

# The Epidemiology and Biostatistics of Aging

**TRAINING PROGRAM MANUAL**  
2017-2018

**TABLE OF CONTENTS**

<b><u>INTRODUCTION</u></b>	3
<b><u>OVERVIEW, MISSION AND GOALS</u></b>	4-5
<b><u>LEADERSHIP AND ADMINISTRATION</u></b>	6-7
<b><u>CORE FACULTY AND AFFILIATED FACULTY</u></b>	8-12
<b><u>PROGRAM COMPETENCIES</u></b>	13-15
<b><u>TRAINING REQUIREMENTS AND EXPECTATIONS</u></b>	16
- <u>Degree and non-degree program requirements</u>	17-18
- <u>Core curriculum: required and recommend courses</u>	19-20
- <u>Research-in-progress meetings and educational seminars</u>	21
- <u>Mentorship structure and meetings (including Individual Development Plans)</u>	22
- <u>Clinical and research practica</u>	23-24
- <u>Multidisciplinary “360-degree” project</u>	25
- <u>Directed aging research experience</u>	26
- <u>Research compliance training</u>	27
<b><u>ADDITIONAL EDUCATIONAL RESOURCES AND OPPORTUNITIES</u></b>	28-29
<b><u>APPENDICES</u></b>	30
- <u>Appendix A: Eligibility Requirements</u>	31
- <u>Appendix B: Sample Course Schedules</u>	32-36
- <u>Appendix C: Mentor-Mentee Information</u>	37-38
- <u>Appendix D: Table of 360 Degree Projects</u>	39-41

## **INTRODUCTION**

The **Epidemiology and Biostatistics of Aging (EBA) Training Program** was first funded by the National Institute on Aging (NIA) in 1996. The overall goal was to produce outstanding leaders in quantitative gerontology, poised to develop and lead increasingly multidisciplinary scientific questions in the field of aging, and this need for such leaders is considered to be even greater now than at the program's inception. With clinical translation at a premium, research must synthesize basic, clinical and social science. Data available to researchers are increasingly complex, whether simply massive (as in genomics, imaging, or real-time measures), high in potential for discovery but not explicitly designed for research (as in electronic health records), multi-dimensional (as in data on physiological regulation over multiple organ systems), or multi-component (as in meta-analyzing data from the many existing cohort studies on aging). Scholars who combine specialty quantitative expertise with immersion and dedication in science on aging will be crucial if such data are to yield valid scientific discoveries, improved strategies for preventing, delaying and treating adverse outcomes of older age, and means to manage the demographic shift to an older population productively and effectively. Therefore this program addresses a critical need for the field of gerontology through its training of quantitative scholars on aging.

The EBA Training Program is an institutional resource and has been recognized by its two home departments as an important departmental focus. Established in 1917 and 1919 respectively, the Departments of Biostatistics and Epidemiology at the Johns Hopkins Bloomberg School of Public Health are the oldest autonomous academic departments of their kind in the world, and remain among the most productive in both research and training of masters, doctoral, and postdoctoral students. Aging is one of the eight formal tracks in the Department of Epidemiology. The Department of Biostatistics highlights aging as one of seven topical working groups around which it organizes education and research. The training program is recognized, by both departments, and the institution, as an exciting and proven model of multidisciplinary scientific training. In our current grant cycle, the Department of Mental Health formal joined the program as a third departmental partner. Aging is one of nine research areas in the Department of Mental Health. Trainees in the EBA program have excelled academically, winning recognition for their disciplinary and interdisciplinary research. In addition to funding a core group of trainees, this program attracts multiple other students who participate in program activities although they are not formally funded. Both our formal trainees and our other participants have gone on to distinguished academic positions, where they have grown into a valuable quantitative resource to the field of gerontology.

The EBA training program is led by: Dr. Karen Bandeen-Roche, Director and co-founder; and an expert group of Associate Directors. The program is bolstered by a large group of core and affiliated faculty members who, along with the directorship, provide wide-ranging expertise and experience in research and training related to disability, frailty, the measurement of complex aging outcomes, social epidemiology of aging, causal inference, molecular genetics, physiological bases for aging, statistical methods for longitudinal studies and intervention trials of older adults, screening, health policy, comparative effectiveness, chronic disease, geriatrics and cognition.

## **OVERVIEW, MISSION AND GOALS**

Growth of the world's aging population continues to accelerate, and the U.S. Census Bureau estimates that 20% of the U.S. population, or 71.5 million people, will be aged 65 years and older when the last of the Baby Boomers turn 65 in 2030. With this demographic shift, chronic diseases and disability will have an increasingly large footprint on individuals, families, and the public. By 2030 the U.S. is expected to spend more than 15% of its resources (gross domestic product) on health care services for Medicare and Medicaid. There are enormous implications for the public health workforce in the U.S.

Preparing to serve the health needs of an aging population is a national imperative that only can be met through research conducted by multidisciplinary teams trained to evaluate the multi-dimensional factors that affect health for older adults. The needed research is relying on increasingly complex study designs and implementation, because devising and implementing strategies to address the causes of adverse health of older adults demands integration of basic, physiological, clinical, and societal data. It also entails increasingly complex data for which new analytic strategies and high-level quantitative expertise will be needed. In such a milieu leadership of cutting-edge research teams will need to include quantitative scientists to direct the design, conduct and analysis of experimental and population-based studies that can determine the causes of adverse health outcomes and successful preventive approaches.

The **Epidemiology and Biostatistics of Aging Training Program** offers such training in the methodology and conduct of significant clinical and population-based research in older adults and the special expertise in gerontologic issues essential to this research. Training in a program which includes numerous investigators actively involved in multidisciplinary research can provide experience in the successful conduct of the collaborative work essential in studies of health in older adults and the mentoring that leads to career dedication to these issues. The specific mission of this training grant is to prepare epidemiologists and biostatisticians who will be both leaders and essential members of the multidisciplinary research needed to define models of healthy, productive aging and the prevention and interventions that will accomplish this.

To prepare the next generation of leaders in the application of quantitative science to research on aging, the EBA program is founded on two principles. First, epidemiologists and biostatisticians with specific training and expertise in gerontologic science, who are trained together in effective collaboration across disciplines, will be best poised to develop interventions that compress the morbidity and disability associated with aging. Our training faculty's extensive involvement together in interdisciplinary research infuses our program with the necessary integration of geriatric and gerontologic perspectives, and of epidemiologic and biostatistical reasoning, to implement such training. Second, for program trainees to be leaders in aging science, their education must be applications-based and of the highest quality, both in aging and in their core disciplines. To achieve such training, this program has exceptional resources on which to draw. Significantly, the EBA Training Program's principles and implementation have established proven value, attracting superb trainees, producing graduates with core disciplinary excellence and commitment to gerontology, generating enthusiasm for aging science among students beyond the scope of program funding, and enriching the aging-related intellectual and research environment at Johns Hopkins.

The key goals of the EBA Training Program are to:

1. *Train* pre- and post-doctoral fellows by providing a structured program consisting of
  - a) course work, b) seminars and working groups, c) practica, d) directed

## Epidemiology and Biostatistics of Aging Training Program

- multidisciplinary collaborative experience through a training program research project, and e) directed research.
2. Ensure *hands-on participation* in multidisciplinary research bringing trainees together with infrastructure, mentors, and resources, thus developing essential skills and experience for launching their research careers.
  3. Provide *in-depth knowledge* in established areas of concentration, including a) the epidemiology of chronic disease, disability and frailty in older adults, b) biostatistics and genetics research methods for gerontology, and c) the psychosocial epidemiology of late life.
  4. *Expand* areas of emphasis to which trainees are exposed by including training opportunities in *translation*: a) clinical trials; b) comparative effectiveness research; c) community-based participatory research.
  5. *Integrate* epidemiology and biostatistics training to form a seamless, synthesized approach whose result is greater than the sum of its parts, to best prepare trainees to tackle aging-related research questions.

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For more information about the EBA Training Program, please contact the Program Administrator, Brian Buta at [bbuta@jhu.edu](mailto:bbuta@jhu.edu) or 410-502-3412.

Interested applicants can please contact the Program Administrator for information about requirements and application procedures. Please see [Appendix A](#) for additional application information.

The EBA Training Program website is available here:

**GRANT INFORMATION**

The Epidemiology and Biostatistics of Aging Training Program is funded by the National Institute on Aging / National Institutes of Health grant number T32AG000247.

<http://coah.jhu.edu/academics/aging-training.html>

For more information on the terms and conditions of institutional research training grants, please visit the following website: [http://grants.nih.gov/grants/policy/nihgps\\_2012/nihgps\\_ch11.htm](http://grants.nih.gov/grants/policy/nihgps_2012/nihgps_ch11.htm).

## **CORE AND AFFILIATED FACULTY**

The Johns Hopkins Medical Institutions, including the Schools of Public Health, Medicine, and Nursing, provide a learning environment to produce outstanding epidemiologists and biostatisticians with a focus on problems of an aging society. This training program focuses the many strengths and activities that are in place on an integrated training program of epidemiologists and biostatisticians in the health-related problems of aging. There is a core group of faculty epidemiologists, biostatisticians and geriatricians who work closely and regularly with each other and the trainees to guide the training program. In addition, there are a number of other outstanding faculty working in aging-related research who serve (or are available to serve) as secondary mentors for our trainees. There is also an Advisory Committee representing expertise in Epidemiology, conduct of training grants, Molecular Epidemiology, Geriatrics, Rehabilitation Medicine, Health Policy, and Public Health broadly.

The central focus of this training grant is to train epidemiologists and biostatisticians jointly in an integrated program. Productive interaction between these two disciplines is crucial to successful research on aging populations. This conclusion is based in large part on the experience of the faculty who participate in this training program that mutual understanding among investigators of health goals, their import, underlying complexity, and methodology improves the import of studies of aging populations. The core investigators - and many affiliated faculty - have extensive histories of collaboration in aging-related research. A central aspect of this training program is, therefore, development of a common knowledge base in gerontology, grounding of all trainees in both the epidemiology of aging and basic biostatistical and epidemiologic methods and their application to aging research, and pursuit of mutually understood gerontologic health goals. Then, the needed interactions between Epidemiology and Biostatistics can be actively developed with trainees.

