

**THE HARVARD EDUCATION AND
RESEARCH CENTER FOR
OCCUPATIONAL SAFETY AND
HEALTH**

**ANNUAL REPORT
July 1, 2006 – June 30, 2007**

**NIOSH Training Grant
No. T42 OH 008416-02**

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NOVEMBER 2007

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II. Introduction and Executive Summary

A. Major Accomplishments

The period from 2003–07 has been a very productive period for the Education and Research Center (ERC) at Harvard School of Public Health (HSPH). Despite the tight federal funding for biomedical and public health research, the Harvard ERC faculty has continued to expand its research portfolio in occupational safety and health (OSH) projects. Moreover, we have maintained our academic programs' quality and enrollment. As each academic program has a detailed progress report included in its own section, the purpose of this overall progress report is to summarize our ERC progress over the past 4 years and provide highlights, listed by program area.

OCCUPATIONAL AND ENVIRONMENTAL MEDICINE CORE

For the Occupational and Environmental Medicine (OEM) Core, changes in the practicum year were made to address the residents' responses on the incoming assessment and more particularly their scores on the in-service exam given every August to residents in both years. Although many residents enter with more than the required 1 clinical year, those who had not had a residency experience were found to be less skilled in the area of suturing, and on the in-service exam their scores were low in the area of infectious disease. For our quality improvement plan, we now arrange a "bioskills" class, when needed, to provide additional suturing practice, and we have added a rotation in Travel Medicine at Tufts-New England Medicine Center that provides experience with diseases such as tuberculosis, HIV/AIDs, cholera, Asian flu, and to emergent diseases such as avian influenza. In addition, research opportunities for practicum-year residents have allowed those interested in research to participate in state-of-the-art research. For example, Dr. Phillip Parks, a second-year resident, is working with Drs. Eileen McNeely and Jack Spengler on a Federal Aviation Administration–funded project to determine the health effects of air travel on the cabin crew and passengers. This is the first large-scale epidemiological study of cabin crews, much-needed research to understand the health effects of mildly hypoxic environments on an aging population of travelers.

Highlights: OEM Academic Program

The OEM Core boasts an illustrious history of training leaders in the field of occupational and environmental medicine. It has produced two of our current national institute directors. **Dr. John Howard**, the current director of the National Institute for Occupational Safety and Health (NIOSH), is an OEM graduate. Additionally, **Dr. David Schwartz**, director of the National Institute of Environmental Health Sciences (NIEHS), is also an OEM alumnus. The core has lost a leader in the field, **Dr. Howard Hu**, but the University of Michigan has gained a new chair of Environmental Health Sciences, educated at the Harvard ERC. The current director of the Agency for Toxic Substances Disease Registry at the Centers for Disease Control and Prevention is **Dr. Howard Frumkin**, also a Harvard ERC OEM alumnus. As noted in the general ERC description, all of the ERC cores have produced leaders in government, academia, the private sector, and labor in the field of OSH.

OEM Core faculty, led by Dr. Stefanos Kales, in collaboration with Occupational Epidemiology faculty (Dr. Christiani), published a groundbreaking article in the prestigious *New England Journal of Medicine* in 2007 on firefighters on the job deaths from cardiovascular disease (Kales SN, Soteriades ES, Christophi CA Christiani

DC. Emergency duties and deaths from heart disease among firefighters in the United States. *N Engl J Med.* 2007 Mar 22;356(12):1207-15), the lead article, with an editorial by Drs. Linda Rosenstock and J. Olsen.

During the period July 2003 through June 2007, Harvard residents have won seven American College of Occupational and Environmental Medicine (ACOEM) research awards, and have published eight peer-reviewed articles based on work undertaken while in OEM training; two more are in press, and one has been submitted. Of

the 40 residents who graduated between 1998 and 2007, 36, or all except the four who completed the program this year (2007), have had the opportunity to take the American Board of Preventive

Medicine (ABPM) exam; 31 of those 36 have taken the exam and passed, making a board-certification rate of 86% and a pass rate for 31 residents of 100%.

Dr. David Christiani won the 2007 Robert A. Kehoe Award of Merit from the American College of Occupational and Environmental Medicine (ACOEM) for scientific achievements in the field.

INDUSTRIAL HYGIENE CORE

In the Industrial Hygiene (IH) Core, our goal is to train leaders who will rise to the top of the field and have a broad impact. Our second strategy is to “train the trainers” by encouraging our MS graduates to obtain doctoral training. More than half of our graduates have earned doctorates from HSPH and other schools, and many of those have taken faculty positions in other IH programs, noted earlier. They have predominantly obtained doctorates in industrial hygiene and in occupational epidemiology. One of the major critiques of epidemiology is the weakness of its exposure assessment. Epidemiologic researchers with an MS in IH have strong training in exposure assessment. We graduated three doctoral students in Occupational Epidemiology with previous MS degrees in IH. This is consistent with our philosophy to have an important impact on a closely related discipline.

From 2003 to 2007, the HSAT program graduated four master’s level students. Two of the four pursued postdoctoral training and are preparing for a research career.

Highlights: IH and HSAT Academic Program

Dr. Thomas Smith, director of the IH Core, led a large national project of diesel particle exposure as part of a National Cancer Institute–funded initiative on lung cancer and diesel exposure. In addition, his pioneering work in modeling human exposure-dose responses to 1,3-butadiene required the construction of an experimental human exposure apparatus that has proved very valuable for biomarker studies of this volatile compound. Dr. Robert Herrick developed TAPS, “Tools and Programs for Improving Occupational Health Conditions in Construction.” These tools will prove indispensable as part of the interactions and collaborations between ERC faculty and the new Center of Excellence for Healthy Workforce, where construction and healthcare are the primary sectors of interest.

Dr. Steven Rudnick, director of the Hazardous Substances Academic Training (HSAT) program within IH, received the International Academy of Indoor Air Sciences’ Best Paper Award in 2005 for his work, “Risk of Indoor Airborne Infection Transmission Estimated from Carbon Dioxide,” demonstrating the cross-cutting value of his work on ventilation beyond traditional chemical hazards to occupationally related common infection hazards.

OCCUPATIONAL HEALTH NURSING CORE

At the time of this continuation submission, the Occupational Health Nursing (OHN) Core is entering its 15th year of NIOSH funding and 18th year of existence. Over the past 15 years, the program has been successful in

recruiting and retaining highly qualified nursing students and has graduated a diverse range of talented advanced practice nurses who have gone on to become academics, researchers, nurse practitioners, administrators, consultants, and advocates for worker populations. The OHN Core is a collaborative program of the Harvard ERC with Simmons College in Boston.

The past 4 years comprising this report period has been marked by difficulty recruiting eligible nurses into the program. This is due to many factors but primarily the market forces at work. Bedside nurses are enjoying record salaries, resulting in little incentive to leave work and pursue an academic degree where tuition costs have

outpaced the return on investment, especially for the older nurse. As the average age of nurses continues to rise into the 50s, it becomes even more difficult for nurses to consider making a career change. Additionally, the popularity of the associate degree program for entry into practice has changed the demographics of the workforce. Almost 60% of new graduates come from associate degree programs where there is virtually no exposure to specialty practices or leadership and research content. Without this exposure, it is hard to impress nurses that occupational health may be a viable career choice. Despite these barriers, we have been able to recruit talented nurses over the past 5 years.

Highlights: OHN Academic Program

Several graduates have entered academic institutions and continue to conduct research. Dr. Susan Duty is a 1999 graduate of the dual-degree OHN program and a June 2002 doctoral graduate of the Occupational Epidemiology Core. She is an assistant professor in the nursing program at Simmons and now director of the OHN Core, replacing Dr. Carol Love who retired 2 years ago. Dr. Duty is a certified adult nurse practitioner and has worked in occupational health clinics. She has continued her research on the relationship between environmental exposures to phthalates and male reproductive outcomes and currently is the principal investigator of a study exploring occupational exposure to dibutyl phthalate among manicurists. She collaborates with her former mentor and colleague, Dr. Russ Hauser, of the Occupational Epidemiology Core.

OCCUPATIONAL EPIDEMIOLOGY CORE

The Occupational Epidemiology academic training program enjoyed growth and is quite large, due to our success in leveraging other training grants (such as the NIEHS-funded Environmental Epidemiology T32 grant), utilizing National Occupational Research Agenda (NORA) supplement research support, and accessing scholarship resources available at Harvard. As of June 30, 2007, we have 16 trainees in the academic program, with eight receiving ERC support. Four 2007 graduates are pursuing postdoctoral training. Three recent graduates (Drs. Katie McCarty, John Meeker and JC Chen) have faculty positions at Yale, University of Michigan, and University of North Carolina, respectively. Another (Dr. Pradeep Rajan) is working as an occupational epidemiologist at the New York Department of Health and Hospitals. The Occupational Epidemiology academic program has expanded its faculty with the addition of Dr. Marc Weisskopf, who has a PhD in neurophysiology as well as an ScD from HSPH in epidemiology; he has a joint appointment in the Department of Epidemiology. We also have welcomed Dr. Robert Wright, an assistant professor at Harvard Medical School (HMS) and HSPH, who has taken over most of Dr. Hu's research portfolio after his departure. Even in these trying times, the faculty's funded research has peaked, with \$12.5 million dollars in NIH- and NIOSH-sponsored grants.

Highlights: Occupational Epidemiology Academic Program

The OE program has been extremely productive over the past funding period. The faculty is at the cutting edge of research in developing and applying biomarkers of exposure, early effects and genetic susceptibility to real-world, human population studies aimed at elucidating workplace health risks. Some of these research highlights include the following:

Dr. Christiani's international collaborative research group reported germinal findings on the role of inhaled

endotoxin in the development of obstructive lung disease in cotton textile workers. The results have implications beyond the cotton textile industry and are relevant for workers exposed to other vegetable dusts such as grain, flax, hemp, plywood manufacturing, sewage treatment plants, and fiberglass production, as well as in animal confinement buildings. The work was highlighted recently on the HSPH home webpage and in the *Harvard Public Health Review* (<http://www.hsph.harvard.edu/review/spring07/spr07shanghai.html>). Many publications have resulted from this work, and the results will be useful for the development of an endotoxin standard.

Dr. Russ Hauser and his group continue to discover new adverse health effects of exposure to persistent organic pollutants, especially phthalates. Using a biomarker of exposure, MEHP, he reported that urinary MEHP concentrations are associated with decreased free T(4) and/or total T(3) thyroid hormone levels in adult men (Meeker JD, Calafat AM, Hauser R. Di(2-ethylhexyl) phthalate metabolites may alter thyroid hormone levels in men. *Environ Health Perspect* 2007 Jul; 115(7):1029-34). His NIH- and NIOSH-funded studies have opened new ground in occupational and environmental epidemiology of male reproductive disorders.

Drs. Hu, Wright and Weisskopf have been leaders in the research on neurocognitive effects of lead exposure, and genetic modification of risk from lead exposure among both occupationally and non-occupationally exposed populations.

Dr. Christiani's research team published the first paper on human gene expression after occupational exposure to metal particulates in boilermaker construction workers (Wang Z, Neuburg D, Li C, Su L, Kim JY, Chen JC, Christiani DC. Global gene expression profiling in whole-blood samples from individuals exposed to metal fumes. *Environ Health Perspect* 2005 Feb; 113(2):233-41).

Dr. Ellen Eisen continued to develop and publish statistical methods for occupational epidemiology research. To allow for non-linear exposure-response relationships, she applied flexible non-parametric smoothing techniques to models of time to lung cancer mortality in two occupational cohorts with skewed exposure distributions, focusing on three different smoothing techniques in Cox models: penalized splines, restricted cubic splines, and fractional polynomials. The dose-response curves from the three methods were similar in both studies over the denser portion of the exposure range, with the difference between curves up to the 50th percentile less than 1% of the total difference. Overall, the penalized spline and the restricted cubic spline were closer to each other than either was to the fractional polynomial.

OCCUPATIONAL INJURY PREVENTION PROGRAM

The Occupational Injury Prevention Research Training Program continues to be directed by Jack T. Dennerlein, PhD, associate professor of ergonomics and safety, and Melissa J. Perry, ScD, associate professor of occupational epidemiology. We continued collaborative training efforts with the Liberty Mutual Research Institute for Safety, the Harvard Injury Control Research Center, Massachusetts Institute of Technology (MIT), and the Massachusetts Department of Public Health. In 2005 we expanded our program faculty with the addition of Drs. Ian Noy and Mary Bouxsein. Dr. Noy is the new director of the Liberty Mutual Research Institute for Safety with a strong research record in traffic safety, and Dr. Bouxsein is an instructor at HMS, a researcher in the Orthopedics Biomechanics Laboratory, and an expert in fracture mechanics and epidemiology.

Highlights: Injury Prevention

Per new NIOSH-funded research projects in injury prevention, in 2005 were three and in 2007 one: Preventing Falls from Ladders, Risk Factors for Lacerations in Meat Packing, and Tools for Exposure Assessment of Physical Risk Factors (2005); and Upper Extremity Dynamics during Keying (2007). Through these and other new research initiatives, we strengthened existing partnerships and developed new ones, e.g., with the Center to Protect Workers Rights (CPWR), Johns Hopkins University, University of Nebraska, Partners HealthCare

(Massachusetts General Hospital and Brigham and Women's Hospital), and the HSPH Department of Society, Human Development, and Health with its new Center of Excellence for a Healthy Workforce, where Dr. Dennerlein co-leads the key project on healthcare workers.

In addition, Dr. Dennerlein and the Occupational Injury Prevention faculty have taken a leadership role, in collaboration with the University of Massachusetts Lowell, in organizing and hosting the 2007 PREMUS (Prevention of Work-Related Musculoskeletal Disorders) conference in Boston.

The Liberty Mutual-HSPH Program in Occupational Safety was renewed with a 5-year commitment of \$500,000 per year. This collaborative program is now based in the Harvard ERC.

Other ERC Highlights and Accomplishments

The Harvard ERC **Continuing Education** program has been updated and now is financially in the black for the first time in 30 years. The program works collaboratively with the Center for Continuing Professing Education (CCPE), which has created a "New Program Development Fund" to promote new relationships and programs by offering \$2,000-\$5,000 to HSPH faculty to develop new programs with CCPE. This initiative, launched in October 2004 with an e-mail sent to all HSPH faculty, is managed by Lynn Fitzgerald, associate director of programming and finance for the CCPE and director of continuing education for the ERC. In recent months, the CCPE Policy Committee has discussed the possibility of increasing the development awards.

Our acclaimed **Outreach Program** has continued to expand the Visiting Scholars Program for area college faculty and stakeholders. In addition, outreach to an underserved population — New England's fishing communities, which have suffered severe loss of life in recent years — is a priority for outreach and research-to-practice activities led by the Outreach director, Ms. Ann Backus. The Outreach program has continued to enhance interactions of faculty with labor unions and professional organizations such as the New England College of Occupational and Environmental Medicine (NECOEM) and the American Association of Occupational Health Nurses (AAOHN), organize health fairs, photographic exhibits, and NORA Town Hall Meetings 2006, participate in the Maine Occupational Research Agenda (MORA), and conduct a Professional Workforce Needs Assessment, the results of which are cited throughout the academic core program descriptions. Finally, the Outreach program worked with the CCPE to offer a highly successful "Acute and Chronic Noise Exposure" CE course in 2007.

Another important accomplishment during the past 5 years of the ERC has been **strengthening ties with other training programs and centers in HSPH**, thus extending the reach of the ERC as well as opening up additional cross-disciplinary opportunities for ERC students. Some relationships have been solidified because of consolidation and integration of leadership. For example, Dr. Christiani directs both the ERC Occupational Epidemiology academic program as well as the NIEHS-funded Environmental Epidemiology T32. Other ties go back years, such as with the Injury Center, the Liberty Mutual-HSPH Program in Occupational Safety and Health, and the NIEHS (T32)-funded Toxicology training program. Still others are new, such as the newly funded collaboration with Dr. Glorian Sorensen on the Center of Excellence to Promote a Healthier Workforce. This Center is developing joint research and educational activities with faculty from the ERC and from the HSPH Department of Society, Human Development, and Health. The goal of the Harvard School of Public Health's (HSPH) Center for Excellence to Promote a Healthier Workforce is to establish a sustainable trans-disciplinary program devoted to research, education, and dissemination, in order to facilitate the integration of occupational safety and health (OSH) and workplace health promotion (WHP) through collaborations among academic researchers, employers, labor unions, and related intermediary organizations. Although traditional efforts to protect the workforce from occupational hazards have been largely independent from efforts to encourage individual health behavior changes, an expanding body of research is providing evidence for the benefits of the integration of these approaches. We aim to actualize a vision for the integration of OSH and

WHP that goes beyond the simple sum of these parts, to envision a new trans-disciplinary culture, science, and practice, operationalized in our work and providing a national model for future research, education and dissemination in support of worker health.

In summary, the Harvard ERC has made significant strides since the last competing renewal in education, training, scholarship and scientific achievements, and in expanding interactions with other centers, training programs and researchers in the community. These achievements have occurred despite significant cuts in federal spending on biomedical research and education initiatives since 2003. We have maintained a very strong Center and presence in the region, the nation and the world and are well-positioned to meet the challenges of the 21st century.

B. Significant Changes since July 1, 2005 – June 30, 2006

There are no significant changes from the prior reporting period.

C. ERC Website

WWW.hsph.harvard.edu/erc

III. Program Progress Reports

A. Program Title

Center Administration

B. Program Director

David C. Christiani, MD, MPH

C. Program Description

The Harvard Education and Research Center has seven academic components: cores: Industrial Hygiene, Occupational Health Nursing, Occupational Medicine, and four special component cores: Occupational Epidemiology, Occupational Injury Prevention and Control, Hazardous Substances Academic Training and Pilot Project Research Training. Each of the three traditional core programs offer curricula leading to masters and doctoral degrees except the nursing core, which does not offer a doctoral program. The Occupational Epidemiology and Injury Prevention components offer doctoral education, and HSAT a master's degree.

The Center Administration is responsible for financial management as well as overall educational and scientific direction of the Center. The Center Administration personnel are made up by the Director (Dr. David Christiani), the Deputy Director (Dr. Thomas Smith) and Center Administrator (Ms. Jean Economos).

D. Program Activities and Accomplishments

In addition to providing general direction for the Center, the Administrative Core manages all appointments and reappointments of faculty, staff and students; organizes biweekly meetings with Core/Component directors as part of Center Governance; organizes External Advisory Committee meetings and meetings with the Dean of the faculty to respond to Advisory Committee recommendations; and holds an annual retreat for ERC faculty to facilitate planning and academic coordination for the next year. In addition, the Administrative core, with ERC faculty, organizes ERC seminars, as well as research seminars and Occupational Medicine Grand Rounds. In addition, the Administrative Core fosters Interdisciplinary Interactions among ERC trainees and faculty.

The ERC is located at the Harvard School of Public Health; Simmons College is an adjacent collaborative academic institution. Both schools are situated in the Fenway-Longwood area of Boston. In addition to courses taken at the two institutions, electives may be taken at other Harvard graduate schools or at the Massachusetts Institute of Technology (MIT) in Cambridge.

Extramural training is offered in a number of locations. All ERC students as part of a required academic course take field trips to local industries. Hospital and industrial sites throughout metropolitan Boston provide practica for occupational health nurses and occupational medicine residents. Industrial hygiene students spend a six-month internship at industrial locations throughout the United States. Occupational medicine residents may rotate through OSHA (Washington, D.C.) and NIOSH (Cincinnati or Morgantown).

A number of formal and informal arrangements with other institutions are integral to the conduct of ERC activities and achievement of the Center's goals. Through activities of the academic programs, the

continuing education program, and the outreach program, the Center has developed close working relationships with a number of regional institutions and organizations. A contractual agreement with Simmons College is in place for the collaborative occupational health nursing program.

All ERC medical faculty interact with colleagues within Harvard or at other institutions. Drs. Christiani, Kales, Goldman and Monson have joint faculty appointments at the Harvard School of Public Health and at Harvard Medical School. Within the School of Public Health, Drs. Monson, Christiani and Hauser have joint appointments in Epidemiology. Clinical occupational medicine is conducted at Cambridge Hospital, Fallon Clinic, Massachusetts General Hospital, Kindred Northeast Specialty Hospital, and Occupational Health and Rehabilitation, Inc. Since the Center does not have a safety training core, a long-standing relationship with safety professionals from the Liberty Mutual Insurance Company has existed. Drs. Albert Mangone, Vincent Ciriello, Ted Courtney, David Lombardi and director Ian Noy have appointments as visiting lecturers. Each is involved in teaching occupational safety and ergonomics in the academic and continuing education programs.

The continuing education program is both intramural and extramural. The intramural component is offered through the Center for Continuing Professional Education and presents long-standing courses in industrial hygiene and radiological health. It has a stable audience of industrial and governmental professionals. The extramural component is administered by the Center and takes place in Massachusetts and throughout the New England region.

With respect to **interdisciplinary interaction**, The Harvard ERC has continued to promote program interaction among the ERC components. Such interactions arise from the demonstrated educational needs of individual programs that are complimentary in strength to utilize unique resources of ERC programs of other disciplines. In addition, the long history of the Harvard ERC has given rise to a multi-layered integration of educational, research, and service activities. Interdisciplinary interaction is enhanced by close geographic proximity: all of our component programs except one are found at the Harvard School of Public Health and the one collaborative program with Simmons is close by (1 block) from HSPH.

Collaboration among the ERC is achieved specifically through a variety of methods. Firstly, didactic educational resources are shared for the purpose of providing instruction to NIOSH trainees in the variety of disciplines represented by the ERC component programs. Secondly, ERC component faculty and students are engaged in collaborative research projects. Thirdly, ERC components are involved in interdisciplinary practicum experiences. Fourthly, the ERC component programs work together to promote continuing education and educational development for professionals and non-professionals in occupational health and safety. Lastly, ERC component programs collaborate in outreach activities to constituent communities: professionals, labor, industry, and government.

E. Program Products

Meeting Regional Needs and Evaluation of Impact of Programs Innovative Outreach Initiatives and Response to Regional Needs

Recognizing the diversity, high-level technology, and industrialization in the New England Region, the potential for occupationally related illnesses and injuries is obvious. The role of the advanced practice occupational health nurse in health promotion, disease prevention and control of occupationally related injuries is well documented. In the New England area, there are insufficient numbers of advanced practice occupational health professionals (Physicians, Nurses, IH's, Epidemiologists) being prepared to meet the current and future health care demands of workers in these highly complex work environments, which are now very diverse and include construction, healthcare, manufacturing, biotechnology, offices/services, universities and laboratories, agriculture, transportation, retail, forestry and fisheries.

Measures of Effectiveness

The following table illustrates the overall ERC Administrative Core performance in Occupational Safety and Health.

Performance Measure	Target	Actual Performance
Maintain diversified grant portfolio of research relevant to OSH	Submit new and competing proposals to NIH, NIOSH and other agencies.	Met
Maintain trainee number	35 per year	49
Graduate professionals in the multi-disciplinary fields of Occupational Safety and Health	At least 10 masters and doctoral graduates per year	Achieved
Annual ERC advisory committee meeting and report	Annual meeting and report to deans	Met
Maintain critical number of full time faculty, and expand expertise to new areas	Recruit a full-time assistant professor with expertise in Occupational and Environmental Neuro-epidemiology.	Achieved (Dr Weisskopf)
Electronic data-base and recruitment for Harvard ERC	Develop website	Met
Maintain diversified outreach to key stakeholders	Workers, Management, Unions	Met
Increase Collaboration between Health Promotion and OH Programs	Receive Center of Excellence (Healthier Workforce)with Faculty of Society, Health and Development (PI: Sorensen, Co-PI: Christiani)	Met
Fund new round of pilot projects	At least 5 new pilots	Exceeded (8 funded).
Track ERC graduates for career progress	1) Track and document masters students who later pursue doctoral training; 2) Institute post-graduation free e-mail access.	Created student and graduate database. E-mail contacts: Post-Harvard e-mail now available to all graduates and post-docs/.
Continuing Education course	Develop and complete a new course on chemical terrorism/emergencies.	Met (see CE)

F. Future Plans

Our plans for the next grant period are to complete our competing renewal application (submitted August, 2007), and to continue our successful sponsored research and educational activities. Our new class will enroll in September, 2007.

