classification using microarray data., *BMC Bioinformatics*, 7(253), 2006.
9. Song X, Ma S, Huang, J and Zhou, X-H. A semiparametric approach for the nonparametric transformation survival model with multiple covariates, *Biostatistics* 8, 197-211, 2007.
10. Ma S, Song X and Huang J. Supervised group Lasso with applications to microarray data analysis. *BMC Bioinformatics* 8(60), 2007.
11. Song X. and Wang CY. Semiparametric approaches for joint modeling of longitudinal and survival data with time varying coefficients. *Biometrics* 64 557--566, 2008.
12. Song X. and Zhou X-H. A semiparametric approach for the covariate specific ROC curve with survival outcome. *Statistica Sinica* 18, 947-965, 2008.
13. Song X. and Ma S. Multiple augmentation for interval-censored data with measurement error. *Statistics in Medicine* 27, 3178-3190, 2008.
14. Song X. and Ma S. Variable selection for semiparametirc transformation with right censored data. *Journal of Nonparametric Statistics*, 22, 499-515, 2010.

D. Research Support

Ongoing Research Support

R01 ES017030 Wang (PI) 7/1/2010 – 5/31/2013
NIH/ES
Functional Methods for Radiation Exposure and Biomarker Data
Role: Co- Investigator and Subcontract PI
The overall goals of this research are to investigate innovative methods for estimating dose-response relationships when exposure is measured with error and biomarker data correlated with exposure are available.

A Zhou (PI) 11/1/09 – 9/30/2011
Department of Veterans Affairs (IPA)
Statistical Designs for Marker Validation Studies in Treatment Election
Role: Co- Investigator
The goal of the study it to develop statistical methods for selecting the cut-off point of a biomarker to achieve the optimal treatment effect.

Pamela Orpinas (PI) 5/1/2010 – 8/31/2011
CDC
Developmental pathways to dating violence and suicidal behavior: The Healthy Teens Study.
Role: Statistical Consultant
Healthy Teens is a longitudinal study of a cohort of approximately 700 Georgia students followed from 6th to 12th grade. The goal of Healthy Teens is to increase our understanding of different levels of risk and protective factors that influence the developmental trajectories (i.e., patterns of continuity or patterns of change over time) that adolescents follow from 6^{th} to 12th grade, in relation to single and combined self-reported violence-related behaviors: aggression toward peers, delinquency, dating violence, weapon carrying, drug and alcohol use, suicide thoughts and attempts, and school dropout.

Completed Research Support

X Song (PI) 1/2/2007 – 12/31/2007
University of Georgia Research Foundation
Statistical Methods for High-Dimensional Gene Expression Data with Survival Outcome
Role: PI
The goal of this study was to develop statistical methods for high-dimensional gene expression data with survival outcome.