*Tables 1 and 2 below provide detailed information on Core and Affiliated program faculty.*



Epidemiology and Biostatistics of Aging Training Program

**Table 1: Core Faculty Members**

NAME, DEGREE(S)	PRIMARY APPOINTMENT (JOINT APPOINTMENT)	AGING INTERESTS
<b>Karen Bandeen-Roche, PhD Director</b>	Hurley Dorrier Professor and Chair, Biostatistics	Longitudinal analysis of complex measurements (latent variable models, multivariate analysis, assessing stability of measurement), Multivariate disease-onset analysis; measuring and tracking disease, disability and frailty over time.
Terri Beaty, PhD	Professor, Epidemiology (Biostatistics, Oncology)	Genetics of lipoprotein disorders; assessing genetic component of diseases among elderly using novel statistical methods; genetic epidemiologic methods for diseases associated with aging.
Brian Caffo, PhD, MS	Professor, Biostatistics	Biostatistics, MCMC, Monte Carlo, the EM algorithm, GLMMs, exact conditional analysis, multilevel models, medical image analysis, fMRI, MRI, SPECT, PET
<b>Michelle Carlson, PhD Associate Director</b>	Associate Professor, Mental Health (Epidemiology)	Cognitive aging, activity and frailty; physical activity and function; cognitive neuropsychology of aging; prevention of dementia.
Ciprian Crainiceanu, PhD	Professor, Biostatistics	Nonparametric statistics; brain imaging; signal processing; wearable computing; complex measurements; functional data analysis; Bayesian analysis; measurement error
Jennifer Deal, PhD	Assistant Scientist, Epidemiology	Epidemiology of aging, cognitive aging, and dementia
Kay Dickersin, PhD	Director, Center for Clinical Trials, Epidemiology	Clinical trials and evidence synthesis
<b>Daniele Fallin, PhD Associate Director</b>	Professor and Chair, Mental Health	Genetic epidemiology; Alzheimer's disease; aging populations; muscle strength and frailty
Luigi Ferrucci, MD, PhD	Scientific Director, NIA	Causal pathways leading to progressive physical and cognitive decline in older persons
Constantine Frangakis, PhD	Professor, Biostatistics	Models of causal inference; estimation of the effect of a risk factor or new treatment when there is only partial compliance and drop-outs in epidemiologic and clinical prospective studies.
Alden Gross, PhD	Assistant Professor, Epidemiology	Cognition and everyday function among older adults
Eliseo Guallar, MD, PhD	Professor, Epidemiology	Cardiovascular Disease Epidemiology; Clinical Epidemiology; Epidemiological Methods
Judith Kasper, PhD	Professor, Health Policy and Management	Health services research on elderly populations; conduct of large-scale prospective studies; health policy in long-term care.
Thomas Louis, PhD	Professor, Biostatistics	Risk assessment; clinical and observational investigations; health and public policy; environmental equity/justice
Naresh Punjabi, MD	Professor, Pulmonary Medicine (Epidemiology)	Epidemiology of pulmonary disease in older populations and resulting disability
George Rebok, PhD	Professor, Mental Health	Cognitive psychology of aging; prevention of cognitive decline.
Michael Rosenblum, PhD	Assistant Professor, Biostatistics	Causal inference, adaptive randomized trial designs, exact confidence intervals, HIV, AIDS, robustness, optimization
<b>David Roth, PhD Associate Director</b>	Professor, Geriatric Medicine; Director, Center on Aging and Health	Gerontology, behavioral research, and applied statistical modeling
Dan Scharfstein, ScD	Professor, Biostatistics	Biostatistics, Causal inference; Longitudinal data analysis; Survival analysis; Missing data; Group sequential clinical trials; Semiparametric models
<b>Jennifer Schrack, PhD</b>	Assistant Professor, Epidemiology	Human energy expenditure and its complex

Epidemiology and Biostatistics of Aging Training Program

<b>Associate Director</b>		interaction with exposures and outcomes in observational epidemiological studies; physical activity and aging
Adam Spira, PhD	Associate Professor, Mental Health	Late-life sleep disturbances and psychopathology as predictive cognitive and functional outcomes among elders; interventions to improve cognitive and functional outcomes in older adults
Moyses Szklo, MD, MPH	Professor, Epidemiology (Cardiology)	Observational cardiovascular disease (CVD) epidemiology in aging populations including natural history and assessment of risk factors for CVD; relationship of estrogen replacement and cognitive function in middle-aged and older adult women.
Roland Thorpe, PhD, MS	Assistant Professor, Health, Behavior and Society (Medicine)	Health Disparities, Race, SES, Poverty Status, Functional Decline, Functional Status, Lower Extremity Functioning, Hypertension, Mobility Limitation, Older Adults, Men's Health Disparities Across the Life Course
<b>Ravi Varadhan, PhD Associate Director</b>	Associate Professor, Oncology (Biostatistics)	Geriatric Medicine and Gerontology; competing risks in observational studies of elderly
Jeremy Walston, MD	Professor, Medicine	Biology of aging; molecular biology of frailty and sarcopenia; geriatric medicine.
Sheila West, PhD	Professor, Ophthalmology	Risk factors for ocular pathology in older persons; prevention of late-life visual disease, including dietary and sunlight exposure recommendations; impact of vision on older persons' functioning; improving access to vision services in nursing homes.
<b>Qian-Li Xue, PhD Associate Director</b>	Associate Professor, Medicine (Epidemiology/Biostatistics)	Epidemiology; Epidemiological design; latent variable; longitudinal data; measurement error; missing data; multivariate categorical data
<b>Sevil Yasar, MD, PhD Associate Director</b>	Associate Professor, Geriatric Medicine and Gerontology	Dementia, cognitive decline, pharmaco-epidemiology
Scott Zeger, PhD	Professor, Biostatistics (Epidemiology); Vice Provost for Research	Regression methods for study trajectories in multivariate outcomes among older adults; design and analysis of longitudinal observational studies of aging.
Vadim Zipunnikov, PhD	Assistant Professor, Biostatistics	Ultra high-dimensional data, methods development for functional and imaging data analysis, matrix decompositions, computational algorithms, multilevel models, and nonlinear time series. Physical, neurological, and cardiovascular aging.

Epidemiology and Biostatistics of Aging Training Program

**Table 2: Affiliated Faculty Members**

<b>NAME</b>	<b>PRIMARY APPOINTMENT (JOINT APPOINTMENT)</b>	<b>AGING INTERESTS</b>
Emily Agree, PhD	Research Professor, Sociology; Associate Director, Hopkins Population Center (Population, Family and Reproductive Health)	Population, Aging, Demography, Long-Term Care, Disability, Family and Household, Intergenerational Relations
Marilyn Albert, PhD	Professor, Neurology, Psychiatry and Behavioral Sciences	Cognitive change with age; disease-related changes of cognition (focus on Alzheimer's Disease); relationship of cognitive change to brain structure and function
Jerilyn Allen, ScD, MS	Professor, Associate Dean for Research and M Adelaide Nutting Chair, School of Nursing (Health, Behavior and Society)	Cardiovascular risk factors, prevention, and lifestyle modification in persons with or at high risk for the development of cardiovascular disease
Keri Althoff, PhD	Associate Professor, Epidemiology	IV/AIDS, aging, influenza, vaccine, health disparities, causal inference, biostatistics, epidemiology, quality of care, United States
Lawrence Appel, MD, MPH	Professor, Medicine (Epidemiology, International Health); Director, Welch Center for Prevention, Epidemiology and Clinical Research	Clinical trials, dietary approaches in prevention of hypertension and cardiovascular disease.
Cynthia Boyd, MD, MPH	Associate Professor, Medicine (Health Policy and Management)	Prevention and progression of disability among older adults; clinical care of comorbid chronically ill and frail older adults
David Celentano, PhD	Professor and Chair, Epidemiology (Environmental Health Sciences, International Health, Health, Behavior and Society)	Epidemiology, international health, HIV, AIDS, STDs, behavior, Asia, HIV/AIDS prevention, Thailand, India, Vietnam
Josef Coresh, MD, PhD	Professor, Epidemiology (Medicine, Biostatistics)	Cardiovascular risk among patients with mild to end-stage renal disease; genetic epidemiology of diabetes and lipid disorders.
Pierre Coulombe, PhD	Professor and Chair, Biochemistry and Molecular Biology	Structural and signaling roles of keratin cytoskeletal assemblies; Epithelial differentiation and homeostasis in health and disease
William Eaton, PhD	Professor, Mental Health	Public mental health; psychiatric epidemiology; sociology of mental disorders; depression; schizophrenia; natural history; Health and Behavior; autoimmune diseases; comorbidity of mental and physical disorders
David Friedman, MD	Professor, Ophthalmology	Age-related Macular Degeneration; eye disease in the elderly
Gary Gerstenblith, MD	Professor, Medicine Director, Geriatric Cardiology	Geriatric Cardiology
Lisa Jacobson, PhD	Professor, Epidemiology	HIV and AIDS; epidemiologic methods; cohort studies; cancer; OpenCourseWare
Michael Klag, MD, MPH	Dean, Johns Hopkins Bloomberg School of Public Health; Professor, Epidemiology(Health Policy and Management, Medicine)	Epidemiology and prevention of high blood pressure; stroke epidemiology; race and socioeconomic status in cardiovascular disease.
Bryan Lau, PhD, MS, MHS	Associate Professor, Epidemiology (Medicine)	HIV/AIDS, epidemiologic methods, cohort studies, biomarkers
Thomas LaVeist, PhD	Professor, Health Policy and Management; Director, Hopkins Center for Health Disparities Solutions	Health policy and health services research.
Bruce Leff, MD	Professor, Medicine (Health Policy and Management)	Primary care of older adults with chronic illness; Development, evaluation, and dissemination of novel models of care for older adults