A. Program Title

Industrial Hygiene Core

B. Program Director

Thomas J. Smith, PhD, CIH

C. Program Description

1. Goals and Objectives:

The ERC supports both professional and research training by offering a professional Master of Science in Environmental Health (concentration in Industrial Hygiene) and the Doctor of Science in Environmental Health (concentration in Industrial Hygiene) degrees. The principal educational objectives of industrial hygiene training are:

1. At the master's level our goal is to prepare broadly educated graduates who will practice as creative and competent professional industrial hygienists, and who can develop into leaders in this profession and environmental health in general.
2. To develop graduates who have learned to work effectively with other professional in Occupational Health, and to provide interdisciplinary training for physicians, nurses, ergonomists, safety specialists, and other professionals in occupational health.
3. To train researchers in four areas of interest: the assessment of occupational exposures, estimation of dose for epidemiologic studies, evaluation of the effectiveness of intervention strategies, and engineering controls. The workplace is constantly changing and IH researchers must anticipate the needs of the practitioner, who must recognize new hazards and have state-of-the-art hazard evaluation and control strategies.

2. Faculty Participation:

Dr. Thomas Smith, Professor of Industrial Hygiene and director of the industrial hygiene program, has worked with Drs. Herrick, Rudnick, and Dennerlein to establish the international reputation of the Harvard Industrial Hygiene Program. They teach all of the core courses for the MS and D.Sc. programs. Dr. Smith's research continues with work on exposure-response relationships in occupational epidemiology, exploring exposures in the trucking industry that may be associated with lung cancer. He also is now working on exposure assessment for the validation of new biomarkers. Dr. Robert Herrick, Senior Lecturer on Industrial Hygiene, and associate director of the industrial hygiene program has developed a strong research program in hazard assessment and exposure controls for several construction settings, including road pavers, roofers, and stone masons. Dr. Stephen Rudnick, Lecturer on Environmental and Occupational Health Engineering, directs our Hazardous Wastes Training subprogram has grown to be a very important component of our industrial hygiene program. His research addresses control of airborne infectious agents. Dr. Jack Dennerlein, Associate Professor of Ergonomics and Safety, has substantially extended our capabilities in ergonomics and biomechanics. He is also co-director of the Occupation Injury Prevention Program, where the current Safety/Ergonomics Program resides.

The industrial hygiene curriculum involves the participation of a number of practicing industrial hygienists in the Boston area as lecturers, who are listed as Teaching Faculty above. In addition, they have also served as

mentors for some of the student internships that have been sponsored by their employers. These mentors are either graduates of the program or are known personally by the faculty, and are generally board-certified industrial hygienists.

3. Curricula:

We are committed to Competency Based Education (CBE) as articulated by the Council on Education for Public Health (CEPH). The CEPH describes CBE as focusing on "...what students need to know and be able to do in varying and complex situations (student and/or workplace focused)." To achieve this, we have adopted the approach of breaking down broad educational objectives and large skill sets into competencies that reinforce one another from basic to advanced as learning progresses.

D. Program Activities and Accomplishments

1. Progress toward Goals and Objectives:

In addition to teaching our interdisciplinary core courses, which include students from all of the programs, we also regularly serve on doctoral committees of students in environmental and occupational epidemiology, and risk assessment. This past year, Dr. Smith has served on one committee (three students graduated) and Dr. Herrick is serving on 2 committees.

Our doctoral program follows the School requirements for a set of coursework on a major (industrial hygiene) and two minors (frequently epidemiology and biostatistics). Often our doctoral students have completed an MS in IH, so they have little additional coursework to take. Drs. Smith is supervising two doctoral students and Dr. Suh and Dr. Levy are supervising the research training of one doctoral student each. Dr. Smith is working with one post-doctoral fellow, Dr. David Kim, a recent graduate from the University of North Carolina. He is interested in pharmacokinetic modeling and is working on Dr. Smith's study of the metabolism of butadiene to epoxy metabolites.

The past year we graduated 2 MS students (1 in IH Core and 1 in HSAT Core), and we have 6 second year MS students (4 in IH Core and 2 in HSAT Core), and 2 new MS students starting (1 in IH Core and 1 in HSAT Core). Victoria Jackson returned to the Navy where she is the IH officer for an aircraft carrier. Wisanti Laohaudomchok has entered our doctoral program in occupational epidemiology. His goal is to return to his native Thailand when he finishes. There were no doctoral graduates in IH. However, one of Dr. Smith's students is on track to finish in June 2008. Two epidemiology students, who were mentored in occupational exposure assessment by Drs. Smith and Herrick, graduated this year.

2. Trainee honors, awards, scholarships:

Dr. David Kim was awarded a highly competitive NIH Pathways Post-Doctoral Fellowship. This will support his work on transporter proteins that may facilitate the entry of toxic materials into target cells as a mechanism of susceptibility to toxic effects.

3. Faculty honors, awards, appointments:

Dr. Smith served on the National Research Council, NAS, Committee on Human Health Risks of Trichloroethylene, which concluded its work in 2006.

Dr. Herrick served as a reviewer for a National Academy of Sciences document, "Evaluation of the Presumptive Disability Decision-Making Process for Veterans," and he is currently on a scientific review panel for a benzene health research project being sponsored by the American Petroleum Institute.

4. New Courses:

A new course planned for toxicology has been postponed due to the resignation of our professor in toxicology.

A revision is still planned by it will have to wait for new faculty, and the course will continue under the old format. A new broadly integrative exposure assessment course is being fine tuned and will be offered next year. After some revisions, our new tutorial course will be offered a second time for first year doctoral students on writing a grant proposal. This course is to guide them in the basics of writing an NIH R01 style grant application. Each doctoral student has to write a proposal that is part of their preliminary oral exam.

5. New Faculty:

A new faculty search is seeking candidates for the position of assistant or associate professor in the area of biologically-based exposure assessment, especially development and use of exposure biomarkers. Three candidates have been interviewed and a fourth is coming this fall.

6. Trainee Recruitment:

We recruit students by a variety of means: word of mouth by our graduates, students, and adjunct faculty, web postings, summer internships, and meetings with accepted students who are deciding which school to attend. Potential students range from recent graduates to individuals with many years of experience. We have had good success with active military applicants because they are more mature and bring a background of experience that is highly relevant to our program.

E. Program Products

During the past year we offered our full course program and conducted internships for the five second year students during the summer and fall semester of 2006. They each produced posters on their internships and gave seminars. Three students went to the AIHC&E and presented their posters there. A group of our students visited Cyprus, during the winter semester. They toured worksites and met with researchers and government officials to learn about the occupational health problems in Cyprus. In the Spring, we held an open house to meet with students who had been accepted by HSPH. This is an important recruiting event to encourage women and minorities to attend Harvard. The School provides supplemental funding for minority students to make us more competitive. During the summer Dr. Smith had a minority intern student from the University of Puerto Rico doing a research project as part of a minority recruitment program.

F. Future Plans

Our on-going course by course review of our program will continue. We will continue to emphasize our minority recruiting effort. We hope to conclude our search for a new faculty member this coming year. As a result of the reaccrediting review of the School of Public Health by CEPH, each course's objectives and plans are being revised to better meet the requirements of CBE and put them into a standard format. A number of new research grant applications have been submitted by Drs. Smith and Herrick. These include collaborative epidemiologic studies by Dr. Smith of lung cancer from diesel and traffic exposures, and male reproductive effects and biomarkers from dimethylformamide, and by Dr. Herrick for a broad mortality study of workers in the semiconductor industry, and biomarkers of DNA damage in road pavers exposed to asphalt fumes.

APPENDIX A INDUSTRIAL HYGIENE CURRICULUM

INDUSTRIAL HYGIENE/ ERGONOMICS TWO-YEAR MS DEGREE PROGRAM WITH INDUSTRIAL INTERNSHIP #

FALL SEMESTER, FIRST YEAR

BIO 201 (Fall)

Introduction to Statistical Methods - 5.0

EH 205 (Fall)

Human Physiology - 5.0

EH 510 (Fall)

Fundamentals of Environmental Exposures Assessment - 2.5

EH 262 (Fall)

Introduction to the Work Environment - 2.5

EPI 201 (Fall1)

Introduction to Epidemiology - 2.5

WINTER SESSION, FIRST YEAR

EH 516

Environmental Genetics - 2.5

EH 517

Ecotoxicology- 2.5

EH 330 (Winter)

Field Experience in International Occupational Health Safety - 2.5

SPRING SEMESTER, FIRST YEAR

EH 231 (Spring)

Occupational Health Policy & Administration - 2.5

EH 241 (Spring)

Occupational Safety and Injury Prevention - 2.5

EH 254 (Spring)

Evaluation & Control of Noise & Vibration - 2.5

EH 292 (Spring)

Properties & Behavior of Airborne Particles - 2.5

ID 263 (Spring)

Practice of Occupational Health - 5.0

RDS 500 (Spring2)

Risk Assessment - 2.5

SUMMER SEMESTER

Summer Internship

FALL SEMESTER, SECOND YEAR

Full time Internship EH 303 or combination of practicum and other coursework including:

EH 243 (Fall)

Ergonomics/Human Factors - 2.5

EH 256 (Fall2)

Introduction to Aerobiology - 2.5

EH 279(Fall)

Radiation Environment: Its Identification, Evaluation and Control - 2.5

EH 504 (Fall)

Principles of Toxicology (01) - 5.0

SHH 201 (Fall1)

Society and Health - 2.5

Other electives as arranged with your advisor - 5.0

WINTER SESSION, SECOND YEAR

Other electives as arranged with your advisor

SPRING SEMESTER, SECOND YEAR

EH 250

Protecting Workers & Communities from Hazardous Substances - 2.5

EH 253*

Ventilation - 2.5

EH 263 (Spring)

Analytical Methods and Exposure Assessment - 2.5

EH 267 (Spring)

IH/ERGO Internship and Environmental Sciences Research Seminar - 2.5

ID 215 (Spring)

Environmental and Occupational Epidemiology - 2.5

IH STUDENTS WHO DO THE "HAZARDOUS SUBSTANCE" SUBSPECIALTY ARE ALSO REQUIRED TO TAKE ONE OF THE FOLLOWING SPRING COURSES

ID 287

Bioterrorism: Public Health Preparedness and Response - 2.5

ID 517 (Winter)

Public Health Response to Mass Emergencies - 2.5

EH 516 (Spring)

Ecotoxicology - 2.5

EH 517 (Spring)

Environmental Genetics - 2.5

GSD 6323 (Spring)

Brownfield practicum - 2.5

MIT 1.812J

Regulation of Chemicals, Radiation, and Biotechnology - 5.0

MIT 11.370

Brownfields Policy and Practice - 5.0

Other hazardous substance related course approved by your advisor

*Note: Given in 2008-2009

STUDENTS WHO CONCENTRATE IN ERGONOMICS ARE ALSO REQUIRED TO TAKE THE FOLLOWING, IN PLACE OF SOME IH ELECTIVES

EH 296

Occupational Biomechanics - 5.0

EH 282

Injury Epidemiology - 2.5

ID 240

Principles of Injury Prevention - 2.5

Additional electives other than the courses listed may be chosen. Other potential electives may be found in the curriculum listings for the Risk Assessment, Environmental Epidemiology, and Industrial

Hygiene/Ergonomics/Hazardous Substance Tracks. In addition, there are many courses available at Harvard and MIT that may be suitable electives. Consult your advisor for course recommendations that may be suitable to your specific area(s) of interest.

A list of suggested electives for both these programs may be obtained from EER Office. MIT&HSPH courses are available.

ERGONOMICS TWO-YEAR SM DEGREE PROGRAM (80 credits)

FALL SEMESTER

BIO 201 (Fall)

Introduction to Statistical Methods - 5.0

EH 205 (Fall)

Human Physiology - 5.0

EH 243 (Fall)

Ergonomics/Human Factors - 2.5

EH 262 (Fall)

Introduction to the Work Environment - 2.5

EH 504(Fall)

Principles of Toxicology - 2.5

EH 510 (Fall)

Fundamentals of Environmental Exposure Assessment - 2.5

EPI 201 (Fall1)

Introduction of Epidemiology - 2.5

SPRING SEMESTER

EH 231 (Spring)

Occupational Health Policy & Administration - 2.5

EH 241 (Spring)

Occupational Safety and Injury Prevention - 2.5

EH 253 (Spring)

Ventilation - 2.5

(not offered 2008)

ID 263 (Spring)

Practice of Occupational Health - 5.0

RDS 500 (Spring2)

Risk Assessment - 2.5

REQUIRED (ERGO) COURSES OFFERED ALTERNATE YEARS

EH 296(Spring)

Occupational Biomechanics - 5.0

(not offered 2008)

EH 250 (Spring)

Protecting Workers from Hazardous Substances - 2.5 (not offered 2008)

EH 253 (Spring)

Ventilation - 2.5

(not offered 2008)

EH 254 (Spring)

Control of Noise & Vibration - 2.5

EH 263 (Spring)

Analytical Chemistry and Exposure Assessment - 5.0

OTHER RECOMMENDED COURSES (ERGO)

Additional 5 Credits of Biostatistics—or—2.5 Biostatistics & HPE299d

EH 236 (Fall)

Epidemiology of Environmental and Occupational Health Regulations - 5.0

EH 273 (Fall)

IH/ ERGO Internship (second year) - 20.0

EH 267 (Spring)

IH/ ERGO Internship Seminar (second year) - 2.5

ENG SCI 145

Intro. to Sys. Anal. with Physiological Applications 5.0

**APPENDIX B
INDUSTRIAL HYGIENE PUBLICATIONS**

Banahan KF, Vincent RL, Brickner PW. Fundamental Factors Affecting Upper Room Ultraviolet Germicidal Irradiation—Part I. Experimental. *J Occ Environ Hyg* 2007; 4(5):321-331.

Bello, D., C. A. Herrick, T. J. Smith, S. R. Woskie, R. P. Streicher, M. R. Cullen, Y. Liu and C. A. Redlich (2007). "Skin exposure to isocyanates: reasons for concern." Environ Health Perspect 115(3): 328-35.

Huang, W., T. J. Smith, L. Ngo, T. Wang, H. Chen, F. Wu, R. F. Herrick, D. C. Christiani and H. Ding (2007). "Characterizing and biological monitoring of polycyclic aromatic hydrocarbons in exposures to diesel exhaust." Environ Sci Technol 41(8): 2711-6.

Herrick RF, Meeker JD, McClellan MD, Zwack LM, Hanley K. Physical and Chemical Characterization of Asphalt Paving Exposures. *Journal of Occupational and Environmental Hygiene* 2007; 4(Suppl 1):209-216.

Kile, M. L., E. A. Houseman, C. V. Breton, T. Smith, Q. Quamruzzaman, M. Rahman, G. Mahiuddin and D. C. Christiani (2007). "Dietary arsenic exposure in bangladesh." *Environ Health Perspect* 115(6): 889-93.

McCarty, K. M., L. Ryan, E. A. Houseman, P. L. Williams, D. P. Miller, Q. Quamruzzaman, M. Rahman, G. Mahiuddin, T. Smith, E. Gonzalez, L. Su and D. C. Christiani (2007). "A case-control study of GST polymorphisms and arsenic related skin lesions." *Environ Health* 6: 5.

McCarty KM, Chen YC, Quamruzzaman Q, Rahman M, Mahiuddin G, Hsueh YM, Su L, Smith T, Ryan L, Christiani DC. Arsenic methylation, GSTT1, GSTM1, GSTP1 polymorphisms, and skin lesions. *Environ Health Perspect*. 2007 Mar;115(3):341-5. Epub 2006 Dec 20.

McCarty KM, Smith TJ, Zhou W, Gonzalez E, Quamruzzaman Q, Rahman M, Mahiuddin G, Ryan L, Su L, Christiani DC. Polymorphisms in XPD (Asp312Asn and Lys751Gln) genes, sunburn and arsenic-related skin lesions. *Carcinogenesis*. 2007 Aug;28(8):1697-702. Epub 2007 Apr 29.

Chen JC, Stone PH, Verrier RL, Nearing BD, MacCallum G, Kim JY, Herrick RF, You J, Zhou H, Christiani DC. Personal coronary risk profiles modify autonomic nervous system responses to air pollution. *J Occup Environ Med*. 2006 Nov;48(11):1133-42.

Yu CL, Wang SF, Pan PC, Wu MT, Ho CK, Smith TJ, Li Y, Pothier L, Christiani DC; Kaohsiung Leukemia Research Group. Residential exposure to petrochemicals and the risk of leukemia: using geographic information system tools to estimate individual-level residential exposure. *Am J Epidemiol*. 2006 Aug 1;164(3):200-7. Epub 2006 Jun 5.

Herrick RF, Meeker JD, Hauser R, Altshul L, Weymouth GA. Serum PCB levels and congener profiles among U.S. construction workers. *Environ Health: A Global Access Science Source* 2007;6:25.

Victoria Jackson presented a poster entitled "Effects of Wind Transport on Diesel Emissions from Truck Terminals" at the annual American Industrial Hygiene Conference.

Rudnick, S.N. and M.W. First, Fundamental Factors Affecting Upper-Room Ultraviolet Germicidal Irradiation—Part II. Predicting Effectiveness, *J. Occ. Environ. Hyg.* 4(5):352-362 (2007),

First, M.W., S.N. Rudnick, K.F. Banahan, R.L. Vincent, and P.W. Brickner, Fundamental Factors Affecting Upper Room Ultraviolet Germicidal Irradiation—Part I. Experimental, *J. Occ. Environ. Hyg.* 4(5):321-331 (2007)

McDevitt, J.J., K.M. Lai, S.N. Rudnick, E.A. Houseman, M.W. First, and D.K. Milton. Characterization of UVC Light Sensitivity of Vaccinia Virus, *Appl. Environ. Microbiol.* 73(18):5760-5766 (2007)

Lander, L.L., S.N. Rudnick, and M.J. Perry, Assessing Noise Exposure in Farm Youths, *In Press. Journal of Agromedicine* (2007).

A. Program Title

Occupational Health Nursing Core

B. Program Director

Susan Duty MSN, Sc.D.

C. Program Description

Goals and Objectives: The occupational health nursing core prepares nurses in the role of occupational health nurse practitioner (OHNP) and occupational health nurse clinician (OHNPDD). The objectives of the occupational health nursing program include: 1.) to plan, develop, implement and evaluate a rigorous academic program for nurses seeking the advanced practice role in occupational health, 2.) to recruit and retain qualified graduate students including minorities and individuals from underserved areas into the OHN program and 3.) to provide research training in the area of occupational and environmental health. The

Harvard School of Public Health ERC and Simmons College cooperative nursing program is designed to prepare registered nurses as occupational safety and health nurse practitioners with expertise in research methodology, and/or advanced practice nursing.

Curricula: The nursing program offers two areas of concentration, a 49 credit program preparing nurse practitioners with expertise in occupational health nursing (OHNP) and a 74 credit dual degree program preparing nurses with expertise in both occupational health nursing and research methodologies (OHNPDD). This curriculum has been in place since major revisions were made 2.5 years ago in collaboration with HSPH and Simmons. The primary care core curriculum consists of a sequence of four primary care courses and four clinical practicum courses. The primary health care clinical practicum (NUR 580, 580A, 581, 582, 582A, 584, 584B) consists of 410 classroom hours and 680 clinical hours. The classroom content focuses on the essential content necessary to provide primary health care to clients from diverse populations. A holistic approach is stressed, with attention to health promotion, disease prevention and the diagnoses and management of common health problems encountered in primary care. Interventions for health problems are addressed within the scope of the practice of the advanced practice nurse. Interventions for nursing and medical diagnoses are based on current research and accepted practice. All students participate in interdisciplinary evaluations of worksite risks and hazards and complete worksite needs assessment in the ID263cd, Practice of Occupational Health Course. Students from industrial hygiene and occupational medicine as well as nursing students are enrolled in this course and participate in the interdisciplinary analysis of worksite issues.

Faculty participation: Dr. Carol Love, the director of the OHN core for many years has turned over the directorship of the OHN core to Dr. Susan Duty an alum of the Simmons/Harvard Program and an Asst Professor of Nursing at Simmons College. Susan Duty, RN, MSN, MS, Sc.D. is a 2002 graduate of the Harvard ERC Occupational Epidemiology program and a 1999 graduate of Simmons College and Harvard School of Public Health dual degree program. In January of 2003 she was appointed Assistant Professor of Nursing at Simmons College. Her responsibilities include program development, curriculum design, research supervision, recruitment and teaching.

D. Program Activities and Accomplishments

In response to recruitment efforts, 3 students are enrolled but more excitingly we had a record number of inquiries that I plan to continue to cultivate. On average it takes 2-3 years from the time of inquiry to make a decision to enroll in the OHN program. Simmons College has undergone a major renovation program which included significant additions to the nursing clinical laboratory facilities and enlargement of the library (which is

under construction) and enhancements to the electronic holdings, all of which will directly enhance access to the latest technologies and most up-to-date literature. A Certificate of Advanced Graduate Study (CAGS) in Occupational Health to meet the needs of certified Adult or Family Nurse Practitioners who are seeking a mid-career change to occupational health began in the fall 07. Additionally, the technology IT center at Simmons College has programs to train faculty in on-line technology and development of on-line programs which will be instrumental as we develop on-line contact hour educational programs in occupational health. This will allow for a greater distribution of course content to practicing occupational health nurses which will facilitate their professional development and perhaps promote interest in applying to our academic programs offering training and certification in occupational health nursing.

The Simmons College Department of Nursing has full accreditation by the Commission on Collegiate Nursing Education valid until 2009. The department is also developing a Doctorate in Nursing Practice program, a clinical doctorate program which is currently in curriculum meetings for a vote. It is proposed as a post-master's doctorate and we will retain the MSN into the foreseeable future.

Simmons College has also begun a Health Professions Education doctoral program which is open to master's degree prepared OHNs.

E. Program Products

A trainee Rachel Kwapniewski has a manuscript entitled A Pilot Study: Characterizing Phthalate Exposure among Nail Salon Workers under review at the Journal of Occupational and Environmental Medicine: Rachel Kwapniewski, Sarah Kozaczka, Russ Hauser, Manori J. Silva, Antonia M. Calafat, Susan M. Duty. Occupational exposure to dibutyl phthalate among manicurists. In review *Journal of Occupational and Environmental Medicine*.

There is evidence of cross-fertilization of ideas when non-occupational health students become exposed to issues of workplace health and ultimately identify research projects that focus on occupational health issues. These other students not in the OHNP program have collaborated with faculty on an environmental health study entitled A Pilot Study to identify the distribution and determinants of indicator and pathogenic target bacteria in homes with healthcare workers, young children and pets. The results of this pilot study were presented November 2006 at the American Association of Public Health Annual Meeting in Boston, MA and a manuscript is in Press: Elizabeth Scott, Susan Duty, Maureen Callahan. A Pilot Study to Isolate Staphylococcus aureus and MRSA from Environmental Surfaces in the Home. *American Journal of Infection Control* In Press

A 2004 graduate, Robin Ackerman went to Law school, graduated and is now working for OSHA (Directorate of Standards and Guidance, Office of Chemical Hazards).

F. Future Plans

Simmons College began a new certificate of advanced graduate study (CAGS) in Occupational Health Nursing for those Adult or Family Nurse Practitioners who want to change career focus and work in occupational health settings. Recruitment is currently slow but many inquiries have been made. A graduate program offered either as graduate credit or for CEU's in administration and management is in development phase to be planned in cooperation with the Health Care Administration Program.

APPENDIX A OCCUPATIONAL HEALTH NURSING CURRICULUM

Nursing students in Occupational Health have two program options: a two-year master's program which earns a Nurse Practitioner degree from Simmons College, or a Dual Degree program which results in a master's degree from Simmons and a second master's degree from the Harvard School of Public Health.

