FINAL PERFORMANCE REPORT

Northern California Education and Research Center
Center for Occupational and Environmental Health
University of California
School of Public Health
Berkeley, CA 94720

John R. Balmes, M.D.
Director

NIOSH Grant # T42 OH008429
Years 29-33
July 1, 2010 - June 30, 2015

TABLE OF CONTENTS

ABSTRACT

The Northern California ERC (NCERC) was established in 1982. During the 33 years of its existence, it has provided professional and research training at the graduate and post-graduate levels in industrial hygiene, occupational medicine, occupational health nursing, and ergonomics. Occupational epidemiology was added in 2011. A clinic administered by the Division of Occupational and Environmental Medicine (OEM) at UCSF provides interdisciplinary training. In addition to academic and clinical training, the ERC provides a wide spectrum of continuing education and outreach activities.

The NCERC programs are located on two campuses of the University of California – Berkeley (UCB) and San Francisco (UCSF). Located at Berkeley are Industrial Hygiene, Occupational Epidemiology, the Labor Occupational Health Program (outreach), Ergonomics (jointly with UCSF), and the Continuing Education Program. An Occupational and Environmental Medicine (OEM) Residency Program and the Occupational and Environmental Health Nursing (OEHN) Program are housed in the Schools of Medicine and Nursing, respectively, at San Francisco.

John R. Balmes, MD, former director of the OEM Residency Program, assumed the director's role in 2006 and Marion Gillen, RN, MPH, PhD, former director of the OEHN Program, served as deputy director until her retirement in 2011 when Patty Quinlan, MPH, CIH, assumed the role of deputy director in July 2011.

The ERC is complemented by the state-funded Northern California Center for Occupational and Environmental Health (COEH), directed by Professor John R. Balmes since 2000. The COEH comprises the same programs as the ERC at Berkeley and UCSF, plus programs at UC Davis, and programs of the Labor Occupational Health Program. Most importantly, the COEH provides funding for the faculty and staff infrastructure that supports the teaching programs at Berkeley, UC Davis, and UCSF. Approximately 60 faculty, plus researchers and other professional staff from many schools and disciplines, are involved in the COEH. In addition to NIOSH ERC funding, the University of California provides approximately $2.2 million in annual funding, and core ERC faculty, along with other significant contributors to the ERC training mission, have been highly successful in obtaining extramural funding to support research and training activities.

The University provides fully equipped teaching facilities at all of the NCERC locations. They include classrooms, faculty and staff offices, laboratories, and clinical facilities. Both campuses have an extensive library and are connected into the University's system-wide library. They also have essential computing resources.

CENTERIDE HIGHLIGHTS AND SIGNIFICANT RESULTS

During the reporting period, the NCERC has trained 125 students or residents (20 IH, 62 OEHN, 17 OEM, 12 Ergonomics, 14 OE). Of this number, 98 have graduated from their respective programs. Of the 98 graduates, there were 14 OEM graduates, 52 OEHN graduates (8 PhD and 44 MS), 16 IH Graduates, 11 Ergonomics graduates, and 5 Occupational Epidemiology graduates. Fifty-one are employed in the private sector; 27 in the public sector, and 20 are in academia, including 11 pursuing advanced degrees post-graduation. During this period, trainees authored or co-authored more than 80 peer-reviewed publications. In addition, students in all programs made presentations at many regional, national, and international conferences.

The 2010-15 NIOSH reporting period was a very successful one for the **COEH Continuing Education (CE) Program.** The program offered 385 CE courses and trained 13,394 professionals. This number included 3920 physicians, 1349 nurses, 2421 industrial hygienists and 1495 safety professionals. The 4209 trainees from other professions or for whom information was not available included asbestos and lead abatement contractors, physical and occupational therapists, professional ergonomists, consultants, scientists and agricultural employees.

During the 2010-15 NIOSH reporting period **the Outreach Program at LOHP** helped to implement our ERC's broad outreach goals. This included connecting ERC resources with OS&H practitioners in the field to increase their capacity to participate in promoting effective injury and illness prevention programs in the workplace. The program also collaborated with OH professionals to raise awareness of OHS issues within labor, business and community organizations. They had great success with their partnership with the NIOSH-funded national TPG, Occupational Health Internship Program, to provide community-based internships to undergraduate and graduate students. As a result of their outreach efforts over 90 undergraduate and graduate students applied to our internship program each summer. Student majors have included public health, conservation resource studies, environmental health, international studies, as well as nursing and medical students. LOHP also Promoted integration of OH&S into curricula that the high school, community college and university level. Finally, they built a network among faculty within Region IX to share resources, research results and promote research to practice initiatives.

ADMINISTRATION

The Northern California ERC and COEH are guided by an Executive Committee:

ERC & COEH Director:	**John R. Balmes, MD**
Deputy Director:	**Patty Quinlan, MPH, CIH**
Program Directors of the ERC:	
Occupational and Environmental Medicine:	**Paul Blanc, MD, MSPH**
Occupational and Environmental Health Nursing:	**Oisaeng Hong, RN, PhD**
Industrial Hygiene:	**S. Katherine Hammond PhD**
Ergonomics:	**David Rempel, MD, MPH**
Occupational Epidemiology:	**Ellen Eisen, ScD**
Targeted Research Training:	**Michael Bates, PhD**
Outreach Program:	**Laura Stock, MPH**
Continuing Education:	**Patty Quinlan, MPH, CIH**

The NCERC has an external advisory committee composed of representatives from each of the occupational health disciplines and from industry, labor, government and academia. This external advisory committee meets twice a year.

Because the NCERC has programs on two campuses of the University of California, we have made special efforts to integrate activities to create a whole that is greater than the sum of its parts. The Executive Committee has encouraged the development of interdisciplinary activities that cross program and campus lines, and some of these have become institutionalized. This team approach is also initiated by enterprising individuals who capitalize on the expertise of their colleagues and students from different programs.

Examples of integrative activities of the NCERC include the clinic at UCSF which provides multidisciplinary training opportunities, the MPH program at Berkeley which brings the OEM residents into contact with the industrial hygiene and ergonomics students, the Ergonomics course at UC Berkeley that also includes the OEHN students, the twice-a-year ERC/COEH get-togethers and annual symposia, service projects, faculty providing lectures in each others' classes, and research projects and COEH student award projects that support interdisciplinary collaboration among students and faculty, including Targeted Research Training seminars.

Program Status

In the 5-year period covered by this report, the NCERC has undergone significant strengthening. As detailed in the program reports the following has occurred:

Leadership of the Industrial Hygiene Program at Berkeley has been transferred to Dr. Katharine Hammond during this cycle.

Leadership of the OEM Residency Program changed with long-time faculty members Paul Blanc and Robert Harrison assuming positions as Director and Co-Director, respectively.

The Targeted Research Training (TRT) program was successfully reactivated during the reporting period under the leadership of Drs. Balmes and Gillen. In 2012 leadership of the TRT was transferred to Dr. Michael Bates. The major accomplishment of the TRT program was the expansion of the OEM Research Seminar into an interdisciplinary Research Training Seminar focusing on research design and implementation under the leadership of UC Berkeley epidemiologist, Dr. Michael Bates. UCSF trainees in OEHN and OEM, as well as those in the TRT program, attend this monthly seminar.

The Occupational Epidemiology program was established in 2011 under the leadership of UC Berkeley epidemiologist, Ellen Eisen, and has been successfully integrated into the NCERC. An integral part of this new program is a new interdisciplinary course, "Case Studies in Occupational and Environmental Epidemiology" that was developed by Dr. Eisen.

Many faculty of the core and allied disciplines in the NC-ERC are nationally or internationally recognized leaders in their fields. For example, David Rempel, the Director of the Ergonomics program, has been pioneering randomized, clinical trials to evaluate the efficacy of workstation interventions to prevent musculoskeletal disorders as well as pooling of prospective epidemiological studies of risk factors for these disorders among workers exposed to repetitive strain. These studies have demonstrated the benefit of forearm support and ergonomic training for computer operators, an improved chair for sewing machine operators, an alternative mouse for engineers, a newly designed rig for overhead drilling of concrete, and the importance of workplace factors predicting wrist tendinosis (time-weighted average values of percent time spent in heavy pinch and the ACGIH-TLV for Hand Activity Level. The wrist tendinosis risk factor research led to the publication of a paper (Harris C, Eisen EA, Goldberg R, Krause N, Rempel D. Workplace and individual factors in wrist tendinosis among blue-collar workers--the San Francisco study. Scand J Work Environ Health 2011;37:85-98) that won 1st Place PREMUS best paper competition.

In Industrial Hygiene, Dr. S. Katharine Hammond, the new Director of the program, is a nationally and internationally recognized expert in exposure assessment (for environmental and occupational exposures as well as second hand smoke exposures). She has served on numerous advisory committees for the World Health Organization, the National Academy of Sciences, the Institute of Medicine and the Board of Scientific Counselors for the National Toxicology Program, and she was an author of the US Surgeon General's report on involuntary smoking. The immediate past Director of IH, Dr. Mark Nicas, continues to serve as the Editor of the *Journal of Occupational and Environmental Hygiene*, the official journal of the American Industrial Hygiene Association. Dr. Stephen Rappaport, a pioneer in the development of biomarkers and the conceptual framework of the exposome, received the 2010 Jerome J. Wesolowski award from the International Society for Exposure Science for his work in human exposure assessment.

In Occupational and Environmental Medicine, Dr. Paul Blanc, the new Director of the program received a highly competitive award from the National Library of Medicine to write his second book, a history of rayon including occupational health risks associated with its manufacture. He was also recently selected through a national search to be Chief of a new Division of OEM at the San Francisco Veterans Administration Medical Center that comes with the opportunity of hiring several new faculty. The former Director of OEM, Dr. Gina Solomon, was appointed Deputy Secretary for Science and Health of Cal/EPA. In 2010, Dr. John Balmes received the Rutherford T. Johnstone Award for "significant contributions to furthering of Occupational and Environmental Medicine" from the Western Occupational and Environmental Medicine

Association and he continues to serve as the physician member of the California Air Resources Board.

In Occupational Epidemiology, Dr. Ellen Eisen, the Director of the program, has pioneered the use of new causal inference analytical approaches to the study of the healthy worker effect in epidemiological studies of automobile workers exposed to metal working fluids and aluminum workers exposed to $PM_{2.5}$. In addition to serving on multiple Institute of Medicine committees, Dr. Eisen, was also recently appointed Head of the Division of Environmental Health Sciences at UC Berkeley, as noted above. The Director of the OEHN program, Dr. Oi Saeng Hong, continues to be a leader in the prevention of noise-induced hearing loss and international occupational health research with active collaborations in Brazil and South Korea. In addition, Dr. Barbara Burgel, long-time OEHN faculty member, received the UCSF School of Nursing Excellence in Teaching Award in 2013.

During the reporting period, ERC core and affiliated faculty published >400 manuscripts and book chapters. The variety of research topics attest to the breadth of work performed including the following: physical and psychosocial risk factors for carpal tunnel syndrome, noise-induced hearing loss prevention, development of job exposure matrices, pesticide exposure, risk of ischemic heart disease and exposure to $PM_{2.5}$ in the aluminum industry and metalworking fluid in automobile manufacturing, obstructive lung disease and work exposures, lung transplantation for occupational lung diseases, chronic beryllium disease, health effects of ambient exposure to hydrogen sulfide, firefighter health and safety, prevention of musculoskeletal injury among critical care nurses, evaluation of breaks at workplaces to promote physical activity, and Research to Practice (r2p) in computer-related design (keyboard spacing, font size and glare, touch screens, tablet design), dental hygiene tool design, pipette design, and development of a new rig for overhead drilling of concrete and a personal weight transfer device to prevent lower back injuries in agricultural workplaces.

The faculty of the ERC core programs also take great pride in developing future leaders in their fields. One outstanding example of a recent graduate who has been successful in having her research published is Carisa Harris-Adamson whose doctoral work in ergonomics has led to the publication of eight papers, including the one that won 1st place at PREMUS as noted above. Dr. Harris-Adamson is now Assistant Professor at Samuel Merritt University. Another such example is OEHN graduate, Dr. Soo-Jeong Lee, who has published four papers from her dissertation work on safe work behavior, risk perception, and predictors for musculoskeletal injury due to patient handling in critical care hospital settings. Dr. Lee is currently Assistant Professor in the OEHN program at the UCSF School of Nursing and, in addition to doctoral work, has investigated chemical exposures among hospital cleaning workers and evaluation of influenza vaccination coverage among health care workers since joining the faculty.

Bridges Newsletter

Since its inception the NCCOEH has published a newsletter three times a year. The newsletter, *Bridges*, covers the accomplishments of students and faculty of the NCERC. During the reporting period, we expanded the newsletter by adding more researched-focused topics, and enhanced the visual nature of the newsletter in order to be more attractive to a broader audience. Newsletters are archived on the COEH web site: http://coeh.berkeley.edu/bridges and serve as an historical record of COEH and ERC activities.

Multidisciplinary Integration

One of the great successes of the NCERC has been the continued substantive collaboration among the faculty and students of programs that are separated by distance and time schedules (semester versus quarter systems). Despite these barriers, we can point to extensive interaction across program and campus lines. The following table of courses shows enrollment of students from multiple programs and courses offered by faculty of one program for students in another program.

Interdisciplinary Courses

Course Number and Title	Students	Faculty
M180 *Industrial Toxicology*	*OEHN other UCSF students*	*Shusterman (OEM)*
N271.06 *Management of Clinical Occupational Health Problems*	*OEM, OEHN*	*Burgel (OEHN) and Blanc (OEM)*
N273B *Issues in Occupational Health*	*OEHN attend OEM Grand Rounds as part of this course*	*Hong and practitioners from multiple disciplines*
Joint UCSF/UCB: N274A and PH299 *Health & Safety Hazards of the Workplace*	*IH, OEHN, OEM participate in site visits together*	*Quinlan (IH), Burgel (OEHN)*
N274C / PH299 *Occupational Safety*	*IH, OEHN, Ergonomics*	*Plog (IH)*
N405 *OEHN Program Planning Practicum*	*OEHN: Internships with professionals in all disciplines*	*Drew-Nord, Segovia-Bain (OEHN)*
PH 220C *Risk Assessment, Policy and Toxics Regulation*	*IH, Ergonomics, OEM*	*Hammond and McKone (EHS)*
PH234 *Green Chemistry: an Interdisciplinary Approach to Sustainability*	*IH, Epi*	*Megan Schwarzman (EHS) Martin Mulvihill (Chemistry)*
PH254A *Occupational and Environmental Epidemiology*	*IH, Ergonomics, OEM, OE*	*A. Smith and Craig Steinmaus (Epidemiology)*
PH 269C/BioE C279 *Ergonomics*	*Ergo, Bioengineering, OEHN, IH, OEM -- job analysis and intervention design in the field with student from one of the other disciplines*	*Rempel (OEM, Ergo)*
PH 269D *Occupational Biomechanics*	*Ergo, Engineering, OEM*	*Rempel and Janowitz (OEM, Ergo)*
PH 270 *Introduction to Environmental Health Sciences*	*IH, OEM, Ergonomics, OE*	*Balmes (OEM)*
PH270A *Exposure Assessment and Control*	*IH, OEM*	*Nicas and Rappaport (IH)*
PH270B *Environmental Toxicology*	*IH, OEM*	*M. Smith (Toxicology)*
PH271E *Environmental Science and Policy*	*IH, OEM, Toxicology, Epidemiology*	*A. Kyle (EHS)*
PH271G *Health Impacts of Climate Change*	*OE, IH, OEM*	*M. Jerrett (EHS)*
PH272B *Case Studies in Occupational and Environmental Epidemiology*	*IH, OE,OEM, Ergonomics*	*Eisen (OE)*
PH 297	*Ergonomics, IH*	*Rempel (Ergonomics)*

Field Study in Ergonomics		
PH 290-005 *Exposure Assessment and Control II*	*OEM, IH*	*Hammond (IH)*
PH290-002 *Social Justice and Worker Health*	*OEM, IH, Epi, Ergo*	*Chang (LOHP)*
PH 298 *Clinical Ergonomics*	*Ergonomics, OEM*	*Rempel (Ergo) and physical therapists*
Joint UCSF/UCB: PH 298 and N404 *Clinical rotations (UCSF and UC Berkeley Tang Center)*	*OEHN, OEM, IH, Ergonomics*	*Burgel (OEHN,) Quinlan (IH), Harrison and Kosnik (OEM), Rempel (Ergonomics)*

The number of NCERC faculty making major contributions to disciplines other than their own demonstrates the extent to which the programs have become integrated, and indeed, inter-dependent. Faculty from all of the programs contribute to the NCERC's Continuing Education Program.

Listed below are the permanently established ways in which the NCERC is integrated. In addition to these, there are many collaborations among the faculty and students. Evidence of research collaborations can be seen in the publication record. Faculty also provide lectures for each other's classes and serve on dissertation committees across programs and campuses.

- **Summer Institute on Continuing Education** - Annual, weeklong set of courses open to the professional community in which faculty and students from all programs participate.