Epidemiology and Biostatistics of Aging Training Program

David Levine, MD, ScD, MPH	Professor, Medicine (Health Policy and Management)	Community health; behavioral sciences.
Tianjing Li, PhD	Assistant Professor, Epidemiology	Randomized controlled trial, systematic review, meta-analysis, network meta-analysis, evidence-based healthcare, comparative effectiveness research, reporting bias, missing data, adaptive design, Bayesian method, epidemiology, biostatistics, ophthalmology
Frank Lin, MD, PhD	Associate Professor, Otolaryngology-Head and Neck Surgery (Epidemiology, Geriatric Medicine)	Hearing loss and older adults, dementia, cognition, functional decline, social isolation, and health economic costs
Constantine Lyketsos, PhD	Professor and Chair, Psychiatry (Epidemiology, Mental Health)	Epidemiology of Dementia
Curtis Meinert, PhD	Professor, Epidemiology (Biostatistics)	Design, operation and analysis of clinical trials; meta-analysis; ethics of human research.
Jeanine Parisi, PhD	Associate Scientist, Mental Health	Adult development and aging; cognition; intellectual and social engagement; personality; prevention and intervention; program evaluation
Roger Peng, PhD	Associate Professor, Biostatistics	Environmental biostatistics, point processes, air pollution, reproducible research
Jodi Segal, MD MPH	Professor, Medicine ((Epidemiology; Health Policy and Management)	Clinical epidemiology of thrombosis and blood disorders; pharmaco-epidemiology
A. Richey Sharrett, PhD	Professor (Adjunct), Epidemiology	Epidemiology; arteriosclerosis; ARIC; MESA; cognitive impairment
Eleanor Simonsick, PhD	Associate Professor, Medicine (Part Time); Senior Staff Scientist, Epidemiologist, Intramural Research Program, National Institute on Aging	Mobility, exercise capacity, energy expenditure in older adults
Bonnielin Swenor, PhD	Assistant Professor, Ophthalmology (Epidemiology)	Visual impairment; aging; impact of vision loss and eye disease on age-related functional decline
Sarah Szanton, PhD, MSN, CRNP	Associate Professor, School of Nursing	Health disparities in older adults
Elizabeth Tanner, PhD,	Associate Professor, School of Nursing	Chronic illness; late-life depression
Antonio Trujillo, PhD	Associate Professor, International Health	Program Impact Evaluation, Economics of Chronic Conditions, Aging, International Health
Mei-Cheng Wang, PhD	Professor, Biostatistics	Survival, Longitudinal And Multivariate statistics (SLAM); epidemiological statistics; semiparametric models; point processes and recurrent event processes; ROC analysis and risk assessment
Jennifer Wolff, PhD	Associate Professor, Health Policy and Management	Patient Safety, Disclosure, Quality of Life, Comparative Effectiveness Research, Adherence
Albert Wu, MD, PhD	Professor, Health, Policy and Management (Epidemiology, International Health)	Patient Safety, Disclosure, Quality of Life, Comparative Effectiveness Research, Adherence
Barry Zirkin, PhD	Professor, Biochemistry and Molecular Biology	Molecular markers of aging

## **PROGRAM COMPETENCIES**

Trainees must gain firm grounding in gerontology and the health-related issues associated with aging, so as to participate in defining the objectives for the health status of our aging population in the 21st century. A **set of core competencies** (described below and in Table 3) has been established and is to be met through coursework, research leading to a dissertation, mentorship, participation in seminars and research in progress sessions, as well as other meetings. The core competencies are:

- Expert grounding in epidemiology and biostatistics of aging and in gerontology
- Development of core competencies:
  - knowledge of special methodologic and content issues in chronic disease epidemiology as it applies to older populations
  - measurement and analysis of complex gerontologic outcomes such as physical and cognitive function, disability, frailty and falls, and identification of new outcomes that could improve our understanding and measurement of health status in older populations
  - measurement and analysis of multiple risk factors for critical health outcomes, including chronic diseases and their risk factors, comorbidity, and genetic and molecular characteristics that may underlie health outcomes
  - methods for design and conduct of studies, and knowledge essential to successful recruitment, data collection and retention of older populations in such studies, including large scale prospective studies
  - longitudinal and survival analysis, with special expertise in analysis of multidimensional gerontologic outcomes and definition of trajectories of higher risk subpopulations of older adults
  - criteria and methodology of preventive health care, future arenas for development of prevention and health promotion and applications to subsets of older populations
  - health services research for aging populations
  - understanding of social, demographic, economic and health care policy dimensions associated with the issues of aging
- Development of expertise necessary for a long-term career in research on aging

To achieve these objectives, trainees will engage in the following components:

- A sequence of courses on human aging and health care issues for aging populations, in addition to departmental degree requirements in epidemiology and biostatistics.
- Participation with faculty mentors and other trainees in Research-in-Progress meetings

## Epidemiology and Biostatistics of Aging Training Program

on aging research, and other relevant seminars

- Participation in field experience or practica on conduct of population-based studies of older adults and on clinical geriatric medical care
- A multidisciplinary aging-focused research project in collaboration with a trainee, fellow, or student from another related field
- A research experience under the direction of faculty mentors that results in a publishable thesis or for non-degree candidates, publishable manuscripts

See the section below, [Training Requirements and Expectations](#) (page 16), for more information.

**Table 3: Program Competencies**

<b>Competency</b>	<b>Learning Opportunity</b>	<b>Measured By</b>
<i>Knowledge of special methodologic and content issues in aging research, including:</i>		
Public health import of aging populations worldwide: social, demographic economic and health care policy dimensions	Epidemiology of Aging Health issues for an Aging Population Demography of Aging Health Care Systems for An Aging Population	Course exams Written comprehensive and oral exams
Special issues and methods in chronic disease epidemiology and prevention as they apply to aging populations	Epidemiology of Aging Health Issues of an Aging Population Biology of Aging Seminars on Aging Special content epidemiology courses	Course exams Written comprehensive and oral exams
Special issues and methods for psychosocial risk factors associated with aging	Psychosocial aspects of aging Statistics for psychosocial Research I and II Seminars on Aging	Course exams Written comprehensive and oral exams
Methods for measurement and analysis of complex gerontologic outcomes, trajectories in subpopulations, and dynamic, comorbid risk factors	Epidemiology of Aging Statistics for psychosocial Research I and II Longitudinal and Survival Analysis Seminars on Aging	Course exams Written comprehensive and oral exams Mentored research
Operational conduct of studies in older populations: recruitment, data collection, retention, special populations, proxies, cognitive and sensory deficits	Epidemiology of Aging Practicum on the Operational Conduct of Studies in Older Adults Practicum on Medical Care for Older Adults Seminars on Aging	Course exams Written comprehensive and oral exams Mentored research
Knowledge of and critical review of current literature in epidemiology of aging and analytic issues	Epidemiology of Aging Seminars on Aging Journal Clubs: Welch Center and chronic disease epidemiology Biostatistics Grand Rounds	Course exams Written comprehensive and oral exams Mentored research
Translation of epidemiologic findings to improved screening, health promotion and treatment of older populations	Epidemiology of Aging Clinical Epidemiology Practicum on Medical Care For Older Adults Health Care Systems for an Aging Population Design and Conduct of Clinical Trials Seminars on Aging Genetics courses	Course exams Written comprehensive and oral exams Mentored research

## **TRAINING REQUIREMENTS AND EXPECTATIONS**

A philosophy of this program is that the best training is through apprenticeship with accomplished investigators in a combination of formal and informal settings. Students must exercise and refine skills that they develop in the classroom through hands-on research experience. Thus, EBA trainees will conduct research under the direction of program faculty. It is also believed that high-quality research on aging requires close collaboration between epidemiologists and biostatisticians, as well as other scientists. Therefore, effective graduate education in aging research must foster multidisciplinary communication and expertise. Based upon these principles, training has been designed to be similar for pre-doctoral students and postdoctoral fellows. It consists of five essential components:

1. *core curriculum* that includes a sequence of courses on human aging, as well as departmental requirements in epidemiology and biostatistics;
2. *participation* with faculty mentors and other trainees in Research-in-Progress meetings, the Seminar Series on Aging, and core discipline seminars;
3. participation in *practica* on i) the provision of medical care in geriatric patient populations and ii) conduct of population-based studies of older adults;
4. participation in a multidisciplinary “360-degree” project; and
5. a directed *research experience* under faculty mentors designed to result in high-quality aging publications

These essential components are described in the further detail in the following sections:

- Degree and non-degree program requirements
- Core curriculum (required and recommended)
- Research-in-progress meetings and educational seminars
- Mentorship meetings (including Individual Development Plan requirements)
- Clinical and research practica
- Multidisciplinary “360-degree” collaborative project
- Thesis research project and aging research (including publication requirements)
- Research compliance training



## **DEGREE REQUIREMENTS**

All degree-earning students must succeed in passing a series of benchmarks to progress and successfully complete their programs. At the end of the first year of training, both Ph.D. and MHS students must pass a departmental written examination. Postdoctoral fellows seeking an MHS in Biostatistics must additionally complete a culminating data analysis project; postdoctoral fellows earning an Epidemiology M.H.S. additionally write a Master's thesis. Ph.D. students are required to pass a school-wide preliminary oral examination intended to assess their capacity for original research and will then typically spend 2-3 years completing research under the mentorship of a faculty advisor. For additional details, please see below and refer to the respective Departmental Student Guides.