TWO-YEAR DUAL SM/ MSN DEGREE PROGRAM

FALL SEMESTER, FIRST YEAR

NUR 404

Normal and Abnormal Human Physiology - 4.0

SHS 570

Health Promotion: A Global Perspective - 2.0

EH 243 (Fall)

Ergonomics/ Human Factors - 2.5

BIO 200 or 201 (Fall)

Principles of Biostatistics - 5.0

EPI 200 or 201 (Fall1)

Principles of Epidemiology - 2.5

EH 262 (Fall)

Intro to Work Environment - 2.5

WINTER SESSION, FIRST YEAR

EH 281 (cross listed – NUR 576)

Occupational Health Care Delivery - 2.5
(not offered 2008)

SPRING SEMESTER, FIRST YEAR

EH 231 (Spring)

Occupational Health Policy and Administration - 2.5

ID 215 (Spring)

Environmental and Occupational Epidemiology - 2.5

ID 263 (Spring)

Practice of Occupational Health - 5.0

NUR 507

Scholarly Inquiry I - 2.0

NUR 580

Primary Health Care I - 2.0

NUR 580A

Clinical Decision Making I - 1.0

SUMMER SESSION, FIRST YEAR

NUR 508

Scholarly II - 2.0

NUR 581

Clinical Practicum - 3.0

FALL SEMESTER, SECOND YEAR

EH 236 (Fall)

Epidemiology of Environmental and Occupational Health Regulations - 5.0

EH 504 (Fall)

Principles of Toxicology - 5.0

NUR 422

Clinical Pharmacology - 3.0

NUR 582

Primary Health Care II - 3.0

NUR 582A

Clinical Decision Making II (Occ Hlth Setting) - 3.0

SPRING SEMESTER, SECOND YEAR

EH 232 (Spring)

Intro to Occupational and Environmental Medicine - 2.5

EH 241 (Spring)

Occupational Safety - 2.5

NUR 509

Research Practicum - 2.0

NUR 584

Primary Health Care III - 3.0

NUR 584B

Clinical Decision Making in the Workplace III - 4.0

NURSE PRACTITIONER TRACK

FALL SEMESTER, FIRST YEAR

NUR 404

Normal and Abnormal Human Physiology - 4.0

NUR 575

Ergonomics/ Human Factors - 2.0

SHS 410

Research Methods - 3.0

SHS 570

Health Promotion: A Global Perspective - 2.0

SPRING SEMESTER, FIRST YEAR

NUR 507

Scholarly Inquiry I - 2.0

NUR 571 (Spring)

Practice of Occupational Health - 4.0

NUR 572 (Spring)

Occupational Health Policy and Administration - 2.0

NUR 580

Primary Health Care I - 2.0

NUR 580A

Clinical Decision Making I - 1.0

SUMMER SESSION, FIRST YEAR

NUR 508

Scholarly Inquiry II - 2.0

NUR 581

Clinical Practicum - 3.0

FALL SEMESTER, SECOND YEAR

NUR 422

Clinical Pharmacology - 3.0

NUR 573

Tutorial in Toxicology - 2.0

NUR 582

Primary Health Care II - 3.0

NUR 582A

Clinical Decision Making II (Occupational Health setting) - 3.0

SPRING SEMESTER, SECOND YEAR

NUR 509

Research Practicum - 2.0

NUR 574

Intro To Occupational And Environmental Medicine - 2.0

NUR 584

Primary Health Care III - 3.0

NUR 584A

Clinical Decision Making in the Workplace III - 4.0

NUR and SHS courses are at Simmons College and carry Simmons credits.

APPENDIX B OCCUPATIONAL NURSING PUBLICATIONS

Publications and Presentations

Hauser R, Meeker JD, Duty S, Silva MJ, Calafat AM. Altered semen quality in relation to urinary concentrations of phthalate monoester and oxidative metabolites. *Epidemiology* 2006:17(6), 682-91

R. Hauser, J.D. Meeker, N.P. Singh, M.J. Silva, L. Ryan, S. Duty, and A.M. Calafat
DNA damage in human sperm is related to urinary levels of phthalate monoester and oxidative metabolites
Hum. Reprod.2007: 22(3):688-695. (Advance Access published on November 7, 2006.
doi:10.1093/humrep/del428)

Elizabeth Scott, Susan Duty , Maureen Callahan. A Pilot Study to Isolate Staphylococcus aureus and MRSA from Environmental Surfaces in the Home. *American Journal of Infection Control* In Press

Rachel Kwapniewski, Sarah Kozaczka, Russ Hauser, Manori J. Silva, Antonia M. Calafat, Susan M. Duty.
Occupational exposure to dibutyl phthalate among manicurists. In Press *Journal of Occupational and Environmental Medicine*.

A. Program Title

Occupational Medicine Core

B. Program Director

Stefanos N. Kales, MD, MPH

C. Program Description

The goals and objectives: (1) to develop board-certified, physician specialists who will be effective practitioners in the field of occupational medicine; (2) to provide sufficient flexibility in the curriculum after attaining basic competency in order that physicians might be trained in a variety of orientations suitable for careers in industry, government, academia, and elsewhere; (3) to provide research experience that enhances the ability to conduct research in the future as well as the skills needed to practice evidence-based occupational medicine; and finally (4) to identify a limited number of physicians with potential to become the next generation of academia in OM.

Responsible Conduct of Science Training: The program is committed to the ethical conduct of research and practice. All MPH residents take a course in ethics. All residents complete Human Subjects training certification with the HSPH Human Subjects Committee, as well as HIPAA training. All residents performing non-exempt research must complete Institutional Review Board (IRB) applications to all appropriate institutions and receive approval prior to undertaking their actual investigations. Each resident's research advisor plays a key role in assuring that all resident research is conducted in a responsible and ethical manner, with all appropriate approvals in place.

Faculty Participation: Supervision comes from an outstanding nationally- and internationally-renowned OM faculty who interact with trainees in a various roles- both in small groups and one-on-one. First, each trainee has an academic advisor, who is assigned prior to matriculation. Second, OM core faculty are prominent among those directing and teaching coursework. Third, a core faculty member supervises/mentors each resident's research project. Additionally, faculty serve as case discussants for grand rounds and as Practicum rotation preceptors.

Curricula: The Harvard Occupational & Environmental Medicine Residency is a fully ACGME-accredited 2-year training program for physicians leading to board-eligibility in Occupational Medicine. The MPH curriculum is built around the requirements specified by CEPH, ACGME and ABPM. The practicum year is designed to provide mastery of all ACGME general, PM & OM competencies and to meet/exceed ABPM requirements. (For more details see: http://www.hsph.harvard.edu/erc/oemr/general_description.htm) The program is also committed to the ethical conduct of research and practice.

D. Program Activities and Accomplishments

Progress toward goals and objectives:

Goal 1. To develop board-certified physician specialists who will be effective practitioners in the field of occupational medicine.

Five graduates took the ABPM boards in November 2006 and all passed with scores significantly higher (Core 609, OM 654) than the national average for OM-residency trained examinees (Core 552, OM 575). Overall, from 1998-2006, we have produced 31 board-certified specialists, with a pass rate of 100%.

Three second year residents completed training June 30, 2007, and are employed as follows:
academia/clinical

practice, the US Navy Leadership, and clinical practice/post-doctoral research. Four graduates (two of the three June 2007 graduates and two more who were part-time residents and finished between January 2006 and Spring 2007) just took the ABPM boards and are awaiting their results. Three first year residents completed MPH (1) or MOH (2) degrees. As of July 1, one resident is on a one-year leave to start a pulmonary fellowship (she returns to finish our program this July), two continued to the second (practicum) year and were joined by an additional second year resident who completed his HSPH MPH in 2005. This last resident already had two years of occupational medicine residency experience at the University of Toronto. Three new first year residents entered for the 2007-2008 year: one active duty Navy, one former U.S. Navy flight physician, and one former HSPH MPH alumnus who has decided to return to complete the occupational medicine residency.

Recruitment prospects and applications for July 2008 are very strong at this writing. We expect our census to be limited by available funding, as we have many qualified and motivated applicants so far.

Goal 2: To provide sufficient flexibility in the curriculum after attaining basic competency in order that physicians might be trained in a variety of orientations suitable for careers in industry, government, academia, and elsewhere.

Our Special Student option provides curricular flexibility for those with a prior MPH who seek to redefine their careers in the direction of occupational and environmental medicine. A 2007 HSPH OEMR graduate, who had received an MPH from Tulane in tropical medicine, completed 22.5 credits of required occupational medicine courses as an HSPH Special Student and is now ABPM board-eligible. For the upcoming year, two of the three residents will enter as Special Students: one is an aerospace-trained physician, and the other a physician who completed an HSPH MPH with a health care policy concentration and who needs to augment his basic public

health training with didactics in occupational and environmental medicine and health.

As another example of our curricular flexibility, we have granted a year's leave to an internal medicine-certified second year resident to pursue a pulmonary fellowship at UPENN. When she returns full-time in July 2008, she will undertake several specialized elective experiences in pulmonary occupational medicine. Upon graduation, she will then return to UPENN to finish her fellowship. Her ultimate plan will be a career in occupational lung disease.

Goal 3. To provide research experience that enhances the ability to conduct research in the future and provides the skills needed to practice evidence-based occupational medicine.

Not only is the research component of the OEMR rigorous, but the breadth of available topics is substantial, thereby enabling residents to follow their special areas of interest. This year the research topics included pulmonary dysfunction related to asbestos exposure, birth outcomes associated with arsenic exposure, and the predictors of case-fatality among firefighters with on-duty coronary heart disease events. The resident who undertook the birth outcomes research had established an interest in female reproductive outcomes through her previous PhD research. She was able to access Dr. Christiani's extensive research on arsenic in Bangladesh and the cohorts he has established and thereby continue her unique interests in maternal and child health. The research project undertaken by our Navy Scholar, involving on-duty coronary heart disease in firefighters was an extension of Dr. Kales' in-depth work with his well-established firefighter cohort. This resident's study has direct application to his U.S. Navy work with emergency responders. The resident who worked on asbestos is starting an academic career as a clinician investigator and is now well suited to undertake similar clinical research in the future.

Goal 4: To identify a limited number of physicians with the potential to become the next generation of academics in OM.

Dr. Belayneh Abejie, a 2007 graduate, has accepted a full-time position at University of California San Francisco's Fresno campus as an Assistant Professor of Medicine. He will begin to build an occupational medicine clinical and research program there. Dr. Karen Huyck, another 2007 graduate, is performing post-doctoral research at HSPH and continues to move towards an academic career balancing clinical and research facets. Dr. Britt Hatfield, a 2004 graduate, is full-time faculty at Mt Sinai and other recent graduates (2003 to present) are part-time faculty at medical schools and/or residency programs.

Trainee honors, awards and scholarships: Two of the three second year residents were ACOEM resident research awardees and presented their research at AOHC in May 2007. The third resident had her abstract accepted and presented at ISEE in Mexico in April 2007. Since 2000, our residents have won 10 ACOEM resident research awards, a tremendous track record. We continue our strong record of Naval and OPSF scholars. Of the six full-time residents in the program in 2006-2007, one was a Navy Scholar and three were OPSF scholars. We currently have two OPSF scholars and one Naval scholar.

Faculty honors, awards, appointments: Dr. Howard Hu, former director of the OEM Residency, received the 2006 Harriet Hardy Award from the New England College of Occupational & Environmental Medicine in November. Dr. David Christiani, Professor & ERC Director, received the 2007 Kehoe award from ACOEM. Dr. Kales was voted teacher of the year by the residents for 2006-2007.

Trainee theses and dissertations: All three second-year residents completed intense research projects and have submitted their papers to the following peer-reviewed journals.

- Belayneh Abejie: Patterns of Pulmonary Dysfunction in Asbestos Workers. Submitted to the American Journal of Industrial Medicine. Research Advisor: David Christiani, MD, MPH, MS.
- Karen Huyck: Arsenic Exposure and Birth Outcomes in Bangladesh. Submitted to Journal of Environmental and Occupational Medicine. Press release is located at <http://www.acoem.org/news.aspx?id=3604?> Research Advisor: David Christiani, MD, MPH, MS

- Jesse Geibe: On-duty Coronary Heart Disease in Firefighters, Predictors of Fatal Events. Submitted to the American Journal of Cardiology. Research Advisor: Stefanos Kales, MD, MPH.

New faculty positions: On July 1, 2006, Dr. Stefanos Kales, a program alumnus and faculty member, became the Director of the Occupational and Environmental Medicine Residency.

New courses: We have made no significant changes to the MPH curriculum since our last report.

Trainee recruitment including diversity efforts: Trainees were recruited through the Harvard ERC/OEMR website, Frieda On-Line, and the ACGME website. Potential candidates were emailed and called by both Dr. Kales and Ms. Backus. More than 60% of the completed applications for the residency program 2007-2008 were from minority candidates. Of the nine applicants, 3 were African-American, 2 were Asian, and 2 were women. Of the five minority candidates interviewed, two were accepted and one will attend beginning in August 2007. During the 2006-2007 year, 33% of the residents were women and 33% were ethnic minorities.

E. Program Products

The OEMR program sponsored bimonthly Grand Rounds throughout the academic year. Second year residents present cases from their clinical experience and invite experts to discuss them. For the 11 Grand Rounds we held in 2006-2007, the topics ranged from Young Worker Safety and Health in Massachusetts to

Silicosis and Lung Cancer Screening Controversies. Speakers were from HSPH and a variety of affiliated institutions including MIT, Massachusetts General Hospital, and Massachusetts Department of Public Health. One highlight was a Grand Rounds presentation by an HSPH OEMR alumnus on Employees' Risks associated

with Exposure to Anti-neoplastic Agents in the Oncology Clinic by Elpidoforus Soteriades, MD, SM, ScD, of the Bank of Cyprus Oncology Center. These Grand Rounds are attended by IH, injury, nursing, and epidemiology students; health care providers and health and safety professionals from the community are welcomed and attend as well. One hour of CME credit is awarded to physicians who attend.

In addition, a monthly Career Seminar Series, designed and launched by Dr. Kales and Dr. Abejie, Chief Resident in 2006-2007, featured topics on workers' compensation, the medical review officer role, independent medical assessment, and board preparation.

The ERC-sponsored Acute and Chronic Noise Exposure developed collaboratively by Ann Backus, Robert Herrick, and Royce Clifford, a 2006 MPH graduate, was attended by 10 physicians, five PhDs, five audiologists, two industrial hygienists, four RN/BSNs, seven certified occupational health nurses, and five others. The content that drew physicians was the pathophysiology of noise-induced hearing loss (NIHL), future drug treatments, synergistic exposures of chemicals and noise, and a strong emphasis on both civilian and military research on NIHL.

Physicians were also attracted to a CME course providing an update on asbestos, which was sponsored jointly by HSPH, Harvard Medical School and the Massachusetts General Hospital.

Research to practice is underscored primarily during the annual conference of the New England College of Occupational and Environmental Medicine (NECOEM, the regional component society of ACOEM) where Harvard faculty moderate and present in the Clinical Research Update segment of the two-day congress. Ann Backus, OEMR administrator, presented a vendor table featuring the occupational medicine and occupational nursing programs as well as the ERC Continuing Education course offerings.

F. Future Plans

The Acute and Chronic Noise Exposure Course which was very successful in 2007 will be repeated March 26-

28, 2008. This year, in addition to CMEs for physicians and CEUs for audiologists, we will offer CNEs for occupational health nurses.

In 2007-2008, The OEMR will pilot-test a project to webcast the traditional Grand Rounds in an effort to reach out to the larger community and to national audiences. Several practice sessions have been scheduled for the fall of 2007; beta-testing of the 2008 spring series of webcast Grand Rounds will take place at the University of Connecticut Occupational Medicine Residency Program. We will continue to expand the Career Seminar series to encompass additional topics such as health, productivity and management, and physician health and wellness.

A preliminary agreement has been signed with Les Yee, MD, MPH, an HSPH alumnus and Medical Director of Proctor and Gamble, to establish a corporate rotation for residents at Gillette (belongs to P& G) in the Boston area. Negotiations are also underway with Raytheon.

APPENDIX A OCCUPATIONAL MEDICINE CURRICULUM

SUMMER SEMESTER^a

(The Summer Session of the Clinical Effectiveness Program {CEP} is recommended for all occupational and environmental medicine residents. 15 credits must be taken.) Courses taken in CEP or traditional Summer School sessions replace some listed here for Fall and Spring.

BIO 206b (Summer1)

Introductory Statistics for Medical Research - 2.5

BIO 207c (Summer2)

Statistics for Medical Research II - 2.5

BIO 208c (Summer2)

Statistics for Medical Research, Advanced - 2.5

EH 202m (Summer2)

Principles of Environmental Health - 2.5

EPI 208b (Summer)

Introduction to Clinical Epidemiology - 5.0

ID 215

Occupational and Environmental Epidemiology - 2.5

ID 251d (Summer1)

Ethical Basis of the Practice of Public Health: Health Care Delivery- 2.5

SHH 201d,g (Summer1)

Society and Health - 2.5

FALL SEMESTER

BIO 200e (Fall)

Principles of Biostatistics - 5.0

BIO 213 (Fall)

Applied Regression for Clinical Research- 5.0

EH 201* (Fall2)

Introduction to Environmental Health - 2.5

EH 243h (Fall)

Ergonomics/Human Factors - 2.5

EH 262 (Fall)

Introduction to the Work Environment- 2.5

EH 504o (Fall)(Sec1, Sec 2)

Principles of Toxicology - 2.5, 5.0

EPI 200f (Fall1)

Principles of Epidemiology- 2.5

ID 250i,j,k (Fall2)

Ethical Basis of the Practice of Public Health - 2.5

SHH 201g (Fall1)

Society and Health (or approved option) - 2.5

SHH 281 (Fall2)

Methods for research on Social and Behavioral Dimensions of Public Health (or approved option)- 2.5

WINTER SESSION

EH 281k (Winter)

Occupational Health Care Delivery - 2.5

(not offered 2008)

EH 330*(Winter)

Field Experience in International Occupational Health Safety - 2.5

SPRING SEMESTER

BIO 210* (Spring)

The Analysis of Rates and Proportions - 5.0

EH 231k (Spring)

Occupational Health Policy and Administration - 2.5

EH 232k (Spring)

Introduction to Occupational and Environmental Medicine - 2.5

EH 241h (Spring)

Occupational Safety - 2.5

EH 278* (Spring)(cancelled)

Health and the Global Environment - 5.0

ID 215 (Spring)

Environmental and Occupational Epidemiology - 2.5

ID 250i,j,m (Spring1)

Ethical Basis of the Practice of Public Health - 2.5

ID 263k (Spring)

Practice of Occupational Health - 5.0

MIT 10.805J*

Technology, Law, and the Working Environment - 5.0

*Elective

a The Clinical Effectiveness Program (CEP) is recommended for all occupational and environmental medicine residents. Please discuss with Ann Backus.

- b Required if enrolled in Summer Session. (CEP)
- c BIO 206 and BIO 207 summer2 or BIO 208 summer2 required if enrolled in Summer Session; BIO 208 summer2 is more highly recommended as preparation for the Residency research projects, if available.
- d Available during the summer or regular academic year; one of these (ID 250 fall2 or ID 251 summer1) should be taken.
- e Not to be taken if BIO 206 summer1 and BIO 207 summer2 (or BIO 208 summer2) taken during the Summer.
- f Not to be taken if EPI 208 summer or 2.5-5.0 credits of another basic EPI taken during the Summer.
- g Either SHH 201 summer1 , SHH 201 fall1 , or an approved option must be taken.
- h EH 243 fall or EH 241 spring required.
- i Elective in the MOH Program; required in the MPH Program.
- j Not to be taken if ID 251 summer1 taken during the Summer. Alternative is ID 250 spring1
- k Required for Residency.
- l Not to be taken if ID 251 summer2 taken during the Summer.
- m To be taken if ID 251 is not offered.
- n Not required for residency.
- o With permission from S. Kales, Section 2 (~66%) may be taken for 2.5 credits. See Ann Backus.
- # This track must be taken if in the occupational and environmental medicine residency.

APPENDIX B OCCUPATIONAL MEDICINE PUBLICATONS

Smith GS, Timmons RA, Lombardi DA, Mamidi DK, Matz S, Courtney TK, Perry MJ. Work-related ladder fall fractures: identification and diagnosis validation using narrative text. Accid Anal Prev. 2006 Sep;38(5):973-80.

Lueken RJ, Heffner AC, Parks PD. Treatment of severe carbon monoxide poisoning using a portable hyperbaric oxygen chamber. Ann Emerg Med. 2006 Sep;48(3):319-22.

Weuve J, Sanchez BN, Calafat AM, Schettler T, Green RA, Hu H, Hauser, R. Exposure to phthalates in neonatal intensive care unit infants: urinary concentrations of monoesters and oxidative metabolites. Environmental Health Perspectives. 2006 Sep; 114(9):1424-31.

Holder JD, Stalling L, Peeples L, Burress JW, Kales SN. Firefighter Heart Presumption Retirements in Massachusetts: 1997-2004. J Occup Environ Med. 2006 Oct; 48:1047-1053.

Kapoor S, Shaw WS, Pransky G, Patterson W. Initial patient and clinician expectations of return to work after acute onset of work-related low back pain. J Occup Environ Med. 2006 Nov;48(11):1173-80.

Muzzafer S, Kales SN. Occupational Medicine Forum: What Are the Major Points and Emerging Issues in Radiologic Imaging for Pneumoconiosis Surveillance and Diagnosis? (submitted)

Mbanu I, Wellenius GA, Mittleman MA, Peeples L, Stallings LA, Kales SN. Seasonality and Coronary Heart Disease Deaths in United States Firefighters. (submitted)

Lee EC, Kales SN. Chemical Weapons and Public Health. In: Levy BS, Sidel V, eds. War and Public Health, 2nd ed. 2007 (in Press).

Greenough PG, Lappi MD, Hsu EB, Fink S, Hsieh YH, Vu A, Heaton C, Kirsch TD. 2007. Burden of disease and health status among hurricane Katrina-displaced persons in shelters: A population-based cluster sample. Ann Emerg Med. Jun 19

Kales SN, Huyck KL, Goldman RH. Elevated Urine Arsenic: Un-Speciatiated Results Lead to Unnecessary Concern and Further Evaluations. *J Analytic Toxicol* 2006;30:80-5.

Kales SN, Soteriades ES, Christophi CA, Christiani DC. Emergency Duties and Deaths from Heart Disease among Firefighters in the United States. *N Engl J Med*. 2007;356:1207-15.

Mbanu I, Wellenius GA, Mittleman MA, Peeples L, Stallings LA, Kales SN. Seasonality and Coronary Heart Disease Deaths in United States Firefighters. *Chronobiol Int*. 2007; 24: 715–26.

Abejie BA, Chung EH, Nesto RW, Kales SN. Grand Rounds: Asbestos-Related Pericarditis in a Boiler Operator. *Environ Health Perspect*. (In Press) doi:10.1289/ehp.10354 available via <http://dx.doi.org/> [Online 11 September 2007].

Spaeth K, Tsismenakis AJ, Kales SN. Neurotoxicity and Heavy Metals: A Clinical Perspective. In: *Neurotoxicity Syndromes Research*. Nova Science Inc., New York (In Press).

Huyck K, Kile M, Mahiuddin G, Quamruzzaman Q, Rahman M, Breton C, Dobson C, Frelich J, Hoffman E, Yousuf J, Afroz, S, Islam S, Christiani D. Maternal Arsenic Exposure Associated With Low Birth Weight in Bangladesh. *J Occup Environ Med*. 49 (10); 2007.

Geibe JR, Holder J, Peeples L, Kinney AM, Burress JW, Kales SN. Predictors of On-Duty Coronary Events in U.S. Male Firefighters. *Amer J Cardiol* 2008 (in press).

Ji H, Ramsey MR, Hayes DN, Fan C, McNamara K, Kozlowski P, Torrice C, Wu MC, Shimamura T, Perera SA, Liang MC, Cai D, Naumov GN, Bao L, Contreras CM, Li D, Chen L, Krishnamurthy J, Koivunen J, Chirieac LR, Padera RF, Bronson RT, Lindeman NI, Christiani DC, Lin X, Shapiro GI, Janne PA, Johnson BE, Meyerson M, Kwiatkowski DJ, Castrillon DH, Bardeesy N, Sharpless NE, Wong KK. LKB1 modulates lung cancer differentiation and metastasis. *Nature*. 2007 Aug 16;448(7155):807-10. Epub 2007 Aug 5.

Bajwa EK, Boyce PD, Januzzi JL, Gong MN, Thompson BT, Christiani DC. Biomarker evidence of myocardial cell injury is associated with mortality in acute respiratory distress syndrome. *Crit Care Med*. 2007 Aug 14.

Sholl LM, John Iafrate A, Chou YP, Wu MT, Goan YG, Su L, Huang YT, Christiani DC, Chirieac LR. Validation of chromogenic in situ hybridization for detection of EGFR copy number amplification in nonsmall cell lung carcinoma. *Mod Pathol*. 2007 Aug 3.

Cavallari JM, Eisen EA, Chen JC, Fang SC, Dobson CB, Schwartz J, Christiani DC. Night heart rate variability and particulate exposures among boilermaker construction workers. *Environ Health Perspect*. 2007 Jul;115(7):1046-51.

Chen JC, Cavallari JM, Stone PH, Christiani DC. Obesity is a modifier of autonomic cardiac responses to fine metal particulates. *Environ Health Perspect*. 2007 Jul;115(7):1002-6.

Harezlak J, Wang M, Christiani D, Lin X. Quantitative quality-assessment techniques to compare fractionation and depletion methods in SELDI-TOF mass spectrometry experiments. *Bioinformatics*. 2007 Jul 11.