- **Clinical Training** - Training sites for the residents, nurses, industrial hygiene, and ergonomics students. Required clinic rotations bring the trainees together to collaborate on the evaluation of patients and their workplaces. For example, OEM residents and ergonomics students participate in Dr. Rempel's hand clinic at the UC Berkeley Tang Center; OEM residents and either IH or OEHN students participate in clinical case conferences, when feasible.

- **Annual COEH Symposium** - in-depth presentations on topics of current interest to faculty, students, and external stakeholders. During this time period, four symposia were offered.

- **COEH Student Award Program** - $10,000 in funding from COEH and $5,000, when possible from NIOSH, for up to three student projects involving interdisciplinary teams conducting a research, teaching, or service project. A minimum of two students from different disciplines is required, and preference is given to teams from more than one campus. The projects conducted by recipients of the award are showcased at COEH get-togethers.

- **Targeted Research Training** - NCERC students who are successful in competing for TRT stipend awards can receive up to $7,500 to support their research projects from COEH funds. Projects involving students from more than one discipline are encouraged. A monthly TRT seminar involves students from all disciplines.

- **Occupational Health Internship (OHIP) Program** - $5000 in funding from COEH to support one OHIP intern for a summer project. The purpose of OHIP is to help students learn more about the field of occupational safety and health from working people. COEH has successfully used this program to recruit new students into the OEHN program as well as provide current students with unique research and program planning activities.

- The **COEH web page** links the web sites of the COEH-affiliated programs on all three campuses: http://coeh.berkeley.edu.

- **OEM Grand Rounds and workplace site visits**, and case conferences - the nursing and industrial hygiene students, as well as the residents participate in most or all of these activities.

- **Interactions outside of the ERC** - Faculty who collaborate with colleagues across the campuses provide students with opportunities to broaden their perspectives. For example, Dr. Blanc is Associate Medical Director of the San Francisco Poison Control Center and Dr. Rappaport collaborates with College of Chemistry faculty.

- **Distance Learning** - We continue to seek new ways to broaden our reach beyond the Bay Area. The CE program developed a Nevada-focused mining safety and health webinar and collaborated with the California Department of Public Health to provide a symposium on lead in the workplace that was both webcast live and available for viewing on the web in October 2013 that included NIOSH Director John Howard as moderator and was extremely successful. In addition, the CE program has provided two other successful web-based courses, one on seafood safety and another on pesticides, during the reporting period. Finally, the CE program is collaborating with the California State Compensation Fund to support CME credit for an online course on physician guidelines for opioid prescription for injured workers.

- **Outreach** - the desire to recruit high quality applicants to the programs as well as to expose students from other disciplines to occupational health principles has resulted in formalized activities targeting non-ERC students. For example, medical students do elective rotations in OEM, as do residents in family practice and internal medicine. In nursing, occupational health curriculum has been added to all nurse practitioner programs, including family and women's health. As noted above, the COEH supports one Occupational Health Internship Program student each year, and Dr. Balmes teaches occupational health to students in the undergraduate public health major program at UC Berkeley.

- **Short Term Educational Experiences for Research (STEER) program** – The COEH has been funded by the NIEHS throughout the reporting period to provide summer research internships for undergraduate students. The goal of the program is to encourage the students to pursue careers in environmental and occupational health. Two former STEER students are currently enrolled in the OEHN program.

- **Joint Faculty Appointments** - Further evidence of the interdisciplinary integration of our programs is seen in joint faculty appointments. Examples include: David Rempel (UCSF-OEM and UCB-Bioengineering); John Balmes (UCSF-OEM and UCB-SPH); Patty Quinlan (UCSF OEM and OEHN)

- **Research** – Projects involving faculty and students from at least two of the NCERC collaborating programs included:
  - Berkeley-Stanford Children's Environmental Health Center (funded by NIH and EPA) -- Hammond (IH), Balmes (OEM), and Eisen (OE)
  - Exposures to Metal Working Fluid in Automobile Manufacturing (funded by NIOSH) – Eisen (OE), Hammond (IH), and Balmes (OEM)
  - Bay Area Solvent Study (funded by NIH) – Hammond (IH), Bates (TRT), and Eisen (OE)

Enrollments and Graduates

Attachment #1 provides a comprehensive listing of students and residents who completed their training in one of the ERC-funded programs during the three-year reporting period. During the reporting period, the NCERC has trained 125 students or residents (20 IH, 62 OEHN, 17 OEM, 12 Ergonomics, 14 OE). Of this number, 97 have graduated from their respective programs. During this period, trainees authored or co-authored more than 40 peer-reviewed publications. In addition, students in all programs made presentations at many regional, national, and international conferences.

Funding

For the most part, faculty and administrative staff in occupational health are supported by state funding provided by the University. The COEH provides a significant portion of this support, including funding for most of the NCERC program directors. These permanent positions provide stability to the teaching program.

NIOSH support of students and residents has been crucial to our success in developing a truly interdisciplinary program and in maintaining enrollments during difficult financial times. All of the programs depend heavily upon this support to recruit a qualified applicant pool and to attract particular students to their programs.

Each of our programs needs more NIOSH support than they are getting to match the increases in educational costs and to address the demand for occupational health specialists. The nursing students, especially, are relying more heavily upon outside employment to support their schooling.

Federal training support for students is often crucial to a career in occupational health because of the nature of students and residents who come to our programs. They are often older people who have work experience and discovered these fields after they have incurred financial responsibilities for families and homes. They return to school with considerable motivation, but need financial assistance. The occupational health specialties are not typically visible to undergraduates and few of our students come directly from college. Hence, support while in school is essential to make entry into these professions feasible for those who are committed and who understand the nature of work and the needs of working people.

Supply and Demand

The NCERC helps address the shortage of health care professionals with expertise in occupational and environmental health in the U.S. by training occupational and environmental health specialists for careers in industry, academia, labor, non-governmental organizations, and government agencies. Demand for graduates of the NCERC programs remains strong in all disciplines, in part because we are unable to graduate enough students to meet the ongoing demand. Despite constraints, the OEHN program has expanded significantly during the reporting period. Given the national and state nursing shortage of nursing faculty, the expansion of the OEHN doctoral program is encouraging. Nonetheless, a considerable gap continues to exist between supply of and demand for qualified OEHNs. Uncertainty on an almost annual basis regarding whether funding for the ERC will be included in the federal budget has made it difficult to recruit a larger pool of OEM residents, given the expense of their 2-year training program.

Many of the graduates of the NCERC training programs have remained in the region to work in critical jobs in government or industry. For example, the Chief of the Occupational Health Branch of the California Department of Health Services, Barbara Materna, is a graduate of the Industrial Hygiene Program, and the Corporate Medical Director of two of the largest companies headquartered in the region, Intel and Pixar, Michael Fischman, is a graduate of the Occupational and Environmental Medicine Residency, and Chair of our EAC. Many graduates receive multiple job offers and can stay in the greater Bay Area if they wish, or relocate to areas in need of their expertise.

Future Plans

The NCCOEH and NCERC annual symposium in 2013 was an opportunity to reflect on what has changed in California over the 35 years that had passed since the founding legislation for the Northern and Southern California COEHs was signed into law by then Governor Jerry Brown; the NCERC was initially established with NIOSH funding in 1981. The changes that stand out include 1) the outsourcing of many, but certainly not all, hazardous manufacturing jobs; 2) the growth of electronics, biotech and the underground economy; 3) the growth of immigrant, low-wage, non-union workforces in almost all sectors of the economy; and 4) the dramatic change in work organization, including non-permanent, temporary, contingent workforces at all levels of enterprises that are increasingly without job stability and health/retirement benefits.

The NCERC program directors have agreed on several priority areas where we felt that our resources could be applied to have the greatest occupational safety and health impact. The areas selected were the construction industry; agriculture; and low-wage, immigrant workers in general. A notable example of such work is that of Dr. Fadi Fathallah and colleagues in the UC Davis Agricultural Engineering program component of the COEH who have been conducting cutting edge research on practical ways to prevent musculoskeletal injuries in strawberry picking, wine grape pruning, and citrus tree bud grafting. Another example is the work of Dr. Rempel of the Ergonomics program to design an inverted drill press intervention on shoulder and neck posture during overhead drilling of concrete ceilings; an additional benefit of this new drill rig was reduced risk of silica exposure. Students have been involved in both of these projects. Dr. Marc Schenker, head of COEH programs at UC Davis edited a special edition of the *American Journal of Industrial Medicine* with 13 peer-reviewed articles on low-wage, immigrant workers published in 2010. Our 2014 annual symposium was on climate change and included the potential impacts of increasing frequency of extreme heat days in California on farm and construction workers. The LOHP has developed a successful outreach program to farm workers on heat stress that was used as a model by federal OSHA. The LOHP also developed a UC Berkeley course on “Social Justice and Worker Health” (PH290.002) that was first offered in the fall semester of 2014.

In addition to our efforts to shift program focus as potential occupational hazards arise with the development of new industrial sectors, the NCCOEH has used its resources to foster new program initiatives. We are vey proud of our investment in the development of a program in Green Chemistry at UC Berkeley. Based largely on our COEH-sponsored efforts to promote the importance of safer approaches to chemical production and usage, the Department of Toxics Substance Control (DTSC) of Cal/EPA has initiated a Green Chemistry Initiative with the goal of transforming California industry through improved chemicals policy. In concert with this initiative, the Berkeley Center for Green Chemistry (BCGC) that brings together faculty from the schools of Public Health, Chemistry, Engineering, Law, Business, and the College of Natural Resources was formed. An emphasis on the occupational health benefits from green chemistry has been advocated by participation of the COEH and NC-ERC in the BCGC. During the review period, the BCGC has been supported by a grant from Google to study material selection

in building construction with the aim of advancing understanding of the impact -- throughout the material life cycle -- of building materials on human health and the environment. A second grant from Google supports investigation of the health and environmental impacts of materials used in the consumer electronics sector. The BCGC also has several major teaching grants: 1) a National Science Foundation Interdisciplinary Graduate Education and Research Traineeship (IGERT) on Systems Approach to Green Energy that provides $5,000,000 for 5 years (2012-2017) to train students from multiple disciplines to develop inherently greener energy technologies by incorporating health and environmental impact assessment into the earliest stages of clean energy research; and 2) a Greener Solutions Program funded by the California Department of Toxic Substances Control (DTSC) of Cal/EPA that supports students to work in multi-disciplinary teams to tackle a research question posed by a host organization that is working to adopt safer chemicals in products or operations. Students learn to evaluate the human and environmental health consequences of a current technology; they gain practical experience in green chemistry, business applications, communicating complex scientific ideas, and advancing the adoption of safer materials. Partners to date have included Hewlett Packard (to investigate worker impacts of electronics recycling), and Levi Straus & Co. (to investigate safer alternatives to formaldehyde and diisocyanate crosslinkers in garment finishing). A second grant from the DTSC supports curriculum development in green chemistry, which led to a new course (PH234) "Green Chemistry: an Interdisciplinary Approach to Sustainability" that is cross listed with the College of Chemistry, School of Business, and the Environmental Science and Management Program.

Another new program that we have been developing is an Agricultural Health and Safety (ASH) training program at UC Davis. The goal of the ASH program is to address the unmet needs for improved working conditions and an occupational health and safety-promoting climate in the farms and fields of California and the other states in federal Region 9. While the Western Center for Agricultural Health and Safety at UC Davis has been an enormous success with regard to research productivity, its funding does not provide support for graduate student training expenses. The addition of an ASH program to the NC-ERC will facilitate recruitment of students into the field of ASH and allow greater integration of the UC Davis components of the COEH with those at UC Berkeley and UCSF.

External Advisory Committee
Northern California COEH

Garrett Brown, MPH, CIH
Coordinator
Maquiladora Health & Safety Support Network
P.O. Box 124
Berkeley, CA 9701-0124
510-558-1014 (tel) 510-778-0074 (cell)
garrettdbrown@comcast.net
www.igc.org/mhssn website

James Craner, MD, MPH, FACOEM, FACP
P.O Box 17481
Reno, NV 89511
775-345-1407
JCraner@DrCraner.com

Ann Dinh, RN, MSN, OHNP
Health Services Nurse Manager
SF Marriott Marquis
780 Mission St.
San Francisco, California 94103
dinh.ann@gmail.com
Ann.dinh@marriott.com
415-442-6082 (w)

Michael L. Fischman, M.D., MPH (Chair)
Fischman Occupational & Environmental Medical Group
1270 Arroyo Way
Walnut Creek, CA 94596
925-283-2366 (tel) 925-283-3275 (fax)
michaelX.L.fischman@intel.com

Richard Hirsh, MPH, CIH
Associate Director, EH&S
Nektar Therapeutics
455 Mission Bay Blvd. South
San Francisco, CA 94148
T: +1 415-482-5658
F: +1 415-3395354
C: +1 650-722-3853
rhirsh@nektar.com
richardhirsh@sbcglobal.net

Meg Honan, RPT, MS, CPE
Senior Ergonomics Program Manager
Health Services & Ergonomics.
Genentech
1 DNA Way, MailStop 71
South San Francisco, CA 94080
650-467-6289
megh@gene.com
www.gene.com

Lynette Landry, PhD., RN
Dean, College of Health and Society
Professor
Hawaii Pacific University
1164 Bishop Street
HLC, Suite 226
Honolulu, HI 96813
Phone: (808) 236-5811
Email: llandry@hpu.edu

Barbara Materna, PhD, CIH
Occupational Lead Poisoning Prevention Program
California Department of Health Services
850 Marina Bay Parkway, Bldg. P, 3rd Floor
Richmond, CA 94804 (866-282-5516)
510-620-5730 (tel) 510-620-5743 (fax)
Barbara.Materna@cdph.ca..gov
bmaterna@dhs.ca..gov
www.cdpa.ca.gov/programs/ohb

Nancy Nivison Menzel, PhD, RN, PHCNS-BC, CPH, CNE
Associate Professor
School of Nursing
University of Nevada, Las Vegas
4505 S. Maryland Parkway Box 453018
Las Vegas, NV 89154-3018
Ph. (702) 895-5970
Fax: (702) 895-3420
Nancy.Menzel@unlv.edu

Robert Nocco, MS, CIH, CSP
OH Center of Excellence
Chevron Technology Company
6001 Bollinger Canyon Road
San Ramon, Ca 94583
(925)842-3846
rnoc@chevron.com

Margaret Robbins, BS, MPH
National Director, Occupational Safety & Health
Coalition of Kaiser Permanente Unions
1 Kaiser Plaza, Room 2450, 24th floor
Oakland, CA 94612
(510) 289-4770
Maggie.Robbins@unioncoalition.org

Pat Tittiranonda, PhD
Vice President, User Experience
TRIRIGA
5994 West Las Positas Suite 217
Pleasanton, CA 94588
702-932-4371 (tel)
925.998.0293 (cell)
ptittiranonda@tririga.com
pat_tittiranonda@yahoo.com (preferred)

Melinda Vertin, RN, MS
Director – Strategy, Governance & Communications
Global Health Services
Johnson & Johnson
970 Glenridge Dr.
San Jose, CA 95136
408-265-4627
MVertin@its.jnj.com

Ad Hoc Members:

John R. Balmes, MD
Director, COEH
415-206-8953 (UCSF)
510-643-4702 (UCB)
john.balmes@ucsf.edu

Patty Quinlan, MPH, CIH
Deputy Director, COEH
510-642-8365
pquinlan@medsfgh.ucsf.edu

Robin Baker, MPH
Director, R2P, COEH
510- 643-8900
rbaker@berkeley.edu

Highlights/Significant Results

The program over the 5 years of the reporting period has been characterized by evolutionary growth, building upon our solid record of previous accomplishments. In July 2010, Dr. Sarah Jewell who had been program co-director, relocated to Germany. In 2012, the other co-director, Dr. Gina Solomon, was appointed Deputy Secretary of Cal/EPA. Two long-time members of the UCSF OEM faculty, Dr. Paul Blanc and Dr. Robert Harrison, then became Director and Deputy Director of the OEM Residency, respectively. Also during the reporting period, the Health Resources and Services Administration (HRSA) made funding available to preventive medicine (PM) residency programs. Our program was one of only three OEM residencies nationwide to successfully compete for such support (other awards were all made to general PM residencies). That support allowed us not only to expand our program, supporting additional residency positions, it also provided vital fiscal stability through a multi-year period in which the NIOSH award was repeatedly threatened with erasure. We have recently received a delayed competitive renewal of the HRSA award, earmarked to increase program outreach to at-risk workers and vulnerable populations. During the period of review we have initiated a number of new rotation opportunities in particular clinical sites to better meet new ACGME training requirements. In brief, they include: the San Francisco Veterans Administration Medical Center; the UCSF needlestick hotline; a new multispecialty multi-site elective; a new Salinas, CA site serving farm workers; and Premier Comp, a clinical occupational site with large surveillance contracts (run by a UCSF nursing faculty member and her husband). Representatives of the ACGME performed a full-day site-visit of our program in October 2010 leading to successful full reaccreditation. A new ACGME system that has replaced the every 5-year cycle means that we (as with other programs) submit ongoing documentation that is under continuous review.