### **Doctor of Philosophy Degree (Ph.D.) in Epidemiology or Biostatistics**

#### **Residence:**

One consecutive full-time year of residence is required at the time of matriculation. In order to fulfill the residence requirement, students are required to register for 16 credits for four consecutive terms. A doctoral student may not be registered for part-time or non-resident status until the residency requirement has been met. Additionally, full-time Biostatistics students are encouraged to register for 16 credits per term, every term, until they have completed all degree requirements.

#### **Comprehensive Examination:**

For students in the Department of Biostatistics, a comprehensive examination covering course material is taken at the end of the first year. The Biostatistics examination consists of a day-long in-class examination on the first Monday in June, followed by a take-home data analysis project due usually due 72 hours later. For students in the Department of Epidemiology, the examination covering the general principles of epidemiology and the area of concentration is given in late May for two full days. By the time of the exam, students should have completed at least one full year of a residence, an Epidemiology course sequence (the 340.751-754 series is strongly recommended), a Biostatistics course sequence (the 140.651-654 series is strongly recommended) and the required coursework by program/concentration area.

During the first two years, students are expected to complete required coursework, the departmental comprehensive examination, and develop a thesis project under the guidance of their research mentor. The remaining time is devoted to completion of the thesis.

#### **Thesis:**

Research leading to a dissertation must be based on original research, worthy of publication, and acceptable to their respective Department and to a thesis committee. Students must adhere to protocol and guidelines on thesis development, Departmental and School oral examinations, and final oral examination (thesis defense) set forth by the University.

See the section below, [Directed Aging Research Experience](#) (page 26), for more information.

**DEGREE REQUIREMENTS - CONTINUED**

**Postdoctoral Students: Master of Health Sciences (MHS) in Epidemiology of Aging or MHS in Biostatistics**

Residence:

Two years of residence are required. At least one year of residence must be consecutive and full-time. In order to fulfill the residence requirement, students must register for 16 credits for four consecutive terms. Those with pertinent prior training may complete the degree in as little as one calendar year subject to approval of their advisors, the Departmental Admissions and Credentials Committee, and the Department Chairman.

Comprehensive Examination:

For students in the Department of Biostatistics, a comprehensive examination covering course material is taken at the end of the first year. The Biostatistics examination consists of a day-long in-class examination on the first Monday in June, followed by a take-home data analysis project due usually due 72 hours later. For students in the Department of Epidemiology, the examination covering the general principles of epidemiology and the area of concentration is given in late May for two full days. By the time of the exam, students should have completed at least one full year of a residence, an Epidemiology course sequence (the 340.751-754 series is strongly recommended), a Biostatistics course sequence (the 140.651-654 series is strongly recommended) and the required coursework by program/concentration area.

For further details on the examination, please refer to the respective Departmental Student Guides.

Thesis Requirement:

Postdoctoral fellows earning an MHS in Biostatistics must complete a culminating data analysis project. Postdoctoral fellows earning an MHS in Epidemiology must complete a satisfactory thesis in his/her area of concentration. Research mentors should be identified by the third term of the first year. Students should be aware that in order to graduate by the end of the second year, all requirements must be completed early, usually April. Please refer to the Epidemiology Student Guide for further details.

**Non-degree seeking Postdoctoral Research in Epidemiology and Biostatistics of Aging**

Research:

This training program provides research opportunities in the epidemiology and biostatistics of aging to non-degree seeking post-doctoral fellows who wish to receive further training in the methodology and conduct of significant clinical and population-based research on aging and older adults. Fellows would conduct independent research under the guidance of a mentor that could lead to presentation at scientific meetings and publishable manuscripts. This special training can also potentially be acquired in coordination with a clinical fellowship training program. Postdoctoral students are required to register for 16 credits each term.

See the section below, [\*Directed Aging Research Experience\*](#) (page 26), for more information.

**CORE CURRICULUM: REQUIRED AND RECOMMENDED COURSES**

**Required Curriculum in Aging and Aging-Related Methodology, 2017-2018**

Term	Dept	Course #	Course Title	Instructor
1 <sup>st</sup> Term	Epidemiology	340.616	Epidemiology of Aging*	Jennifer Schrack & Alden Gross
3 <sup>rd</sup> Term	Biostatistics	140.655	Analysis of Longitudinal Data	Elizabeth Colantuoni
	Biostatistics	140.642	Design of Clinical Experiments	Elizabeth Sugar
	Health Policy and Management	309.605	Health Issues for Aging Populations*	Jennifer Wolff

\*Required course for [Certificate in Gerontology Program](#)

**Recommended Courses in Aging and Aging-Related Methodology, 2017-2018**

Term	Department	Course #	Course Title	Instructor
1 <sup>st</sup> Term	Biostatistics	140.641	Survival Analysis	Mei-Cheng Wang
	Epidemiology	340.731	Principles of Genetic Epidemiology 1	Priya Duggal
	Mental Health	330.657 (in-person & online)	Statistics for Psychosocial Research: Measurement	Jeannie-Marie Leoutsakos & Qian-Li Xue
	Mental Health	330.802	Seminar on Aging, Cognition, and Neurogenerative Disorders**	George Rebok, Michelle Carlson, Peter Zandi
2 <sup>nd</sup> Term	Biostatistics	140.658	Statistics for Psychosocial Research: Structural Models	Qian-Li Xue & Jeannie-Marie Leoutsakos
	Health and Policy Management	309.712 (online)	Assessing Health Status and Patient Outcomes	Albert Wu
	Epidemiology	340.640	Eye Disease: Epidemiology and Control	Bonnie Swenor
	Health Policy and Management	309.715	Advanced Methods in Health Services Research: Research Design	Judy Kasper & Kitty Chan
	Health Policy and Management	309.607 (online)	Innovations in Health Care for Aging Populations*	Amber Willink
	Epidemiology	340.666	Foundations of Social Epidemiology	Lorraine Dean & Amanda Latimore
	Mental Health	330.802	Seminar on Aging, Cognition,	George Rebok, Michelle Carlson, Peter

Epidemiology and Biostatistics of Aging Training Program

			and Neurogenerative Disorders**	Zandi
3 <sup>rd</sup> Term	Biostatistics	140.664	Causal Inference in Medicine and Public Health#	Elizabeth Stuart & Constantine Frangakis
	Epidemiology	340.607	Introduction to Cardiovascular Disease Epidemiology	Josef Coresh & Casey Rebholz
	Mental Health	330.802	Seminar on Aging, Cognition, and Neurogenerative Disorders**	George Rebok, Michelle Carlson, Peter Zandi
4 <sup>th</sup> Term	Biostatistics	140.656	Multilevel Statistical Models in Public Health	Elizabeth Colantuoni
	Biostatistics/ Epidemiology	140.840 340.840	Special Studies and Research on Aging	Various
	Mental Health	330.623	Brain and Behavior Disorders**	George Rebok
	Mental Health	330.802	Seminar on Aging, Cognition, and Neurogenerative Disorders**	George Rebok & Karen Bandeen-Roche

\*Required course for Certificate in Gerontology Program

\*\* Elective course for the Certificate in Gerontology Program

# Also offered online in 4<sup>th</sup> term.

**Please note:** all trainees are also required to complete one of the following courses: 550.600, Responsible Conduct of Research [1 credit, Krag] or 306.665, Research Ethics and Integrity [3 credits, Kass]. See page 27 for further information.

See [Appendix B](#) for sample curricula for trainees in Epidemiology and Biostatistics

## **RESEARCH-IN-PROGRESS MEETINGS AND EDUCATIONAL EVENTS**

In addition to formal course work, we have developed seminar and discussion group opportunities to prepare students in our training program to conduct and present original research and to critically evaluate others' research. These include:

**Research-in-Progress (RIP) Meetings.** These required, bi-weekly meetings involve the trainees, the program Directors, Core Faculty members, and interested guests. RIP meetings provide a successful and welcoming forum for students to report their research, learn methods for research presentation, offer and receive feedback, network, and discuss quantitative methods and prominent publications. They further aim to generate collaborations across disciplines. Each funded trainee presents a formal RIP seminar at least once a year during his or her training. One or two meetings a year are devoted to general research skill development (how to develop a hypothesis, write an abstract/paper, collaborate across disciplines, etc.) and career development (preparing for a career; seeking a job). To summarize, the sessions have served to develop trainees' critical thinking, oral communication skills, and knowledge of issues integral to aging research and career development.

**Scientific Seminar Series on Aging and Health.** The training program has long sponsored a series of Seminars on Aging, held monthly-to-bimonthly at the Johns Hopkins Center on Aging and Health. Seminars are attended by trainees, Core Faculty, and others with interests in aging, and trainees meet with speakers over lunch. Many other seminar series also enrich trainees' intellectual environment on aging, for instance, weekly Geriatrics Grand Rounds seminars.

**Departmental Seminar Series.** The Epidemiology, Biostatistics, and Mental Health Departments each conduct weekly-to-biweekly seminars throughout the academic year. Both series host scientists who are globally prominent in the respective disciplines and are subscribed by interested parties throughout the Baltimore-Washington area. Trainees are required to attend the seminars of their home department and encouraged to cross disciplines.

## **MENTORSHIP MEETINGS**

The EBA Training Program provides mentoring structures and processes to guide trainees who collaborate in teams of investigators and coordinate with thesis advisors who are Core Faculty but not Program Directors. With the interdisciplinary milieu we aim to promote, a team mentorship format can be particularly advantageous, and boosted by coordinated mentorship from Program faculty. The thesis advisor is a student's primary mentor; s/he will monitor progress by trainees on an ongoing basis through close contacts in day-to-day research. Additionally, we identify two individuals from our directorate, one from Epidemiology and one from Biostatistics, to serve as Program Mentors for each trainee working in close coordination with the thesis advisor. The goals of the Program Mentors are to provide guidance on career development and the informal "rules of the road" in academics generally and within the local institution; identify obstacles and problem-solving strategies; encourage effective networking both nationally and locally; advise 360 degree projects; and identify opportunities that can help the trainee to meet his or her goals. Trainees should be proactive in meeting with their EBA Program Mentors and are required to semi-annually (or quarterly if possible) for the specific purpose of reviewing the trainee's progress, and as needed to discuss other issues. A "Basic Information Sheet" providing trainees with tips on participating in a mentor-mentee relationship appears in [Appendix C](#).