Kile ML, Houseman EA, Breton CV, Smith T, Quamruzzaman Q, Rahman M, Mahiuddin G, Christiani DC. Dietary arsenic exposure in bangladesh. *Environ Health Perspect*. 2007 Jun;115(6):889-93.

Huang W, Smith TJ, Ngo L, Wang T, Chen H, Wu F, Herrick RF, Christiani DC, Ding H. Characterizing and biological monitoring of polycyclic aromatic hydrocarbons in exposures to diesel exhaust. *Environ Sci Technol*. 2007 Apr 15;41(8):2711-6.

McCarty KM, Smith TJ, Zhou W, Gonzalez E, Quamruzzaman Q, Rahman M, Mahiuddin G, Ryan L, Su L,

Christiani DC. Polymorphisms in XPD (Asp312Asn and Lys751Gln) genes, sunburn and arsenic-related skin lesions. *Carcinogenesis*. 2007 Aug;28(8):1697-702. Epub 2007 Apr 29.

McCarty KM, Chen YC, Quamruzzaman Q, Rahman M, Mahiuddin G, Hsueh YM, Su L, Smith T, Ryan L, Christiani DC. Arsenic methylation, GSTT1, GSTM1, GSTP1 polymorphisms, and skin lesions. *Environ Health Perspect*. 2007 Mar;115(3):341-5. Epub 2006 Dec 20.

Bajwa EK, Yu CL, Gong MN, Thompson BT, Christiani DC. Pre-B-cell colony-enhancing factor gene polymorphisms and risk of acute respiratory distress syndrome. *Crit Care Med*. 2007 May;35(5):1290-5.

Christiani DC, Pao W, DeMartini JC, Linnoila RI, Malkinson AM, Onn A, Politi KA, Sharp M, Wong KK. BAC consensus conference, November 4-6, 2004: epidemiology, pathogenesis, and preclinical models. *J Thorac Oncol*. 2006 Nov;1(9 Suppl):S2-7. Erratum in: *J Thorac Oncol*. 2007 Jan;2(1):11.

Liu G, Gurubhagavatula S, Zhou W, Wang Z, Yeap BY, Asomaning K, Su L, Heist R, Lynch TJ, Christiani DC. Epidermal growth factor receptor polymorphisms and clinical outcomes in non-small-cell lung cancer patients treated with gefitinib. *Pharmacogenomics J*. 2007 Mar 20.

Breton CV, Zhou W, Kile ML, Houseman EA, Quamruzzaman Q, Rahman M, Mahiuddin G, Christiani DC. Susceptibility to arsenic-induced skin lesions from polymorphisms in base excision repair genes. *Carcinogenesis*. 2007 Jul;28(7):1520-5.

Zhang H, Hang J, Wang X, Zhou W, Sun B, Dai H, Su L, Christiani DC. TNF polymorphisms modify endotoxin exposure-associated longitudinal lung function decline. *Occup Environ Med*. 2007 Jun;64(6):409-13. Epub 2007 Mar 1.

Zhai R, Gong MN, Zhou W, Thompson TB, Kraft P, Su L, Christiani DC. Genotypes and haplotypes of the VEGF gene are associated with higher mortality and lower VEGF plasma levels in patients with ARDS. *Thorax*. 2007 Aug;62(8):718-22. Epub 2007 Feb 8.

McMahon PM, Christiani DC. Computed tomography screening for lung cancer. *BMJ*. 2007 Feb 10;334(7588):271.

McCarty KM, Ryan L, Houseman EA, Williams PL, Miller DP, Quamruzzaman Q, Rahman M, Mahiuddin G, Smith T, Gonzalez E, Su L, Christiani DC. A case-control study of GST polymorphisms and arsenic related skin lesions. *Environ Health*. 2007 Feb 6;6:5.

Liu G, Zhou W, Yeap BY, Su L, Wain JC, Ponerros JM, Nishioka NS, Lynch TJ, Christiani DC. XRCC1 and XPD polymorphisms and esophageal adenocarcinoma risk. *Carcinogenesis*. 2007 Jun;28(6):1254-8.

Zhai R, Zhou W, Gong MN, Thompson BT, Su L, Yu C, Kraft P, Christiani DC. Inhibitor kappaB-alpha haplotype GTC is associated with susceptibility to acute respiratory distress syndrome in Caucasians. *Crit Care Med*. 2007 Mar;35(3):893-8.

Porojnicu AC, Robsahm TE, Dahlback A, Berg JP, Christiani D, Bruland OS, Moan J. Seasonal and geographical variations in lung cancer prognosis in Norway. Does Vitamin D from the sun play a role? *Lung Cancer*. 2007 Mar;55(3):263-70.

Zhou W, Heist RS, Liu G, Asomaning K, Miller DP, Neuberg DS, Wain JC, Lynch TJ, Christiani DC. Second hand smoke exposure and survival in early-stage non-small-cell lung cancer patients. *Clin Cancer Res*. 2006 Dec 1;12(23):7187-93.

- Gong MN, Zhou W, Williams PL, Thompson BT, Pothier L, Christiani DC. Polymorphisms in the mannose binding lectin-2 gene and acute respiratory distress syndrome. *Crit Care Med*. 2007 Jan;35(1):48-56.
- Zhou W, Heist RS, Liu G, Neuberg DS, Asomaning K, Su L, Wain JC, Lynch TJ, Giovannucci E, Christiani DC. Polymorphisms of vitamin D receptor and survival in early-stage non-small cell lung cancer patients. *Cancer Epidemiol Biomarkers Prev*. 2006 Nov;15(11):2239-45.
- Chen JC, Stone PH, Verrier RL, Nearing BD, MacCallum G, Kim JY, Herrick RF, You J, Zhou H, Christiani DC. Personal coronary risk profiles modify autonomic nervous system responses to air pollution. *J Occup Environ Med*. 2006 Nov;48(11):1133-42.
- Heist RS, Marshall AL, Liu G, Zhou W, Su L, Neuberg D, Lynch TJ, Wain J, Christiani DC. Matrix metalloproteinase polymorphisms and survival in stage I non-small cell lung cancer. *Clin Cancer Res*. 2006 Sep 15;12(18):5448-53.
- Fang SC, Eisen EA, Dai H, Zhang H, Hang J, Wang X, Christiani DC. Cancer mortality among textile workers in Shanghai, China: a preliminary study. *J Occup Environ Med*. 2006 Sep;48(9):955-8.
- Miller DP, Asomaning K, Liu G, Wain JC, Lynch TJ, Neuberg D, Su L, Christiani DC. An association between glutathione S-transferase P1 gene polymorphism and younger age at onset of lung carcinoma. *Cancer*. 2006 Oct 1;107(7):1570-7.
- Webster BS, Courtney TK, Huang YH, Matz S, Christiani DC. Survey of acute low back pain management by specialty group and practice experience. *J Occup Environ Med*. 2006 Jul;48(7):723-32. Erratum in: *J Occup Environ Med*. 2006 Sep;48(9):969-71.
- Zhou W, Heist RS, Liu G, Park S, Neuberg DS, Asomaning K, Wain JC, Lynch TJ, Christiani DC. Smoking cessation before diagnosis and survival in early stage non-small cell lung cancer patients. *Lung Cancer*. 2006 Sep;53(3):375-80. Epub 2006 Jun 30.
- Yu CL, Wang SF, Pan PC, Wu MT, Ho CK, Smith TJ, Li Y, Pothier L, Christiani DC; Kaohsiung Leukemia Research Group. Residential exposure to petrochemicals and the risk of leukemia: using geographic information system tools to estimate individual-level residential exposure. *Am J Epidemiol*. 2006 Aug 1;164(3):200-7. Epub 2006 Jun 5.
- Breton CV, Houseman EA, Kile ML, Quamruzzaman Q, Rahman M, Mahiuddin G, Christiani DC. Gender-specific protective effect of hemoglobin on arsenic-induced skin lesions. *Cancer Epidemiol Biomarkers Prev*. 2006 May;15(5):902-7.
- Astrakianakis G, Seixas NS, Camp JE, Christiani DC, Feng Z, Thomas DB, Checkoway H. Modeling, estimation and validation of cotton dust and endotoxin exposures in Chinese textile operations. *Ann Occup Hyg*. 2006 Aug;50(6):573-82.
- Hauser R, Meeker JD, Duty S, Silva M, Calafat A. Altered semen quality in relation to urinary levels of phthalate monoester and oxidative metabolites. *Epidemiology* 2006;17:682-691.
- Meeker JD, Barr DB, Serdar B, Rappaport SM, Hauser R. Utility of 1-naphthol and 2-naphthol levels to assess environmental carbaryl and naphthalene exposure in an epidemiology study. *J Exp Sci Environ Epid* 2007;17:314-320.

Hauser R, Meeker JD, Singh NP, Silva MJ, Ryan L, Duty S, Calafat AM. DNA damage in human sperm is related to urinary levels of phthalate monoester and oxidative metabolites. Human Reprod 2007;22:688-695.

Meeker JD, Altshul L, Hauser R. Serum PCBs, p,p'-DDE and HCB predict thyroid hormone levels in men. Environ Res 2007;104:296-304.

Meeker JD, Godfrey-Bailey L, Hauser R. Relationships between serum hormone levels and semen quality among men from an infertility clinic. J Androl 2007;28:397-406.

Meeker JD, Missmer SA, Cramer DW, Hauser R. Maternal exposure to secondhand tobacco smoke and pregnancy outcome among couples undergoing assisted reproduction. Human Reprod 2007;22:337-345.

Meeker JD, Calafat AM, Hauser R. Di-(2-ethylhexyl) phthalate metabolites may alter thyroid hormone levels in men. Environ Health Perspect 2007;115:1029-1034.

Meeker JD, Missmer SA, Vitonis AF, Cramer DW, Hauser R. Risk of spontaneous abortion in women with childhood exposure to parental cigarette smoke. Am J Epidemiol 2007;166:571-575.

Vandenberg LN, Hauser R, Marcus M, Olea N, Welshons WV. Human exposure to bisphenol A (BPA). Reprod Toxicol (In Press).

vom Saal FS, Akingbemi BT, Belcher SM, Birnbaum LS, Crain DA, Ericksen M, Farabollini F, Guillette LJ, Hauser R, Heindel JJ, et al. Chapel Hill Bisphenol A Expert Panel Consensus Statement: Integration of Mechanisms, Effects in Animals and Potential to Impact Human Health at Current Levels of Exposure. Reprod Toxicol (In Press).

Herrick RF, Meeker JD, Hauser R, Altshul L, Weymouth GA. Serum PCB levels and congener profiles among U.S. construction workers. Environ Health: A Global Access Science Source 2007;6:25.

Silva MJ, Samandar E, Reidy JA, Hauser R, Needham LL, Calafat AM. Metabolite profiles of di-n-butyl phthalate in rats and humans. Environ Sci Technol (In Press).

Presentations

Kales SN. "Heart Disease in Firefighters: from Risk Factors to On-Duty Death". Occupational Health Colloquium, University of Connecticut Health Center, Division of Occupational & Environmental Medicine, Farmington, Connecticut.

Kales SN. Moderator, Research Session. New England College of Occupational & Environmental Medicine, 2006 Annual Conference, Bedford, MA.

Kales SN. Invited Presentation, "Estimated Burden of Disease from Household Carbon Monoxide Poisonings in Europe." WHO second technical meeting on quantifying disease from inadequate housing. WHO Regional Office for Europe, Bonn, Germany.

Dr. Russ Hauser presented a lecture entitled "Phthalates and Male Reproductive Health" in September 2006 to the European Council for Phthalate Esters and Intermediates and a lecture on endocrine disruptors at the Boston University School of Public Health in November 2006.

Dr. Belayneh Abejie, Chief Resident made a presentation at the Cambridge Health Alliance in January 2007 on the topic of "Silica Exposure and Autoimmune Diseases."

Dr. Kales. Invited Speaker and Trainer, "Clinical Syndrome-Based Recognition of Chemical Hazards." European Training for Health Professionals on Rapid Response to Health Threats: Pilot Course, Athens,

Greece. May 2007

Dr. Kales. Invited Speaker. "Cardiovascular Disease in Firefighters". Occupational Health Speaker Series, University of Michigan School of Public Health, April 2007.

A. Program Title

Occupational Epidemiology Special Component Core

B. Program Director

David C. Christiani, MD, MPH

C. Program Description

The primary goal of the Occupational Epidemiology Academic Training is to train research leaders in the discipline, capable of conducting independent research on populations exposed to workplace hazards. Program objectives include: educating trainees with doctoral preparation in occupational epidemiology, providing rigorous training in general epidemiologic methods, and enabling trainees to acquire expertise in the subject area of occupational epidemiology. Education occurs at the doctoral and post-doctoral levels, with eligible research topics including the gamut of occupational disorders. The core faculty in Epidemiology includes Dr. Richard Monson, Dr. David Christiani, Dr. Ellen Eisen, Dr. Russ Hauser, Dr. Philippe Grandjean, Dr. Robert Wright, and Dr. Marc Weisskopf (new). Several hold a joint appointment with the Department of Environmental Health and Department of Epidemiology in the Harvard School of Public Health. The core faculty and associated faculty from the Departments of Biostatistics, Epidemiology, Environmental Health, and Health and Social Behavior, cover the entire gamut in research disciplines: from methodology to applied field research. Indeed, the HSPH faculty is one of the most productive in epidemiologic and biostatistical research in the world today. Students without a prior Master's degree will spend most of their first two years in formal courses in epidemiology, biostatistics, occupational health, industrial hygiene and exposure assessment, toxicology and biostatistics. In their third or fourth semester at HSPH, pre-doctoral students identify a thesis topic and work on that until completion of the doctoral degree. The average duration of a doctoral degree program is 5 years.

D. Program Activities and Accomplishments

The faculty has been very successful in continuing to raise sponsored research funds from NIH, CDC and other agencies.

Moreover, an increasing number of pre-doctoral and post-doctoral applicants have identified occupational epidemiology as their focus. A number of these individuals are pursuing joint degrees in Epidemiology and Occupational Health.

Trainee honors, awards, and scholarships

Shona Fang won the best student research award in a school-wide research poster competition in March, 2007. Her research has focused on the acute endothelial vascular responses to welding fume exposure.

Jennifer Cavallari presented a poster "Circadian variation of heart rate variability following metal-rich fine particulate exposures in boilermaker construction workers" at the 19th International Conference on Epidemiology in Occupational Health in Banff, Canada. It was well received and she was awarded Best Poster by a Young Investigator by the European Centre for Ecotoxicology and Toxicology for Chemicals.

Trainee theses and dissertations

Jennifer Cavallari - Cardiovascular Responses to Occupational Metal-Rich Particulate Exposure

Chenyu Liu - Gene-Environment Interactions for Childhood Leukemia

Jennifer Adibi – Placental Function and Pregnancy Outcomes in Relation to Phthalate Exposure

New faculty positions

A search for an assistant professor in environmental and occupational neuroepidemiology, which will analyze the interplay between genetic and environmental exposures of neuro-degenerative diseases was completed and resulted in the addition of Dr. Marc Weisskopf to the core faculty.

There have been no changes in the curriculum for the Occupational Epidemiology training program.

Trainee recruitment including diversity efforts: With respect to trainee diversity and recruitment efforts, The Harvard School of Public Health recognizes the need for increased participation of persons from underrepresented groups as students, fellows, and faculty. In 1985, the School established the Office of Professional Development to take the lead in developing a program for minority development and retention. Mr. Stan Hudson, Associate Dean for Students has responsibility for this program. Dean Hudson has targeted recruitment activities toward the Departments of Biostatistics, Environmental Health, Epidemiology, and Nutrition. Focus is on increasing the numbers of inquiries about our training programs, enhancing the number and quality of applications, and facilitating the admission and matriculation of high quality students.

Also, HSPH is a member of the National Consortium for Educational Access (NCEA). This consortium is comprised of 35 graduate degree-granting institutions and 47 historically Black colleges and universities. NCEA's goal is to increase the number of doctoral-trained minorities. Literature is distributed regularly to NCEA member institutions, and seven institutions have identified candidates as potential HSPH students.

E. Program Products

Trainee publications are listed in the appendix. In addition, a number of research projects were performed that have significant trainee involvement including an epidemiologic study of the effects of phthalates on male reproductive parameters (PI: Hauser; trainee: Adibi); a study of the cardiac effects of welding exposures (PI: Christiani; trainees- Cavallari, Fang), a study of parental occupational exposures and leukemia in offspring (PI: Christiani; trainees – Liu). In addition, several large studies were initiated, including a study of injuries in the meatpacking industry (PI: Perry; trainee- Lander), a study of repetitive upper extremity injuries (PI: Dennerlein; trainee - Lee), a study of work organizational factors in the health care industry and their impact on worker health (PI: McNeely; trainee- Hopcia), the role of occupational injury in suicide (PI: Christiani; trainee – Kim), the role of genetic modification of occupational endotoxin exposure (PI: Christiani; trainee- Mehta); exposure to machining fluids and endotoxins and cancer in auto workers (PI: Eisen; trainee- Miller), as well as developmental effects of lead and other metal exposures (PI: Wright and Hu; trainees – Wang), and mercury exposures among whalemens

(Grandjean).

F. Future Plans

Our plans include continued recruitment of the best candidates for the doctoral program. Those receiving support will be chosen on a competitive basis and comprise the most promising future researchers in the field of epidemiology.

**APPENDIX A
OCCUPATIONAL EPIDEMIOLOGY PROGRAM CURRICULUM**

The following is a list of didactic courses that will be required for pre-doctoral students. Exceptions to these requirements will be made only if suitable prior training (e.g., MD degree, Master's degree) or alternate courses exist. A description of each course is provided in the school course catalogue. Ordinarily, a 2.5-credit course has 32 class-hours per semester and a 5.0-credit has 64 class-hours per semester. Courses listed as "F₁ and F₂" meet in the fall, and "S₁ and S₂" courses meet in the spring. Courses listed as "W" meet during Winter session.

COURSE	TITLE	CREDITS
BIO201 F ₁ F ₂	Principles of Biostatistics	5.0
BIO210 S ₁ S ₂	Analysis of Rates and Proportions	5.0
-or- BIO213	Applied Regression for Clinical Research	
EH205 F ₁ F ₂	Human Physiology	5.0
EH231 S ₁ S ₂	Occupational Health Policy and Administration	2.5
EH236 F ₁ F ₂	Epidemiologic Basis of Occ and Env Health Standards	5.0
EH243 F ₁ F ₂	Ergonomics/ Human Factors	2.5
EH262 F ₁ F ₂	Introduction to the Work Environment	2.5
EH269 S ₁ S ₂	Exposure Assessment for Env & Occ Epidemiology	2.5
EPI201 F ₁	Introduction to Epidemiology	2.5
EPI202 F ₂	Elements of Epidemiologic Research	2.5
EPI203 S ₁	Design of Cohort and Case-Control Studies	2.5
EPI204 S ₂	Analysis of Case-Control and Cohort Studies	2.5
HPM292 S ₂	Research Ethics	1.25
EH508 F ₁ F ₂	Principles of Toxicology	5.0
ID215 S ₁ S ₂	Environ and Occupational Epidemiology	2.5
ID263 S ₁ S ₂	Practice of Occupational Health	5.0

ELECTIVES - Among the electives, students supported by the ERC Occupational Epidemiology Core will take at least 10 credits from the following list of courses related to occupational and environmental exposures or to biomarkers:

COURSE	TITLE	CREDITS
BIO222 F ₁ F ₂	Basics of Statistical Inference	5.0
BIO245 F ₁ F ₂	Analysis of Multivariate and Longitudinal Data	5.0
EH201 F ₂	Introduction to Environmental Health	2.5
EH201 S ₂	Principles of Environmental Health	2.5
EH241 S ₁ S ₂	Occupational Safety and Injury Prevention	2.5
EH282 S ₂	Injury Epidemiology and Prevention	2.5
EH261 F ₁	Properties of Environmental Contaminants	2.5
EH281 W	Occupational Health Care Delivery	2.5
EH292 S ₁	Properties and Behavior of Airborne Particles	2.5
EH295 S ₁ S ₂	Air Pollution and Energy Processes	5.0
EPI221 W	Pharmacoepidemiology	2.5
EPI240 S ₂	Use of Biomarkers in Epidemiologic Research	1.25

EPI249 F ₁	Molecular Biology for Epidemiologists	2.5
EPI 250 F ₂	Molecular Epidemiology of Chronic Diseases	2.5
EPI251 S ₁	Studies in Molecular Epidemiology	1.25
ID214 S ₁ S ₂	Nutritional Epidemiology	2.5
ID228 S ₂	Principles of Screening	2.5
RDS500 S ₂	Risk Assessment	2.5

In addition, students will ordinarily take at least 10 credits from the following list:

COURSE	TITLE	CREDITS
BIO211 S ₁ S ₂	Regression and Analysis of Variance in Experimental Research	5.0
BIO212 S ₁ S ₂	Survey Research Methods in Community Health	2.5
BIO213 F ₁ F ₂	Applied Regression for Clinical Research	5.0
BIO226 F ₁ F ₂	Applied Longitudinal Analysis	5.0
BIO233 S ₁ S ₂	Methods II	5.0
EH208 S ₁ S ₂	Pathophysiology of Human Disease	5.0
EH232 S ₁ S ₂	Introduction to Occ. and Environmental Medicine	2.5
EPI205 F ₁ F ₂	Practice of Epidemiology	2.5
EPI207 F ₁	Advanced Epidemiologic Methods	2.5
EPI213 S ₁	Epidemiology of Cancer	2.5
EPI246 F ₂	Applied Biomarkers in Cancer Epidemiology	2.5
EPI247 F ₂	Epidemiologic Methods Development	2.5
EPI269 F ₂	Epidemiologic Research in Obstetrics and Gynecology	2.5
EPI287 F ₂	Epidemiology of Reproductive Morbidity	1.25
ID269 F ₂	Respiratory Epidemiology	1.25
ID271 S ₁	Advanced Regression for Environmental Epi	2.5

APPENDIX B
OCCUPATIONAL EPIDEMIOLOGY PUBLICATIONS

Ji H, Ramsey MR, Hayes DN, Fan C, McNamara K, Kozlowski P, Torrice C, Wu MC, Shimamura T, Perera SA, Liang MC, Cai D, Naumov GN, Bao L, Contreras CM, Li D, Chen L, Krishnamurthy J, Koivunen J, Chirieac LR, Padera RF, Bronson RT, Lindeman NI, Christiani DC, Lin X, Shapiro GI, Janne PA, Johnson BE, Meyerson M, Kwiatkowski DJ, Castrillon DH, Bardeesy N, Sharpless NE, Wong KK. LKB1 modulates lung cancer differentiation and metastasis. *Nature*. 2007 Aug 16;448(7155):807-10. Epub 2007 Aug 5.

Bajwa EK, Boyce PD, Januzzi JL, Gong MN, Thompson BT, Christiani DC. Biomarker evidence of myocardial cell injury is associated with mortality in acute respiratory distress syndrome. *Crit Care Med*. 2007 Aug 14.

Sholl LM, John Iafrate A, Chou YP, Wu MT, Goan YG, Su L, Huang YT, Christiani DC, Chirieac LR. Validation of chromogenic in situ hybridization for detection of EGFR copy number amplification in nonsmall cell lung carcinoma. *Mod Pathol*. 2007 Aug 3.

Cavallari JM, Eisen EA, Chen JC, Fang SC, Dobson CB, Schwartz J, Christiani DC. Night heart rate variability and particulate exposures among boilermaker construction workers. *Environ Health Perspect*. 2007 Jul;115(7):1046-51.

Chen JC, Cavallari JM, Stone PH, Christiani DC. Obesity is a modifier of autonomic cardiac responses to fine metal particulates. *Environ Health Perspect*. 2007 Jul;115(7):1002-6.

Harezlak J, Wang M, Christiani D, Lin X. Quantitative quality-assessment techniques to compare fractionation and depletion methods in SELDI-TOF mass spectrometry experiments. *Bioinformatics*. 2007 Jul 11.

Kile ML, Houseman EA, Breton CV, Smith T, Quamruzzaman Q, Rahman M, Mahiuddin G, Christiani DC. Dietary arsenic exposure in bangladesh. *Environ Health Perspect*. 2007 Jun;115(6):889-93.

Huang W, Smith TJ, Ngo L, Wang T, Chen H, Wu F, Herrick RF, Christiani DC, Ding H. Characterizing and biological monitoring of polycyclic aromatic hydrocarbons in exposures to diesel exhaust. *Environ Sci Technol*. 2007 Apr 15;41(8):2711-6.