Outcomes/Relevance/Impact

Drs. Blanc and Harrison, as with Dr. Solomon before her transition, are active representatives of the program through grand rounds and other clinical presentations nationally and internationally. Moreover, Drs. Blanc and Harrison effectively reach-out through complementary but not overlapping venues. Dr. Blanc, in particular, is active nationally/internationally in the American Thoracic Society, the European Respiratory Society, the International Commission on Occupational Health, and medical toxicology meetings. Dr. Harrison is active in the American Public Health Association and participates in multiple other surveillance and applied occupational public health meetings. The program profile has also been raised in the previous program period in multiple other ways. This includes an updated Division website with considerable content related to the OEM residency (http://oem.ucsf.edu/education). We also organize a series of highly successful CME offerings with national outreach. Our continued sponsorship of a UCSF Department of Medicine Grand Rounds, the annual Alice Hamilton Lecture (http://oem.ucsf.edu/about/hamilton.html) is dedicated to the topic of OEM and brings in international caliber speakers (including in the current program period Dr. Jonathan Samet, USC – The Risks of Breathing: Workplace & Environmental Threats to Lung Health [2014]; Talmadge King, UCSF, Medicine Dept. Chair – Hypersensitivity Pneumonitis: A Paradigm of Occupational and Environmental Disease [2013]; Kjell Toren (Gothenburg, Sweden) – Pneumonia and Occupation: A New Paradigm for Investigating the Work-relatedness of Disease [2012]; Kay Kreiss (NIOSH) – Investigating Emerging Work-Related Diseases [2011]; and Benoit Nemery (Leuven, Belgium) – Outbreaks of Occupational Disease: From the Clinic to the Factory Floor and the Laboratory, 2010]).

An important source of OEM residents for our program is from physicians with clinical training and a MPH degree or similar graduate training, including residents who have completed a general PM residency. Our ability to offer a rich clinical and non-clinical elective selection and structured research opportunities promotes such recruitment. The recent establishment of a joint UCSF-Kaiser Permanente internal medicine-PM residency has provided a new and important avenue for program outreach for us: we have one new current OEM resident who completed that program and is obtaining additional specialization with us and we are heavily recruiting another pending graduate of the same program, with a high likelihood that that resident will join our program. Our new offering of the Advanced Training in Clinical Research certificate program should

further serve to enhance recruitment for OEM residents with a previous MPH but who nonetheless will be two years with the training program.

Our close ties to the Medical Toxicology training program further promote outreach and recruitment. This includes selected residents who seek training leading to joint board eligibility but also serves as a general program resource for our OEM residents, nearly all of whom experience elective work at our poison control center. The recent addition of Dr. Durani (a graduate of the joint track) to our full-time faculty serves to further strengthen these links. Dr. Durani completed his training while in the military reserve and post-completion did fulfill a tour of overseas service duty. His military experience is also of assistance in recruitment outreach to potential armed services-supported OEM residents. One of our current trainees (Dr. Tran) is supported by this mechanism and we are actively recruiting at least one more Navy or Air Force-supported resident for the coming year after Dr. Tran completes his training. We find that such candidates enrich the program with their particular perspective on OEM and special environments. In a similar vein, we have also found that selected candidates from overseas further add to our OEM residency cohort (not eligible for NIOSH support but coming with international governmental stipends). In the previous period one of these (Dr. Jiranantakan) was also in the joint medical toxicology-OEM track; a second (Dr. Khafagy) completed a full-US based Family Practice Residency and then joined our program with Saudi academic development support.

The overall impact of the program includes the increased number of Board-certified occupational medicine physicians in the region, an active continuing medical education program internally and externally, a multidisciplinary consulting clinic practice that receives referrals from various local, state and federal agencies, local physicians, UCSF departments, the Pediatric Environmental Health Specialty Unit (PEHSU), attorneys and individuals. Additionally the impact can be measured by the publications and presentations that residents and faculty have made.

Technical Report

The primary goal of the Occupational Medicine Program at UCSF is to continue to recruit and train physicians who will become future leaders of the field. A specific objective is to provide high quality academic and practicum training experiences. The expected outcomes include high levels of attainment in the ACGME General Competencies and significant exposure to and competence in the vast majority of the ACOEM OEM Competencies. The utilization of these benchmarks guides the training program and allows for periodic assessment of the progress of the residents. Upon graduation, it is expected that the resident is capable of performing as a highly competent OEM specialist and will be well prepared for the American Board of Preventive Medicine (ABPM) examination. The UCSF OEM program actively seeks multidisciplinary training opportunities for residents and continues to seek enhancement of training opportunities through development of new practicum rotations, industrial site visits, and broader didactic instruction. NIOSH traineeship support is essential for UCSF to continue to meet the training goals and objectives set forth by the program.

Briefly, the basic two-year program of the UCSF OEM Residency includes the following: two months of summer didactic instruction and industrial site visits in both years; a nine-month program at the University of California at Berkeley (UCB) School of Public Health culminating in the award of a Master of Public Health degree; a practicum year with four months of core OEM rotations, with two months of public health, three months of elective, and two months of research content. OEM residents evaluate and treat patients in the clinics throughout the two years of the program, as well as attend OEM Grand Rounds twice monthly and Case Conferences weekly. In addition, residents participate in monthly journal club and research seminars. Each resident is expected to make a formal presentation at OEM Grand Rounds and at the OEM Research Seminar before the end of their training program.

Residents are required to take a 10-week UCSF course with OEHN students co-taught by OEM and OEHN faculty that is entitled “Clinical Management of Occupational Health Problems.” There are additional courses the residents are required to attend such as the annual 2-day UCSF Occupational and Environmental Medicine CME and COEH Ergonomics courses as well as those given during the COEH Summer Institute on topics such as toxicology, workers’ compensation, and disability evaluation. Interdisciplinary training is included in UCSF courses, COEH conferences, and through multidisciplinary clinic activities.

The residents are evaluated according to the ACGME competencies on a monthly basis in clinic and rotations, as well as on the ACOEM competencies on a semi-annual basis. These evaluations serve to provide timely information to the trainee and the program director, as well as produce evidence of progressive improvement and responsibility.

A major factor that has severely affected the UCSF OEM Residency Program has been the UC-mandated increase in resident stipends as well as housing and relocation allowances. A second factor is the rapidly rising tuition at the UCB SPH that now includes a professional school fee for the students in the MPH track. Out-of-state tuition has also increased to an amount that is now twice that of the in-state fees. These factors have made it increasingly difficult to support our ACGME-approved number of trainees. The HRSA grant has helped in this regard. The UCSF Department of Medicine has assisted with salary differentials and tuition support as well as supporting the Program Director and Program Coordinator.

The 14 OEM residents who completed our OEM residency program during the reporting period are summarized in **Attachment 1**.

Our OEM program alumni continue to make considerable contributions to the discipline of occupational and environmental health through clinical service (being especially important in occupational health care delivery in the Kaiser Health Plan, the largest deliverer of such services in California); industrial consulting (in particular hi-tech related sectors); governmental public health; uniformed services (UPHS and armed services); international work; and academics. Our record of peer-reviewed publication involving recent or past trainees is strong [22-39]. The latest edition of the LaDou OEM textbook, published just a few months ago, further underscores our record of programmatic success. Dr. Robert Harrison is now co-editor of the text and alumni chapter authors include: Drs. Durani and Dinenberg (noted above) as well as OEM alumni Drs. Das, Fischman, Janssen, Kosnett, Lichty, Rempel, Rinker, Shusterman, and Steinmaus. We are proud of this record of success. NIOSH funding is vital to the core of our training program. This is true both for the OEM residency itself and for the ERC in which it is embedded. NIOSH support, which includes the Targeted Research Training (TRT) component, has guaranteed the academic opportunities and research focus of our trainees and, ultimately, the contributions of our graduates to the improvement of broader discipline of occupational and environmental medicine.

Publications Co-authored or Authored by Trainees
The following is a list of publications on which residents are authors. The residents' names are in **bold.**

1. Welling R, Beaumont JJ, **Petersen SJ,** Alexeeff GV, Steinmaus C. Chromium VI and stomach cancer: a meta-analysis of the current epidemiological evidence. Occup Environ Med. 2014 Sep 17. [Epub ahead of print]
2**. MacIsaac JK**, Gerona RR, Blanc PD, **Apatira L**, Friesen MW, Coppolino M, Janssen S. Health care worker exposures to the antibacterial agent triclosan. J Occup Environ Med. 2014;56:834-9.
3. Pereira A, Hsieh CM, **Laroche C**, Rempel D. The effect of keyboard key spacing on typing speed, error, usability, and biomechanics, Part 2: vertical spacing. Human Factors 2014; 56:752-759.
4. Darwish-Yassine M, **Berenji M**, Wing D, et. al. Evaluating long-term patient-centered outcomes following prostate cancer treatment: findings from the Michigan Prostate Cancer Survivor study. J Cancer Surviv. 2014;8:121-30.
5. **Dinenberg RE**, McCaslin SE, Bates MN, Cohen BE. Social support may protect against development of posttraumatic stress disorder: findings from the Heart and Soul Study. Am J Health Promot 2014;28:294-7.
6. Schmidt B, **Dinenberg RE**. Total worker health approach helps organizations and employees thrive. Occup Health Saf. 2014;83:72, 74, 76
7. Lovallo E, Patterson, S, Erickson M, Chin C, Blanc P, **Durrani T**. When is "Pseudo-Ludwig's Angina" associated with coagulopathy also a "pseudo" hemorrhage? J Invest Med High Impact Case Rep 2013 1:
8. **MacIsaac J**, Harrison R, Krishnaswami J, McNary J, Suchard J, Boysen-Osborn M, Cierpich H, Styles L, Shusterman D. Fatalities due to dichloromethane in paint strippers: a continuing problem. Am J Ind Med. 2013;56:907-10.

9. **Zhao YA**, Shusterman D. Occupational rhinitis and other work-related upper respiratory tract conditions. Clin Chest Med. 2012; 33:637-47.

10. **Schwilk E**, Zhang L, Smith MT, Smith AH, Steinmaus C. Formaldehyde and leukemia: an updated meta-analysis and evaluation of bias. J Occup Environ Med. 2010; 52:878-86.

11. **Jiranantakan T**, Olson KR, Magge H, Blanc, PD. “Acute Pancreatitis in Amanita Phalloides Poisoning.” Clin Toxicol 2009; 47:141.

12. Gerona RL, **Jiranantakan T**, Armenian P, Blanc PD, Olson K, Wu AH. “Determination of 5-Oxoproline and Other gamma-Glutamyl Cycle Metabolites in Acute and Chronic Acetaminophen Intoxication Using LC-MS/TOF.” Am J Clin Path 2010; 134: 506-507.

13. **Jiranantakan T**, “Methotrexate”; Jiranantakan T, Anderson IB, “Ethylene Glycol and Other Glycols”; Jiranantakan T, Benowitz NL, “Lithium.” In: *Poisoning & Drug Overdose*, 6th ed, KR Olson and IB Anderson (Eds), McGrawHill, New York, 2011.

14. Moitra S, **Puri R**, Paul D, Huang YC. Global perspectives of emerging occupational and environmental lung diseases. Curr Opin Pulm Med. 2015 Mar;21(2):114-20**.**

Highlights/ Significant Results

During the reporting period, the OEHN program was under the leadership of Dr. OiSaeng Hong. She has been involved in various levels of student work, including MS and PhD courses and curriculum development, MS students' comprehensive papers, PhD committees, and research training for postdoctoral fellows funded by other sources such as the Global Korean Nursing Foundation. She personally directs the OEHN doctoral program, and is ably assisted in the MS clinical training program by Dr. Barbara Burgel, whose long tenure with the OEHN program assures strong relationships with regional preceptors and the OEH professional and practice community, advanced clinical skills, and expert teaching and curriculum development skills. In addition to her ongoing teaching, curriculum development, and student recruitment efforts, Dr. Hong also provides leadership by creating and strengthening international collaborations in OEHN education and research, including consultation in curriculum development for other graduate programs, and research training and conducting collaborative research in other countries (Brazil, Hungary, Korea, Peru, Taiwan, Thailand); serving on dissertation committees for OEHN and IH PhD students (Korea, Thailand); serving as coordinator and research mentor for Brazilian government-sponsored nursing students in the 'Doctoral Student Training Abroad Program'; being Visiting Professor of OEHN in the College of Nursing at the University of Sao Paulo at Ribeirao Preto in Brazil, Semmelweis University in Hungary, and Mahidol University in Thailand; hosting and providing research mentoring for OEHN visiting scholars from other countries; and participating in the international collaborative research on firefighter health and safety.

Globally, Dr. Hong plays professional leadership roles in international organizations such as the World Academy of Nursing Science (Board of Directors), Global Korean Nursing Foundation-US (President), International Advisory Board for Association of Educational Sciences in Hungary (Board of Directors), and the Korean Occupational Nurses Association (Board of Directors). She continues her contributions to nursing and OEH scholarship by serving on the Editorial Boards for *Nursing Research* and *Health and Safety at Work*. She is also internationally recognized for her expertise in intervention research to prevent occupational diseases and injuries, specifically occupational hearing loss. Dr. Hong's contributions increase the visibility of the NIOSH ERC and COEH with respect to international relations with global partners and OEHN, further establishing the UCSF OEHN program as an international leader.

During the reporting period, there have been several changes in the OEHN Program faculty. Dr. Lisa Thompson was promoted to Associate Professor with tenure in 2014. Dr. Marion Gillen retired as COEH Deputy Director in 2011 but continued teaching in the OEHN program. Assistant Clinical Professor Segovia resigned in June 2011 to assume a full-time OEH-NP position at the UCSF Employee Health Clinic. She continued her clinical teaching as without-salary faculty. Three affiliated nursing faculty (Froelicher, Janson, White) retired. One affiliated faculty (Krause) transitioned to UCLA to assume the Director role for NIOSH's Southern CA ERC. Through national searches, Drs. Soo-Jong Lee and Dana Drew-Nord were hired as a tenure-track Assistant Professor in 2010 and as an Assistant Clinical Professor in 2012, respectively. Both are UCSF PhD graduates with OEH-NP preparation. In addition, we appointed five new affiliated faculty (Drs. Alkon, Foley, Gershon, Thompson, Wagner). With these changes in the faculty, the Program continues to maintain its educational excellence. During the reporting period, three of our faculty received SON Excellence-in-Teaching awards (Alkon, Burgel, Hong), demonstrating our faculty's strong commitment to training the next generation.

Several OEHN students received awards for their excellence in scholarly work and grants to support their research: Greysen (National Institute for General Medical Sciences Graduate Fellowship), Phelps (UCSF Graduate Student Research Award, Travel scholarship from the National Hearing Conservation Association), Buss (AAOHN Research Award), Hill (Eugene Cota-Robles Fellowship, UCSF Graduate Division, UCSF Blue Cross Blue Shield Clinical Leadership Fellowship, Center for Health Professions), Chin (AAOHN Research Award, Sigma Theta Tau Research Grant, PEO International Fellowship, UCSF Graduate Dean's Fellowship),

Hwang (Pacific Rim Research Funding, Sigma Theta Tau Leadership grant, UCSF Graduate Dean's Fellowship, PEO International Fellowship, NCEMNA Mentee Award).

Outcomes/Relevance/Impact

Dr. Hong's computer-based hearing protection intervention projects have long been recognized for their immediate applicability to various settings, particularly in areas where there are limited or no OEH services. Dr. Hong and her multidisciplinary research team have obtained funding from the Department of Defense for a tinnitus multimodal imaging study with career firefighters. Dr. Hong's work with University of Michigan research teams on the efficacy of The Tobacco Tactics website intervention is a model that can be widely distributed to various groups of workers who are tobacco users. Dr. S. Lee's project with the CDC and California Department of Public Health evaluated a standardized measure of healthcare personnel influenza vaccination in various healthcare settings. The measure was endorsed by the National Quality Forum and the Centers for Medicare and Medicaid Services and was required to use as a reporting tool from 2013 forward. Dr. S. Lee's projects that evaluate the impact of regulatory efforts (California Safe Patient Handling Law) on reducing musculoskeletal injuries among healthcare workers have direct impact on practical efforts to improve working conditions of health care personnel through regulation as well as local effort to change practices. Dr. S. Lee's project on chemical exposure and symptoms among hospital cleaning workers, and their safe work practices, contributes to the growing literature on health disparities in underserved working populations. Dr. Burgel's work significantly contributes to the limited literature on taxi drivers' OH including psychosocial factors, unfairness at work, violence, and ergonomic risks including vibration. Dr. Drew-Nord's work on cardiovascular risk factors in career firefighters led to considerably increased interest in reducing risk factors through administrative and behavioral interventions. Her historical prospective analysis on cardiovascular risk factors in firefighters is in its twelfth year of data collection and is currently undergoing analysis. Drs. Alkon and Thompson's work on environmental exposure and adverse health outcomes significantly added to our range of R2P activities.