There are three higher-altitude processes to ensure that all trainees are making good progress and receiving appropriate mentoring. Firstly, both of sponsoring departments regularly review progress of all their Ph.D. candidates. In the Department of Biostatistics, each candidate is reviewed twice per year by the entire faculty; in Epidemiology, this occurs annually. These meetings ensure that students receive timely feedback and assistance should their progress fall below expectations. Secondly, the EBA program directorate holds quarterly meetings in which they review the individual degree candidates, incorporating feedback from the departmental reviews and from core faculty currently mentoring each of our trainees. At these meetings, students' progress as well as their participation and presentation at the RIP sessions are reviewed, problems identified and recommendations for needed improvements drafted. Dr. Bandeen-Roche or Dr. Glass, or the appropriate Program Mentor, will then meet with each trainee to provide the feedback, as needed. When a student experiences difficulty within the training program, recommendations are provided in writing to the directors of the training program and to his or her department chair. Finally, trainees meet bi-weekly with each other and the program faculty in the Research-In-Progress meetings.

### **\*Individual Development Plans**

Per NIH policy, all EBA trainees are required to develop Individual Development Plans (IDPs). These IDPs are used to identify and promote the career goals of graduate students and postdoctoral researchers associated with NIH awards. The following websites provide helpful tools for self-assessment and drafting your IDP. Meetings with your EBA mentors are to include a review and discussion of your IDP.

- Online IDP Tool: <http://myidp.sciencecareers.org/>
- NIH Training Office: <https://www.training.nih.gov/trainees>
- National Postdoctoral Association: <http://www.nationalpostdoc.org/careers/career-planning-resources>

## **CLINICAL AND RESEARCH PRACTICA**

### **Clinical Perspectives Practicum: Patient Populations of Older Adults Led by Dr. Sevil Yasar, MD, PhD**

This practicum was developed to help bring the next generation of researchers closer to understanding the spectrum of health and health concerns for older adults, what the important questions are and, thus, doing important research on aging. It also provides opportunity for trainees to be exposed to a wide variety of geriatric care delivery programs, and to see the care provided and understand the different health issues that patients have who are treated in these different programs and the roles of different members of the health care team.

The goals of the clinical practicum are:

1. To inform clinically relevant hypotheses related to study of aging populations.
  - Observation of common prevalent conditions (CHD, arthritis, hearing loss, osteoporosis, diabetes, etc.), risk factors, and sequella
  - Basic medical needs of older patients
  - Differences in presentation of common illnesses in younger vs. older (e.g., depression)
2. To observe heterogeneity among the older population
  - For example, the range of functional ability among people of the same age.
3. To understand issues related to communicating with older persons
  - Barriers such as hearing loss, concentration span
  - Strategies to overcome barriers
4. To define functional and social needs in addition to medical needs of older patients (e.g., transportation, use of aids, support at home, etc.)
  - Complexity of caring for geriatric population
  - Importance of multi-disciplinary approach
5. To network with Geriatric clinical staff (possible linkages for future research)

The following is a list of the participating clinical locations:

#### Terrace Rehabilitation Unit

Trainees observe geriatric inpatient rounds and also observe patients during their physical therapy, occupational and/or speech therapy sessions.

#### Hip Fracture/Subacute Unit

Trainees observe rounds on this service to understand the issues involved in post-acute care of hip fracture patients.

#### Geropsychiatry (geriatric mental health)

Each trainee can accompany a nurse to a senior Baltimore City Housing Site to observe a follow-up psychiatric assessment as part of the PATCH outreach program (Psychiatric Assessment Treatment and Teaching in City Housing), a program which targets the impoverished senior population in Baltimore City. Each trainee does one visit and only one trainee goes at a time

Primary Care Outpatient Clinic

Each trainee is assigned to an Attending physician or resident to observe either a morning or afternoon primary care outpatient clinic session in the Beecham Center located in the Geriatric Center on the Bayview Campus. Each trainee does one session and only one trainee can go at a time.

**Research Practicum: Operational Conduct of Research in Older Populations**

This practicum was developed to give trainees exposure to issues in study implementation and the special issues to be considered in studying older adults.

The research practicum, *when available*, is twofold:

I. Study implementation - trainees gain an understanding of

- Recruitment of a cohort
- Protocol and questionnaire development
- Training of project staff
- Data management and analysis
- Project organizational issues

II. Special issues in studying older adults - trainees gain an understanding of

- Issues in bringing frail older adults to a clinic
- Designing home visits
- Data collection issues in an older population
- Impact of sensory and cognitive development on data collection
- Specific approaches to recruitment and retention



**MULTIDISCIPLINARY “360-DEGREE” COLLABORATIVE PROJECT**

The Multidisciplinary “360-degree” collaborative project is an invaluable component of our training program that all supported trainees are required to complete. The goal is to provide a mentored experience in a) multidisciplinary research collaboration; b) identifying a significant issue in aging; c) becoming an expert on the relevant content and methodologic knowledge; and d) developing a research project that will fill gaps in knowledge. Over two years, trainees (1) pair with a trainee in a different discipline (for example, epidemiology with biostatistics); (2) identify a significant aging-related issue of interest and in need of additional knowledge through discussion, reading and consultation with mentors from two disciplines; (3) review the content and methodologic literature relevant to this issue; and (4) present in an RIP session a summary of the area and its issues. As a result, the trainees identify a research project that they will conduct together to investigate an issue identified as being of import, and as yet unanswered, in this area.

Examples of many “360-degree” projects conducted for the EBA Training Program over the last 15 years are provided in [Appendix D](#) below. Trainees have provided consistent feedback that this project has given them invaluable experience in collaboration across disciplines. For example, in recent years a pair of trainees, one from Biostatistics and one from Epidemiology, jointly developed interest in developing more effective ways to visualize and analyze data on health transitions. Their collaboration, initiated by this program, became seminal in the development of their research and capabilities as researchers. In direct result of this collaborative project, the pair published a manuscript on their project and received the Louis I. and Thomas G. Dublin award, given annually by the Departments of Biostatistics and Epidemiology to recognize excellence in student research making effective use of statistical reasoning and methods in epidemiology.

## **DIRECTED AGING RESEARCH EXPERIENCE**

Each trainee must undertake significant research leading to disciplinary and aging publications\*. As a first step toward accomplishing this, under the direction of their faculty mentors, trainees will choose an initial project on which they will become a collaborator, interact on a regular basis with other investigators, and identify an area of study for their own investigation. In these research projects, they will function as researchers-in-training. During their second year of training (or first year for post-docs), students will develop a research project representing their own intellectual product, under their mentors' guidance, and leading to a thesis (in the case of degree candidates) and ultimately to publishable papers. Faculty mentors agree to meet with trainees on regular basis discuss progress.

For doctoral students, the above process will culminate in a dissertation. Post-doctoral fellows may earn an M.H.S. degree in Epidemiology, Biostatistics or Mental Health; fellows with a Ph.D. will develop a body of research for publication, in collaboration with their primary mentors. For Epidemiology and Mental Health trainees, the thesis research project will involve conduct of an original data collection project or secondary data analysis for which the trainee has intellectual ownership and responsibility. For Biostatistics trainees, it will involve development of novel statistical methods, and their application to a scientific question that is relevant to aging. The mechanism for approval and oversight of thesis projects is well established in the academic departments. Briefly, following successful completion of written qualifying examinations, the trainee (in collaboration with his or her Faculty Advisor) develops an idea for a thesis proposal. For doctoral candidates, a thesis committee comprising the Faculty Advisor and at least three other faculty members is formed to review a brief proposal. The thesis committee meets periodically to assist and monitor progress throughout the course of the student's thesis project. The student proceeds through the following sequential steps: 1) presentation at a RIP meeting, 2) departmental adjudication of project, 3) school-wide preliminary oral examination, 4) conduct of the research project, 5) preparation of a thesis, 6) final presentation in the Aging RIP Series, and finally, 7) a school-wide oral "thesis defense" examination. A similar, less demanding, set of requirements is in place for M.H.S. students.

### **\*Publications:**

Please note that per NIH policy peer-reviewed trainee publications that arise from support of the training grant must be submitted to PubMed Central in accord with the Public Access Policy, and the PubMed Central reference number (PMCID) or NIH Manuscript Submission reference number (NIHMS ID) provided. If the publication was already submitted because it also arose as the result of other NIH support, simply provide the PMCID or NIHMS ID. If the PMCID is not yet available because the Journal submits articles directly to PMC on behalf of their authors, indicate "PMC Journal –In Process." A list of these Journals is posted at the following website:

[http://publicaccess.nih.gov/submit\\_process\\_journals.htm](http://publicaccess.nih.gov/submit_process_journals.htm)

## **RESEARCH COMPLIANCE TRAINING**

Ethical issues in the conduct of public health research have always received strong emphasis at the Johns Hopkins Health Institutions. The School of Public Health offers a course on ethical conduct of research which all students on training grants are required to take. All human research conducted by trainees must be approved by the School's Committee on Human Research before it is initiated, and students will learn to deal with IRBs first-hand. In addition, the School of Public Health has an outstanding program in ethics and public health, with the opportunity for trainees to engage in advanced study of bioethics.

The following **must be completed** by all supported trainees at least once during each career stage, and at a frequency of no less than once every four years. It is highly encouraged that initial instruction during pre-doctoral training occurs as early as possible in graduate school.