McCarty KM, Smith TJ, Zhou W, Gonzalez E, Quamruzzaman Q, Rahman M, Mahiuddin G, Ryan L, Su L, Christiani DC. Polymorphisms in XPD (Asp312Asn and Lys751Gln) genes, sunburn and arsenic-related skin lesions. *Carcinogenesis*. 2007 Aug;28(8):1697-702. Epub 2007 Apr 29.

McCarty KM, Chen YC, Quamruzzaman Q, Rahman M, Mahiuddin G, Hsueh YM, Su L, Smith T, Ryan L, Christiani DC. Arsenic methylation, GSTT1, GSTM1, GSTP1 polymorphisms, and skin lesions. *Environ Health Perspect*. 2007 Mar;115(3):341-5. Epub 2006 Dec 20.

Bajwa EK, Yu CL, Gong MN, Thompson BT, Christiani DC. Pre-B-cell colony-enhancing factor gene polymorphisms and risk of acute respiratory distress syndrome. *Crit Care Med*. 2007 May;35(5):1290-5.

Christiani DC, Pao W, DeMartini JC, Linnoila RI, Malkinson AM, Onn A, Politi KA, Sharp M, Wong KK. BAC consensus conference, November 4-6, 2004: epidemiology, pathogenesis, and preclinical models. *J Thorac Oncol*. 2006 Nov;1(9 Suppl):S2-7. Erratum in: *J Thorac Oncol*. 2007 Jan;2(1):11.

Kales SN, Soteriades ES, Christophi CA, Christiani DC. Emergency duties and deaths from heart disease among firefighters in the United States. *N Engl J Med*. 2007 Mar 22;356(12):1207-15.

Liu G, Gurubhagavatula S, Zhou W, Wang Z, Yeap BY, Asomaning K, Su L, Heist R, Lynch TJ, Christiani DC.

Epidermal growth factor receptor polymorphisms and clinical outcomes in non-small-cell lung cancer patients treated with gefitinib. *Pharmacogenomics J.* 2007 Mar 20.

Breton CV, Zhou W, Kile ML, Houseman EA, Quamruzzaman Q, Rahman M, Mahiuddin G, Christiani DC. Susceptibility to arsenic-induced skin lesions from polymorphisms in base excision repair genes. *Carcinogenesis.* 2007 Jul;28(7):1520-5.

Zhang H, Hang J, Wang X, Zhou W, Sun B, Dai H, Su L, Christiani DC. TNF polymorphisms modify endotoxin exposure-associated longitudinal lung function decline. *Occup Environ Med.* 2007 Jun;64(6):409-13. Epub 2007 Mar 1.

Zhai R, Gong MN, Zhou W, Thompson TB, Kraft P, Su L, Christiani DC. Genotypes and haplotypes of the VEGF gene are associated with higher mortality and lower VEGF plasma levels in patients with ARDS. *Thorax.* 2007 Aug;62(8):718-22. Epub 2007 Feb 8.

McMahon PM, Christiani DC. Computed tomography screening for lung cancer. *BMJ.* 2007 Feb 10;334(7588):271.

McCarty KM, Ryan L, Houseman EA, Williams PL, Miller DP, Quamruzzaman Q, Rahman M, Mahiuddin G, Smith T, Gonzalez E, Su L, Christiani DC. A case-control study of GST polymorphisms and arsenic related skin lesions. *Environ Health.* 2007 Feb 6;6:5.

Liu G, Zhou W, Yeap BY, Su L, Wain JC, Poneris JM, Nishioka NS, Lynch TJ, Christiani DC. XRCC1 and XPD polymorphisms and esophageal adenocarcinoma risk. *Carcinogenesis.* 2007 Jun;28(6):1254-8.

Zhai R, Zhou W, Gong MN, Thompson BT, Su L, Yu C, Kraft P, Christiani DC. Inhibitor kappaB-alpha haplotype GTC is associated with susceptibility to acute respiratory distress syndrome in Caucasians. *Crit Care Med.* 2007 Mar;35(3):893-8.

Porojnicu AC, Robsahm TE, Dahlback A, Berg JP, Christiani D, Bruland OS, Moan J. Seasonal and geographical variations in lung cancer prognosis in Norway. Does Vitamin D from the sun play a role? *Lung Cancer.* 2007 Mar;55(3):263-70.

Zhou W, Heist RS, Liu G, Asomaning K, Miller DP, Neuberger DS, Wain JC, Lynch TJ, Christiani DC. Second hand smoke exposure and survival in early-stage non-small-cell lung cancer patients. *Clin Cancer Res.* 2006 Dec 1;12(23):7187-93.

Gong MN, Zhou W, Williams PL, Thompson BT, Pothier L, Christiani DC. Polymorphisms in the mannose binding lectin-2 gene and acute respiratory distress syndrome. *Crit Care Med.* 2007 Jan;35(1):48-56.

Zhou W, Heist RS, Liu G, Neuberger DS, Asomaning K, Su L, Wain JC, Lynch TJ, Giovannucci E, Christiani DC. Polymorphisms of vitamin D receptor and survival in early-stage non-small cell lung cancer patients. *Cancer Epidemiol Biomarkers Prev.* 2006 Nov;15(11):2239-45.

Chen JC, Stone PH, Verrier RL, Nearing BD, MacCallum G, Kim JY, Herrick RF, You J, Zhou H, Christiani DC. Personal coronary risk profiles modify autonomic nervous system responses to air pollution. *J Occup Environ Med.* 2006 Nov;48(11):1133-42.

Heist RS, Marshall AL, Liu G, Zhou W, Su L, Neuberger D, Lynch TJ, Wain J, Christiani DC. Matrix metalloproteinase polymorphisms and survival in stage I non-small cell lung cancer. *Clin Cancer Res.* 2006 Sep 15;12(18):5448-53.

Fang SC, Eisen EA, Dai H, Zhang H, Hang J, Wang X, Christiani DC. Cancer mortality among textile workers

in Shanghai, China: a preliminary study. *J Occup Environ Med.* 2006 Sep;48(9):955-8.

Miller DP, Asomaning K, Liu G, Wain JC, Lynch TJ, Neuberg D, Su L, Christiani DC. An association between glutathione S-transferase P1 gene polymorphism and younger age at onset of lung carcinoma. *Cancer.* 2006 Oct 1;107(7):1570-7.

Webster BS, Courtney TK, Huang YH, Matz S, Christiani DC. Survey of acute low back pain management by specialty group and practice experience. *J Occup Environ Med.* 2006 Jul;48(7):723-32. Erratum in: *J Occup Environ Med.* 2006 Sep;48(9):969-71.

Zhou W, Heist RS, Liu G, Park S, Neuberg DS, Asomaning K, Wain JC, Lynch TJ, Christiani DC. Smoking cessation before diagnosis and survival in early stage non-small cell lung cancer patients. *Lung Cancer.* 2006 Sep;53(3):375-80. Epub 2006 Jun 30.

Yu CL, Wang SF, Pan PC, Wu MT, Ho CK, Smith TJ, Li Y, Pothier L, Christiani DC; Kaohsiung Leukemia Research Group. Residential exposure to petrochemicals and the risk of leukemia: using geographic information system tools to estimate individual-level residential exposure. *Am J Epidemiol.* 2006 Aug 1;164(3):200-7. Epub 2006 Jun 5.

Breton CV, Houseman EA, Kile ML, Quamruzzaman Q, Rahman M, Mahiuddin G, Christiani DC. Gender-specific protective effect of hemoglobin on arsenic-induced skin lesions. *Cancer Epidemiol Biomarkers Prev.* 2006 May;15(5):902-7.

Astrakianakis G, Seixas NS, Camp JE, Christiani DC, Feng Z, Thomas DB, Checkoway H. Modeling, estimation and validation of cotton dust and endotoxin exposures in Chinese textile operations. *Ann Occup Hyg.* 2006 Aug;50(6):573-82.

Hauser R, Meeker JD, Duty S, Silva M, Calafat A. Altered semen quality in relation to urinary levels of phthalate monoester and oxidative metabolites. *Epidemiology* 2006;17:682-691.

Meeker JD, Barr DB, Serdar B, Rappaport SM, Hauser R. Utility of 1-naphthol and 2-naphthol levels to assess environmental carbaryl and naphthalene exposure in an epidemiology study. *J Exp Sci Environ Epid* 2007;17:314-320.

Hauser R, Meeker JD, Singh NP, Silva MJ, Ryan L, Duty S, Calafat AM. DNA damage in human sperm is related to urinary levels of phthalate monoester and oxidative metabolites. *Human Reprod* 2007;22:688-695.

Meeker JD, Altshul L, Hauser R. Serum PCBs, p,p'-DDE and HCB predict thyroid hormone levels in men. *Environ Res* 2007;104:296-304.

Meeker JD, Godfrey-Bailey L, Hauser R. Relationships between serum hormone levels and semen quality among men from an infertility clinic. *J Androl* 2007;28:397-406.

Meeker JD, Missmer SA, Cramer DW, Hauser R. Maternal exposure to secondhand tobacco smoke and pregnancy outcome among couples undergoing assisted reproduction. *Human Reprod* 2007;22:337-345.

Meeker JD, Calafat AM, Hauser R. Di-(2-ethylhexyl) phthalate metabolites may alter thyroid hormone levels in men. *Environ Health Perspect* 2007;115:1029-1034.

Meeker JD, Missmer SA, Vitonis AF, Cramer DW, Hauser R. Risk of spontaneous abortion in women with childhood exposure to parental cigarette smoke. *Am J Epidemiol* 2007;166:571-575.

Vandenberg LN, Hauser R, Marcus M, Olea N, Welshons WV. Human exposure to bisphenol A (BPA). *Reprod Toxicol (In Press)*.

vom Saal FS, Akingbemi BT, Belcher SM, Birnbaum LS, Crain DA, Ericksen M, Farabollini F, Guillette LJ, Hauser R, Heindel JJ, et al. Chapel Hill Bisphenol A Expert Panel Consensus Statement: Integration of Mechanisms, Effects in Animals and Potential to Impact Human Health at Current Levels of Exposure. *Reprod Toxicol* (In Press).

Herrick RF, Meeker JD, Hauser R, Altshul L, Weymouth GA. Serum PCB levels and congener profiles among U.S. construction workers. *Environ Health: A Global Access Science Source* 2007;6:25.

Silva MJ, Samandar E, Reidy JA, Hauser R, Needham LL, Calafat AM. Metabolite profiles of di-n-butyl phthalate in rats and humans. *Environ Sci Technol* (In Press).

Banahan KF, Vincent RL, Brickner PW. Fundamental Factors Affecting Upper Room Ultraviolet Germicidal Irradiation—Part I. Experimental. *J Occ Environ Hyg* 2007; 4(5):321-331.

Bello, D., C. A. Herrick, T. J. Smith, S. R. Woskie, R. P. Streicher, M. R. Cullen, Y. Liu and C. A. Redlich (2007). "Skin exposure to isocyanates: reasons for concern." *Environ Health Perspect* 115(3): 328-35.

Herrick RF, Meeker JD, McClellan MD, Zwack LM, Hanley K. Physical and Chemical Characterization of Asphalt Paving Exposures. *Journal of Occupational and Environmental Hygiene* 2007; 4(Suppl 1):209-216.

Chen JC, Stone PH, Verrier RL, Nearing BD, MacCallum G, Kim JY, Herrick RF, You J, Zhou H, Christiani DC. Personal coronary risk profiles modify autonomic nervous system responses to air pollution. *J Occup Environ Med*. 2006 Nov;48(11):1133-42.

Herrick RF, Meeker JD, Hauser R, Altshul L, Weymouth GA. Serum PCB levels and congener profiles among U.S. construction workers. *Environ Health: A Global Access Science Source* 2007;6:25.

Victoria Jackson presented a poster entitled "Effects of Wind Transport on Diesel Emissions from Truck Terminals" at the annual American Industrial Hygiene Conference.

Rudnick, S.N. and M.W. First, Fundamental Factors Affecting Upper-Room Ultraviolet Germicidal Irradiation—Part II. Predicting Effectiveness, *J. Occ. Environ. Hyg.* 4(5):352-362 (2007),

First, M.W., S.N. Rudnick, K.F. Banahan, R.L. Vincent, and P.W. Brickner, Fundamental Factors Affecting Upper Room Ultraviolet Germicidal Irradiation—Part I. Experimental, *J. Occ. Environ. Hyg.* 4(5):321-331 (2007)

McDevitt, J.J., K.M. Lai, S.N. Rudnick, E.A. Houseman, M.W. First, and D.K. Milton. Characterization of UVC Light Sensitivity of Vaccinia Virus, *Appl. Environ. Microbiol.* 73(18):5760-5766 (2007)

Lander, L.L., S.N. Rudnick, and M.J. Perry, Assessing Noise Exposure in Farm Youths, *In Press. Journal of Agromedicine* (2007).

Elizabeth Scott, Susan Duty, Maureen Callahan. A Pilot Study to Isolate Staphylococcus aureus and MRSA from Environmental Surfaces in the Home. *American Journal of Infection Control* In Press

Rachel Kwapniewski, Sarah Kozaczka, Russ Hauser, Manori J. Silva, Antonia M. Calafat, Susan M. Duty. Occupational exposure to dibutyl phthalate among manicurists. In Press *Journal of Occupational and Environmental Medicine*.

Smith GS, Timmons RA, Lombardi DA, Mamidi DK, Matz S, Courtney TK, Perry MJ, Work-related ladder fall fractures: identification and diagnosis validation using narrative text. *Accid Anal Prev.* 2006 Sep;38(5):973-80.

Lueken RJ, Heffner AC, Parks PD. Treatment of severe carbon monoxide poisoning using a portable hyperbaric oxygen chamber. *Ann Emerg Med*. 2006 Sep;48(3):319-22.

Weuve J, Sanchez BN, Calafat AM, Schettler T, Green RA, Hu H, Hauser, R. Exposure to phthalates in neonatal intensive care unit infants: urinary concentrations of monoesters and oxidative metabolites. *Environmental Health Perspectives*. 2006 Sep; 114(9):1424-31.

Holder JD, Stalling L, Peeples L, Burress JW, Kales SN. Firefighter Heart Presumption Retirements in Massachusetts: 1997-2004. *J Occup Environ Med*. 2006 Oct; 48:1047-1053.

Kapoor S, Shaw WS, Pransky G, Patterson W. Initial patient and clinician expectations of return to work after acute onset of work-related low back pain. *J Occup Environ Med*. 2006 Nov;48(11):1173-80.

Muzzafer S, Kales SN. Occupational Medicine Forum: What Are the Major Points and Emerging Issues in Radiologic Imaging for Pneumoconiosis Surveillance and Diagnosis? (submitted)

Mbanu I, Wellenius GA, Mittleman MA, Peeples L, Stallings LA, Kales SN. Seasonality and Coronary Heart Disease Deaths in United States Firefighters. (submitted)

Lee EC, Kales SN. Chemical Weapons and Public Health. In: Levy BS, Sidel V, eds. *War and Public Health*, 2nd ed. 2007 (in Press).

Greenough PG, Lappi MD, Hsu EB, Fink S, Hsieh YH, Vu A, Heaton C, Kirsch TD. 2007. Burden of disease and health status among hurricane Katrina-displaced persons in shelters: A population-based cluster sample. *Ann Emerg Med*. Jun 19

Kales SN, Huyck KL, Goldman RH. Elevated Urine Arsenic: Un-Speciated Results Lead to Unnecessary Concern and Further Evaluations. *J Analytic Toxicol* 2006;30:80-5.

Kales SN, Soteriades ES, Christophi CA, Christiani DC. Emergency Duties and Deaths from Heart Disease among Firefighters in the United States. *N Engl J Med*. 2007;356:1207-15.

Mbanu I, Wellenius GA, Mittleman MA, Peeples L, Stallings LA, Kales SN. Seasonality and Coronary Heart Disease Deaths in United States Firefighters. *Chronobiol Int*. 2007; 24: 715–26.

Abejje BA, Chung EH, Nesto RW, Kales SN. Grand Rounds: Asbestos-Related Pericarditis in a Boiler Operator. *Environ Health Perspect*. (In Press) doi:10.1289/ehp.10354 available via <http://dx.doi.org/> [Online 11 September 2007].

Spaeth K, Tsismenakis AJ, Kales SN. Neurotoxicity and Heavy Metals: A Clinical Perspective. In: *Neurotoxicity Syndromes Research*. Nova Science Inc., New York (In Press).

Huyck K, Kile M, Mahiuddin G, Quamruzzaman Q, Rahman M, Breton C, Dobson C, Frelich J, Hoffman E, Yousuf J, Afroz, S, Islam S, Christiani D. Maternal Arsenic Exposure Associated With Low Birth Weight in Bangladesh. *J Occup Environ Med*. 49 (10); 2007.

Geibe JR, Holder J, Peeples L, Kinney AM, Burress JW, Kales SN. Predictors of On-Duty Coronary Events in U.S. Male Firefighters. *Amer J Cardiol* 2008 (in press).

Balakrishnan AD, Jindrich DL, Dennerlein JT. Designing a keyswitch utilizing horizontal forces of the fingertip. *Human Factors*, 48(1): 121-129, 2006.

Barrero LH, Hsu YH, Terwedow H, Perry MJ, Dennerlein JT, Brain JD, Xu X. Prevalence and physical determinants of low back pain in a rural Chinese population. *Spine* 2006; 1(23):2728-34.

Chang CH, Amick BC III., Chaumont Menéndez C, Katz JN, Johnson PW, Robertson MM, Dennerlein JT. Daily computer usage correlated with undergraduate students' musculoskeletal symptoms. *AJIM*. 50, 481-8, 2007

Chaumont Menéndez C, Amick BC III., Jenkins M, Janowitz I, Rempel DM, Robertson M, Dennerlein JT, Chang CH, Katz JN. A Multi-Method Study Evaluating Computing-Related Risk Factors Among College Students. *Work: A Journal of Prevention, Assessment, and Rehabilitation*, 28, 287-297, 2007

Courtney TK, Huang YH, Verma SK, Chang WR, Li KW, Filiaggi A. Factors Influencing Restaurant Worker Perception of Floor Slipperiness. *Injury Prevention*. Accepted.

Dennerlein JT, DiMarino MHJ. Forearm EMG changes with the use of a haptic force-feedback computer mouse. *Human Factors* 48(1): 130-141, 2006.

Hsu YH, Niu T, Terwedow H, Xu X, Feng Y, Bouxsein M, Brain J, Betensky R, Laird N, Rosen C, Xu X. Genetic variation in genes involved in the RANKL/RANK/OPG bone remodeling pathway are associated with bone mineral density at different skeletal sites in men. *Human Genetics* 2006; 118: 568-577

Hsu YH, Venners SA, Terwedow H, Niu T, Feng Y, Bouxsein M, Betensky R, Laird N, Brain J, Cummings SR, Rosen C, Xu X. Relationship of body composition, fat mass and serum lipids to osteoporotic fractures and bone mineral density in men and women. *American Journal of Clinical Nutrition* 2006; 83: 146-154

Jin K, Lombardi DA, Courtney TK, Sorock GS, Perry MJ, Cheng H, Wang X, Liang Y. The challenge of cross-cultural collaborative research: lessons learned from a pilot case-crossover study of severe occupational hand trauma in the P.R. China. *Injury Preven* 2007 Apr;13(2):133-6.

Kotani K, Barrero L, Lee D, Dennerlein, JT. Effect of horizontal position of the computer keyboard on upper extremity posture and muscular load during computer work. *Ergonomics*. 50, 1419-32, 2007.

Kuo PL, Lee DL, Jindrich DJ, Dennerlein JT. Finger joint coordination during tapping. *J. Biomechanics*. 39, 2934-42, 2006.

Lander IL, Connor JA, Shah RK, Kentala E, Healy GB, Roberson DW. Otolaryngologists' responses to errors in their practice. Manuscript under review. *Laryngoscope* (in press).

Lee DL, McLoone H, Dennerlein JT. Observed finger behavior during computer mouse use. *Applied Ergonomics*, 39, 107-13, 2008.

Wasiak, Radoslaw and Eileen McNeely. Utilization and costs of chiropractic care for work-related low back injuries: Do payment policies make a difference? *The Spine Journal* 2006. Volume 6 (2) 146-153.

Peters, J, Kubzansky L, McNeely E, Schwartz J, Spiro A, Sparrow D, Wright R, Huiling N, Hu H. Stress as a Potential Modifier of the Impact of Lead Exposure on Blood Pressure: The Normative Aging Study. *Environmental Health Perspectives*. Submitted January 2007.

O'Connell, D, McNeely, E., Hall, D. Unpacking personal adaptability at work. *Journal of Leadership and Organizational Studies*, Accepted for publication. February 2007.

Presentations

Nimgade, A. and McNeely, E. "The fate of occupational and non-occupational low back injury in a community HMO sample: LBP injuries and "spill-over" health effects?". Workers compensation Research Group Annual Conference, Boston, MA, November 2006.

McNeely, E. Hopcia, K and Bradley, J. Occupational Injury Tracking with OSHA logs: Ruler or Rubbish? Presented at the NIOSH Worklife Conference, September 2007.

Jae Young Kim. Depression, Suicide and Work Injury. Presented at the NIOSH Worklife Conference, September 2007.

Kales SN. "Heart Disease in Firefighters: from Risk Factors to On-Duty Death". Occupational Health Colloquium, University of Connecticut Health Center, Division of Occupational & Environmental Medicine, Farmington, Connecticut.

Kales SN. Moderator, Research Session. New England College of Occupational & Environmental Medicine, 2006 Annual Conference, Bedford, MA.

Kales SN. Invited Presentation, "Estimated Burden of Disease from Household Carbon Monoxide Poisonings in Europe." WHO second technical meeting on quantifying disease from inadequate housing. WHO Regional Office for Europe, Bonn, Germany.

Dr. Russ Hauser presented a lecture entitled "Phthalates and Male Reproductive Health" in September 2006 to the European Council for Phthalate Esters and Intermediates and a lecture on endocrine disruptors at the Boston University School of Public Health in November 2006.

Dr. Belayneh Abejje, Chief Resident made a presentation at the Cambridge Health Alliance in January 2007 on the topic of "Silica Exposure and Autoimmune Diseases."

Dr. Kales. Invited Speaker and Trainer, "Clinical Syndrome-Based Recognition of Chemical Hazards." European Training for Health Professionals on Rapid Response to Health Threats: Pilot Course, Athens, Greece. May 2007

Dr. Kales. Invited Speaker. "Cardiovascular Disease in Firefighters". Occupational Health Speaker Series, University of Michigan School of Public Health, April 2007.

A. Program Title

Occupational Injury Prevention Research Training

B. Program Directors

Jack T. Dennerlein, PhD, Associate Professor of Ergonomics and Safety
Melissa J. Perry, ScD, Assistant Professor of Occupational Epidemiology

C. Program Description

Occupational injury is a large public health burden in the United States and elsewhere. The occupational injury prevention research training program offers the Doctor of Science (SD) degree in Occupational Health and Masters of Science in Environmental Health. The goals and objectives of the program are:

To produce the next generation of qualified professionals and researchers with the multidisciplinary skills necessary to conduct studies designed to understand the etiology and prevention of occupational injury

To provide interdisciplinary training for future professionals and researchers with traditional disciplinary backgrounds to expand the breadth and depth of their knowledge within the public health framework. This approach **emphasizes prevention** through:

Identifying and evaluating risks for injury in the workplace,

Intervening and reducing risks by developing administrative and engineering controls in the design of workplace environments, and

Managing and developing policies and programs to prevent workplace acute and chronic injuries as well as return to work of those injured.

Curriculum

General description of requirements. Students are expected to first master information and competencies in occupational injury prevention and control. The higher-level courses each relate different principles, methods and theories that are directly applicable to occupational injury prevention research and allow for the trainees to focus in either occupational injury epidemiology or occupational safety engineering and science. Training specialization is achieved through occupational health, environmental science and engineering, health and social behavior and health policy and management courses that offer advanced teachings in safety engineering, ergonomics, biomechanics, behavioral epidemiology and health services research.

D. Program Activities and Accomplishments

Major and recent accomplishments of the training program include:

- For 2006-2007 academic year we have graduated another doctoral trainee and we currently have eight doctoral students. We have recruited an African/Native American student into the 2007-08 incoming doctoral class.
- Melissa Perry, Program Co-Director, was promoted to Associate Professor and Jeffrey Katz, MD, MPH (Associate Professor) joins the Harvard ERC Faculty as a core member of the program's faculty this year. He has joint appointments in the Department of Environmental Health, Health Policy and Management, and the Harvard Medical School. He is a physician and the director of the Orthopedic and Arthritis Center for Outcomes Research at the Brigham and Women's Hospital in Boston.
- We have strengthened existing and developed new partnerships with the Center to Protect Workers Rights (CPWR), Johns Hopkins University, University of Nebraska, Partners Health Care (Massachusetts General Hospital and Brigham and Women's Hospital) the Dana Farber Cancer Institute, Boston University School of

Public Health University of Massachusetts, the University of Washington and Beth-Israel Deaconess Orthopaedics Biomechanics Laboratory.