Dr. Hong served on the Institute of Medicine Committee on Respiratory Protection Curriculum for Occupational Health Nursing Programs and Dr. Burgel served on the National Academy of Sciences/IOM Expert Advisory Committee on the Certification of Personal Protective Technologies. Following up the IOM report on respiratory protection in nursing curriculum, Dr. Burgel took the lead on a nationwide survey assessing current OEHN educational preparation, roles and responsibilities, and training needs in respiratory protection. Dr. S. Lee served on the NIOSH NORA Healthcare and Social Assistance Sector's Healthcare Interest Workgroup (2013-2014), which developed a white paper on OH issues and recommendations regarding disinfection and cleaning in the healthcare setting. She also co-developed the CASOHN comment letter on the proposed Cal/OSHA Safe Patient Handling regulation, and served on the Northern CA Occupational Health Internship Program (OHIP) Advisory Board. Dr. Drew-Nord wrote the chapter on Direct Care for the new AAOHN Core Curriculum textbook and the AAOHN Foundation "booklet" on opening an OEH service. With funding from the UC Pacific Rim Program, Dr. Faucett led the International Collaboration for the Occupational Health of Nurses (ICOHN) to develop a multi-country (Australia, China-Hong Kong, Japan, South Korea, the Philippines, UK, and US) questionnaire on the work conditions, health outcomes and employment decisions of newly graduated nurses.

The OEHN faculty and trainees have also made contributions to and played significant leadership roles in conferences and symposia. Highlights include serving on the planning committee for 2014 AAPINA conference (Hong); AAOHN annual conferences and preconference workshops; Association of Occupational Health Professionals in Healthcare (Dr. Burgel); Invited symposium speakers for International Conference on Research Methods for Standardized Terminology (Chin, Hong); Planning committee and panelists for AAOHN global summit (Burgel, Hong); and Co-chairing for Overseas Korean Nurses Association biennial International conference (Hong); Co-Chair, National Advisory Working Group on Respiratory Protection (Burgel); Member of the American Red Cross Scientific Advisory Committee (Burgel).

Dr. Julia Faucett has served as a founding member of the UC Berkeley Interdisciplinary Center for the Healthy Workplace (ICHW) since its inception at the Haas School of Business in 2012. The Center's goals include the identification of evidence-based strategies to improve worker health and that complement the Total Worker Health© approaches established by NIOSH. Drs. Burgel and Hong also participated in ICHW activities to

provide OEHN perspectives. ICHW has identified a number of businesses, such as Google, Safeway and Herman Miller, who are interested in partnering to assess steps that support employee health and well-being.

Both our graduates and faculty are currently serving in leadership positions in AAOHN. Examples include: Alumni Thompson is active in the San Diego chapter of AAOHN and chairs the statewide conference committee; Alumnae Nuchols, Souza, Quan and Phelps are on the CECRAOHN Board of Directors; and Alumna Taormina serves on the national AAOHN Respiratory Protection Advisory Committee. Drs. Burgel and Childre both serve on the Editorial Board for the AAOHN journal; Burgel and Childre were both highlighted in the new ABOHN Careers in OEHN book; and Segovia is the AAOHN representative to the American Red Cross National Nursing Committee. Dr. S. Lee served on a regional CECRAOHN Government Affairs task force to draft a CSAOHN position statement on the statewide Safe Patient Handling Cal/OSHA standard. Drew-Nord provides a dedicated preceptor OEH placement in her clinic, Premier COMP Medical Group, Inc., in Pleasanton, CA. Drew-Nord additionally provides health and safety tours for IH and OEHN students in the East Bay. All of these activities demonstrate the ongoing dynamic relationships that our program has with the occupational health and safety community.

As a result of the OEHN educational program and training efforts, graduate nursing students have offered high quality nursing care and consultation to workers and employers in many industries, including manufacturing, pharmaceutical, biotechnology, and health care; presented at national and international symposia about their research and clinical work; and provided consultation and assistance with federal OSHA's nationwide projects and publications. Through their clinical placements, they have provided prevention program projects related to chemical safety, respiratory protection, ergonomics, food preparation hygiene, health promotion and other topics of import to workers and employers. PhD program graduates have become University faculty and professional leaders both in the U.S. and abroad. Our graduates are one of our most distinctive contributions to the field. They have achieved recognition as leaders in professional associations, expert clinicians, consultants, and promising researchers.
The UCSF OEHN Program has successfully maintained its record of high achievement during the reporting period, graduating clinical experts, leaders and researchers from its MS and PhD programs. Trainees and faculty have contributed to the knowledge base of the profession, and offer exceptional OEHN expertise in key industries and occupations: health care, agriculture, construction, fire service, hotel cleaning service, including foci on serious adverse effects of worksite and environmental conditions, such as musculoskeletal injuries, asthma, sharps injuries, work stress and cardiovascular diseases, and noise-induced hearing loss. Research conducted by OEHN faculty and students is responsive to NIOSH's National Occupational Research Agenda and AAOHN's priority research areas. Thus, results have high relevance for practice and will aid in developing the evidence base essential for specialty practice.

Technical Report

Background. The UCSF OEHN Program in the Department of Community Health Systems at the SON was initiated in 1979 to prepare advanced practice nurses in OHN at the Master of Science (MS) level. The Program is a component of the Northern California COEH which was created by 1997 state legislative mandate. This MS program prepares graduates with role specialization as OEHN nurse practitioners (NP) or nurse specialists. In addition, the program offered post-master's curriculum.

The PhD program in nursing at UCSF was initiated in 1984. The main goal of the PhD program is the development of nurse scientists who provide leadership within the community of scholars and society. In 1986, NIOSH approved and extended funding for research trainees in the PhD program, with an occupational health focus. PhD students are encouraged to engage in ongoing faculty research, conduct their own relevant research, and disseminate their findings via publications and at professional and scientific meetings.

Program Description: The OEHN Program offers MS and PhD degrees. The MS program has two tracks: a 2-year OEH nurse practitioner (NP) specialty and a 4-quarter Specialist program. The Specialist track is intended to attract both nurses already working in the OEH field and those who prefer participating in roles with more emphasis on program development, implementation and evaluation than direct clinical care. The OEH

NP graduates are eligible for national certification. All graduates may obtain ABOHN's COHN-S certification when eligible.

Goals and objectives: The goal of the program is to prepare advanced practice nurses with expertise in OEH and to become leaders in their field. NP graduates can diagnose and treat work-related injuries and illnesses in collaboration with other core OEH disciplines. Specialists are prepared to develop, implement and evaluate OEH programs including occupational injury and illness prevention and/or return to work, health promotion and risk reduction programs. Doctoral program (PhD) graduates contribute to occupational health knowledge development through research and assume leadership positions in their profession.

***Program Faculty*:** Five OEHN core faculty, five affiliated nursing faculty, seven multidisciplinary faculty, and four supporting faculty contribute to the OEHN program. The OEHN program provides multidisciplinary teaching and research training in the fields of Occupational Medicine, Environmental Health, Ergonomics, Engineering, Industrial Hygiene, Nursing, Occupational Epidemiology, Public Policy, and other areas. Interdisciplinary teaching and clinical placements include: Occupational and environmental medicine Grand Rounds, choice of many courses at UCSF and Berkeley, joint placements in clinical and community settings including employee health clinics, various worksites, and public health departments, and joint tours of high-risk industries. This program has strong ties with graduates in the community who participate and collaborate with the program by precepting students and providing lectures. With such multidisciplinary training in various settings, the OEHN program fosters OEHN graduates who are dually prepared for clinical and OEH practices and can work in multiple settings and bring their OEHN knowledge to the table in all settings.

***Training Record*:** During the reporting period, 44 MS and 8 PhD students have graduated, and 7 MS and 3 PhD students are continuing in the Program.

Our recruitment efforts have yielded highly qualified and motivated students during this funding cycle. Efforts include faculty presentations and student attendance at regional and national conferences (e.g., AAOHN, APHA, CSAOHN annual meetings). We continue to recruit through web sites, phone calls, e-mails, alumni and personal contacts. NIOSH training funds are critical to the success of these recruitment efforts. During the past 5 years 53 MS students have graduated. The majority of MS graduates have been NIOSH-funded, although many of our students continue to receive other scholarships and awards that support their education. During this period, 7 PhD students have graduated, bringing the total over the life of the program to 23 PhD graduates.

Publications Co-authored or Authored by Trainees
The following is a list of publications on which students are authors. The students' names are in **bold**.

1. Alkon, A., **Nouredini, S.**, **Swartz, A.**, Sutherland, A.M., Stephens, M., Davidson, N.A., Rose, R. (2015). Integrated Pest Management Intervention in Child Care Centers Improves Knowledge, Pest Control, and Practices. Manuscript submitted to Environmental Health Perspectives for publication. Department of Family Health Care Nursing, University of California, San Francisco.
2. **Buss J.**, Epel E., Havel P., Lin J., Blackburn E., Daubenmier J. (2014). Associations of ghrelin with eating behaviors, stress, metabolic factors, and telomere length among overweight and obese women: Preliminary evidence of attenuated ghrelin effects in obesity? Appetite. 76:84-94.
3. Cataldo, J.K., Slaughter, R., Jahan, T.M., Pongquan, V.L., **Hwang, WJ** (2011). Measuring Stigma in People with Lung Cancer: Psychometric Testing of the Cataldo Lung Cancer Stigma Scale. Oncology Nursing Forum, 38(1), E46-54.
4. **Chin, D. L.**, Hong, O., Gillen, M., Bates, M. N., & Okechukwu, C. A. (2012). Cigarette smoking in building trades workers: The impact of work environment. American Journal of Industrial Medicine, 55(5), 429-439.
5. **Chin, D. L.**, Hong, O., Gillen, M**.,** Bates, M. N., & Okechukwu, C. A. (2012). Occupational factors and Smoking Cessation among unionized building trades workers. Workplace Health & Safety.60 (10), 445-452.
6. **Chin, D. L.**, Hong, O., Gillen, M**.,** Bates, M. N., & Okechukwu, C. A. (2013). Heavy and light/moderate smoking among building trades construction workers. Public Health Nursing.30 (2) 128-139.

7. **Chin, D.,** Duffy, S., & Hong. O. Knowledge of occupational chemical exposure and smoking behavior in Korean immigrant drycleaners. *Journal of Immigrant and Minority Health. 2014 Feb 14. [Epub ahead of print]. DOI: 10.1007/s10903-014-9989-7.*
8. **Foley, M** (2013). Playing it Safe: A Look at Needlestick Injuries, *Imprint (National Student Nurses Association).* 7:(2), 38-41.
9. Fukuoka, Y., Gay, C.L., **Joiner, K.L.**, Vittinghoff, E. A. Novel Diabetes Prevention Intervention Using a Mobile App: A Randomized Controlled Trial with Overweight Adults at Risk. Am J Prev Med. 2015 Aug; 49(2):223-37.
10. Ha, J. G., Kim, J. M., **Hwang, W. J**. & Lee, S. G. Impact of organizational characteristics on turnover intention among care workers in nursing homes in Korea: a structural equation model, Australian Health Review. (2014)
11. Hong, O**., Chin, D. L**., **Phelps, S. M**., Feld, J., & Vogel, S. (2012). Occupational injuries, duty status, and factors associated with injuries among firefighters. Workplace Health & Safety. 60(12), 517-523.
12. Hong, O**., Chin, D. L.,** Kerr, M. J., & Ronis, D. L. (2012). Stages of change in hearing-protection behavior, cognition, and hearing status. American Journal of Health Behavior, 36(6), 811-822.
13. Hong, O**.,** Monsen, K. A., Kerr, M. J., **Chin, D. L**., Lytton, A. B., & Martin, K.S. (2012). Firefighter hearing health: An informatics approach to screening, measurement, and research. International Journal of Audiology. 51(10), 765-770.
14. Hong, O**., Chin, D. L.**, & Ronis, D. L. (2013). Predictors of hearing protection behavior among firefighters in the United States. International Journal of Behavioral Medicine. 20(1), 121-130.
15. Hong, O., Eakin, B., **Chin, D. L**., Feld, J., & Vogel, S. (2013). An internet-based tailored hearing protection intervention for firefighters: Development process and users' feedback. Health Promotion Practice. 14(4), 572-579.
16. Hong, O**., Chin, D. L.**, Fiola, L., & Kazanis, A. (2013). The effect of a booster intervention to promote hearing protection behavior in operating engineers. American Journal of Industrial Medicine. 56 (2), 258-266.
17. Hong, O., **Chin, D. L**., & Samo D. G. (2013). Hearing loss and use of hearing protection among career firefighters in the United States. Journal of Occupational and Environmental Medicine. 55(8), 960-965.
18. Hong, O., **Chin, D. L.,** & Thomas, E. A. (2013). Global occupational health and safety activities by nurses in the U.S. Workplace Health & Safety. 61(7), 287-295.
19. Hong, O., **Duffy, S.,** Choi, S. H., & **Chin, D. L.** (2014). The association between occupational exposures and cigarette smoking among operating engineers. Archives of Environmental & Occupational Health. 69(3), 172-179.
20. Hong, O., **Chin, D.**, & Kerr, M. (2015). Lifelong occupational exposures and hearing loss among Latino American elderly. *International Journal of Audiology.* 54, Supplement 1:S57-64.
21. **Hwang, W.** (2011). Philosophical and ethical perspectives on cardiovascular disease risk in low-wage workers, *Public Health Nursing.* (28(2):168-75. doi: 10.1111/j.1525-1446.2010.00922.x.
22. **Hwang, W**. & Hong, O. (2012). Work-related cardiovascular disease risk factors using a socioecological approach: Implications for practice and research. Journal of European Cardiovascular Nursing, 11(1), 111-126.
23. **Hwang, W.,** Hong, O, & Kim, M, (2012). Factors associated with blue-collar workers' risk perception of cardiovascular disease. Journal of Korean Academy of Nursing, 42(7), 1095-1104.
24. **Hwang, W. J.**, Hong, O. S., & Rankin, S. H. (2015). Predictors of Health-Promoting Behavior Associated With Cardiovascular Diseases Among Korean Blue-Collar Workers. Asia-Pacific Journal of Public Health. Vol. 27(2) NP691–NP702.
25. **Hwang, W.,** Kang, D.R, & Hong, O. Testing reliability and validity of a short version of Effort Reward Imbalance measure with blue-collar workers in South Korea. Research in Health and Nursing.
26. **Hwang, W**. & Lee, JY (2014). Effect of psychosocial factors on metabolic syndrome in male and female blue-collar workers *Japan Journal of Nursing Science,* 11, 23–34
27. Incollingo-Belsky, A.C., Finch, L.E., **Buss, J.**, Guardino, C.M., Tomiyama, A.J. (2015) An experimental field study of weight salience and food choice. Appetite. 89:215-218.
28. Tomiyama, A.J., Finch, L.E., Incollingo-Belsky, A.C., **Buss J.**, Finley, C., Schwartz, M.B., & Daubenmier, J. (2014). Weight Bias in 2001 versus 2013: Contradictory attitudes among obesity researchers and health professionals. Obesity. 23(1):46-53.
29. Won, J., Hong, O, & **Hwang, W.** (2013). Actual cardiovascular disease risk and the related factors: A cross-sectional study of Korean blue-collar workers employed by small-businesses. Workplace Health & Safety; 61(4), 163-71.

Highlights/Significant Results

In July 2013, Dr. S. Katharine Hammond, PhD, CIH, replaced Dr. Mark Nicas as the IH Program Director. The transition was seamless because Professor Hammond served as the IH Program Director from 1994 to 2002, at which time Dr. Nicas assumed that position, and she remained an integral part of the IH program. Additionally, Dr. Sa Liu, PhD, CIH, serves as Assistant IH Program Director under Professor Hammond. Professor Hammond has internationally-recognized expertise in exposure assessment for occupational epidemiology studies [most recently particle exposure (mass, size, composition) in the aluminum production industry, solvent exposure among automobile repair technicians, welding fumes and metal working fluids in auto assembly, as well as exposure studies of emissions from office equipment and PBDE from electronic waste recycling and previous studies in the semiconductor, boatbuilding, railroad and fiberglass industries], in monitoring air contaminants including extremely low concentrations of solvents and PAHs in workplaces, chemical species in secondhand smoke, and in laboratory analytical methods. Professor Hammond has published over 180 peer-reviewed articles as well as numerous book chapters and monographs. She is a Fellow of the AIHA and is actively engaged in professional organizations and committees. Among her many accomplishments, she is a recipient of: (i) the NIOSH Alice Hamilton Award for Excellence in Occupational Safety and Health; (ii) the AIHA Rachel Carson Award; (iii) the Flight Attendants Medical Research Institute Dr. William Cahan Distinguished Professor Award; and (iv) the American Academy of Industrial Hygiene Council Henry F. Smyth Award. She has served as an advisor to numerous MPH, MS and PhD students in the IH Program over the years, and she is the principal advisor for incoming IH students. Dr. Hammond teaches the "Characterization of Airborne Contaminants" course, "Exposure Assessment and Control II: Physical Agents, Ventilation, and other Controls"; and "Health Risk Assessment, Regulation and Policy" course (PH 220C) (with Dr. Tom McKone); these courses are required for IH students. Professor Hammond's return as IH Program Director reflects the commitment of the EHS Division and the SPH to the IH Program.

Dr. Liu is a researcher in the Division of Environmental Health Sciences at UC Berkeley, where she earned her PhD degree; Professor Hammond was her thesis advisor. She is a certified industrial hygienist and has a MPH in Industrial Hygiene and MS degrees in Environmental Sciences and Environmental Engineering, and has a strong background in analytical chemistry. She worked for 2 years as the U.S. Local Safety Officer for the Lawrence Berkeley National Laboratory on a collaborative research project in southern China before returning to UC Berkeley in August 2012. She has published papers on occupational topics including a global study of manganese exposures from welding, particle size distribution and exposure in the aluminum industry, developing methods for particle mapping in the workplace, and solvent exposure in automobile repair.