**Training in the Responsible Conduct of Research.** Trainees must complete one of the following in-person courses through the School of Public Health in order to satisfy this requirement:

1. 550.600 Responsible Conduct of Research [1 credit, Krag]. Once per week, 1<sup>st</sup> term. This course is specifically designed to focus broadly on RCR issues and is appropriate for all students regardless of discipline or research focus.  
OR
2. 306.665 Research Ethics and Integrity [3 credits, Kass]. Twice per week, 3<sup>rd</sup> term. This course has a stronger emphasis on human subjects research than the above course.

Registration in either course is recorded on the student's transcript and serves as documentation of completion of the requirement.

**Training in Human Subjects Research and HIPAA Compliance.** Trainees are expected to complete ALL of the following online modules:

1. Basic Humans Subjects Research (CITI)
2. Conflict of Interest (CITI)
3. HIPAA For Research

Trainees enroll and complete these courses the Johns Hopkins MyLearning website: <http://learning.jhu.edu>. Once completed, the student will receive a certificate, which must be submitted to the EBA Program Administrator for confirmation. These certificates serve as documentation of completion of the requirement.

## **ADDITIONAL RESOURCES AND EDUCATIONAL OPPORTUNITIES**

**The Center on Aging and Health (COAH)** —COAH is a multidisciplinary Center of Excellence for aging research and research training, directed by Dr. David Roth, an Associate Director of the training program. COAH is jointly sponsored by the Schools of Public Health, Medicine and Nursing. Faculty members appointed in these Departments reside in the Center, including Drs. Carlson, Roth, Varadhan, and Xue. Dr. Bandeen-Roche resides at COAH part-time. The COAH faculty leads in multiple population-based cohort studies and randomized intervention trials in older populations. COAH serves as the administrative home for the Johns Hopkins Older Americans' Independence Center (OAIC; see below), the Program in the Epidemiology of Aging and this training program. It provides infrastructure for aging research which is utilized by trainees, including offices where they sit, a data core, and research assistants with experience in studies of older adults. Website: <http://coah.jhu.edu>

**Division of Geriatric Medicine and Gerontology**—The Division is one of the oldest in the U.S. and a leading academic division. It has over 30 full-time faculty members and a full range of clinical, teaching, and research programs. The Division's clinical services include a house-calls program, an ambulatory geriatric medicine practice, a Program of All-Inclusive Care of the Elderly (PACE), a complete long-term and sub-acute care center, an inpatient consultation service and geriatrics specialty clinics. The Division makes its clinical resources available to the trainees in this training program, for example, by hosting our clinical practicum to introduce trainees to issues in research in clinical populations and varied care settings, and through COAH and its Biology of Healthy Aging research program. Website: [http://www.hopkinsmedicine.org/geriatric\\_medicine\\_gerontology/](http://www.hopkinsmedicine.org/geriatric_medicine_gerontology/)

**Johns Hopkins Older Americans Independence Center (OAIC)** – Established in 2003, this Center is dedicated to fostering research on the etiology of frailty in older adults. It includes a Biostatistics Core and a Genetics Core which work together closely and offer consultative as well as service resources to investigators developing research on the causes of frailty, as well as cores (i) providing Leadership and supporting (ii) Pilot studies and (iii) Research and Career Development for junior faculty. The OAIC provides intellectual and infrastructural resources to support research on the etiology of frailty, including a clinic-based registry of potential participants for intervention trials. It also provides training and seminars which enhance the learning environment for our trainees regarding frailty and translation and offers support for pilot studies and protected time for investigators, thus is a potential bridge from trainee status to faculty. Website: <http://coah.jhu.edu/oaic>

**Alzheimer's Disease Research Center (ADRC)** – Established in 1984, this Center is dedicated to stimulating significant research in Alzheimer's disease and related disorders. It comprises Administrative, Clinical, Biostatistics, Neuropathology, and Education Cores that oversee and support research progress, a pilot grants program, dissemination of information on dementia to the public, and the development of clinical and neuropathology databases for research on dementia. ADRC data provide a rich resource for trainees interested in the epidemiology of cognitive aging. Website: <http://www.alzresearch.org/index.cfm>

**Institute for Clinical and Translational Research (ICTR)** - Awarded in 2007 under the NIH Clinical and Translational Science Awards program, the ICTR offers a wide variety of programs and services to members of the Johns Hopkins research community who are preparing or executing a clinical or translational study. Programs most relevant to this training program include the Biostatistics Clinical and Translational Research (BCTR) Core to promote the appropriate use of biostatistics in the design, implementation, and interpretation of clinical and

translational research studies; the Innovative Methodology Workgroup (GWAS), an ICTR-supported think tank of basic scientists, clinicians and biostatisticians developing novel ways of working with genome-wide association study data; and the ICTR Clinical Research Units (CRUs), designed to support clinical research at Johns Hopkins. The ICTR also supports a number of programs and events designed to enrich and improve the clinical and translational skills of future and current researchers, including postdoctoral fellows and pre-doctoral trainees. Dr. Bandeen-Roche leads the ICTR BCTR; numerous training program faculty participate on the Center's various research cores, working groups, CRUs and education programs. Website: <http://ictr.johnshopkins.edu/ictr/>

**Welch Center for Prevention, Epidemiology, and Clinical Research.** The Welch Center is a multidisciplinary academic unit that is co-sponsored by the School of Medicine (SOM) and Bloomberg School of Public Health (SPH) at Hopkins. As part of its mission, the Welch Center conducts patient-oriented clinical, epidemiologic, and translational research that promotes adoption of best practices in clinical settings and populations. Through patient-oriented research, the Welch Center evaluates the application of laboratory discoveries as well as the adoption of best practices in clinical settings and populations. Because biologic, environmental, and clinical factors interact in causing illness and disability, the Center's work is fundamentally interdisciplinary, relying on active collaboration among faculty members from the Schools of Medicine, Public Health, and Nursing. Welch Center faculty members employ the full range of research methodology, including longitudinal observational studies, randomized trials, and effectiveness and outcomes studies. Website: <http://www.jhsph.edu/welchcenter>

**Related Training Programs.** There are several other training programs in the School of Public Health that are most relevant to EBA program, including two supported by the Department of Biostatistics: one on quantitative genetics and genomics, and the other on environmental biostatistics. The Department of Epidemiology supports programs that provide training in cardiovascular disease, cancer, genetics, and clinical trials, among others. The Departments of Mental Health and Neurology support programs in aging and dementia and in psychiatric epidemiology, several of whose trainees have participated considerably in the activities of the EBA program. Directors of most these programs are among the EBA Core and Affiliated faculty members. These programs can serve to enhance training collaborations by their emphases on dementia, genomics, statistical methods, and diseases that frequently affect older adults. Website: <http://www.jhsph.edu/academics/programs/trainings>  
See also: <http://coah.jhu.edu/academics/>

**Certificate in Gerontology Program.** The Certificate is geared to graduate students and post-doctoral fellows who are pursuing research-oriented degrees and wish to emphasize gerontological issues. It is a credential certifying completion of 5 core courses, many taken by our trainees, covering: the epidemiology of aging; health status in older populations; psychosocial and biological aspects of gerontology; health service design for older individuals; and health policy in an aging society. The Certificate Program is long-standing at the School of Public Health but was reworked in 2002. Since then, it has been jointly administered by the COAH and the Departments of Health Policy & Management and Epidemiology. Website: <http://www.jhsph.edu/academics/certificate-programs/certificates-for-hopkins-students/gerontology.html>

## **APPENDICES**

## **Appendix A**

### **ELIGIBILITY AND APPLICATION REQUIREMENTS**

#### **Eligible Candidates for the EBA Training Program:**

Pre- and Post-doctoral candidates are eligible to apply for training and funding under this program if:

- Pre-doctoral candidates are accepted into either the Epidemiology or Biostatistics Ph.D. program in the JHSPH
- Post-doctoral candidates are accepted into the JHSPH post-doctoral fellowship program (in either Epidemiology or Biostatistics)
- Candidates are United States citizens or have U.S. Permanent Residence

Qualified candidates must follow the admissions procedures of the Johns Hopkins Bloomberg School of Public Health (JHSPH) and submit appropriate application materials as specified to the JHSPH Admissions Office. Information on the application process can be obtained from the Admissions Office (<http://www.jhsph.edu/Admissions> or 410-955-3543). Postdoctoral application information can be found here: <http://www.jhsph.edu/GER/Postdocs.html>)

#### **Application to the Training Program:**

Eligible candidates should send\*:

- A letter of intent (*a brief letter or email that states your intent to apply*)
- Statement of career objectives/research goals (2-3 pages) (*please see description of what to include in this statement on the following page*)
- Curriculum Vitae
- 3 letters of recommendation
- Proof of U.S. citizenship/permanent residence
- Official Transcripts (for postdoctoral applicants, only PhD/MD transcripts required)

To: Brian Buta, MHS, Program Administrator  
Epidemiology and Biostatistics of Aging Training Program  
2024 E. Monument Street, Suite 2-700  
Baltimore, Maryland 21205  
410-502-3412 (tel); 410-614-9625 (fax)  
[bbuta@jhu.edu](mailto:bbuta@jhu.edu)

*\*Please note:* A copy of the candidate's application to the School of Public Health would be acceptable as long as it includes the above listed items. The applicant must personally request from the Admissions Office that a sealed and confidential copy be delivered to Brian Buta at the address above.

#### **Statement of objectives:**

For pre-doctoral candidates, the letter should describe research and career goals. For post-doctoral applicants, the statement should address career development plans for the fellowship, including a) the skills, knowledge or certifications the applicant seeks to obtain; b) expected effects on career goals; and c) potential mentors at Johns Hopkins. In both cases, applicants are also encouraged to describe why they are interested in research on aging and the health of older adults.