- We continued collaborative training efforts with the Liberty Mutual Research Institute for Safety, Harvard Injury Control Research Center, Massachusetts Institute of Technology and the Massachusetts State Department of Health.
- Through a set of outreach activities and proposed research projects we and our trainees developed new international research projects in Colombia, Cyprus (Cyprus International Institute for Environmental and Public Health), Japan, the Netherlands, the Peoples' Republic of China, South Africa, and New Zealand.
- 2006-07 also saw the establishment of a formal postdoctoral training program in occupational injury prevention with four collaborative fellowship positions funded by the Liberty Mutual –HSPH Program in Occupational Safety and Health.

E. Program Products

- In 2006-07 we had over 26 publications in peer reviewed journals and in conference proceedings by or with injury program trainees.

- 2006-07 saw the continuing discussion of injury topics in pre-existing classes within the School of Public Health's courses continuing our efforts for the occupational prevention training curriculum.
- We saw an increase in our attendance in our continuing education class for Ergonomics and Human Factors with over 48 confirmed people registering for the class from around the country.
- We also saw an increase in enrollment to 35 students in the Injury Epidemiology and Prevention class, up from 12 in the prior offering.
- We also planned and hosted an international conference, PREvention of work-related MUSculoskeletal Disorders (www.premus2007.org) with over 400 abstracts presented and 460 international registrants.

F. Future Plans

Our future plans are to continue to build the program three ways. First we plan on submitting more research grants in the area of injury prevention from agriculture to office workers. We also plan to recruit more students for the fall of 2008 through our recruitment efforts. Finally, we plan on having an advisory board meeting to describe the progress and get new guidance on the program based on the local advisor board needs.

APPENDIX A OCCUPATIONAL INJURY PREVENTION CURRICULUM

All Doctoral students in the NIOSH supported occupational injury prevention program will take: a) the course requirements for the School of Public Health, b) those specific to Occupational Health, and c) those specific to Occupational Injury Prevention, as described below.

COURSE REQUIREMENTS SPECIFIC TO OCCUPATIONAL INJURY PREVENTION

BIO 225 (Fall)

Multiple Regression Analysis - 2.5

EH 236 (Fall)

Epidemiology of Environmental and Occupational Health Regulations - 5.0

EH 241 (Spring)

Occupational Safety and Injury Prevention - 2.5

EH 243 (Spring)

Ergonomics and Human Factors - 2.5

EH 282 (Every other Spring2)

Injury Epidemiology - 2.5

ID 240 (Spring1)

Principles of Injury Control - 2.5

RDS 500 (Spring1)

Risk Assessment - 2.5

ELECTIVES

EH 250

Protecting Workers and Communities from Hazardous Substances - 2.5

EH 254 (Every other Spring)

Evaluation and Control of Noise and Vibration - 2.5

EH 296 (Spring)

Occupational Biomechanics - 5.0

ENG SCI 145a(Fall)

System Analysis and Physiology Applications - 5.0

MIT 2.181

Human Factors Engineering - 5.0

MIT 2.182

Biomechanics and Neural Control of Movement

a ENG SCI is a course in the Harvard University Faculty of Arts and Sciences.

**APPENDIX B
OCCUPATIONAL INJURY PREVENTION PUBLICATIONS**

Balakrishnan AD, Jindrich DL, Dennerlein JT. Designing a keyswitch utilizing horizontal forces of the fingertip. *Human Factors*, 48(1): 121-129, 2006.

Barrero LH, Hsu YH, Terwedow H, Perry MJ, Dennerlein JT, Brain JD, Xu X. Prevalence and physical determinants of low back pain in a rural Chinese population. *Spine* 2006; 1(23):2728-34.

Chang CH, Amick BC III., Chaumont Menéndez C, Katz JN, Johnson PW, Robertson MM, Dennerlein JT. Daily computer usage correlated with undergraduate students' musculoskeletal symptoms. *AJIM*. 50, 481-8, 2007

Chaumont Menéndez C, Amick BC III., Jenkins M, Janowitz I, Rempel DM, Robertson M, Dennerlein JT, Chang CH, Katz JN. A Multi-Method Study Evaluating Computing-Related Risk Factors Among College Students. *Work: A Journal of Prevention, Assessment, and Rehabilitation*, 28, 287-297, 2007

Courtney TK, Huang YH, Verma SK, Chang WR, Li KW, Filiaggi A. Factors Influencing Restaurant Worker

Perception of Floor Slipperiness. Injury Prevention. Accepted.

Dennerlein JT, DiMarino MHJ. Forearm EMG changes with the use of a haptic force-feedback computer mouse. Human Factors 48(1): 130-141, 2006.

Hsu YH, Niu T, Terwedow H, Xu X, Feng Y, Bouxsein M, Brain J, Betensky R, Laird N, Rosen C, Xu X. Genetic variation in genes involved in the RANKL/RANK/OPG bone remodeling pathway are associated with bone mineral density at different skeletal sites in men. Human Genetics 2006; 118: 568-577

Hsu YH, Venners SA, Terwedow H, Niu T, Feng Y, Bouxsein M, Betensky R, Laird N, Brain J, Cummings SR, Rosen C, Xu X. Relationship of body composition, fat mass and serum lipids to osteoporotic fractures and bone mineral density in men and women. American Journal of Clinical Nutrition 2006; 83: 146-154

Jin K, Lombardi DA, Courtney TK, Sorock GS, Perry MJ, Cheng H, Wang X, Liang Y. The challenge of cross-cultural collaborative research: lessons learned from a pilot case-crossover study of severe occupational hand trauma in the P.R. China. Injury Preven 2007 Apr;13(2):133-6.

Kotani K, Barrero L, Lee D, Dennerlein, JT. Effect of horizontal position of the computer keyboard on upper extremity posture and muscular load during computer work. Ergonomics. 50, 1419-32, 2007.

Kuo PL, Lee DL, Jindrich DJ, Dennerlein JT. Finger joint coordination during tapping. J. Biomechanics. 39, 2934-42, 2006.

Lander IL, Rudnick SA, Perry MJ. Farm youth exposure to noise. J of Agromedicine (in press).

Lander IL, Connor JA, Shah RK, Kentala E, Healy GB, Roberson DW. Otolaryngologists? responses to errors in their practice. Manuscript under review. Laryngoscope (in press).

Lee DL, McLoone H, Dennerlein JT. Observed finger behavior during computer mouse use. Applied Ergonomics, 39, 107-13, 2008.

A. Program Title

Hazardous Substance Academic Training (HSAT) Program

B. Program Director

Stephen N. Rudnick, ScD, CIH

C. Program Description

The goals and objectives of the Hazardous Substance Academic Training Program at the Harvard School of Public Health are to train competent Master of Science (MS) level industrial hygienists 1) to protect the health and safety of workers involved with hazardous substances, 2) to develop leaders in the field of industrial hygiene who have an in-depth knowledge about controlling the risks associated with hazardous substances, and 3) to prepare students for doctoral programs, so they can teach and do research in industrial hygiene, focusing on hazardous substances. In addition, a secondary goal of the HSAT Program is to make coursework available to non-industrial-hygiene environmental-health students that will help them to protect workers and communities from hazardous substances.

Dr. Rudnick, HSAT Program Director, has been a member of the Industrial Hygiene faculty at Harvard since 1988. He presently teaches four academic courses: 1) Protecting Workers and Communities from Hazardous

Substances (EH 250), 2) Behavior and Properties of Airborne Particles (EH 292), 3) Ventilation (EH 253), and 4) Control of Noise and Vibration (EH 254). He also is a co-director of five continuing-education courses: 1) Basic Hands-On CAMEO Training, 2) Integrated Emergency Planning: A Step-By-Step Approach to "One Plan", 3) Advanced Hands-On CAMEO Training, 4) Comprehensive Industrial Hygiene: Practical Applications of Basic Principles, and 5) In-Place Filter Testing Workshop.

Students obtaining a Harvard MS degree in Industrial Hygiene with emphasis on hazardous substances are generally required to take eighty credits over a two-year period. Two options are available. For one of the options, students take 60 credits of coursework over three semesters. In addition, they complete a paid industrial hygiene internship related to hazardous substances (EH 303) for which they are awarded 20 credits. This internship requires six months, the entire fall semester of their second year and the preceding summer. For the second option, students take 80 credits of coursework over four semesters. In addition, they are required to complete a three-month practicum related to hazardous substances. This practicum is usually completed during the summer between their first and second year, but may extend into the academic year. Although this practicum is required for graduation, no academic credit is awarded. For both options, students are graded on a special project focusing on hazardous substances. Results from this special project are submitted in a written report and presented orally in the course "Industrial Hygiene Internship Seminar" (EH 267). HSAT students are also required to submit their findings for presentation at the student poster section of the annual American Industrial Hygiene Conference or an equivalent forum. In addition to all of the courses required for an MS degree in industrial hygiene, HSAT students take the following four courses that deal with hazardous substances in a significant manner: 1) Protecting Workers and Communities from Hazardous Substances (EH 250), 2) The Radiation Environment: Its Identification, Evaluation & Control (EH 279), 3) Public Health Response to Mass Emergencies (ID517), and 4) Industrial Hygiene Internship Seminar (EH 267). EH 250 was specifically designed for the HSAT Program. It was first offered in 1993 and continues to be a key course for HSAT students. HSAT students must also take one of the following courses: 1) Ecotoxicology (EH 517), 2) Regulation of Chemicals, Radiation, and Biotechnology (MIT 1.812J), 3) Brownfield Practicum: Regeneration and Reuse of Brownfield Sites (GSD 6323), 4) Environmental Genetics (EH 516), or 5) Brownfields Policy and Practice (MIT 11.370).

D. Program Activities and Accomplishments

During this reporting period (7/1/06 – 6/30/07), we had two HSAT-supported trainees, who are Asian Americans: 1) Shalu Shelat and 2) Thomas Lee. They both completed the first year of a two-year MS degree program. In addition, Margaret Parks also completed the first year of the HSAT Program (formerly counted under IH Core), and Victoria Jackson, who is a Native American, graduated from the HSAT Program in June 2007. Victoria and Margaret were both supported by the U.S. Navy.

In addition to the Harvard School of Public Health website, we have utilized various strategies to attract qualified students. Dr. Rudnick manned booths at the School's open houses for prospective students. He talked to prospective students and handed out written material. With the help of the New England chapter of American Industrial Hygiene Association, we have also advertised the HSAT Program at local meetings and in their emailed newsletter.

On January 4, 2007, a meeting of the joint HST/HSAT Advisory Committee meeting took place. The committee includes representatives from FEMA, OSHA, EPA, industry, and academia, as well as a consultant who was formerly manager of health and safety for a large national company involved in hazardous waste transportation and disposal, emergency response, and hazardous waste site remediation. The committee discussed various topics important to the HSAT Program including student recruitment and curriculum evaluation.

E. Program Products

During the past year, Victoria Jackson presented a poster entitled “Effects of Wind Transport on Diesel Emissions from Truck Terminals” at the annual American Industrial Hygiene Conference. None of our HSAT trainees authored publications. Dr. Rudnick was a coauthor on four publications: 1) Rudnick, S.N. and M.W. First, Fundamental Factors Affecting Upper-Room Ultraviolet Germicidal Irradiation—Part II. Predicting Effectiveness, *J. Occ. Environ. Hyg.* 4(5):352-362 (2007), 2) First, M.W., S.N. Rudnick, K.F. Banahan, R.L. Vincent, and P.W. Brickner, Fundamental Factors Affecting Upper Room Ultraviolet Germicidal Irradiation—Part I. Experimental, *J. Occ. Environ. Hyg.* 4(5):321-331 (2007), 3) McDevitt, J.J., K.M. Lai, S.N. Rudnick, E.A. Houseman, M.W. First, and D.K. Milton. Characterization of UVC Light Sensitivity of Vaccinia Virus, *Appl. Environ. Microbiol.* 73(18):5760-5766 (2007), and 4) Lander, L.L., S.N. Rudnick, and M.J. Perry, Assessing Noise Exposure in Farm Youths, *In Press. Journal of Agromedicine* (2007).

F. Future Plans

In order to enhance the HSAT Program in the future, we plan to direct our efforts to effect the following improvements:

- Heighten the visibility of the HSAT Program in New England in order to attract a greater number of qualified applicants to the Program.
- Search for supplemental sources of funding for students.
- Better utilize our HST/HSAT Advisory Committee, the ERC Advisory Committee, and the Harvard Industrial Hygiene Alumni Guild to enhance the HSAT Program.
- Promote our relationships with companies and government agencies involved with hazardous waste site remediation; treatment, storage, and disposal facilities; emergency response activities; and related activities.

APPENDIX A HAZARDOUS SUBSTANCE ACADEMIC TRAINING PROGRAM CURRICULUM

FALL SEMESTER, FIRST YEAR

BIO 201 (Fall)

Introduction to Statistical Methods - 5.0

EH 205 (Fall)

Human Physiology - 5.0

EH 510 (Fall)

Fundamentals of Environmental Exposures Assessment - 2.5

EH 262 (Fall)

Introduction to the Work Environment - 2.5

EPI 201 (Fall1)

Introduction to Epidemiology - 2.5

WINTER SESSION, FIRST YEAR

EH 516

Environmental Genetics - 2.5

EH 517

Ecotoxicology- 2.5

EH 330 (Winter)

Field Experience in International Occupational Health Safety - 2.5

SPRING SEMESTER, FIRST YEAR

EH 231 (Spring)

Occupational Health Policy & Administration - 2.5

EH 241 (Spring)

Occupational Safety and Injury Prevention - 2.5

EH 254 (Spring)

Evaluation & Control of Noise & Vibration - 2.5

EH 292 (Spring)

Properties & Behavior of Airborne Particles - 2.5

ID 263 (Spring)

Practice of Occupational Health - 5.0

RDS 500 (Spring2)

Risk Assessment - 2.5

SUMMER SEMESTER

Summer Internship

FALL SEMESTER, SECOND YEAR

Full time Internship EH 303 or combination of practicum and other coursework including:

EH 243 (Fall)

Ergonomics/Human Factors - 2.5

EH 256 (Fall2)

Introduction to Aerobiology - 2.5

EH 279(Fall)

Radiation Environment: Its Identification, Evaluation and Control - 2.5

EH 504 (Fall)

Principles of Toxicology (01) - 5.0

SHH 201 (Fall1)

Society and Health - 2.5

Other electives as arranged with your advisor - 5.0

WINTER SESSION, SECOND YEAR

Other electives as arranged with your advisor

SPRING SEMESTER, SECOND YEAR

EH 250

Protecting Workers & Communities from Hazardous Substances - 2.5

EH 253*

Ventilation - 2.5

EH 263 (Spring)

Analytical Methods and Exposure Assessment - 2.5

EH 267 (Spring)

IH/ERGO Internship and Environmental Sciences Research Seminar - 2.5

ID 215 (Spring)

Environmental and Occupational Epidemiology - 2.5

IH STUDENTS WHO DO THE "HAZARDOUS SUBSTANCE" SUBSPECIALTY ARE ALSO REQUIRED TO TAKE ONE OF THE FOLLOWING SPRING COURSES

ID 287

Bioterrorism: Public Health Preparedness and Response - 2.5

ID 517 (Winter)

Public Health Response to Mass Emergencies - 2.5

EH 516 (Spring)

Ecotoxicology - 2.5

EH 517 (Spring)

Environmental Genetics - 2.5

GSD 6323 (Spring)

Brownfield practicum - 2.5

MIT 1.812J

Regulation of Chemicals, Radiation, and Biotechnology - 5.0

MIT 11.370

Brownfields Policy and Practice - 5.0

Other hazardous substance related course approved by your advisor

*Note: Given in 2008-2009

**APPENDIX B
HAZARDOUS SUBSTANCE ACADEMIC TRAINING PUBLICATIONS**

Because the HSAT Program supports only Master of Science level students, no publications resulted from this training grant. However, as stated above, Victoria Jackson presented a poster at the 2007 AIHA conference and Dr. Rudnick co-authored 4 publications this reporting period.

Victoria Jackson presented a poster entitled "Effects of Wind Transport on Diesel Emissions from Truck Terminals" at the annual American Industrial Hygiene Conference.

Rudnick, S.N. and M.W. First, Fundamental Factors Affecting Upper-Room Ultraviolet Germicidal Irradiation—Part II. Predicting Effectiveness, J. Occ. Environ. Hyg. 4(5):352-362 (2007),

First, M.W., S.N. Rudnick, K.F. Banahan, R.L. Vincent, and P.W. Brickner, Fundamental Factors Affecting Upper Room Ultraviolet Germicidal Irradiation—Part I. Experimental, J. Occ. Environ. Hyg. 4(5):321-331 (2007)

McDevitt, J.J., K.M. Lai, S.N. Rudnick, E.A. Houseman, M.W. First, and D.K. Milton. Characterization of UVC Light Sensitivity of Vaccinia Virus, Appl. Environ. Microbiol. 73(18):5760-5766 (2007)

Lander, L.L., S.N. Rudnick, and M.J. Perry, Assessing Noise Exposure in Farm Youths, *In Press*. Journal of Agromedicine (2007).

A. Program Title

Health Services Research

B. Program Director

Eileen McNeely, PhD, MS, RNC

C. Program Description

This program prepares researchers to examine employee health within the context of the work environment. This investigation includes studies about the quality and effectiveness of health programs and organizational policies that affect employee health. These policies and programs encompass many aspects of working life, including benefits plans (i.e., group health care insurance, disability and personal leave policies), in addition to, workers compensation insurance, worksite health clinics, health promotion programs, safety programs, management policies (specifically, job design and work organization) and organizational culture. Also, students are taught to recognize the broader political, economic and cultural context for the coordination and continuity of these programs, such as; the influence of regulatory policy, labor policy and practice, family policy, changing demographics, work-home conflicts and pressures, and increasing global market competition. Importantly, researchers learn skills in research methods and principles of human subjects protections, statistics, epidemiology, environmental and occupational health, organizational behavior and leadership, economics, and policy-analysis, in order to identify research questions and to translate study findings into recommendations for policies that will optimize approaches to health in the workplace, such the prevention of disease and disability, the promotion of well-being and productivity, and the rehabilitation of injured or ill workers/employees.

The specific goals of the program are:

- To train qualified researchers with the skills and experience to design and conduct studies concerning the delivery and impact of health services associated with the employment relationship.
- To provide cross-training opportunities for individuals who already have preparation in either health services research or occupational health or a related field and also, to expand the breadth and depth of their knowledge through coursework, seminars, and discussion groups.
- To bring together into a combined program leading occupational health services researchers, research centers, and faculties from disparate universities and research organizations in the greater Boston area.
- To build a national locus of expertise in occupational health services research that could benefit NIOSH and other researchers and government agencies throughout the nation.

D. Program Activities and Accomplishments

We have two doctoral students, expected to graduate in 2007 and 2008. One student has studied the outcomes of knee surgery for work-related injuries considering physical therapy, noting in particular, the effects of the timing of treatments, the type of services and the intensity of services for sustained return to work. In addition, she has examined the disparities in treatment outcomes associated with different state policies for workers' compensation. This knowledge can inform the recommendations for improving the quality of care for workers.

The other student is characterizing the association between depression and work-related injury using two national data sets, NHANES and the Medical Expenditure Survey. She is examining the temporal relationship between the onset of depression following work injury in a cohort of workers and considering also, the rates of suicide in this group. Further, she is trying to understand whether depression is a risk factor for work injury. These questions have relevance for the prevention and treatment of a notoriously underreported condition. Over the past year, she has altered her focus slightly from an emphasis on medical treatment to and understanding about the epidemiology of depression and work injury. She recently defended her proposal.

We have just completed another run of the EH281 course. We attracted occupational medical residents, doctoral students in industrial hygiene, and Master's students in health policy. We added new classes this year that examined the relationship between health and productivity. Part of the class requirements included a field experience in which the students work in groups to conduct a gap analysis of employee health needs within specific organizations. This experience is very instructive for the students and the class received top ratings again this year.

E. Program Products

For the past six months, given the small size of the program, the productivity was remarkable. We had 2 papers accepted, another one submitted and two presentations at the annual Workers' Compensation Research Conference in Boston. Also, we had two posters accepted at the recent NIOSH Worklife Conference in Washington.

F. Future Plans

The amount of monies for occupational health services has been drastically cut within NIOSH. A number of the funded health services programs are struggling to keep their programs afloat. The viability of supporting health services students in the future is under consideration.

**APPENDIX A
HEALTH SERVICES RESEARCH CURRICULUM**

FALL SEMESTER, FIRST YEAR

HPM 206 (Fall)

Economic Analysis - 5.0

ID 250 (Fall2)

Ethical Basis of Public Health - 2.5

RDS 280 (Fall2)

Decision Analysis - 2.5

Elective - 2.5

SPRING SEMESTER, FIRST YEAR

ID 215

Environmental and Occupational Epidemiology - 2.5

HPM 208

Health Care Regulation and Planning - 5.0

HPM 292 (Spring)

Research Ethics - 1.25

EH 231

Occupational Health Policy and Administration - 2.5

RDS 285

Decision Analysis Methods- 5.0

FALL SEMESTER, SECOND YEAR

EH 281 (Winter Session)

Occupational Health Care Delivery - 2.5

EH 243

Ergonomics and Human Factors - 2.5

SHH 201 (Fall)

Society and Health - 2.5

BIO 213

Applied Regression - 5.0

BIO 222

Basics: Statistical Inference - 5.0

EH 236

Epidemiology of Environmental and Occupational Health Regulations - 5.0

SPRING SEMESTER, SECOND YEAR

ID 215

Environmental and Occupational Epidemiology - 2.5

HPM 247

Political Analysis for Health Policy - 5.0

RDS 282 (Spring2)

Cost Effectiveness/Benefit Analysis- 2.5

HPM 232

Operations Management - 2.5

HPM 516

Health Care: Quality Improvement - 2.5

Elective - 2.5

Elective - 2.5

a Either BIO 200 fall or BIO 201 fall required.

b Either EPI 200 fall or EPI 201 fall required.

**APPENDIX B
HEALTH SERVICES RESEARCH PUBLICATIONS**

Wasiak, Radoslaw and Eileen McNeely. Utilization and costs of chiropractic care for work-related low back injuries: Do payment policies make a difference? *The Spine Journal* 2006. Volume 6 (2) 146-153.

Peters, J, Kubzansky L, McNeely E, Schwartz J, Spiro A, Sparrow D, Wright R, Huiling N, Hu H. Stress as a Potential Modifier of the Impact of Lead Exposure on Blood Pressure: The Normative Aging Study. *Environmental Health Perspectives*. Submitted January 2007.

O'Connell, D, McNeely, E., Hall, D. Unpacking personal adaptability at work. *Journal of Leadership and Organizational Studies*, Accepted for publication. February 2007.

Presentations

Nimgade, A. and McNeely, E. "The fate of occupational and non-occupational low back injury in a community HMO sample: LBP injuries and "spill-over" health effects?". Workers compensation Research Group Annual Conference, Boston, MA, November 2006.

McNeely, E. Hopcia, K and Bradley, J. Occupational Injury Tracking with OSHA logs: Ruler or Rubbish? Presented at the NIOSH Worklife Conference, September 2007.

Jae Young Kim. Depression, Suicide and Work Injury. Presented at the NIOSH Worklife Conference, September 2007.

A. Program Title

Pilot Projects Research Training Program (PPRT)

B. Program Directors

Russ Hauser and David Christiani

C. Program Description

The purposes of the Pilot Project Research Training Program are:

- 1) To foster new research projects at the pilot project level that enhance the research training capacity of the Harvard ERC and other occupational safety and health training institutions in Region I.
- 2) To promote research in one or more of the 21 priority areas defined in the National Occupational Research Agenda (NORA)
- 3) To promote increased interdisciplinary interaction in the field of occupational safety and health.
- 4) To promote research that addresses regional occupational safety and health concerns.
- 5) To promote collaborative research and training activities among Training Program Grantees and other institutions and entities in Region I that focus on occupational safety and health.

D. Program Activities and Accomplishments

The ERC continues to collaborate in this research training program with the NIOSH funded Training Project Grantees and other occupational health and safety research training programs in Region I. There are currently three TPG's (Yale, U-Conn, UMass-Lowell) in Region I who have agreed to participate as collaborators.