Drs. Hammond, Nicas, and Schwarzman have continued to develop coursework involving the general area of green chemistry, sustainable design and product stewardship. In conjunction with Dr. David Dornfeld (Mechanical Engineering), Dr. Thomas McKone (EHS Division) and Mr. Akos Kokai (UC Berkeley Center for Green Chemistry), Drs. Hammond, Nicas and Schwarzman developed and presented a new course in Spring 2012 titled "Engineering and Health Impact Methods in Green Design" (PH 290-007). IH-related material in the course included toxicological endpoints for assessing human health impact and chemical exposure assessment methods (environmental measurements, biological monitoring, and mathematical modeling). Other topics included design principles for sustainable materials and methods for evaluating sustainability. Dr. Nicas was the instructor of record. This course was presented in combination with two other modules concerning methods for evaluating the toxicity of new chemical structures and ethical considerations in sustainable manufacturing. Funding for curriculum development was provided by the California Department of Toxic Substances Control.

As part of an effort to integrate such material into the IH Program curriculum, starting in 2013 we require all IH students to take "Green Chemistry: An Interdisciplinary Approach to Sustainability" (PH 234). At the same

time, we are collaborating with members of the AIHA Stewardship and Sustainability Committee (SSC) to identify applicable material targeted to IH students that would become part of PH 234 and/or be fashioned into new courses and/or made part of other existing courses (for example, “Exposure Assessment and Control I and II”, “Greener Solutions (PH290.2)”, “Green Product Development: Design for Sustainability (ME 290H)”, “Sustainable Manufacturing (ME 290I)” and “Technology and Sustainability (CE293A)”). As previously stated, Drs. Wilson and Nicas are working with a group of SSC members in this effort.

As part of our expanding international industrial hygiene work and in response to students’ interests we will offer seminar on “Global Occupational Health”. Global occupational health is an emerging field. A few of our alumni have been actively involved in this work for over a decade. Mr. Garrett Brown (1991) works with the Maquiladora Health and Safety Support Network (MHSSN), which he helped found, as well as industrial hygiene training in Asia; Mr. Richard Hirsh (1986) chairs Developing World Outreach Initiative, Ms. Nina Townsend (2011) chairs the AIHA Social Concerns Committee which involves substantive global occupational health activities. We also have hosted visiting scholars from Africa, India, and China who work on occupational health at their home institutions. The UC Berkeley School of Public Health has close relations with SRU in Chennai, India, and helped to establish their MPH program, which focuses on occupational and environmental health (the first in India). We are currently working with colleagues in China to establish training in industrial hygiene activities in China as we continue our occupational research there.

During the reporting period, we have had a mix of students enrolled in the IH program, usually 4 MPH students and at least 1 PhD student. During the reporting period, 14 students completed master’s level training in IH and two IH PhD students have graduated, with a third still in training. Two of the MPH IH students have gone on to get PhDs in Environmental Health Sciences at UC Berkeley.

Outcomes/Relevance/Impact

In addition to green chemistry and the globalization of occupational health noted above, the other area where the IH Program has been impactful during the reporting period is exposure biology and the concept of the exposome. Dr. Stephen Rappaport, CIH, has internationally recognized expertise in statistical aspects of exposure assessment and in the laboratory development and field application of biomarkers of exposure. Dr. Rappaport received the Jerome J. Wesolowski Award for sustained and outstanding contributions to the knowledge and practice of human exposure assessment, awarded by the International Society of Exposure Science (2010); the Friend E. Clark Lecturer (2012) that is awarded annually to a chemist with an outstanding record of academic achievement by the Department of Chemistry, West Virginia University; the Welcome Trust Fellowship in 2012 from Department of Epidemiology and Biostatistics, Imperial College, London, U.K; the Senior Visiting Scientist Award in 2013 from International Agency for Research on Cancer (Lyon, France); and The Centennial Whittenberger Lecturer from the Department of Environmental Health, Harvard School of Public Health (2013). He has published 215 peer-reviewed articles and is actively engaged in professional organizations and committees. He was Co-Director of the UC Berkeley Center for Exposure Biology, a Biological Response Indicators of Environmental Stress Center, funded by the NIH from 2007-2012. The Center was a collaborative effort between the SPH, the College of Chemistry, and the College of Engineering. The Center developed state-of-the-art biomarkers and biosensors of biological stress for applications to studies of blood-borne cancers associated with environmental contaminants (e.g., benzene), work that Dr. Rappaport contines to conduct. Note that Dr. Rappaport was the UC Berkeley IH Program Director in the 1980s before taking a faculty position at the University of North Carolina. Dr. Rappaport teaches “Exposure Assessment and Control I” (PH270A), which is required for IH students, and the “Quantitative Exposure Assessment” (PH 290) course that addresses statistical issues and recent developments in the use of biomarkers.

Dr. Mark Nicas, CIH, is a Fellow of the AIHA and a recipient of the AIHA Edward J. Baier Technical Achievement Award. He has expertise in exposure assessment methods, microbial risk assessment, and personal respiratory protection. He has been the Editor-in-Chief of the *Journal of Occupational and Environmental Hygiene* (a joint publication of the AIHA and ACGIH) since July 2010. He has published over 60 publications in the peer-reviewed technical literature, of which three received “best paper” awards. Dr. Nicas conducts research involving exposure/risk assessment for airborne chemical toxicants and microbial pathogens. He also develops mathematical models for the emission and airborne dispersion of infectious

agents and chemical toxicants in occupational settings. His current research concerns the mathematical modeling of contaminant emission and dispersion in indoor air, and microbial risk assessment. Although he is retired from UC Berkeley, he maintains an office, meets and advises students, and contributes to courses as invited.

Technical Report

The goal of the Industrial Hygiene (IH) Program is to educate committed and passionate industrial hygienists with both a firm theoretical background to enable growth and flexibility in our rapidly changing world and a good grasp of the practical aspects of the field to implement this knowledge as practioners (MS and MPH students) and researchers (PhD students). IH is part of the Environmental Health Sciences (EHS) Division, School of Public Health. It offers the MPH professional degree and the MS and PhD academic degrees. For all degree objectives, the curriculum provides fundamental knowledge in toxicology, epidemiology, exposure assessment and control, risk assessment, and biostatistics, and the ability to integrate these disciplines in identifying controls for diverse occupational health problems. With the requisite job experience, all graduates should be able to pass the ABIH certification exam.

Our goal is to provide students with a multi-disciplinary approach to analyzing and solving occupational and environmental health problems, along with the requisite knowledge foundation and basic technical skills. The knowledge foundation and problem-solving skills are gained via required coursework in exposure assessment and control, toxicology, biostatistics, epidemiology, geographic information science, health policy, and risk assessment. Practitioner-oriented training has several components.

- hands-on practice with monitoring equipment in the “Characterization of Airborne Contaminants” course. The three field sampling projects focus on: 1) direct reading particle measurements, with size selection, at foundry, construction sites, near-road traffic, etc.; 2) solvent vapor measurements using charcoal tubes and PDI (naphthalene and PDB exposures in UCB Entomology Museum in 2013); 3) assessing exposures associated with asphalt in UCB Pavement Research Lab (included particle measurements and collection and analysis of airborne PAHs);
- hands-on practice with monitoring and control equipment in the “Exposure Assessment and Control II: Control Ventilation and Physical Agents” course. This includes making measurements for radiation and noise exposure and evaluating the efficacy of ventilation systems and respirators.
- the occupational safety course and the case fatality analysis course;
- participation in the UCSF occupational medicine clinic and workplace site visits; and
- the summer internship (for the MPH IH students) under the supervision of a CIH. Starting in 2013, we have required IH students to take “Green Chemistry: An Interdisciplinary Approach to Sustainability,” a survey course in principles of green chemistry, sustainable design and product stewardship. In 2015 we plan to initiate a course in Global Occupational Health. As their schedules permit, students can take elective courses in relevant areas such as biological hazards, biomarkers, drinking water and safety, business management, environmental law, and social/cultural perspectives in public health, as well as environmental engineering, green product development, sustainable manufacturing, indoor air quality, fire protection engineering, traffic safety and injury prevention from engineering departments.

Publications Co-authored or Authored by Trainees

The following is a list of publications on which students are authors. The students’ names are in **bold**.

1. Sahmel, J., C.A. Barlow, **B. Donovan Simmons,** S.H. Gaffney, H.J. Avens, A.K. Madl, J. Henshaw, R.J. Lee, D. Van Orden, M. Sanchez, M. Zock, and D.J. Paustenbach. 2014. Evaluation of take-home exposure and risk associated with the handling of clothing contaminated with chrysotile asbestos. Risk Anal. 34(8):1448-68

2. Donovan, EP, **Donovan, BL**, McKinley, MA, Cowan, DM, Paustenbach, DJ,, 2012, Evaluation of take home (para-occupational) exposure to asbestos and disease: a review of the literature. Crit Rev Toxicol. 2012 Oct;42(9):703-31.

3. **S Liu**, SK Hammond (2012): “Gases, Vapors, and Solvents,” Chapter 7, in Fundamentals of Industrial Hygiene, Sixth Edition, National Safety Council.

5. **S Liu**, SK Hammond and SM Rappaport (2011): “Statistical Modeling to Determine Sources of Variability Exposures to Welding Fumes,” *Annals of Occupational Hygiene, Volume 55, pp* 305-318.

6. **S Liu** and SK Hammond (2010): “Mapping Particulate Matter at the Body Weld Department in an Automobile Assembly Plant,” Journal of Occupational and Environmental Hygiene, Volume 7, 593-604.

7. **M Stewart**, T Bausman, K Kumagai, M Nicas. “Formaldehyde Exposure during Simulated Use of a Hair Straightening Product”. Journal of Occupational and Environmental Hygiene, 2013: 10(8).

8. **Gaspar, FW**. Castorina, R. Maddalena, R. Nishioka, M. Williams, J. Jenkins, P. McKone, TE. Bradman, “Phthalate Exposure and Risk Assessment in California Child Care Facilities.” 2014. Environmental Science and Technology.

9. Bradman, A. Castorina, R. **Gaspar, FW**. Nishioka, M. Colón, M. Weathers, W. Egeghy, P. Maddalena, R.Williams, J. Jenkins, P. McKone, TE. “Flame Retardant Exposures in California Early Childhood Education Environments.” 2013. Chemosphere.

Highlights/Significant Results

During the reporting period, seven students obtained the MS degree (three Masters in Translational Medicine in Bioengineering; three in Mechanical Engineering; and one in Environmental Health Sciences). This is an important increase over the three MS graduates in the prior reporting period. In addition, three students obtained the PhD degree (Environmental Health Sciences) during the reporting period but only two of the PhD graduates received a NIOSH traineeship.

Of the seven MS graduates, four advanced to PhD training in Bioengineering or Mechanical Engineering, one is doing consulting in ergonomics, safety and IH in Los Angeles; one is completing medical school training; and one is the Chief Technology Officer at a medical device company in San Jose.

Of the three doctoral graduates, one is an ergonomics consultant with a regional workplace safety and health consulting firm (EORM); one is in charge of ergonomics and usability testing for keyboards and mice at Microsoft; and one is an occupational health/epidemiology consultant for the World Health Organization.

An exciting highlight is the number of undergraduates involved in the program. In 2014 there were three engineering and two biology undergraduates working in the laboratory. Two were from underrepresented minority groups. They worked with a graduate student or laboratory engineer on research projects. Two summer students were supported by the Occupational Health Internship Program and developed a 5-minute video describing a drill rig for concrete drilling that was developed by the Ergonomics Program. https://www.youtube.com/channel/UCAC28BCIEBdALIJ8A--MhWw?feature=watch. Three of the undergraduate students plan to continue graduate studies in Occupational Health.

Outcomes/Relevance/Impact

Several of the research projects during the reporting period involved important r2p activities. The Ergonomics Program developed and widely disseminated a universal drilling rig to assist construction workers with drilling into concrete (see http://ergo.berkeley.edu for details). The program conducted research with support from Herman Miller that was used to guide the design of arm supports on office chairs. The program also conducted research with Hewlett Packard on the design of touch screen monitors and new hand gesture systems for human-computer interaction. The program also conducted research on design features of tablets that was partially funded by Microsoft. Funding from industry (Dell, Microsoft, and Hewlett-Packard) also partially funded research on keyboard key design. In 2013, the program assisted Cal/OSHA in the writing and dissemination of a new regulation on Safe Patient Handling. The program assisted the California Department of Public Health on their NIOSH funded surveillance project for carpal tunnel syndrome and on the development of five short videos for training dental hygienists on the prevention of musculoskeletal disorders through the proper positioning of themselves and patients and the proper selection and maintenance of dental tools.

A total of 29 peer-reviewed scientific papers involving significant contributions from current students and post-doctoral fellows were published or accepted for publication during the reporting period. All but two of these papers were first-authored by students or post-doctoral fellows. Student authors represent undergraduate, MS, PhD and post-doctoral level trainees at Berkeley demonstrating the breadth of mentorship involved in the ergonomics program. Current students and post-doctoral fellows also had 31 papers accepted or presented at national and international scientific meetings such as the International Ergonomics Association meeting and the Human Factors and Ergonomics Society annual meeting.

Technical Report

California is the only state in the country with a workplace ergonomics standard and this graduate training program is the only program in California and the surrounding states to provide an M.S. and Ph.D. degree with training in Ergonomics. Students come to the program from a variety of backgrounds, such as engineering and biology. Trainees receive their degree from UC Berkeley's School of Public Health (Department of Environmental Health Sciences) or the UC Berkeley College of Engineering (Department of Mechanical Engineering or Bioengineering). The Program is small but the quality of its graduates is high as demonstrated by their rapid employment by regional firms and agencies or advancement to Ph.D. training programs. Five of the Program graduates have filled faculty positions in ergonomics at other universities. Trainees usually have multiple job offers as consultants or as health and safety employees at companies or agencies.

As a small program, the courses, lectures and research advising are built by forming collaborative relationships with faculty from other disciplines. For example, students are required to take courses from the Departments of Industrial Engineering, Mechanical Engineering and Integrative Biology. Students from bioengineering, nursing, industrial hygiene and occupational medicine take the Ergonomics course (PH269C) side-by-side with ergonomics students.

The program supports a research engineer who is responsible for experimental methods, data collection and assists graduate students with their research projects. The program also supports two ergonomics consultants part-time (Mr. Janowitz and Ms. Delsaer) who provide access to workplaces in the Bay Area for practical training of trainees in ergonomics.

Publications Co-authored or Authored by Trainees below

The following is a list of publications on which students are authors. The students' names are in **bold**.

1. **Harris C**, Eisen E, Goldberg R, Krause N, Rempel D. Workplace and individual factors in wrist tendinosis among blue-collar workers - the San Francisco study (1st Place PREMUS best paper competition). Scandinavian Journal of Work and Environmental Health. 2011; 37(2):86-98. PMID:21298225

2. **Lichty MG**, Janowitz IL, Rempel DM. Ergonomic evaluation of 10 single-channel pipettes. Work 2011; 39(2):177-185. PMID:21673445

3. Rempel P, Janowitz I, **Alexandre M, Lee D**, Rempel D. The Effect of Alternative Arm Support on Shoulder and Upper Back Muscle Loading During Pipetting. Work 2011; 39(2):195-200. PMID: 21673447

4. Rempel D, **Lee D**, Dawson K, Loomer P. Effect of periodontal curette handle weight and diameter on dental practitioner arm pain: A 4-month randomized controlled trial. J Am Dental Assoc 2012; 143(10):1105-1113. PMID: 23024308.

5. **Pereira A, Lee DL**, Sadeeshkumar H, Laroche C, Odell D, Rempel D. The effect of keyboard key spacing on typing speed, error, usability, and biomechanics: Part 1. Human Factors. 2012; 55(3):557-566. PMID: 23829030.

6. Coelho D, **Harris C**, Lima T, Janowitz I, Rempel D. Correlation between Different Hand Force Assessment Methods from an Epidemiological Study. Human Factors and Ergonomics in Manufacturing & Service Industries. 2013; 23(2):128-139. PMID:

7. Dale AM, **Harris-Adamson C**, Rempel D, Gerr F, Hegmann K, Silverstein B, Burt S, Garg A, Kapellusch J, Merlino L, Thiese MS, Eisen EA, Evanoff B. Prevalence and incidence of carpal tunnel syndrome in US working populations: Pooled analysis of six prospective studies. Scand J Work Environ Health. 2013; 39(5):495-505. PMID: 23423472

8. Kapellusch J, Garg A, Bao S, Silverstein B, Burt S, Dale A, Evanoff B, Gerr F, **Harris-Adamson C**, Hegmann K, Merlino L, Rempel D. Pooling Job Physical Exposure Data from Multiple Independent Studies in a Consortium Study of Carpal Tunnel Syndrome. Ergonomics 2013; 56(6):1021-1037. PMID: 23697792.