## **Appendix B**

### **Sample Trainee Curriculum – Epidemiology**

***Please note: Some courses and instructors may have changed.***

#### **Year One**

##### First Term

140.651	Methods in Biostatistics I	Louis	(4 units)
340.751	Epidemiologic Methods 1	Gange, Selvin	(5 units)
309.605	Health Issues for Aging Populations	Leff, Wolff	(3 units)
(Other departmental requirements/electives)			

##### Second Term

140.652	Methods in Biostatistics II	Louis	(4 units)
340.752	Epidemiologic Methods 2	D'Souza, Phuhan, and Ehrhart	(5 units)
340.627	Epidemiology of Infectious Diseases	Nelson	(3 units)
(Other departmental requirements/electives)			

##### Third Term

140.653	Methods in Biostatistics III	Ji	(4 units)
340.753	Epidemiologic Methods 3	Gange & Mehta	(5 units)
260.665	Biologic Basis of Aging	Levitskaya	(3 units)
340.607	Epidemiologic and Preventive Aspects Of Cardiovascular Disease	Coresh	(4 units)
(Other departmental requirements/electives)			

##### Fourth Term

140.654	Methods in Biostatistics IV	Ji	(4 units)
340.754	Methodologic Challenges in Epidemiology	Fallin, Glass, Lau	(5 units)
340.616	Epidemiology of Aging	Schrack	(3 units)
(Other departmental requirements/electives)			

#### **Summer, Year One-Year**

First Year Qualifying Examination  
Aging Practicum #1

#### **Year Two**

##### First Term

140.641	Survival Analysis I	Wang	(3 units)
340.731	Principles of Genetic Epidemiology 1	Beaty, Duggal, Fallin	(3 units)
330.657	Statistics for Psychosocial Research: Measurement (online)	Leoutsakos	(4 units)
550.600	Responsible Conduct of Research	Krag	(1 unit)
(Other departmental requirements/electives)			



## Epidemiology and Biostatistics of Aging Training Program

### Second Term

140.658	Statistics for Psychosocial Research: Structural Models	Xue, Leoutsakos	(4 units)
340.717 (Other departmental requirements/electives)	Health Survey Research Methods	Sherman, Go	(4 units)

### Third Term

140.655	Analysis of Longitudinal Data	Colantuoni	(4 units)
140.642 (Other departmental requirements/electives)	Design of Clinical Experiments	Sugar, Herson	(3units)

### Fourth Term

140.840	Special Studies in Aging Research	Various	(1 unit)
340.840	Special Studies and Research on Aging	Various	(1 unit)
340.715 (Other departmental requirements/electives)	Problems in the Design of Epidemiologic Studies	Kirk	(4 units)

### **Summer, Year Two**

Departmental Oral Examination  
Schoolwide Preliminary Oral Examination  
Aging Practicum #2

### **Year Three**

340.820	Special Studies		
340.821 (Other departmental requirements/electives)	Thesis Research		

### **Year Four**

340.820	Thesis Research; Final Thesis Defense		
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Epidemiology and Biostatistics of Aging Training Program

**Sample Trainee Curriculum - Biostatistics**

***Please note: Some courses and instructors may have changed.***

**Year One**

First Term

140.751	Advanced Methods in Biostatistics I	Caffo	(3 units)
340.601	Principles of Epidemiology	Moss, Celentano	(5 units)
309.605	Health Issues for Aging Populations	Leff, Wolff	(3 units)

Second Term

140.752	Advanced Methods in Biostatistics II	Caffo	(3 units)
340.608	Observational Epidemiology	Golub, Gange	(3 units)
(Other departmental requirements/electives)			

Third Term

140.753	Advanced Methods in Biostatistics III	Leek	(3 units)
140.673	Introduction to Statistical Theory I	Frangakis	(4 units)
260.665	Biologic Basis of Aging	Levitskaya	(3 units)

Fourth Term

140.754	Methods in Biostatistics IV	Leek	(3 units)
140.674	Introduction to Statistical Theory II	Frangakis	(4 units)
(Consider 340.616 - Epidemiology of Aging)			
(Other departmental requirements/electives)			

**Summer, Year One-Year Two**

First Year Qualifying Examination  
Aging Practicum #1

**Year Two - Complex Measurement Focus**

First Term

140.755	Advanced Methods in Biostatistics V	Crainiceanu	(4 units)
140.771	Advanced Statistical Theory I	Scharfstein	(3 units)
330.657	Statistics for Psychosocial Research: Measurement (online)	Leoutsakos	(4 units)
550.600	Responsible Conduct of Research	Krag	(1 unit)

Second Term

140.756	Advanced Methods in Biostatistics VI	Crainiceanu	(4 units)
140.772	Advanced Statistical Theory II	Scharfstein	(3 units)
140.658	Statistics for Psychosocial Research: Structural Models	Xue, Leoutsakos	(4 units)
(Other departmental requirements/electives)			

Third Term

## Epidemiology and Biostatistics of Aging Training Program

140.642	Design of Clinical Experiments	Sugar, Herson	(3 units)
140.664	Causal Inference in Medicine and Public Health	Stuart, Frangakis	(4 units)
140.773	Foundations of Statistical Inference	Rohde	(4 units)
140.655	Analysis of Longitudinal Data	Colantuoni	(4 units)
(Other departmental requirements/electives)			

### Fourth Term

140.665	Experimental and Non-Experimental Designs for Estimating Causal Effects	Frangakis, Stuart, Rosenblum	(3 units)
140.840	Special Studies in Aging Research	Various	(1 unit)
(Other departmental requirements/electives)			

## Year Two - Genetics Focus

### First Term

140.755	Advanced Methods in Biostatistics V	Crainiceanu	(4 units)
140.771	Advanced Statistical Theory I	Scharfstein	(3 units)
340.731	Principles of Genetic Epidemiology 1	Beaty, Duggal, Fallin	(3 units)
550.600	Responsible Conduct of Research	Krag	(1 unit)
(Other departmental requirements/electives)			

### Second Term

140.756	Advanced Methods in Biostatistics VI	Crainiceanu	(4 units)
140.772	Advanced Statistical Theory II	Scharfstein	(3 units)
140.638	Analysis of Biological Sequences	Wheelan	(3 units)
550.860	Research Ethics	DiPietro	(1 unit)
340.732	Principles of Genetic Epidemiology 2	Fallin, Duggal	(3 units)
(Other departmental requirements/electives)			

### Third Term

140.773	Foundations of Statistics Inference	Rohde	(4 units)
140.655	Analysis of Longitudinal Data	Colantuoni	(4 units)
340.733	Principles of Genetic Epidemiology 3	Beaty, Klein	(3 units)
(Other departmental requirements/electives)			

### Fourth Term

140.774	Foundations of Statistics II	Rhode	(3 units)
140.688	Statistics for Genomics	(to be determined)	(3 units)
140.840	Special Studies in Aging Research	Various	(1 unit)
340.332	Methods for Linkage Analysis in Genetic Epidemiology	Klein, Duggal	(3 units)
(Other departmental requirements/electives)			

Epidemiology and Biostatistics of Aging Training Program

**Summer, Year Two -Year Three**

Schoolwide Preliminary Oral Examination  
Aging Practicum #2

**Year Three**

140.820                      Thesis Research: Biostatistics  
(Other departmental requirements/electives)

**Year Four**

140.820                      Thesis Research; Final Thesis Defense

## Appendix C

### **Basic Information for Epidemiology and Biostatistics of Aging Training Program Mentors and Mentees**

#### I. Purpose of this Information sheet.

The purpose of this document is to provide guidance on how to participate in an advising team as an EBA Program Mentor or Mentee. In addition, this document may be useful for sharing with thesis advisors and other primary mentors.

#### II. Rationale

Aging research is a multidisciplinary activity. Therefore scholarship in any particular aging topic will likely require meaningful input from a variety of experts. While mentoring is generally a very important element in the development of junior investigators, it stands to reason that in aging research developing an effective team of mentors and advisors is of particular importance.

Many aspects of successful mentoring occur spontaneously and need not be prescribed. However, ambiguity or perceived inefficiencies regarding roles and responsibilities among mentors and advisees can form a challenge to successful career development. Without intending to impose restrictions or formality, this description of mentoring/advising activities aims to provide clarity on expectations and suggestions for developing productive collaborative relationships. Such relationships are the lifeblood of academics and *always* evolve.

#### III. What EBA Training Program Mentors Do

There are two main goals of EBA Program Mentors: 1) to bring as many appropriate resources to bear as possible on behalf of each trainee's career development and professional success; and, 2) to mentor a research project on aging and make links between each trainee's specific research topic and larger scientific discussions going on in aging, gerontology and geriatric medicine. More specifically, the EBA Program Mentors play several roles. They:

1. Provide guidance on the stages of career development and how to navigate through them successfully, i.e. the informal "rules of the road" in academics in general and within the local institution.
2. Discuss problem-solving strategies.
3. Provide research mentorship in projects on aging, including key advice on '360 degree' collaborative research projects
4. Provide an interdisciplinary perspective
5. Encourage effective networking, both nationally and within the local institution.
6. Identify obstacles to success and bring them to attention of mentee and primary advisor.
7. Identify opportunities that can help the mentee to meet his or her scholarly goals.
8. Maintain knowledge of mentee progress.
9. Coordinate with primary departmental mentor / thesis advisor
10. Actively participate in the program research-in-progress meetings

EBA Program Mentors are envisioned as a special category of advisor who play active roles but are adjuncts to thesis advisors, i.e. primary mentors. **It is strongly recommended that EBA Program Mentors and Mentees meet semi-annually (or quarterly if possible) for the specific purpose of reviewing the trainee's progress, and as needed to discuss other issues.** As a general suggested practice the EBA Program Mentors will communicate the results of interactions with the primary advisors via email, with a copy also sent to the mentees.

IV. Recommendations for a productive relationship with one's mentor

Mentees are encouraged to consider the following principles of mentored interaction. Ethical and loyal conduct in research and training, including giving due credit to supporters, is a key element of academic partnership. Respect for the members of your mentorship team includes being mindful of their other commitments and being responsive and giving proper attention to the advice that is received. Successful mentees will seek advice when appropriate, and ask for help when obstacles are reached. Your mentorship experience will be well served by careful preparation for meetings, realistic goal-setting, and time management. Your feedback regarding the mentoring process is a valuable and important part of the relationship; it is important to let the team know about disagreements as they arise, and discuss them in a professional manner.