To foster collaboration between the ERC and other research training institutions we published and disseminated an annual Pilot Project Research Report. All investigators funded by the PPRT Program were required to prepare and present a report describing their project both to other scientists and to the non-scientific community. We grouped the annual reports into an annual pilot project symposium which is scheduled with the monthly Visiting Scholars' meetings. The daylong symposium enhances interactions between grantees, ERC faculty and trainees; between ERC members, TPG faculty and students; and between ERC/TPG faculty, trainees and visiting scholars. All investigators funded by the PPRT Program are required to prepare a presentation (verbal or poster) describing their project, both to other scientists and to the non-scientific community. Recipients of pilot grants, who are not from the immediate Boston area, will be provided

with travel funds to support the daylong event. Our most recent symposium was held on September 15, 2006, for the recipients of the 2004-06 year PPRT awards. A copy of the agenda is included in the appendix.

During the previous 5 years the pilot projects program has funded pilots from nine New England Institutions:

- Harvard School of Public Health
- Partners (Brigham and Women's Hospital)
- University of Connecticut
- University of Massachusetts at Lowell
- Yale University
- The Connecticut Agricultural Experiment Station
- Cambridge Health Alliance
- Beth Israel Deaconess Medical Center
- Simmons College

E. Program Products

Please see below for a summary of the outcomes from pilot funding for the previous 5 years. Outcomes include publications, obtaining additional funding and other activities that resulted from the pilot projects. In summary, at least five of the pilot projects from 2004-2006 received additional funding, this includes university and governmental funding. Several pilots led to the completion of a doctoral dissertation for students in occupational health training programs. At professional meetings and in academic settings, there have been numerous research presentations of the data generated from the pilot projects. Finally, several research groups have published or are in the process of publishing their results in peer reviewed journals.

1) Pilot Awardees have used the funding to conduct research that formed the basis for trainee dissertations. In addition, pilot project research has been presented at scientific research conferences listed below.

Scientific conference presentations

- AIH conference
- AOHC/AECOEM
- APHA conference
- International Society of Environmental Epidemiology
- NORA poster presentation
- North American Congress of Epidemiology
- Prevention of Work-Related Musculoskeletal Disorders (PREMUS) conference

2) Pilot projects have also led to the recipient receiving additional funding from the following sources:

- NIOSH R21
- UMass Lowell funding
- Maine workers compensation board
- Public employee retirement administration commission (PERAC)
- Simmons College
- Industry

3) Below is a table of our most recently funded pilot projects for the 2006-2007 budget year.

**Pilot Project Symposium
Harvard-NIOSH ERC
Harvard School of Public Health
Building1/Room 1302
September 14, 2007, Agenda**

- 9:00 a.m. Continental Breakfast
- 9:20 a.m. Welcome and Introductions
Dr. David C. Christiani, Director, Harvard-NIOSH ERC
Dr. Russ Hauser, Director, Pilot Project Research Training
- 9:30 a.m. JaeYoung Kim
Social Consequences of Occupational Injury: Depression and Suicide
- 9:45 a.m. Q & A
- 9:50 a.m. Jacqui Van Sipe
Use of Solid Phase Microextraction (SPME) to Assess Biomarkers of Inhalation and Dermal Exposures to Mixed Solvents
- 10:05 a.m. Q & A
- 10:10 a.m. Lenore Azaroff
Field Sampling and Exposure Assessment of Hardwood Floor Finishers
- 10:25 a.m. Q & A
- 10:30 a.m. Stefanos Kales
On-Duty CHD Events in Firefighters: Predictors of Fatal Incidents
- 10:45 a.m. Q & A
- 10:50 a.m. BREAK
- 11:05 a.m. Jon Boyer
Development of an Ergonomic Job Exposure Matrix (JEM) for the Healthcare Sector
- 11:20 a.m. Q & A
- 11:25 a.m. Ramaswamy Krishnan

Project Title	PI Name	CoPI Name	Home Institution	Funding Received
Field Sampling and Exposure Assessment of Hardwood Floor Finishes	Woskie, Azaroff	Shepard	UMASS - Lowell	\$10,000
Physical exposure assessment for epidemiologic research of musculoskeletal disorders: Pilot study	Dennerlein	Barrero	HSPH	\$10,000
On-Duty CHD Events in Firefighters: Predictors of Fatal incidents	Holder	Geibe	HSPH	\$10,000
Use of Solid Phase Microextraction (SPME) to Assess Biomarkers of Inhalation and Dermal Exposures to Mixed Solvents	Woskie	Van Snipe	UMASS - Lowell	\$10,000
Social consequences of occupational injury: depression and suicide	McNeely	Kim	HSPH	\$10,000
Development of an ergonomic job exposure matrix (JEM) for the healthcare sector	Punnett	Boyer	UMASS - Lowell	\$10,000
Evaluation of usefulness of a near-miss reporting system in reducing the number of OSHA recordable injuries.	Perry	Lander	HSPH	\$10,000
Protein Expression Changes and Work Stress in Pregnant Women	Wright	Wang	HSPH	\$10,000

	<i>Physical Exposure Assessment for Epidemiologic Research of Musculoskeletal Disorders: Pilot Study</i>
11:40 a.m.	Q & A
11:45 a.m.	Discussion
12:00 p.m.	LUNCH
1:00 p.m.	Mike Wang/Rosalind Wright <i>Protein Expression Changes and Work Stress in Pregnant Women</i>
1:15 p.m.	Q & A
1:20 p.m.	Lina Lander <i>Evaluation of Usefulness of a Near-Miss Reporting System in Reducing the Number of OSHA Recordable Injuries</i>
1:35 p.m.	Q & A
1:40 p.m.	Discussion
2:20 p.m.	Adjournment

E. Future Plans

We will continue to track the pilot proposal generated publications that are accepted, as well as the number of presentations, abstracts related to the pilot proposal. In addition, successful grant applications and funding subsequent to ERC pilot funding will be tracked. Investigators will be asked to submit copies of their publications and abstracts so that a record of all disseminated information based on the pilot projects can be maintained and reviewed.

The committee's annual review of the overall program quality and success will include: the number of proposals submitted; the number funded; the number of institutions represented among submitted and funded projects; the mean review scores of submitted and funded projects; a tabulation of NORA priority areas represented by projects; the disciplines represented by investigators; number of publications/presentations based on funded projects; and evidence that research training capacity has been enhanced for institutions engaged in the program. The committee will track and consider trends evidenced by these data over time and will recommend improvements to address program weaknesses. For example, if participation by outside institutions is noted to be minimal or to decrease, improved efforts to announce the program and solicit proposals will be made.

F. PUBLICATIONS

Pilot projects have also led to publications to peer reviewed journals (trainees underlined):

Holder JD, Stalling L, Peeples L, Burress JW, Kales SN. Firefighter Heart Presumption Retirements in Massachusetts: 1997-2004. *J Occup Environ Med.* 2006; 48:1047-1053.

Kales SN, Soteriades ES, Christophi CA, Christiani DC. Emergency Duties and Deaths from Heart Disease among Firefighters in the United States. *N Engl J Med.* 2007;356:1207-1215.

Fang S, Eisen E, Cavallari J, Mittleman M, Christiani D. Vascular responses to metal-rich particulate matter exposure: acute changes in augmentation index among welders. *Epidemiology* 2007 (In press).

Geibe JR, Holder JD, Peeples L, Kinney, AM, Burress JW, Kales, SN. Predictors of On-Duty Coronary Events in US Male Firefighters *Am J Cardiology* (accepted pending revision)

Kwapniewski R, Kozaczka S, Hauser R, Silva MJ, Calafat AM, Duty SM, *J Occup Environ Med* (under review)

Scott E and Callahan M. Isolation of Staphylococcus Aureus and MRSA from Environmental Surfaces in the Home. American Journal of Infection Control (Under review)

Lander, IL, Rudnick SA, Perry MJ. Assessing ototoxic exposures in farm youth. Farm youth exposure to noise. J Agromed (in press).

Perry MJ, Chen X, Lu X. Automated scoring of multiprobe FISH in human spermatozoa. Investigation of pesticides and aneuploidy in human sperm. Cytometry (in press).

A. Program Title

Hazardous Substance Training (HST) Program

B. Program Director

Stephen N. Rudnick, ScD, CIH

C. Program Description

The goals and objectives of the Hazardous Substance Training Program (HST) at the Harvard School of Public Health are to offer continuing-education courses to professionals who have environmental health and safety responsibilities for hazardous waste sites, emergency response operations, or other activities involving hazardous substances where a potential for significant exposures to workers and communities exists. In addition, because the 9/11 terrorist attacks have resulted in an increased perceived and real threat of hazardous chemicals, biological agents, and nuclear materials being used by terrorists, our goal is also to provide courses for professional training in emergency response and clean-up of hazardous substance releases that are appropriate to this threat.

Dr. Rudnick, the Program Director for the Hazardous Substance Training Program, has been a member of the industrial hygiene faculty at Harvard since 1988. During the past year, he was a co-director of five continuing-education courses: 1) Basic Hands-On CAMEO Training (March 20-22, 2006), 2) Integrated Emergency Planning: A Step-By-Step Approach to "One Plan" (May 25, 2006), 3) Advanced Hands-On CAMEO Training (May 22-24, 2006), 4) Comprehensive Industrial Hygiene: Practical Applications of Basic Principles (June 19-23, 2006), and 5) In-Place Filter Testing Workshop (August 22-26, 2005). He teaches four graduate courses: 1) Protecting Workers and Communities from Hazardous Substances, 2) Behavior and Properties of Airborne Particles, 3) Ventilation, and 4) Control of Noise and Vibration.

The School's Center for Continuing Professional Education (CCPE) assists Dr. Rudnick in marketing and implementing the continuing-education courses offered by the HST Program. The staff of CCPE working directly with Dr. Rudnick includes Lynn Fitzgerald, Associate Director of Programming, marketing experts, and program associates, who act as facilitators, making sure courses run smoothly and efficiently.

D. Program Activities and Accomplishments

We offer a diverse selection of courses that are important to environmental health and safety professionals

who help protect workers and communities from deleterious effects of hazardous substances. A list of these courses and the number of participants in each course are given in the next section. We are also in the process of conducting a formal needs assessment to determine what other hazardous substance courses are needed. We are hopeful that this will aid us in developing and offering additional courses that fulfils the needs of professionals.

For advice on matters involving hazardous substances, Dr. Rudnick relies on the joint HST/HSAT Advisory Committee, which last met on January 4, 2007, to provide advice and needs-assessment information necessary to guide our program offerings. This committee includes representatives from FEMA, OSHA, EPA, industry, and academia, as well as a consultant who was formerly manager of health and safety for a large national company involved in hazardous waste transportation and disposal, emergency response, and hazardous waste site remediation.

We have recently begun a more formal needs assessment. On January 4, 2007, prior to the HST/HSAT Advisory

Committee Meeting, we conducted what we called a "Focus Group on Continuing Professional Education in Hazardous Substance Training and other Occupational Hazards." Our objective was to develop a few concise questions that we could use for the purpose of conducting an email-based needs assessment.

We plan to administer a questionnaire to professionals for whom we have email addresses. These professionals will include two groups: 1) individuals who have participated during the past 10 years in Harvard continuing-education courses that were related to worker health and safety and to the environment, and 2) individuals who have made inquiries about environmentally related continuing-education courses in the last few years. This questionnaire will be administered using Zoomerang™ software (zoomerang.com), which is designed for this purpose. We plan to redo this survey every year.

E. Program Products

All of the courses offered by the HST Program from July 1, 2006 through June 30, 2007 were given at the Harvard School of Public Health in Boston MA. The course titles, duration, and the number of attendees and scholarships awarded are listed below in chronological order:

- August 8-11, 2006 – Radiological Emergency Planning: Terrorism, Security, and Communication (39 participants; 2 scholarships)
- March 26-28, 2007 – Basic Hands-On CAMEO Training (28 participants; 14 scholarships)
- May 21-23, 2007 – Advanced Hands-On CAMEO Training (23 participants; 12 scholarships)
- May 31, 2007 – Integrated Emergency Planning: A Step-by-Step Approach to "One Plan" (29 participants; 2 scholarships)
- June 11-15, 2007 – Radiation Safety Officer Training for Laboratory Professionals (46 participants; 3 scholarships)

"Radiological Emergency Planning: Terrorism, Security, and Communication" examines the latest principles and regulatory requirements for responding to radiological emergencies, the new federal framework for Homeland Security, and terrorist incidents involving radioactive materials. It also looks at lessons learned in communicating with the media and the public and updates on emergency preparedness issues for nuclear utilities.

The two CAMEO (Computer-Aided Management of Emergency Operations) courses provide significant assistance in understanding and utilizing the CAMEO system, a group of software applications used widely by government and industry to plan for and respond to chemical emergencies. CAMEO integrates a chemical database, air dispersion model, geographical information system, and data management capability. The

CAMEO system contains response information and recommendations for a large number of chemicals, models to assist in evaluating release scenarios and evacuation options, and several easily adaptable databases and computational programs that address the emergency planning provisions of SARA Title III, the Emergency Planning and Community Right-to-Know Act of 1986. CAMEO can include such diverse information as facility floor plans with chemical storage locations, lists of people who may need to be contacted, locations of schools, hospitals, and other population concentrations, transportation corridor analysis, available resources, historical weather information, and digitized maps of the planning area using overlays of plumes and other critical information.

“Integrated Emergency Planning: A Step-by-Step Approach to One Plan” is a course designed for facilities that need to develop or review their existing emergency response plans to meet rules from nine different regulatory agencies including EPA, DOL/OSHA, DHS, DOI, and DOT. The course provides significant help in writing and utilizing a “One Plan” to consolidate multiple plans into one functional emergency response plan or integrated emergency plan.

“Radiation Safety Officer Training for Laboratory Professionals” is a course designed for biotechnology, university, hospital, and medical laboratories that use radionuclides in their research and clinical practice. These

labs are required to appoint a qualified Radiation Safety Officer (RSO) to oversee the use, application, monitoring, and disposal of radionuclides. The person occupying this position must meet the training and experience qualifications specified in licenses issued by the NRC or Agreement States. “Radiation Safety

Officer Training for Laboratory Professionals” is a fundamental forty-hour training program for RSOs designed to provide them with the necessary skills to implement a radiation protection program and comply with regulations regarding the use of radionuclides. We believe that this is the only program available in the U.S. that specifically trains individuals for the radiological safety issues faced by the biotechnology, university, hospital, and medical laboratory.

F. Future Plans

The following courses, which are presently advertised on our website (<http://www.hsph.harvard.edu/ccpe/calendar.html>), have been scheduled for July 1, 2007 – June 30, 2008:

- August 7 – 10, 2007: Radiological Emergency Planning: Terrorism, Security, and Communication (Note: this course has already been given and had 40 participants.)
- March 24 – 26, 2008: Basic Hands-On CAMEO Training
- May 29, 2008: Integrated Emergency Planning: Step-By-Step Approach to “One Plan”
- June 9 – 11, 2008: Advanced Hands-On CAMEO Training
- June 9 – 13, 2008: Radiation Safety Officer Training for Laboratory Professionals

In addition, we are in the process of conducting a needs assessment survey. Other courses may be offered in the upcoming year based on the results of this survey.

A. Program Title

NORA Research Support Program Area

B. Program Director

David C. Christiani, MD, MPH

C. Program Description

Since the Region I (New England) economy is very diverse, regional needs tend to reflect national needs in occupational safety and health. Our regional research needs assessments are updated regularly and derive from several activities. Firstly, our ERC Advisory Committee, with representation from various stakeholder sectors, meets annually to review our training program, including both research and professional training. The Advisory Committee also advises the ERC faculty on research needs. Secondly, individual cores/special components have their own advisory committees, which meet regularly (annually to semi-annually) and assess research training needs and progress. Thirdly, the Visiting Scholars Program (see Outreach Core) is a group of multi-disciplinary professionals from academia, federal and state governments, industry, and non-profit organizations in Region I. This group intensifies our links with various entities in the region in a bi-directional, mutually beneficial way. Specifically (as part of their learning experience), the scholars raise issues related to gaps in OSH research while they interact with faculty and students. Fourthly, all ERC faculty are members of the regional branches of their respective professional organizations (e.g., occupational medicine, occupational health nursing, industrial hygiene), and regular meetings of these groups include discussions of the state-of-the-art research needs for the region and the nation. Fifthly, many of the ERC faculty members have served on NIOSH Advisory Committees (e.g., Mine Health and Safety Research Advisory Committee; Board of Scientific Counselors), which have targeted research needs. Lastly, a number of NIOSH faculty members serve on NORA committees for NIOSH and attend regularly NORA research meetings organized by NIOSH.

The major use of NORA funds have been to support doctoral student research in the form of tuition and stipend support and to support activities toward the goal of research training and translation of research findings.

D. Program Activities and Accomplishments

Providing Administrative and Technical Research Support for Research Training

The NORA research budget has been critical in supporting research training at the Harvard ERC. To date, we have targeted the student support for doctoral candidates and post-doctoral (esp. MD) trainees only, ensuring maximal effect for research productivity and for output of graduate level, doctorally-prepared researchers in the

field of occupational safety and health. Priority funding for scholarships and stipends (available on a competitive basis) is aimed at candidates whose theses address a NORA research priority area. Research administrative support is made possible by the NORA supplement, and includes: computer/IT services; library, copying, and search services; limited travel support for trainees to scientific meetings; minority student recruitment initiatives; and faculty and teaching assistant support for interdisciplinary courses.

Coordinating Interdisciplinary Research

The NORA research support has enabled the ERC to expand interdisciplinary research. Most of the large projects funded by NIOSH, NIH, or other agencies obtained by ERC faculty accommodate two or more doctoral students—usually one focused on exposure assessment, and one focused on epidemiology/health outcomes.

NORA support has also made it possible for doctoral students to pursue broader NORA research goals.

Doctoral

training support in Occupational Epidemiology, Industrial Hygiene, Occupational Health Services, and Occupational Injury Prevention has been extremely limited. In addition, education in workplace health promotion and behavioral science is needed, and cross-training has not been possible in the traditional academic components. The NORA supplement has expanded interdisciplinary research training support, and is open to students in all academic cores and special components.

Training Graduate Students with NORA Focus

All students supported by this component are pre-doctoral, and all do thesis research that focuses directly on a NORA research priority topic. The students come from all of the cores/special components (see individual progress reports for each). Faculty advisors meet regularly with students, and full, formal doctoral committee meetings occur at least semi-annually. The committee consists of the thesis advisor, plus two or three other faculty members in relevant areas (e.g., biostatistics, epidemiology, industrial hygiene). The final thesis consists of three chapters (which usually translates into three papers to be submitted for publication). Faculty experience and funded research relevant to NORA research priorities are listed in the Administrative Core report.

Research to Practice: Supporting CE/Outreach to translate NORA Research

The Harvard ERC CE and Outreach programs are designed to present current advancements in occupational safety and health to OSH professionals (CE), and, through the Visiting Scholars program, disseminate and translate current research results from NORA-related activities.

Continuing Professional Education: NORA research supplements have enhanced the CE program by providing administrative support for new programs relevant to the NORA mission. *Outreach Program:* The NORA research support has assisted in administering the Visiting Scholars program, a nationally recognized outreach program in OSH (see above). In addition, enhanced support for the ERC outreach website, faculty outreach, and ERC research services all serve to provide translational activities aimed at serving all OSH stakeholders in Region I.

Student Honors

Ms. Shona Fang, a doctoral student supported by NORA, won the best student research poster in a school-wide competition in March, 2007. She also won a scholarship to the annual meeting of the International Society of Environmental Epidemiology (ISEE). Other NORA doctoral students receiving ISEE scholarships included Amar Mehta and Jennifer Cavallari.

Jennifer Cavallari presented a poster "Circadian variation of heart rate variability following metal-rich fine particulate exposures in boilermaker construction workers" at the 19th International Conference on Epidemiology in Occupational Health in Banff, Canada. It was well received and she was awarded Best Poster by a Young Investigator by the European Centre for Ecotoxicology and Toxicology for Chemicals.

Faculty Honors

Dr. David Christiani, ERC Director, won the ACOEM Robert S. Kehoe Award for scientific achievement at the annual ACOEM in New Orleans in May, 2007.

E. Program Products

The most important program product is the graduates of the class of 2007, who left the school with doctoral degrees and have begun their careers in research. They include: Jennifer Cavallari and Jennifer Adibi.

F. Future Plans

To continue our focus on doctoral training is our main focus. We also will propose to expand the NORA research training to include post-doctoral research training for MD's and others with doctoral training on OSH fields to pursue additional or new directions in OSH research.

APPENDIX B NORA PUBLICATIONS

Cavallari JM, Eisen EA, Chen JC, Fang SC, Dobson CB, Schwartz J, Christiani DC. Night heart rate variability and particulate exposures among boilermaker construction workers. Environ Health Perspect. 2007 Jul;115(7):1046-51.

Chen JC, Cavallari JM, Stone PH, Christiani DC. Obesity is a modifier of autonomic cardiac responses to fine metal particulates. Environ Health Perspect. 2007 Jul;115(7):1002-6.

Harezlak J, Wang M, Christiani D, Lin X. Quantitative quality-assessment techniques to compare fractionation and depletion methods in SELDI-TOF mass spectrometry experiments. Bioinformatics. 2007 Jul 11.

Kile ML, Houseman EA, Breton CV, Smith T, Quamruzzaman Q, Rahman M, Mahiuddin G, Christiani DC. Dietary arsenic exposure in bangladesh. Environ Health Perspect. 2007 Jun;115(6):889-93.

Liu G, Gurubhagavatula S, Zhou W, Wang Z, Yeap BY, Asomaning K, Su L, Heist R, Lynch TJ, Christiani DC. Epidermal growth factor receptor polymorphisms and clinical outcomes in non-small-cell lung cancer patients treated with gefitinib. Pharmacogenomics J. 2007 Mar 20.

Breton CV, Zhou W, Kile ML, Houseman EA, Quamruzzaman Q, Rahman M, Mahiuddin G, Christiani DC. Susceptibility to arsenic-induced skin lesions from polymorphisms in base excision repair genes. Carcinogenesis. 2007 Jul;28(7):1520-5.

Fang SC, Eisen EA, Dai H, Zhang H, Hang J, Wang X, Christiani DC. Cancer mortality among textile workers in Shanghai, China: a preliminary study. J Occup Environ Med. 2006 Sep;48(9):955-8.

Breton CV, Houseman EA, Kile ML, Quamruzzaman Q, Rahman M, Mahiuddin G, Christiani DC. Gender-specific protective effect of hemoglobin on arsenic-induced skin lesions. Cancer Epidemiol Biomarkers Prev. 2006 May;15(5):902-7.

Kales SN, Huyck KL, Goldman RH. Elevated Urine Arsenic: Un-Speciatiated Results Lead to Unnecessary Concern and Further Evaluations. J Analytic Toxicol 2006;30:80-5.

Huyck K, Kile M, Mahiuddin G, Quamruzzaman Q, Rahman M, Breton C, Dobson C, Frelich J, Hoffman E, Yousuf J, Afroz, S, Islam S, Christiani D. Maternal Arsenic Exposure Associated With Low Birth Weight in Bangladesh. J Occup Environ Med. 49 (10); 2007.

McNeely, E. Hopcia, K and Bradley, J. Occupational Injury Tracking with OSHA logs: Ruler or Rubbish? Presented at the NIOSH Worklife Conference, September 2007.

A. Program Title

Continuing Education Core

B. Program Director

Lynn C. Fitzgerald

C. Program Description

The Continuing Education Core of the Harvard Education and Research Center is housed within the Center for Continuing Professional Education (CCPE) at the Harvard School of Public Health (HSPH). Complementing the mission of the Harvard ERC, the primary mission of ERC/CE is to provide occupational health and safety professionals with continuing education that emphasizes leadership development and opportunities to develop a public health perspective across the curriculum of practice-based CCPE programs. CCPE participants are professionals employed in industry, insurance, labor, government, unions, health care settings, consulting, research and teaching. CCPE draws from a rich legacy of ground-breaking research, academic excellence, policy expertise and world-wide field application. Content areas are built upon topics pertinent to leaders and practitioners of occupational health and safety.

CCPE is extremely fortunate to have access to the vast talent and resources that are provided by the Harvard School of Public Health and the Harvard University system including affiliated hospitals, research labs and clinics. The Center connects internationally recognized faculty and experts with research and industry experience to produce the highest standard of educational activities. By combining faculty, departments, content and stakeholders, CCPE activities reflect the multi-disciplinary nature of public health delivered with a focus on the realities of participant practice.