9. **Harris-Adamson C**, Eisen EA, Dale AM, Evanoff B, Hegmann K, Thiese MS, Kapellusch J, Garg A, Burt S, Bao S, Silverstein B, Gerr F, Merlino L, Rempel D. Personal and Workplace Psychosocial Risk Factors for Carpal Tunnel Syndrome: A Pooled Study Cohort. Occup & Environ Medicine 2013; 70(8):529-37. PMID: 23645610.

10. **Pereira A**, Miller T, Huang YM, Odell D, Rempel D. Holding a tablet computer with one hand: Effect of tablet design features on biomechanics and subjective usability among users with small hands. Ergonomics 2013; 56(9):1363-75. PMID:23909815.

11. **Camilleri M**, Malige A, Fujimoto J, Rempel DM. Touch displays: The effects of palm rejection technology on productivity, comfort, biomechanics and positioning. Ergonomics 2013; 56(12):1850-62. PMID:24134774.

12. **Pereira A**, Hsieh CM, Laroche C, Rempel D. The effect of keyboard key spacing on typing speed, error, usability, and biomechanics, Part 2: vertical spacing. Human Factors 2014; 56(4):752-759. PMID:25029899.

13. **Harris-Adamson C**, You D, Eisen EA, Goldberg R, Rempel D. The impact of posture on wrist tendinosis among blue-collar workers – the San Francisco study. Human Factors 2014; 56(1):143-150. PMID: 24669549.

14. **You D**, Smith A, Rempel D. Meta-analysis: association between wrist posture and carpal tunnel syndrome among workers. Safety and Health at Work (SH@W) 2014; 5(1):27-31. PMID: 24932417

15. **Ko P**, Mohapatra A, Bailey I, Sheedy J, Rempel D. Effect of font size and glare on computer tasks in young and older adults. Optometry and Vision Science 2014; 91(6):682-689. PMID: 24830373

16. Rempel D, **Lee DL**, **Camilleri M**. The design of gestures for human-computer interaction: Lessons from sign language interpreters. International Journal of Human-Computer Studies 2014; 72:728-735. PMID:

17 Kapellusch JM, Gerr F, Malloy EJ, Garg A, **Harris-Adamson C**, Bao S, Burt S, Dale AM, Eisen EA, Evanoff B, Hegmann KT, Silverstein B, Thiese MS, Rempel D. Exposure-response relationships for the ACGIH TLV for hand activity level: results from a pooled data study of carpal tunnel syndrome. Scand J Work Environ Health. 2014 (In press).

18. **Pereira A**, Wachs JP, Park K, Rempel D. A User Developed 3D Hand Gesture Set for Human-Computer Interaction. Human Factors 2014.

19. Rempel D, **Lee DL, Camilleri M**. The design of gestures for human-computer interaction: Lessons from sign language interpreters. International Journal of Human-Computer Studies 2015; 72(10-11):728-735. PMID: 26028955.

20. Thiese MS, Gerr F, Hegmann KT, **Harris-Adamson C**, Dale AM, Evanoff B, Eisen E, Kapellusch J, Garg A, Burt S, Bao S, Silverstein B, Merlino L, Rempel D. Effects of Varying Case Definition on Carpal Tunnel Syndrome Prevalence Estimates in a Pooled Cohort. Archives of Physical Medicine & Rehabilitation 2014; 95(12):2320-6. PMID: 25175160

21. Kapellusch JM, Gerr F, Malloy EJ, Garg A, **Harris-Adamson C**, Bao S, Burt S, Dale AM, Eisen EA, Evanoff B, Hegmann KT, Silverstein B, Thiese MS, Rempel D. Exposure-response relationships for the ACGIH TLV for hand activity level: results from a pooled data study of carpal tunnel syndrome. Scand J Work Environ Health. 2014; 40(6):610-20. PMID:25266844.

22. Rempel D, Gerr F, **Harris-Adamson C,** Hegmann KT, Thiese MS, Eisen EA, Kapellusch J, Garg A, Burt S, Bao S, Silverstein B, Merlino L, Dale AM, Evanoff B. Personal and workplace factors and median nerve

function in a pooled study of 2396 US workers. Journal of Occupational and Environmental Medicine 2015; 57(1):98-104. PMID:25563546.

23**. Harris-Adamson C**, Eisen EA, Kapellusch J, Garg A, Hegmann K, Thiese MS, Dale AM, Evanoff B, Burt S, Bao S, Silverstein B, Merlino L, Gerr F, Rempel D. Biomechanical Risk Factors for Carpal Tunnel Syndrome: A Pooled Study of 2474 Workers. Occup & Environ Medicine 2015; 72:33-41. PMID:25324489

24. Bao S, Kapellusch J, Garg A, Silverstein B, **Harris-Adamson C**, Burt SE, Dale AM, Evanoff B, Gerr FE, Hegmann K, Merlino L, Thiese MS, Rempel D. Developing a pooled job physical exposure dataset from multiple independent studies: an example of a consortium study of carpal tunnel syndrome. Occupational & Environmental Medicine 2015; 72(2):130-137. PMID:25504866.

25. Dale AM, Zeringue A, **Harris-Adamson C**, Rempel D, Bao S, Thiese MS, Merlino L, Burt S, Kapellusch J, Garg A, Gerr F, Hegmann KT, Silverstein B, Eisen EA, Evanoff B. General population job exposure matrix (JEM) applied to a pooled study of carpal tunnel syndrome. American Journal of Epidemiology 2015; 181(6):431-9. PMID:25700886.

26**. Pereira A**, Wachs JP, **Park K,** Rempel D. A User Developed 3D Hand Gesture Set for Human-Computer Interaction. Human Factors 2015; 57(4):607-621. PMID:25977321.

27. Fan ZJ, **Harris-Adamson C**, Gerr F, Eisen E, Hegmann K, Bao S, Silverstein B, Evanoff B, Dale AM, Thiese MS, Garg A, Kapellusch J, Burt S, Merlino L, Rempel D. Associations between workplace factors and carpal tunnel syndrome: A multi-site cross-sectional study. American Journal of Industrial Medicine 2015; 58(5):509-518. PMID:25778111.

28. **Edsfeldt S**, Rempel D, Kursa K, Diao E, Lattanza L. In vivo flexor tendon forces generated during different rehabilitation exercises. J Hand Surg (Europe) 2015; 40(7):705-10. PMID:26115682.

29. **Madison H, Pereira A,** Korshoj, M, Taylor L, Barr A, Rempel D. Mind the gap: The effect of keyboard key gap and pitch on typing speed, accuracy, and usability, Part 3. Human Factors 2015 (in press). PMID:26002872.

Occupational Epidemiology Program
University of California, Berkeley
Final Progress Report 2010-2015

Highlights/ Significant Results

The Occupational Epidemiology (OE) Program was funded by NIOSH as part of the NCERC in 2012 and it has grown dramatically during the past 3 years. There have been nine matriculating students; three MPH students (one in Biostatistics/Epidemiology, one in EHS and one in OEM) and six PhD students (two in Epidemiology, three in EHS, and one in Biostatistics). During the reporting period, one of these OE trainees obtained the MPH degree (in the joint program in Epidemiology/Biostatistics). In addition, one obtained the PhD degree (Biostatistics). The PhD graduate is now a Research Data Analyst at UC Berkeley, working on projects in occupational, as well as social, epidemiology. He is also a consultant to Apple, Inc, on a study of the causes and consequence of worker attrition in a large electronic supplier in Shanghai, China.

Outcomes/Relevance/Impact

The OE program continues to address a national and regional need for epidemiologists with specialized training in occupational health at both the MS and PhD levels. Occupational epidemiologists are needed in the state health departments within Region 9, other public health agencies and private industry to design and implement surveillance programs for at-risk workers, as well as in research centers and universities to conduct etiologic studies. Our cross-cutting academic program enriches the other existing programs by expanding the number of interdisciplinary courses and seminars relevant for trainees in IH, OEHN, OEM and Ergonomics. The program also expands the research options for all ERC trainees by providing an infrastructure that promotes collaborations with occupational health scientists at UCSF and UC Davis (Marc Schenker, MD, MPH), as well as Stanford (Mark Cullen, MD, MPH). The inclusion of these active and prominent occupational epidemiologists at nearby institutions enhances the research environment of the entire ERC program.

Trainees in OE have published seven papers in the last 2 years. OE is the newest of the training programs and only the earliest PhD trainee has had time to complete his training. Dan Brown (PhD 2014) had already been a co-author on five papers before finishing his dissertation. His first thesis paper applying targeted maximum likelihood estimation to the study of heart disease in ALCOA workers was published in *Epidemiology*, the premier methods journal in the field. In addition, Erika Garcia was a co-author on a paper on heart disease and PM2.5 because of work she did as a MS student in EHS on the exposure assessment for metalworking fluids. We wanted to evaluate PM3.5 exposure with respect to heart disease and she provided the estimates of PM3.5, distinct from PM9.8 and total TPM in the GM-UAW autoworkers studies.

The OE trainees have made presentations at several international conferences, including the Epidemiology section of the International Congress on Occupational Health (ICOH), aka EPICOH, the Society for Epidemiologic Research (SER), and International Society for Environmental Epidemiology. At the EPICOH meeting in Chicago, IL in June 2014, our training program was well represented. Dr. Eisen gave an invited keynote, entitled “Healthy Worker Survivor Effect: An Old Problem with a New Solution”. Two of the PhD students gave presentations; Stella Beckman received the Best Student Abstract Award for her work on metalworking fluid exposure and COPD mortality, with indirect adjustment for smoking.

Technical Report

The goal of the program is to train epidemiologists to evaluate potential health effects of work-related exposures using state of the art methods of epidemiology, biostatistics, exposure and risk assessment, and occupational health surveillance. Areas of focus include health risks of emerging new technologies, the health effects of familiar hazards in underserved minority or migrant worker populations, and suspected hazards in nontraditional workplaces. The OE Training Program prepares MS, MPH and PhD students for careers in research, teaching and leadership roles as occupational epidemiologists in governmental public health agencies, nongovernmental organizations, private consulting, private industry and universities. Our aim is to

ensure that graduates of our program not only do outstanding epidemiologic research, but also appreciate the importance of translating their scientific work into sound occupational health policy as leaders in the field.

Ellen Eisen, ScD, is the Program Director and is administratively responsible for all aspects of the program; from recruitment, to assigning faculty advisors, tracking trainee progress through the program, program evaluation, and follow-up of alumni. Dr. Eisen moved to the UC Berkeley School of Public Health in 2007, and is Head of the Division of Environmental Health Sciences (EHS). She is a member of the Graduate Groups in both EHS and Epidemiology and is therefore eligible to chair doctoral committees in both divisions. She is the author of over 180 scientific publications related to occupational or environmental epidemiology. She has been principal investigator on R01 grants from NIEHS, NHLBI and NCI (NIH), as well as NIOSH (CDC).

Dr. Eisen's research in epidemiologic methods and applied public health bridges three fields – occupational and environmental health, biostatistics and epidemiology. Trained in biostatistics and motivated by questions about the occupational causes of disease, she is interested in new methods for overcoming the analytical limitations imposed by conventional approaches to study design and data analysis. She began her career studying nonmalignant respiratory effects of silica and cotton dust. Based on longitudinal data from Vermont granite workers, she identified a poorly reproducible lung function test as a marker of pulmonary impairment—a discovery which led to changes in the compensation criteria for Black Lung Disease in the early 1990s. She has led many studies based on a cohort of Michigan autoworkers exposed to metalworking fluids, evaluating risks of cancer incidence, as well as chronic heart and lung disease mortality. These autoworker studies have included the development of new exposure metrics for nested case-control studies of bladder, skin, lung, and digestive cancers, and the application of smoothing splines to capture nonlinear exposure-response models. In addition, she has applied g-estimation and other causal inference methods to address the time-varying confounding that characterizes healthy worker survivor bias.

Dr. Eisen has a long history of mentoring graduate students and post-doctoral fellows at Harvard and UC Berkeley, working in the interface between occupational epidemiology, biostatistics, and exposure assessment. She supervised several doctoral theses focused on specific cancer endpoints, e.g., cancer of the pancreas, prostate, and lung, as well as nonmalignant respiratory disease, i.e., COPD, in relation to exposure to specific types of metalworking fluids. She has trained students in the application of advanced statistical modeling for analyzing occupational cohort data, including nonparametric smoothing methods, supported by an R01 from NIEHS. She has co-mentored several other students involved in an ongoing prospective study of pulmonary function in a cross-sectional cohort of Chinese cotton textile workers in collaboration with David Christiani of the Harvard SPH. In addition, doctoral students at Berkeley have become involved in the ALCOA studies of PM2.5 and heart disease, in collaboration with Mark Cullen at Stanford.

Publications Co-authored or Authored by Trainees

The following is a list of publications on which students are authors. The students' names are in **bold**.

1. **Brown DM**, Petersen M, Van der laan M, SK Hammond, Costello S, Cullen MR, Eisen EA. (2015). Occupational Exposure to PM2.5 and Incidence of Ischemic Heart Disease: Longitudinal Targeted Minimum Loss Based Estimation. *Epidemiology*

2. Neophytou, A. M., Costello, S., **Brown, DM**., Picciotto, S., Noth, EM., Hammond, SK. and Eisen, EA. (2014). Marginal Structural Models in Occupational Epidemiology: Application in a Study of Ischemic Heart Disease Incidence and PM2. 5 in the US Aluminum Industry. *Am J Epidemiol*.

3. Costello, S., **Brown, DM**., Hammond, SK., Cullen, MR., & Eisen, EA. (2013). Pathway analysis for healthy worker survivor bias in a cohort of actively employed aluminum fabrication workers. Am J Epidemiol;177:S75-S75).

4. Costello, S., **Brown, DM.,** Noth, EM., Cantley, L., Slade, MD., Tessier-Sherman, B, Hammond SK, and Cullen, MR. (2013). Incident ischemic heart disease and recent occupational exposure to particulate matter in an aluminum cohort. *Journal of Exposure Science and Environmental Epidemiology*, *24*(1), 82-88.

5. Picciotto, S., **Brown, DM.,** Chevrier, J., & Eisen, EA. (2013). Healthy worker survivor bias: implications of truncating follow-up at employment termination. *Occupational and environmental medicine*, *70*(10), 736-742.

6. Costello, S., **Garcia, E**, Hammond, SK., & Eisen, EA. (2013). Ischemic heart disease mortality and PM3. 5 in a cohort of autoworkers. *American journal of industrial medicine*, *56*(3), 317-325.

7. **Beckman S**, Eisen EA, Liu S, Bates M, Haegerstrom-Portnoy G, Hammond SK. Acquired color vision defects and exposure to hexane; a study of Bay Area automotive mechanics. A J Epidem 2015 (In Press).

Targeted Research Training Program
Final Progress Report
University of California, Berkeley,
Final Progress Report 2010-2015

Highlights/Significant Results

Over the 5 years of the reporting period (the first 5 hears of the program), Targeted Research Training (TRT) awards have been made based on student progression in their dissertation and/or research project, financial needs of the programs, and a match with current themes. Funding was provided to four OEM residents, 12 PhD candidates (five OEHN, two IH, two OE and three Ergonomics), and one OE and four IH MPH candidates. Three of the awardees (21%) are from underrepresented minorities. In the last 2 years, trainees have also received up to $7,500 each from the COEH for support of their research projects.

For the last 3 years of the TRT Program, the administration has been under the overall supervision of Dr. Michael Bates, who replaced Acting Program Director, Patty Quinlan, who took over Program management after the unanticipated early retirement of Dr. Marion Gillen. Dr. Bates works closely with the Director of both the NCERC and COEH, Dr. John Balmes, as well as the Deputy Director of the NCERC, Ms. Quinlan. Both Drs. Bates and Balmes have extensive research experience, have conducted joint research together, and have been responsible for the research training of many students. Dr. Bates is trained both in toxicology and epidemiology and has a long history of research productivity, both in terms of garnering extramural support for large cohort studies and publications.

A key intention of our TRT training program is inter-disciplinary research training. To achieve this during the years after its inception, the TRT program focused on several thematic areas that represent strengths of our faculty and were considered to provide good opportunities for Research to Practice (r2p) projects:
(1) vulnerable workers, (2) occupational lung disease, (3) exposure assessment for epidemiologic studies, (4) occupational transmission of infectious disease, (5) musculoskeletal disease, and (6) safety design for “green” jobs. The intention was that focusing on these areas would allow the trainee research activities to play to the strengths of the faculty and their existing research activities, and would encourage and facilitate interdisciplinary research.

Although the TRT Program generally worked well during those years, two key limitations emerged: (1) the number of thematic areas was too many and their scope too broad to focus and encourage a relatively small number of trainees to work together in a multi-disciplinary way; and (2) although TRT funded students for the period of their research training, it provided no funds for actually carrying out the research. This proved a hindrance, particularly since the usual period of TRT funding—one year—was generally insufficient for both raising adequate funding and carrying out the research.
When Dr. Bates became TRT Program Director in 2012, he refocused and strengthened the interdisciplinary training component of the TRT. This was done, as follows:

(1) The focus areas for interdisciplinary research training were reduced to two from six. These two new areas, which represent research strengths of faculty from both Berkeley and San Francisco campuses, are: (i) occupational health and safety of firefighters; and (ii) occupational health and safety of automotive and automotive repair workers.