**Appendix D**

**Table of selected 360 degree projects**

Collaborative Team	Research Topic	Current Status / Achievements
Gwen Windham, MD (EPI Post-doc) Michael Griswold (Biostat Pre-doc)	Addressing the Controversy in the CVD-Cholesterol Relationship in Older Adults	Invited to present their research ideas at the National Institute on Aging Technical Assistance Workshop; 2002
Laura Podewils (EPI Pre-doc) Ravi Varadhan, PhD (Biostat Post-doc)	Competing risk of mortality in evaluating the association between physical activity and risk of stroke: evidence using EPESE cohort	2003 Dublin Award for the Advancement of Epidemiology and Biostatistics; Invited Paper by Editor of American Journal of Epidemiology entitled, Competing risks in studies of the elderly and a principal stratification approach to address truncation by death
Crystal Simpson, MD (EPI Post-doc) Michelle Shardell (Biostat Pre-doc)	Anxiety and functional decline in older women; lung function and physical performance	Presentation, Anxiety and Functional Decline in Disabled Older Community Dwelling Women, JHU Geriatric Grand Rounds, 2003;  Simpson C, Punjabi N, Wolfenden L, Shardell M, Shade DM, Fried L. Relationship Between Lung Function and Physical Performance in Disabled Older Women, J Gerontol A Biol Sci Med Sci. 2005 Mar;60(3):350-4.
Ellen Freeman (EPI Pre-doc) Brian Egleston (Biostat Pre-doc)	Comorbidity and health outcomes in older adults: an analysis of vision loss, depression and mortality	GSA Poster, 2004; Presentation at Joint Statistical Meeting, 2004; Causal Inference for Morbidity Outcomes in the Presence of Death;  Egleston BL, Scharfstein DO, Freeman EE, West SK. Causal Inference for Morbidity Outcomes in the Presence of Death. ENAR, Austin, Texas. March 2005.  Freeman EE, Egleston BL, West SK, Bandeen-Roche K, Rubin G. Visual acuity change and mortality in older adults. Investigative Ophthalmology and Visual Science. 2005; 46(11):4040-5. PMID: 16249478.  Egleston BL, Scharfstein DO, Freeman EE, West SK. "Causal Inference for Non mortality Outcomes in the Presence of Death" Biostatistics. 2007 Jul;8(3):526-45. Epub 2006 Sep 15.PMID:16980696.

Epidemiology and Biostatistics of Aging Training Program

Collaborative Team	Research Topic	Current Status / Achievements
Kelly Benke (Genetic EPI Pre-doc) Sandy Chang (Clinical Epi Post-doc) Sheila Gonzalgo (Geriatrics Post-doc)	Remaining life expectancies in defined states using frailty data in the Women's Health and Aging Study (WHAS);	Proposal, entitled Frailty Free Life Expectancies in the Women's Health and Aging Studies (WHAS) approved by the WHAS Publications Committee and is currently in data acquisition process
Kelly Benke (Genetic EPI Pre-doc) Tom Glass, PhD (Core Faculty) Jeremy Barron, MD (Junior Faculty, Geriatrics) Eleanor Simonsick, PhD (Sr. Staff Scientist, Clinical Res Branch, NIA)	Investigation of the role of paid work and volunteering to preserve cognitive functioning in the Health ABC Study; to provide intellectual input and data analysis towards the use of methods beyond traditional multivariate analysis to control for confounding	"Work/Volunteer Activity and Maintained Cognitive Function over Four Years Finding from the Health ABC Study", presented as a symposium speaker at the 2004 GSA conference.
Kelly Benke (EPI Pre-doc) Karen Bandeen-Roche Dani Fallin Qing Li	Haplotype Methods for longitudinal trajectories	Benke KE. Associating Haplotypes with Trajectories from Longitudinal Studies. International Genetic Epidemiology Society, 2006 Conference.
Carlos Weiss, MD (EPI Post-doc) Ani Manichaikul (Biostat Pre-doc)	Exploring hierarchy in mobility performance among women in a high functioning cohort	Weiss CO, Manichaikul A, Fried LP, Bandeen-Roche K. Exploring Hierarchy in Mobility Disability Among Women in a High Functioning Cohort. Gerontologist. 2004 Oct;44(Special issue I):366  Adaptation of walking behavior is a marker for mobility decline across a spectrum of performance (abstract accepted to AGS Annual Scientific Meeting, May 11-15, 2005 )
Gerald Jerome, PhD (EPI Post-doc) Michelle Mielke, PhD (Mental Health Post-doc)	Examining the complex association between physical activity, one aspect of mobility function, and specific domains of cognition across time on older women	Jerome GJ, Glass TA, Mielke M, Xue QL, Andersen RE, Fried LP. Physical activity participation by presence and type of functional deficits in older women: The Women's Health and Aging Studies. J Gerontol A Biol Sci Med Sci. 2006 Nov;61(11):1171-6. PMID: 17167158
Amy Matteini (Genetic EPI Pre-doc) Dani Fallin (Associate Professor, Epi) Karen Bandeen-Roche (Professor, Biostat)	The heritability of frailty or other disability-related outcomes; genetic and environmental influences of aging	Matteini AM, Walston JD, Bandeen-Roche K, Arking DE, Allen RH, Fried LP, Chakravarti A, Stabler SP, Fallin MD. Transcobalamin-II variants, decreased vitamin B12 availability and increased risk of frailty. J Nutr Health Aging. 2010 Jan;14(1):73-7. PMID: 20082058
Kathryn Eubank, MD (EPI Post-doc) Qian-Li Xue, PhD (Assistant Professor, Biostatistician)	Evidence-based medicine: when is evidence sufficient to support translation?	Eubank KJ. Poster Presentation: Proposed Solutions for Improving Transitional Care: A Qualitative Study of Providers from Multiple Disciplines. Annual Scientific Meeting of the Gerontological Society of America, November 2006.



Epidemiology and Biostatistics of Aging Training Program

Collaborative Team	Research Topic	Current Status / Achievements
<p>Sandy Eckel (Biostat Pre-doc)  Paulo Chaves (Assistant Professor, Epi)  Karen Bandeen-Roche (Professor, Biostat)  Tom Louis (Professor, Biostat)  Linda Fried (Professor, Epi)</p>	<p>Frailty Measures in Older Adults</p>	<p>Eckel SP, Louis TA, Bandeen-Roche K, Chaves P, Fried LP, Margolis HG. Imputation of the Physical Activity Component of Gerontologic Frailty for Use in Modeling the Health Effects of Air Pollution on Older Adults in the Cardiovascular Health Study. Joint Statistical Meetings. Denver, CO. Aug 3-7. 2008.</p> <p>Eckel SP, Louis TA, Chaves P, Fried LP, and Margolis, HG. Modification by frailty status of the association between ambient air pollution and lung function in older adults in the Cardiovascular Health Study. American Journal of Epidemiology 2012; 176(3):214-223. DOI: 10.1093/aje/kws001</p>
<p>Alan Cohen, PhD (Epi Postdoc)  John Tillinghast (Biostat Postdoc)</p>	<p>No consistent effects of prenatal or neonatal exposure to Spanish flu on late-life mortality in 24 developed countries</p>	<p>Cohen AA, Tillinghast J, Canudas-Romo V. No consistent effects of prenatal or neonatal exposure to Spanish flu on late-life mortality in 24 developed countries. Demogr Res. 2010 Apr 13;22(20):579-634.</p>
<p>Bruce Swihart (Biostat Predoc)  Bryan James (Epi Predoc)</p>	<p>Lasagna plots: A saucy alternative to spaghetti plots</p>	<p>2008 Louis I. and Thomas D. Dublin Award.</p> <p>Swihart BJ, Caffo B, James BD, Strand M, Schwartz B, Punjabi N. Lasagna plots: A saucy alternative to spaghetti plots. Epidemiology. 2010 Sep;21(5):621-5.</p>
<p>Jennifer Deal (Epi Predoc)  Taki Shinohara (Biostat Predoc)</p>	<p>Association between hematocrit and domain-specific cognitive impairment in the Ginkgo Evaluation of Memory study</p>	<p>EBA Research in Progress Joint Presentation: "Quantile Regression for Linear Cognitive Outcomes." Sep 20, 2010.</p>
<p>Ann Zenobia Moore (Epi Predoc)  Jeremy Walston (Professor, Geriatric Medicine)  Dan Arking (Assistant Professor, Genetic Medicine)</p>	<p>Mitochondrial genetics and the disablement process in older adults</p>	<p>Moore AZ, Biggs ML, Matteini AM, O'Connor A, McGuire S, Beamer B, Fallin MD, Fried LP, Walston J, Chakravarti A, Arking DE. Polymorphisms in the mitochondrial DNA control region and frailty in older adults. PLoS One. 2010 Jun 10;5(6):e11069.</p>
<p>Jenna Krall (Biostat Predoc)  Qian-Li Xue (Associate Professor, Geriatric Medicine)  Michelle Carlson (Associate Professor, Mental Health)</p>	<p>Associations Between Cognitive and Physical Functioning in Older Adults</p>	<p>Krall JR, Carlson MC, Fried LP, Xue QL. Examining the Dynamic, Bidirectional Associations Between Cognitive and Physical Functioning in Older Adults. Am J Epidemiol. 2014 Sep 8. pii: kwu198. [Epub ahead of print]</p>
<p>Bridget Burke (Epi Predoc)  Laura Samuel (Epi Postdoc)  Therri Usher (Biostat Predoc)</p>	<p>Household and neighborhood conditions and educational disparities in physical function</p>	<p>EBA Research in Progress Joint Presentation: "Do household and neighborhood conditions mediate educational disparities in physical function?" Jan 26, 2015.</p>