CCPE works closely with program directors and directors of the academic cores to provide targeted and innovative course development, shape program content, and recommendations for program revitalization based on information gleaned from a variety of methods used to determine continuing education needs. As experts in their field, HSPH faculty continually reviews and has intimate knowledge of the current literature in public health. This expertise and knowledge base is one fundamental source for identifying educational needs. Results of their research projects, compilations of needs identified through projects, and summaries of their work with outside agencies are identified as sources of needs. Additional methods include industry-related focus groups, as well as surveys, using Zoomerang software, to past participants, professional groups, labor and trade unions. Other sources include: Harvard faculty, current literature, Harvard School of Public Health initiatives, participant feedback, risk management data, periodic surveys of interest, requests from staff members and departmental chairs, advice from experts in the field, requests from participants, ongoing reviews of change in public health, and CCPE initiatives.

CCPE is also accredited by the ACCME. A number of ERC/CE programs attract occupational medicine physicians and the CME credits CCPE is able to offer them is important to their professional development. A CME Committee is comprised of HSPH faculty who are appointed by the Dean for Academic Affairs. Committee members consider critical issues relative to needs assessment, instructional design, content,

methodology, faculty selection, and evaluation while also providing recommendations to program directors and CCPE staff. Richard Monson, MD, Associate Dean for Professional Education, chairs the CME Advisory Committee and he is also a member of the Committee on Educational Policy, the HSPH academic educational review committee. David Christiani, director of the HSPH ERC is also a member.

D. Program Activities and Accomplishments

- **New program development:** The ERC/CE initiated conversations to develop a continuum of interdisciplinary programs around a health workplace initiative. The interdisciplinary nature of this effort has led to a new program proposal for a course entitled, *Building Healthy Work Environments*. The program proposal was approved by the CME Committee and awarded development funds. It is currently being developed for presentation to the CME Committee in the Spring of 2008.
- **Outcomes assessment:** While in its formative stage, a protocol is currently being tested in the ERC/CE course, Acute and Chronic Noise Exposure. Participants in this course were sent a 6-month follow-up questionnaire that will help us understand how well they were able to take the classroom learning and apply it to their jobs.

Meanwhile, focus groups have become an integral part of modifying or enhancing existing programs as well as informing new program development. They also offer a direct and continuous connection with program participants to explore and evaluate the real world issues/current events that are incorporated into existing curriculum as above, or should be considered for new programming initiatives.

- **Extend our reach:** Efforts in this area have contributed to increased enrollment in our public programs. The ERC/CE 2007 goal to extend our reach through the promotion of custom programs resulted in the Risk Communication Challenges course being customized for a group in Toronto.

According to the plan stated in the July076-Feb07 progress report, the ERC/CE has linked faculty biographies and research to the programs they teach in continuing education.

- **Promote multiple learning formats and channels of distribution** was combined with our goal to develop more program collaboration when the ERC/CE handled the logistical planning registration and onsite support to the Sixth International Scientific Conference on Prevention of Work-Related Musculoskeletal Disorders (PREMUS 2007), held in August. Participants numbered close to 450. Working closely with HSPH associate professor, Jack Dennerlein and the University of Massachusetts/Lowell, we delivered a conference that was a resounding success and has generated additional requests for conferences in the years ahead.

E. Program Products

Continuing Education Courses by Core

Industrial Hygiene

- **Comprehensive Industrial Hygiene: Practical Applications of Basic Principles** (updated to include segment on mold contamination)
- **Occupational & Environmental Radiation Protection: Principles and Practices of Radiation Safety** (updated with USNRC and Agreement State Regulations, inspection of licensees, and review of changes in radon dose assessment methodologies)
- **Environmental Radiation Monitoring** – in development

Occupational Medicine/OHN

- Grand Rounds in Occupational and Environmental Medicine
- New England College of Occupational and Environmental Medicine/Massachusetts Association of Occupational Health Nurses annual conference
- Occupational & Environmental Research Seminars
- Seminars in Occupational Health

Safety and Injury Prevention

- Ergonomics and Human Factors: Applications in Occupational Safety & Health (revised to include laboratory design and architect continuing education credit)
- 6th International Scientific Conference on Prevention of Work-related Musculoskeletal Disorders (PREMUS 2007) - held in August 2007.

Hazardous Substance Training

- Advanced Hands-On Cameo Training (2 iterations w/ new software)
- Hands-On CAMEO Training
- Integrated Emergency Planning: A Step-by-Step Approach to One Plan (New)
- Radiation Safety Officer Training for Laboratory Professionals (New)
- Radiological Emergency Planning: The New Face of Emergency Planning – Terrorism, Security and the Public (Revised and updated content/formerly Nuclear Emergency Planning)
- Building Partnerships to Prevent Natural and Human-Created Disasters and Their Consequences – Conference in development

Other

- Analyzing Risk: Science, Assessment and Management
- Guidelines for Laboratory Design
- Management Skills for Emerging Leaders in Environmental Health & Safety (revised and updated content/formerly Leadership and Management Skills)
- Risk Communication Challenge
- Risk Communication Challenge Custom held in Toronto.

F. Future Plans

- Continue to implement outcomes assessment and evaluate the results for further planning
- Plan for hosting a conference on exposures in 2009
- Evaluate the possibility of hosting a conference on lower back pain
- Roll out a program for minority recruitment with ERC Outreach and the academic cores. The short-term Minority Mentorship Program will be developed in consultation with an advisory group made up of labor, industry, and ERC faculty. Employers will be invited to sponsor a minority employee who, as a mentored intern, would benefit from the scientific expertise of ERC faculty.
- Make ERC Grand Rounds accessible via website. This will be tested with the University of Connecticut Medical School in the Spring of 2008 with the expectation of ERC/CE and Outreach providing them on the ERC website in the Fall of 2008.
- Continue to expand our needs assessment efforts. Currently, we are conducting a needs assessment in the New England area. We plan to conduct additional needs assessment by specialty areas.

A. Program Title

Outreach

B. Program Director

Ann S. Backus, M.S.

C. Program Description

The basic goals of outreach are to translate the research findings of the ERC faculty in the fields of injury prevention, epidemiology, occupational health nursing, occupational medicine, and industrial hygiene to an audience consisting of other academics outside the field, practicing professionals, workers, industry managers, and unions among others.

The programs we have established for implementing these goals include 1) the Visiting Scholars Program; 2) "vendor" posters with interactive components at regional conferences; 3) direct work with industries; 4) membership on policy-making councils and task forces; 5) HSPH academic course support, and 6) special projects and events

D. Program Activities and Accomplishments

1) The **Visiting Scholar Program** has recently completed its 19th year as an activity of the Harvard ERC. This is one of our **Research to Practice** translation programs. During the 2006-2007 academic year, the following active visiting scholars in the program:

Ellen Ceppetelli, MS, RNC, Director of Nursing Education, Dartmouth Hitchcock Medical Center (NH)

Jeffrey Ciampa, Safety and Health Manager, Aggregate Industries (MA)

Richard Donahue, MD, an MPH student; former community-based doctor (ME)

Peter Doran, PhD, CHES, Professor Emeritus, Univ. of Maine- Farmington (ME)

Earl Dotter, Photojournalist (MD)

Stanley Eller, Esq., MS, Auburn Enterprises (ME)

Russell Farnen, PhD, Prof. of Political Science, Univ. of CT, West Hartford (CT)

Hollie Shaner-McRae, RN, MSA, FAAN, Coordinator, Professional Nursing Practice, Fletcher Allen Health Care (VT)

Each scholar works on at least one project a year. Miniconferences (listed below), with speakers from the faculty and from outside experts, provide the backbone for transferring knowledge from faculty to the field. Three of the eight scholars apply new knowledge in the academic setting; four use the knowledge in health care or heavy industry; and one reaches a wide audience through photographic exhibits.

2) Posters outlining research results from faculty have been presented at a "vendor" table at the joint conference for practitioners sponsored by the New England College of Occupational and Environmental Medicine and Massachusetts Association of Occupational Health Nurses Annual Conference for the past six years. These posters are expanded by an interactive component that engages the doctors and nurses with recent research findings and related information. Our most successful interactive poster involved measuring peak flow for nurses and doctors in association with a poster on pulmonary disease. At the 2004 and 2005 conferences we demonstrated phthalate-free self-

care and health care products in association with our phthalate research results poster. Through this mechanism we promote faculty and resident research as well as inform doctors and nurses about our occupational medicine and health training programs. We share the vendor table with the ERC Continuing Education Program in order to promote the following year's continuing education offerings. In 2006, we promoted the new Acute and Chronic Noise Exposure Course.

3) Ann Backus works very closely with the northern New England fishing industry, and largely with the lobstermen. Outreach to this industry includes bimonthly articles in two industry publications: *FISH SAFE* appears in Commercial Fisheries News and *The Voice of Safety* appears in The Fishermen's Voice. Ann shared a vendor table at The Fishermen's Forum in Rockport, Maine, March 1, 2, 2007 with the Maine Marine Patrol, presented risk reduction strategies at a workshop sponsored by the Maine Commercial Fishing Advisory Council, and discussed safety strategies with individual fishermen. She made re-boarding ladders out of 3/8 inch rope for fishermen who wanted to be able to re-board their boats after a man-overboard incident.

4) Ann Backus has recently been reappointed to the Maine Commercial Fishing Safety Advisory Council (originally appointed by Maine's Governor Baldacci) for another three year term until 2009. This Advisory Council is working on parity legislation that will ensure that both state registered boats and federally documented boats have the same safety gear requirements.

5) In the 2005-2006 academic year, we continued our course support of EH 243, Occupational Safety by providing the highly-rated session on the importance of safety training that involves HSPH students donning survival suits and engaging in an abandon vessel drill. The US Coast Guard Region I office provides the survival suits and demonstrates the use of inflatable life rafts.

Through our connection with Jeff Ciampa, Visiting Scholar, we were able, for the second consecutive year, to arrange a worksite visit to Aggregate Industries for the students in ID 251, The Practice of Occupational Health. On-sight in Saugus, Massachusetts, they were able to observe, discuss, and evaluate the hazards associated with surface mining, stone crushing, and concrete/asphalt mixing.

Awards and Honors Ann Backus testified in Washington, DC at the invitation of the House Subcommittee on Coast Guard and Marine Transportation on commercial fishing regulations regarding Boundary Line, parity across vessel registration classes, and training for fishermen. She has also accepted an invitation serve as a corresponding member of the NIOSH NORA Agriculture, Fishing, and Forestry sector.

E. Program Products

Mini-Conferences Six miniconferences were provided for the Visiting Scholars. A list of the speakers and topics appears below.

September 15, 2006

Harvard-NIOSH Pilot Project Symposium

Kerry Souza/David Weil: *Evaluation of Personal Characteristics of Immigrant Workers Who Died of Traumatic Occupational Injury*

Lenard Kaye/Sandra Butler: *The Health and Safety of Older Workers in Maine Pilot Project*

Jennifer Cavallari/Shona Fang: *Occupational Exposure to Fine Particulate Matter and Arterial Stiffness among Boilermaker Construction*

Mike Wang: *Exploratory Proteomic Analysis using SELDI-TOF MS Technology in Serum Samples from Individuals Exposed to Metal Fume*

Kenneth Dangman/Nancy Simcox: *A Sampling Strategy for Personal Bioaerosol Exposure Monitoring among Teachers in Connecticut*

DeWei Li/James LaMondia: *A Pilot Study of Workers' Exposure to Airborne and Phylloplane Fungi in Greenhouses in Connecticut with a Traditional Method and QPCR*

Jungkeun Park/Bryan Buchholz: *An Evaluation of Muscle Activity and Posture of Upper Extremity during Simulated Pipette Work*

Elizabeth Scott/Susan Duty: *Characterization and Quantification of Bacterial and Viral Pathogens and Indicator Organisms in Household Environments*

Lu Yuan/Bryan Buchholz: *Biomechanical Analysis of the Low Back and Shoulder during Drywall Installation*

Melissa Perry/Aqiel Dalvie: *Chromosomal Effects of Organochlorine Exposure in Human Sperm*

Earl Dotter (Photography Exhibit)

"Our Future in Retrospect? Coal Miner Health in Appalachia: Photographs by Russell Lee – 1946 & Earl Dotter – 2006"

October 20, 2006

Aaron Blair, PhD - Senior Investigator, Division of Cancer Epidemiology and Genetics, National Cancer Institute: *Confounding and Exposure Misclassification in Epidemiologic Research*

November 17, 2006

Ann Backus: *Peak Flow Measurements: How Open is Your Trachea?*

Jonathan Levy, Sc.D - Mark and Catherine Winkler Associate Professor of Environmental Health and Risk Assessment, Departments of Environmental Health and Health Policy and Management: *Research Findings and Interventions: The Indoor Air Quality of Urban Housing Boston*

Jennifer Cavallari, SM - Doctoral Candidate, Environmental Health, Harvard School of Public Health: *The Association Between Fine Particulate Metal Concentrations and Night Heart Rate Variability: A Panel Study of Boilermaker Construction Workers*

Amar Mehta, MPH - SD Candidate, Environmental Health, Harvard School of Public Health: *Lung Cancer, COPD Mortality, and Exposure to Synthetic Metalworking Fluids in the Auto Industry*

February 9, 2007

Jeffrey Ciampa, BS - Manager, Safety, Training, & Environmental Compliance, Aggregate Industries: *Risk Index in the Construction Industry*

Stephanie Chalupka, EdD, APRN, BC, CNS, FAAOHN - Associate Professor, Undergraduate Nursing Education, Univ. Mass, Lowell: *Working with Community Groups*

Herman Tavani, PhD - Professor and Chair, Philosophy Department, Rivier College: *What does the community need to know about the role of genetics in research and disease?*

Belayneh Abejie, MD, MPH - Resident, Occupational and Environmental Medicine, Harvard School of Public Health: *Grand Rounds: Asbestos - Related Pericarditis*

Jalal Ghaemghami, PhD - Principal Toxicologist, Boston Public Health Commission: *Health Impact Assessment - Community Involvement*

May 5, 2007

Steve Dickens, MA - Director, Healthy Waters, Healthy Communities Program, River Network: *A Citizen's Guide for Investigating Pollution/Health Connections*

Program Products – R2P Visiting Scholar Peter Doran, PhD, CHES, continues to serve on the Maine Occupational Safety and Health Research Agenda (MORA) Steering Committee that meets monthly. A

standing committee on data collection and injury prevention has now been established and reports annually to the state legislature; the group continues to work on improving electronic data collection among the Workers' Compensation Board, the Maine Bureau of Labor Standards and the Maine Center for Disease Control. MORA is also active with the Maine Migrant Workers Health Program and has raised funds to support Earl Dotter's photographic documentary of Migrant workers. The Maine Indoor Air Quality Council (MIAQC) that Doran helped establish continues to offer their annual conference. This year's conference (March 28, 2007 in Augusta) emphasized indoor air quality for public buildings and featured, as a keynote speaker, Richard Shaughnessy, PhD, a chemical engineer, reporting on his research regarding the impact of indoor air quality on student performance. MIAQC has completed work on the technical training program for contractors that rolled out in March 2007 after being pilot-tested in February. The topic is "The Total Building Envelope."

Visiting Scholar Jeff Ciampa, Health and Safety Manager, Aggregate Industries – Northeast Region, Inc. Saugus developed four products for his industry designed to reduce lost work days. 1) Built on previous outreach group experience to develop risk index survey tool to measure behavioral based safety conditions for drivers of concrete delivery trucks. 2) Developed graphic based temporary traffic control plans to improve construction worker and public traffic safety conditions for inner state highway construction projects. 3) Developed public assess website to improve worker and traffic safety conditions. 4) Developed cost of loss economic models to help understand business impacts associated with injuries and other losses.

Visiting Scholar Earl Dotter, nationally recognized photojournalist, developed an exhibit entitled "Our Future in Retrospect? Coal Miner Health in Appalachia: *Photographs by Russell Lee - 1946 & Earl Dotter – 2006*" that revisited, through photography, the coal mining region of West Virginia originally chronicled in the 1946 Medical Survey of the Bituminous Coal Industry by Navy Rear Admiral Joel T. Boone. This 1946 Boone Report lead to the first industrial union health and retirement funds in the US. The exhibit was on display at the Harvard School of Public Health from September 14 through October 5, 2006. Dean Bloom, David Christiani, Earl Dotter, and Jill Kriesky from Wheeling Jesuit University in West Virginia provided opening remarks. The exhibit was dedicated to the 38 coal miners who lost their lives in the first nine months of 2006.

Finally, a new continuing education course for the ERC was developed in collaboration with the ERC Continuing Education Program. This comprehensive two-day course entitled *Acute and Chronic Noise Exposure: Strategies for Preventing, Diagnosing, and Treating Hearing Loss* was given March 29, 30, 2007. The HSPH Center for Continuing Professional Education awarded Ann Backus and the course faculty \$3000 to develop and market the course. The thirty-eight participants included 10 physicians, five PhDs, five audiologists, two industrial hygienists, four RN/BSNs, seven certified occupational health nurses, and five others. Content that was designed to be distinct from that available in traditional hearing conservation courses featured the pathophysiology of noise-induced hearing loss (NIHL), future drug treatments, synergistic exposures of chemicals and noise, and a strong emphasis on both civilian and military research on NIHL. On a rating scale of five points, this course was rated by the participants as 4.8 and considered highly successful by the HSPH Center for Continuing Professional Education.

F. Future Plans

In addition to continuing the established outreach activities mentioned above such as the Visiting Scholars Program, work with the fishing industry and the commercial fishing safety advisory council, the academic course support, and interaction with NECOEM and MaAOHN, the Outreach Program will host an Earl Dotter photography exhibit on Migrant Labor at HSPH in 2008. This exhibit will chronicle the migrant workers harvesting crops in Maine and will feature the ergonomic improvements to harvesting tools by migrants and a model health care access program for migrants managed by the Maine Migrant Health Care Program. As funds permit, this

exhibit will also appear at the Maine State House in Augusta as well as in various other venues throughout Maine.

The Acute and Chronic Noise Exposure CE course has been redesigned by Ann Backus and Sharon Kujawa, AudD, of Massachusetts Eye and Ear Infirmary. It is scheduled to be delivered March 26-28, 2008.

Program Director: Christiani, David C.
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Mary Davis, assistant professor, University of Maine, Orono and Ann Backus, Co-PI, have received funding from NOAA through the Maine Sea Grant Program to survey fishermen in a variety of fisheries along the Maine coast, regarding their compliance with the Commercial Fishing Vessel Safety Act of 1988. This research will deliver an economic model of the cost of compliance which in turn will inform the impact of newly promulgated federal safety regulations.

**APPENDIX B
OUTREACH PUBLICATIONS**

Publications – not peer-reviewed.

- Backus A. 2006. Welcome to The Voice of Safety.—Summer Tips. *Fishermen's Voice*. 11(8):13.
- Backus A. 2006. For 2006, terminations up, casualties down. *Commercial Fisheries News*. 34(1):24A.
- Backus A. 2006. Cascade of events led to entanglement death. *Commercial Fisheries News*. 34(3):11B.
- Backus A. 2007. Replace Your 121.5 MHz EPIRB With the 406 MHz Model Now. *Fishermen's Voice*. 12(1):23.
- Backus A. 2007. Cutting loose: Knife grip, shape matters. *Commercial Fisheries News*. 34(5):12B.
- Backus A. 2007. Prepare to combat the perils of icing. *Commercial Fisheries News*. 4(7):12C.
- Backus A. 2007. Wind Chill and Frostbite. *Fishermen's Voice*. 12(3):8.
- Backus A. 2007. How's your bilge system working? *Commercial Fisheries News*. 34(9):17B.
- Backus A. 2007. The "Wedding Band System" Solution. *Fishermen's Voice*. 12(5):13.
- Backus A. 2007. Boundary line not the way to figure risk. *Commercial Fisheries News*. 34(10):19A.
- Backus A. 2007. Protect against multiple hazards of welding. *Commercial Fisheries News*. 35(1):14B.

- III. Report on Specific Improvements in OS&H Resulting from ERC Programs (Include any specific project or activity that demonstrated a specific impact on worker safety and health.)

INDUSTRIAL HYGIENE

Thorough our Outreach Program we have been working with fishermen on the New England coast to help them deal with occupational hazards from rope entanglement during lobstering and toxic exposures when they

paint and brand their lobster bouys. Ann Backus has worked to pass along ideas about rope lockers to keep ropes from lobster pots away from the feet. We have assisted in measuring exposures to solvents and plastic pyrolysis fume in fishermen's work sheds and inexpensive controls for capturing them.

Dr. Herrick has recently conducted a series of investigations on environmental contamination and human exposure to PCBs from contaminated building materials. Although the presence of PCB in paints and window caulking has been reported in Europe, we were the first to document its presence in the United States. Since our initial publication of these findings (2004), we have continued this line of investigation and found that PCBs readily leach from these buildings, resulting in extensive soil contamination (2006), and that workers who conduct renovations on these buildings have elevated serum PCB levels (2007). These findings have been part of the growing body of evidence that has prompted requirements for PCB testing before building renovation or demolition, for example, in the New York State University system.

OCCUPATIONAL MEDICINE

Below are several examples of projects by second year residents that impact worker safety and health:

Jesse Geibe, MD, MBA, MPH presented a comprehensive review of literature on occupational lung cancer screening with sputum cytology, radiographs and low dose CT during his rotation at Cambridge Health Alliance.

Belayneh Abejie, MD, MPH, during his rotation at the Massachusetts Department of Public Health, developed a survey questionnaire to conduct survey research on work-related asthma and to assess the impact of the SENSOR Bulletin in reporting work-related asthma among Occupational and Environmental Medicine physicians in MA. Dr. Abejie also developed a proposal to evaluate the impact of occupational lung disease SENSOR Bulletin intervention, and identified barriers for reporting work-related asthma in MA.

OCCUPATIONAL EPIDEMIOLOGY

It is difficult to measure large changes in an area where progress is incremental and challenges abound. Improvements we can point out, however, include:

1. As a result of our research with the Boilermakers union, the ventilation system in their apprentice hall has been upgraded.

INJURY PREVENTION CORE

We have several field projects underway aimed at reducing occupational hazards. One study by one of our self-supporting occupational injury doctoral trainees, Lina Lander, evaluated the impact of a near miss reporting system on the rate of OSHA recordable injuries in a manufacturing facility. In comparing OSHA recordable injury rates pre and post implementation of the reporting system, she found that OSHA recordable and major injuries significantly decreased whereas near miss reports significantly increased following reporting system onset. This work is currently being submitted for publication. Other intervention studies currently underway include a project to prevent ladder falls in construction and an analysis of laceration risk factors in meat packing.

HAZARDOUS SUBSTANCE ACADEMIC TRAINING

Victoria Jackson, who graduated from the HSAT Program this past June, returned to the U.S. Navy. She will be much better prepared to protect the health and safety of Navy personnel than she had been prior to entering the program. The additional training she received by completing the HSAT Program will be particularly helpful because Navy activities involve many hazardous substances.

NORA

The research products of the Center have contributed to the body of knowledge on OSH, and provide the scientific basis for standards development and revision.

CONTINUING EDUCATION

As mentioned earlier, ERC/CE worked with Jack Dennerlein and University of Massachusetts/Lowell to host the Sixth International Scientific Conference on Prevention of Work-related Musculoskeletal Disorders. Held in August, this conference provided an international platform to exchange knowledge and expertise in musculoskeletal research and practice. The conference brought together scientists and practitioners in occupational safety and health, ergonomics, industrial engineers, and policy makers, to foster the exchange of ideas and expertise.

OUTREACH

The Maine department of fisheries have adapted improved safety rules and regulations for lobster fisherman.

Visiting Scholar Jeff Ciampa, of Aggregate Industries, established a website, www.pave93.com, designed to reduce injuries to highway construction workers and travelers during the re-paving of Interstate 93 in the summer of 2006. This website, easily accessible to the public, provided daily updates as to the date and time of highway construction and enabled travelers/commuters to plan their trips in order to avoid major construction times. The expectation was that foreknowledge would encourage travelers to observe posted speeds in construction zones. Feedback from website users will be used to determine the effectiveness of the program.

According to Ciampa, "Our safety record has been setting all kinds of records, basically we've come from an injury rate of 12.5/100 in 2003 to a current year rate of 4.1/100 employees, and costs (affected by non-injury losses as well) are down 80% over the same period." Ciampa has been promoted to manager of Aggregate's \$ 150 M asphalt operation.

It is expected that the testimony given by Ann Backus, representatives from NIOSH, The US Coast Guard, a fisherman from Maine, and several others with regard to the commercial fishing safety regulations, will result in stronger **Federal Fishing Policies** that in turn will result in reduced fatalities and casualties at sea.