(2) Each TRT applicant is required to submit a research proposal in the format of an NIH small grant proposal (i.e., R03), including a budget. Submission of a joint proposal in conjunction with another student from another discipline is encouraged, but is not mandatory. Preferably this other student is another TRT trainee, but, given the small number of such trainees, it may be another trainee from another Program under the NCERC. The proposal is developed with guidance and assistance from faculty mentors. Despite the preference for proposals on firefighters and automotive workers, we do not want to exclude from consideration particularly meritorious project proposals that deal with other topics that fit into the National Occupational Research Agenda (NORA). Therefore, such projects, if submitted, are seriously considered. However, potential applicants are encouraged to discuss their research ideas with at least the TRT Program Director before submitting.

(3) Research proposals are required to be submitted to the TRT Program Director by July 31st. Proposals are then reviewed by selected external reviewers, as outlined below. Final decisions are made by a committee comprised of Dr. Bates, the Deputy-Director and the Director of the ERC, plus additional faculty members selected and invited on an ad hoc basis, depending on their expertise. Anyone who has a direct interest in the research proposed is not invited or is required to recuse themselves from participation at the time. More detail on the review process is set out below.

(4) As Director of the Northern California COEH, Dr. John Balmes, has agreed, subject to an acceptable project budget accompanying the application, to make available a total of up to $30,000 per annum in research funds for successful grant proposals, with a maximum amount of $7,500 per person or $15,000 for a two-person joint proposal. This amount is awarded once to a successful applicant, but not again if they receive a second year of TRT funding. If more than two persons combine on a project then the maximum amount offered may scale up accordingly. The total available amount, which will be appropriately divided among successful proposals, will be available for purchase of supplies and equipment, payment of field staff, and travel, but not for student stipends or tuition (these are provided by the TRT program fund). Payment of these research funds is dependent on receipt and acceptance of sufficient research proposals of satisfactory quality. In the first year of the TRT program under this new format, $30,000 in research funds was awarded; in the current year, an additional $15,000 has been awarded.

(5) The students carry out the research, under mentor supervision. They are expected to produce at least a detailed report of their research and findings, but preferably a manuscript for publication in the peer-reviewed literature.

Basis for the selection of "favored" research areas.

The two research areas, firefighters and automotive workers, were selected for several reasons:

(1) The ideal approach to occupational health and safety research for both firefighters and automotive workers involves a collaboration of all the disciplines covered by our TRT proposal. With firefighters, a very high occupational risk group, there is a need for occupational medicine physicians and occupational health nurses, industrial hygienists, epidemiologists and ergonomists; similarly, automotive manufacturing and repair work includes a wide range of occupations that are exposed to chemicals and physical hazards, including solvents and heavy machinery. All of the disciplines involved in the NCERC have a substantial role to play for both occupational focus areas.

Among the NCERC faculty, there is extensive prior and ongoing experience in working with these two occupational groups, excellent contacts with the relevant industry and labor organizations in the Bay Area, and an enthusiasm to extend the work already done.

Outcomes/Relevance/Impact

The primary outcomes and impact of the TRT program are the funded trainees. These are the following:

Heather Papinchak, IH PhD candidate) (TRT funding 2009-10 and 2011-12)
Ms. Papinchak's doctoral research concerned increasing the sensitivity and specificity of monitoring for airborne engineered nanoparticles (ENP). Background particle concentrations in indoor air were reduced by locating a small-scale ENP process within a portable positive-pressure enclosure supplied with HEPA-filtered. For a bench-top process, the enclosure was a type of glove box. For a process conducted within a laboratory hood, a portable enclosure is placed around the hood. These enclosures have been shown to reduce the background concentrations of submicron particles (as measured by a condensation particle counter, CPC) and larger particles (as measured by an optical particle counter, OPC) by 3 to 4 orders of magnitude down to 0 to 2 particles/cm^3. As a result, relatively small increases in airborne particle concentrations measured with the CPC and OPC during an ENP procedure can be quantified. Confirmation of the presence of ENPs is established via filter sampling and transmission electron microscopy.

Carisa Harris-Adamson, Ergonomics PhD candidate. (TRT funding 2009-10): She conducted a longitudinal study of wrist tendonitis in blue collar workers. These diseases have comprised a significant portion of the

number and cost of injuries in the workplace. Aims of the study were to determine the incidence of hand/wrist symptoms and wrist tendonopathies among 453 production workers in four different industries and to determine the relationship between individual physical risk factors and combinations of these and the incidence of hand/wrist symptoms and tendonopathies. This work has led to several papers in the peer-reviewed literature, including one that won 1st Prize in the PREMUS competition.

Peiyi Ko, Ergonomics PhD candidate. (TRT funding 2010-11 and 2011-12): Her research focused on the association between font size, posture, and neck/shoulder symptoms of presbyopic computer users. The main purpose of the study was to address the visual-demand induced neck/shoulder symptoms of presbyopic computer users above the age of 45. The study involved repeated measures with 28 participants. The findings will help develop recommendations for workspace designs that will reduce postural stress and visual symptoms and optimize performance. This work has led to a published peer-reviewed paper.

Dan Brown, Epidemiology PhD candidate. (TRT funding 2009-10 and 2010-11) This student conducted an analysis of heart disease incidence and total particulate matter exposure in a cohort of aluminum manufacturing workers. To avoid bias due to healthy worker survivor effect, he applied inverse probability treatment weights to estimate marginal structural models. This work has led to several papers in the peer-reviewed literature.

Erika Garcia, Epidemiology MPH candidate. (TRT funding 2009-10 and 2010-11). Her project involved chronic obstructive pulmonary disease mortality and determination of metalworking fluids exposure by particulate size fractions in the United Auto Workers-GM cohort. This involved reconstructing PM exposures for each unique fluid-operation-plant exposure category and combining exposure data with work history to calculate annual exposures for particulate types.

Christina Foushee, OEHN PhD Candidate. (TRT funding 2008-09 and 2009-10): This student's research training focused on improved policy approaches to ensure that safer "green" products are used in health care. A leading health maintenance organization in Northern California has adopted a chemicals purchasing guideline which specifies "chemicals to avoid" due to concerns over links to negative human and environmental health outcomes, most specifically asthma in health care workers. Research training for this student includes in-depth case study protocol development, characterization of organizational decisions made during the adoption and implementation of these guidelines, and explication of specific barriers and successes of achieving expected outcomes. As part of her training, Ms. Foushee conducted extensive background work to receive approval for this exploration before starting interviews with senior opinion leaders and key informants.

Karen Hill, OEHN PhD candidate. (TRT funding 2009-10): her research involved transitional youth worker and occupational safety. The goal of her research project was to examine and describe factors such as low SES, race/ethnicity, work safety knowledge and the prevalence of work-related injury in a population of high-school and vocational students in an urban setting in Northern California.

Stephanie Phelps, OEHN PhD candidate. (TRT funding 2010-11):
Her research concerned the effects of workers' injuries on their families. She conducted a secondary data analysis of interview data from 34 family members of injured workers. The goal of the study for her was to enhance data management skills, such as coding, data entry, preparing and utilizing a spreadsheet for managing data, preparing an SPSS data base and writing up the analyses.

Sahar Nouredini, OEHN PhD candidate. (TRT funding 2011-12): Her research involved occupational exposure to solvents and health outcomes in dry cleaners. She is doing a secondary data analysis of data with type of exposures, length of exposure, use of personal protective equipment and protective behaviors, and the incidence of selected health effects in dry cleaners. She is also used the study to enhance her data management skills as in the above-mentioned project of Stephanie Phelps.

Eric Dinenberg, OEM Resident. (TRT funding 2011-12)
His research was based on findings that poor social support has been found to be strongly associated with post-traumatic stress disorder. He used data from the Heart and Soul Study, a prospective cohort study of psychological factors and outcomes in adults with stable cardio vascular disease. This work has been completed and a paper titled "Social Support Predicts Development of Post-traumatic Stress Disorder: Findings from the Heart and Soul Study" has been published in the *American Journal of Health Promotion*.

Michelle Stewart and Trevor Bausman, IH MPH Trainees (TRT funding 2010-11)
Ms. Stewart and Mr. Bausman jointly conducted a study to measure formaldehyde gas exposures to hair stylists associated with a hair-straightening product termed Brazilian Blowout™. Ms. Stewart simulated the treatment by using the product on a human hair wig on a mannequin in an environmental test chamber at the California Department of Public Health (CDPH). Formaldehyde concentrations in the breathing zone and in general chamber air were measured at three different chamber air exchange rates. Measured 15-min TWA formaldehyde exposure levels in the breathing zone ranged from 0.62 to 2.6 ppm, and exceeded the NIOSH ceiling limit of 0.1 ppm. A paper "Experimental Simulation of Personal Exposure to Formaldehyde in Hair Salons", has been published in *J Occup Environ Hyg*.

Nina Townsend, IH MPH Trainee (TRT funding 2010-11)
Ms. Townsend examined all available occupational benzene exposure measurements made during the British Petroleum oil spill cleanup effort. She found that most benzene sample values were non-detects and that, in general, there was no evidence of excessive occupational benzene exposure. In contrast, numerous cases of heat stress illness were reported. Ms. Townsend presented her analysis in a poster session at the 2011 AIHCE in Portland.

David Moore, IH MPH Student. (TRT funding 2011-12)
Mr Moore's research focused on ultrafine particulate matter exposure during the 'overhaul' phase of firefighting (after the main fire has been put out and when remaining hotspots are dealt with) and its impact on respiratory and cardiovascular health. Most firefighters remove their self-contained breathing apparatus during overhaul, as the atmosphere is no longer oxygen-deficient. However, there is exposure to fine particulates during this time. He designed a study of a group of 1400 firefighters in the San Francisco Fire Department who were interviewed regarding their use of respirators during overhaul.

Anna Pereira – Ergonomics PhD Candidate (TRT funding 2012-13)
Ms Pereira's research focused on evaluation of gesturing hardware and software for human-computer interaction. An ergonomic user defined gesture set has the potential to make human-computer interaction more comfortable and reduce associated musculoskeletal disorders. In this study 30 subjects evaluated 34 commands while being video-recorded. Post-hoc analysis was used to examine the gestures for ergonomic risk factors (e.g., extreme wrist extension/flexion, full supination/pronation, asynchronous finger postures, finger extension) and defining of the user gestures.

Manijeh Berenji – OEM Resident (TRT funding 2012-13)
Dr Berenji's research focused on cancer in fire fighters. She sought to understand the activities of firefighters and the cancer risks associated with these activities. She reviewed the current body of literature pertaining to cancer risks among firefighters and concluded the major deficiency was in regard to good exposure assessment. Future studies of cancer in firefighters need to develop improved exposure assessment methods.

Kat Navarro – IH PhD Candidate (TRT funding 2012-13, 2013-14 and 2014-15)
The objective of this project is to assess exposures of wildland firefighters to polycyclic aromatic hydrocarbons (PAH), during firefighting activities and while off-duty at base camps. Wildland firefighters work in high exposure conditions with little to no respiratory protection. Exposure estimates will be based on direct measurements from personal and area air monitoring, measurement of inhalation rates, and environmental biomonitoring, including making area-level exposure estimates from PAH measured in pine needles. The exposure data collected will be combined with data on job tasks, meteorological conditions, and forest characteristics to create multivariate prediction models for firefighter PAH exposures.

Julia Buss – OEHN PhD candidate (TRT funding 2013-14 and 2014-15)
Ms Buss's research focuses on identifying associations between occupational stress and obesity in shift-working, hospital-based female nurses. This was prompted by finding that nurses have a high prevalence of overweight and obesity. The study sample is the 11,147 members of the national organization, The Academy of Medical Surgical Nurses (AMSN). They have been sent an online survey, which takes approximately 30

minutes to complete. Participants must be working 32 hours per week within the USA, not pregnant or delivered a baby within 6 months, and not on leave of absence from work. Collected data are being analyzed.

Krystal Lin and Mike Guarnieri – OEM Residents (TRT funding 2013-14)
This jointly conducted research project by Drs Lin and Guarnieri involved a controlled human exposure study to test the hypothesis that short-term exposure to relatively high concentrations of wood smoke will lead to endothelial dysfunction as has been demonstrated with secondhand tobacco smoke. The project involved characterization of the chemical composition of smoke generated in the newly installed wood smoke exposure system at the Human Exposure Laboratory at San Francisco General Hospital, followed by a controlled human exposure study, measuring heart rate, blood pressure, and flow-mediated dilation of the brachial artery before and after exposure to wood smoke and filtered air on separate days. Also lung function is being measured by spirometry and nduced sputum examined for neutrophils, a biomarker of airway inflammation

Eunice Lee, Epidemiology PhD candidate. (TRT funding 2014-15
Ms Lee is studying long term effects of air pollutants on chromosome telomere length in children, as a bio-marker of oxidative stress in immune cells. She hypothesizes that air pollution affects telomere length of white blood cells, which in turn increases susceptibility to adverse health effects via immune response. She is obtaining blood samples for telomere analysis from the ongoing Children's Health and Air Pollution Study-San Joaquin Valley (CHAPS). She is also investigating whether ambient noise (traffic, airport and trains) acts as an effect modifier of the air pollution.

Technical Report

The TRT application process is outlined below:
(1) In early spring, Program Directors will identify potential TRT applicants from within their own programs and discuss the TRT Program with them. They will then meet with the other Program Directors and define an interdisciplinary pool of possible candidates.
(2) Potential candidates will be encouraged to talk to each other across disciplines, with a view to identifying interdisciplinary research projects that could form the basis of a joint application for research funding. One or more joint research projects may be defined. Two or more potential trainees, up to a total of four, may combine for any one project.
(3) After discussion among themselves and in consultation with Program Directors, candidates may combine as appropriate to prepare joint research proposals that generally conform to the structural and content requirements for an NIH R03 proposal—a page of specific aims and a 6-page research plan. Other candidates, if they cannot identify a suitable co-investigator, will apply on their own. Also included with the application should be an abstract, a budget, a budget justification, and biosketches for investigators. The budget should not include salaries of the applicants, although percent effort should be listed. Faculty should not be listed as investigators, although they may be listed as consultants and may provide letters of support.
(4) Grant applications are submitted concurrently with trainee applications, usually via Program Directors.

Drs. Bates and Balmes annually appoint an advisory committee, the TRT Selection Advisory Committee (TSAC), to evaluate the applications (both TRT traineeship and research funding) and provide confirmation of suitability of the applicants and a priority ranking. TSAC is comprised of three experienced faculty, each representing a different NCERC program, and selected so that they have no direct interest in the outcome of the TRT selection process.
In brief, the student applications and project proposals are reviewed by two to three COEH faculty members with relevant expertise in the area of the proposed project who provide written critiques of the research proposals.

Critiques of the research proposals are provided to the candidates who have 2 weeks to respond point-by-point in writing to the criticisms, but are required to submit a revised research proposal. We consider this type of iterative research proposal writing process to be an important educational experience, especially for those students planning academic careers.
The applications, research proposals, critiques and responses to the critiques are used by the TRT Selection Advisory Committee to recommend which students should be accepted into the TRT program and which

research should be funded. It is an option to accept students into TRT without necessarily funding the currently proposed research; in some instances it may be an option to recommend funding of the research project without the TRT funding.
The NC-ERC and TRT Directors make the final decision with due regard to Center-wide balance of student support and likelihood of research success. Those selected are funded or moved to the TRT budget in the summer at the end of the academic year in which the application was submitted.

Each of the core programs has a curriculum for research training and the responsible conduct of research. If a successful applicant is already enrolled in an Environmental Health Sciences (EHS) specialty at UC Berkeley (UCB), then their coursework will have already given them an understanding of the technical, professional, regulatory and interdisciplinary components of occupational safety and health as these relate to their discipline. If the student comes from a program outside of EHS (e.g., bioengineering), then additional course work in EHS will be required.

For students enrolled in core programs, the additional curricular requirements beyond those of the core are a course on *Responsible Conduct of Research* and the *Interdisciplinary Research Seminar*. In addition, successful applicants must present the results of their research in both a written report (preferably in journal publication format) and an oral presentation at a Center-wide get-together. In addition, there is a ERC-wide interdisciplinary research seminar that all student awardees are required to attend and which provides didactic research training in key areas, emphasizes the necessity for a multi-disciplinary approach to address most key occupational health research questions, and provides a venue for students to critique each other's work.

Publications Co-authored or Authored by Trainees

The following is a list of publications on which students are authors. The students' names are in **bold**.

1. **Harris C**, Eisen E, Goldberg R, Krause N, Rempel D. Workplace and individual factors in wrist tendonosis among blue-collar workers - the San Francisco study. *Scandinavian Journal of Work and Environmental Health*. 2011; 37(2):86-98. (1st Place PREMUS best paper competition).

2. Coelho D, **Harris C**, Lima T, Janowitz I, Rempel D. Correlation between Different Hand Force Assessment Methods from an Epidemiological Study. *Human Factors and Ergonomics in Manufacturing & Service Industries.* 2013; 23:128-139.

3. Costello S, **Garcia E**, Hammond SK, Eisen EA. Ischemic heart disease mortality and PM(3.5) in a cohort of autoworkers. *Am J Ind Med*. 2013;56(3):317-25..

4. **Pereira A**, Miller T, Huang YM, Odell D, Rempel D. Holding a tablet computer with one hand: effect of tablet design features on biomechanics and subjective usability among users with small hands. *Ergonomics*. 2013;56(9):1363-75.

5. **Stewart M, Bausman T**, Kumagai K, Nicas M. Formaldehyde exposure during simulated use of a hair straightening product. *J Occup Environ Hyg*. 2013;10(8):D104-10.

6. **Dinenberg RE**, McCaslin SE, Bates MN, Cohen BE. Social support may protect against development of post-traumatic stress disorder: findings from the Heart and Soul Study. American Journal of Health Promotion. 2014;28(5):294-7.

7. Costello S, **Brown DM**, Noth EM, Cantley L, Slade MD, Tessier-Sherman B, Hammond SK, Eisen EA, Cullen MR. Incident ischemic heart disease and recent occupational exposure to particulate matter in an aluminum cohort. J Expo Sci Environ Epidemiol. 2014 Jan-Feb;24(1):82-8.

8. **Brown D**, Petersen M, van der Laan M, Costello S, Noth E, Hammond K, Cullen M, Eisen E. 0124 PM2.5 and Heart Disease in a Cohort of Aluminium Workers: An Application of Longitudinal Targeted Maximum Likelihood-based Estimation (TMLE). Occup Environ Med. 2014 Jun;71 Suppl 1:A14.

9. Neophytou AM, Costello S, **Brown DM**, Picciotto S, Noth EM, Hammond SK, Cullen MR, Eisen EA. Marginal structural models in occupational epidemiology: application in a study of ischemic heart disease incidence and PM2.5 in the US aluminum industry. Am J Epidemiol. 2014 Sep 15;180(6):608-15.

10. **Ko P**, Mohapatra A, Bailey IL, Sheedy J, Rempel DM. Effect of font size and glare on computer tasks in young and older adults. *Optom Vis Sci*. 2014; 91(6):682-9.

11. **Pereira A**, Hsieh CM, Laroche C, Rempel D. The effect of keyboard key spacing on typing speed, error, usability, and biomechanics, Part 2: Vertical spacing. *Hum Factors*. 2014; 56(4):752-9.

Continuing Education Program
University of California, Berkeley
Final Progress Report 2010-2015

Highlights/Significant Results

The 2010-15 NIOSH reporting period was a very successful one for the COEH Continuing Education (CE) Program. The program offered 385 CE courses and trained 13,394 professionals. This number included 3920 physicians, 1349 nurses, 2421 industrial hygienists and 1495 safety professionals. The 4209 trainees from other professions or for whom information was not available included asbestos and lead abatement contractors, physical and occupational therapists, professional ergonomists, consultants, scientists and agricultural employees.

Important Trends by Training Categories

Occupational and Environmental Health Nursing

The CE Program has again worked extremely hard to significantly increase its nursing activities in the region during the grant period of July 1, 2010 – June 30, 2015. This has resulted in new partnerships and classes that have increased the number of nursing classes offered from the previous multi-year total of four nursing classes to a total of 12 nursing classes.

In addition, the number of nursing attendees in all classes in the CE Program increased from a total of 543 nurse attendees in the previous grant period ending in 2009 to a total of 1349 nurse attendees for the current grant period ending in 2015. This was affected in two ways. First there was an increase in offerings designed for nurses. Second, the CE Program offered a continuation of pricing specifically set for the nursing audience.

Occupational Safety

Again, the CE Program has worked diligently to increase safety programs and attendees. During the period ending in 2009, a total of 4 safety classes were offered. In the period ending in 2014, the program offered a total of 19 identified as safety classes. Safety attendees in all CE Program classes were at 405 students in the period ending 2009, by the period ending with 2014 safety attendees had risen to a total of 1495.

The CE Program continues to offer continuing education courses that fulfill the stated needs of safety professionals in Northern California. Approximately 23% of those attending IH courses are safety professionals (up from 11% last grant period).

The CE Program continues to offer safety courses as part of the annual Summer Institute. Fundamentals of Workplace Safety" was given in August 2010, August, 2011, July, 2012, July 2013, and July 2014.

Industrial Hygiene

The CE Program continued to offer the popular "Industrial Hygiene Forum Series" in collaboration with the Northern California Section of the American Industrial Hygiene Association (AIHA). Three low-cost short sessions each year presented topics of interest to local industrial hygienists and other health and safety professionals and continued to appeal to professionals with limited time and/or training budgets.

Occupational Medicine

The CE Program has continued to target practicing professionals, not academics, in its outreach. Emails are sent to professional organization lists. As a result of these outreaches efforts, there was an increase in physician trainees from private industry over the last four years as compared to the prior grant period. This is also due to COEH presenting a number of important conferences directed at practicing occupational health physicians.

Each year the Occupational and Environmental Medicine Program sponsors a very well-attended 2.5 day conference which specific area-one day-followed by a 1.5 day update in Occupational medicine. In addition, a number of online courses are offered annually.

The Summer Institute continued to provide the opportunity to offer a wider variety of new and timely, but sometimes financially riskier, courses to California occupational safety and health professionals as well as our regular classes, such as “Comprehensive Review of Industrial Hygiene,” “Fundamentals of Industrial Hygiene,” “Fundamentals of Workplace Safety,” and “Respiratory Protection.” Titles of new courses included “Implementing NFPA 70E, A Complete Electrical Safety Program,” “EHS Challenges of Nanotech Revolution,” “New Developments in Occupational Infectious Disease.

The COEH Symposium is a Center-wide event that was offered four times during the reporting period in Northern California. The Symposium features faculty and student research and the agenda often includes national and international guest speakers. At these events, student research is showcased in poster sessions, particularly multidisciplinary research and COEH student award projects. Topics covered in these symposiums have included The public Health Response to Man-made and Human Disasters, the Impact of Climate Change on Occupational and Environmental Health , and National Perspectives on Ergonomics, Workplace Design and Health.

Creating an Online Array of Classes to Serve the Region

In an exciting and highly successful move, the CE Program has now introduced a set of online webinars and online classes. The online webinar series was introduced beginning in February of 2012 with a spring webinar series .

CE Program’s web-based training for physicians has been on-line for eight years. Offerings included his one-hour training entitled “Recognition, Management, and Reporting of Pesticide Illness” , “The California Medical Supervision Program for Pesticide Handlers” Also, the CE program is working with the State Compensations Insurance Fund to provide online training in Pain Management for occupational physicians and OEHNs.

The “2012 Spring Occupational Health & Safety Webinar Series” was the Program’s highly successful entry into online seminars. The series hosted six “webinars.” Attendance was verified with pre and posttests. Accreditation points were awarded based upon attendance

In November 2013, the CE program presented an exciting combination of a live class and an online event, “Lead in the Workplace—The New Science” on November 13, 2013. The symposium took place in Berkeley, California with 113 attendees. The live webcast of the event drew 222 attendees online on that day from varying time zones across 22 states, the District of Columbia, Canada and Germany. The one-day science symposium presented the latest information on the occupational health risks of low-level lead exposures. The five-part video series is available to the public online at UC Berkeley Events.

Outcomes/Relevance/Impact

The COEH CE Program is the premier continuing professional education program in Northern California offering high quality training to occupational health and safety professionals. It is widely recognized as “the” source of state-of-the-art professional training.

Course development always starts with awareness of the latest national and state occupational health and safety issues of which OSH professionals need to be aware. Our courses are accredited by the American Board of Industrial Hygiene, the Board of Certified Safety Professionals, the California Medical Association Institute for Medical Quality, the California Board of Registered Nursing, California OSHA (Asbestos training) and the California Department of Public Health (Lead training and Registered Environmental Health

Specialists). COEH works closely with partners such as professional health and safety associations, state, city and county agencies and others throughout Region IX.

The CE Program polls its trainees on the type of training they need and the topics they are interested in through needs assessment forms. A needs assessment form was posted on the CE website during this period.

The CE Program conducted impact assessment surveys three months after all classes receiving CME credit. The responses showed that a good percentage of attendees received new information that they had taken back to their workplace and used themselves or shared with colleagues. CE trainees in all courses will receive an email impact assessment survey three months after taking the course.

Our courses routinely received very good or excellent evaluations from participants. The CE Program has many loyal trainees who come back again and again for the quality training they know they will receive from COEH. Over 1000 trainees in the CE database have taken 2 or more classes. Four hundred trainees have taken 5 or more classes.

Future Plans

The Northern California ERC program will continue to provide high-quality CE programs to a diverse audiences combining traditional courses with newly developed offerings. The CE program will also continue to develop distance learning programs as needed and when financially feasible, as well as continue to solicit impact assessment feedback from professionals.

COEH CONTINUING EDUCATION ADVISORY COMMITTEE

Brandon DeFrancisci
Associate Director, Health & Safety
UC Berkeley Environment Health and Safety
317 University Hall, MC 1150
Berkeley, CA 94720-1150
Ph: 510-643-6394 / Fax: 510-643-7595
Email: defran@berkeley.edu

Patty Quinlan, MPH, CIH
Deputy Director
CE Director
Center for Occupational & Environmental Health
UC Berkeley School of Public Health
2199 Addison Street, 7th Floor
Berkeley, CA 94720-7360
Ph: 510-642-8365 / Fax: 510-642-5815
Email: pquinlan@medicine.ucsf.edu

Richard B. Hirsh, MPH, CIH
Global Industrial Hygiene and Safety Manager
EHS Manager Stiefel West Coast
Stiefel Laboratories, Inc.
3160 Porter Drive
Palo Alto, CA 94304
Ph: 650-843-2860 / Fax: 650-843-2896
Email: richard.hirsh@stiefel.com

Jeffrey Jones, MS, MPH, CIH
Environmental Compliance Supervisor
Port of Oakland
530 Water Street
Oakland, CA 94607
Ph: 510-627-1360 / Fax: 510-451-5916
Email: jjones@portoakland.com

Barbara Materna, PhD, CIH
Chief, Occupational Health Branch
California Department of Public Health
850 Marina Bay Pkwy, Bldg P
Richmond, CA 94804
Ph: 510-620-5730 / Fax: 510-620-5730
Email: bmaterna@dhs.ca.gov

Hank McDermott, PE, CSP, CIH
President, H.J. McDermott, Inc.
Occupational Safety and Health
P.O. Box 6966
Moraga, CA 94570-6966
Ph: 925-330-0817 / Fax: 925-376-6001
Email: HankMcDermitt@aol.com

Pete Rice, CIH, CSP, REA
Director, Environmental, Health & Safety
CLICKSAFETY
333 Camille Avenue, Suite 100
Alamo, CA 94507
Ph: 925-855-7233/x213 / Fax: 925-855-8989
Email: price@clicksafety.com

Gerald J. Schweickert, MPH
Special Projects
Lawrence Livermore National Lab
PO Box 808
Livermore, CA 94551
Ph: 925-422-5267 / Fax: 925-422-3381
Email: schweickert1@llnl.gov

Vic Toy, MPH, CIH
Program Manager
Industrial Hygiene & Ergonomics
IBM Corporation
650 Harry Road K77/H2B
San Jose, CA 95120
Ph: 650-585-9591 / Fax: 650-585-9591
Email: vtoy@us.ibm.com

Soo-Jeong Lee
Assistant Professor
Community Health Systems
UCSF School of Nursing
2 Koret Way, Room N505
San Francisco, CA 94143-0608
Ph: 415-476-3221 / *Fax:* 415-476-6042
Email: soo-jeong.lee@nursing.ucsf.edu

Kimberly Vergez
Public Education Specialist
COEH – Continuing Education
UC Berkeley School of Public Health
50 UHall, 7nd Floor, MC 7360
Berkeley CA 94720
510-643-7233 / Fax: 510-543-7291
kvergez@berkeley.edu

COEH CONTINUING MEDICAL EDUCATION COMMITTEE

Dennis Shusterman, MD, MPH
Professor of Clinical Medicine, Emeritus, UCSF
Campus Box 0843
San Francisco, CA 94143-0843
510.643.7233/Fax 510.643.7291
dshusterman@sfghoem.ucsf.edu

John R. Balmes, MD
Professor of Medicine, UCSF
Chief, Div. of Occ. & Env. Medicine
Director, Center for Occupational & Environmental Health (COEH)
UC Berkeley School of Public Health
Berkeley CA 94720-7360
415-206-8953 / Fax: 415-206-8949
john.balmes@ucsf.edu

Douglas Benner, MD
Medical Director of Macy's, Inc.
Medical Products Business Dev. Officer, EK Health Services
1320 Kamehame Drive
Honolulu HI 96825
510-589-2169
dougbenner@gmail.com
dbenner@ekhealth.com

Erika Bruce, ANP-BC, COHN-S
Nurse Practitioner
Quadrant Health Strategies, Inc.
Novartis Vaccines and Diagnostics, Inc.
4560 Horton Street G109
Emeryville CA 94608
510-923-3526
erika.bruce@novartis.com

Jordan Rinker, MD, MPH
Rinker Occupational Medicine, Inc.
PO Box 0194
Corte Madera CA 94925
415-924-1990 / Fax: 415-924-1992
jrinker @speakeasy.org

Robert Harrison, MD, MPH
Clinical Professor of Medicine, UCSF
Chief, Occupational Health Surveillance & Evaluation Program
California Department of Public Health
850 Marina Bay Pkwy, Bldg P, 3rd Fl
Richmond CA 94804-6403
510-620-5769 / Fax: 510-620-5743
robert.harrison@ucsf.edu

Roman Kownacki, MD, MPH
Medical Director
Regional Occupational Health
Kaiser Permanente
1800 Harrison Street, 21st Floor
Oakland CA 94612
510-625-7175
roman.kownacki@kp.org

Raymond K. Meister, MD, MPH
Public Health Medical Officer
Division of Workers' Compensation
California Department Industrial Relations
1515 Clay Street
Oakland, CA 94612
raymond.meister@dir.ca.gov

Patty Quinlan, MPH, CIH
Deputy Director, COEH
Director Continuing Education COEH
UC Berkeley School of Public Health
EHS, 50 University Hall, #7360
Berkeley, CA 94720-5815
510.642-8365/fax: 510.643.7291
pquinlan@medsfgh.ucsf.edu

OUTREACH Final Report
University of California, Berkeley
Final Progress Report 2010-2015

Highlights/Significant Results

Over the last four years, LOHP helped to implement our ERC's broad outreach goals including:

- Connecting ERC resources with OS&H practitioners in the field to increase their capacity to participate in promoting effective injury and illness prevention programs in the workplace
- Collaborating with OH professionals to raise awareness of OHS issues within labor, business and community organizations
- Partnering with the NIOSH-funded national TPG, Occupational Health Internship Program, to provide community-based internships to undergraduate and graduate students.
- Promoting integration of OH&S into curricula that the high school, community college and university level
- Building a network among faculty within Region IX to share resources, research results and promote research to practice initiatives.

Outcomes/Relevance/Impact

Impacting OH&S practitioners in the field

Outreach/partnerships with practitioners in labor and community organizations
LOHP has directly reached over 3000 individuals each year through a variety of programs targeting workers in a range of industries including, construction, health care and homecare, retail, domestic work, restaurants, recycling, nail salons, and warehouses
LOHP has helped convene the Collaborative on Refinery Safety and Community Health, following the refinery explosion in Richmond, CA on August 6, 2012.

Outreach/partnerships with employers
LOHP has reached approximate 100 employers each year in training programs designed to increase their ability to comply with the requirements of California's IIPP standard

Outreach to youth leaders in the workplace
Each year LOHP has coordinated the Young Worker Leadership Academy, a program that brings teams of youth throughout the state together to learn about occupational health and plan community outreach programs designed to raise awareness about young workers health and safety in their communities.

Collaborating with OH professionals

LOHP has collaborated with OHS professionals and professional organizations, including the California Industrial Hygiene Association, state and local health departments and health care clinicians in a number of programs, including trainings targeting employers, restaurant inspectors, and occupational and primary health care providers.

Providing OH student internships

LOHP continued to implement a student internship program in collaboration with the NIOSH-funded national Occupational Health Internship Program (OHIP), sponsored by the Association of Occupational and Environmental Clinics (AOEC). LOHP coordinated with COEH academic programs and others on the Berkeley, Davis and San Francisco campuses to conduct outreach to make students aware of community service and research-to-practice opportunities and to recruit students to participate in the internship program. As a result of our outreach efforts over 90 undergraduate and graduate students applied to our internship program each summer. Student majors have included public health, conservation resource studies, environmental health, international studies, as well as nursing and medical students.

Integrating OH&S into existing curricula

Over the past 4 years, LOHP staff have made numerous classroom presentations in universities and community colleges, with a goal of delivering at least 10 presentations a year

LOHP has also partnered with NIOSH to integrate the NIOSH OSH curriculum, *Youth @ Work – Talking Safety* into school-based programs in California and throughout the country LOHP has also been funded by SourceAmerica to develop a curriculum for teaching basic occupational safety and health skills to workers with developmental and intellectual disabilities, called *Staying Safe at Work* and state agencies around the country.

Building a broad network reaching faculty throughout Region IX

Over the last 4 years, LOHP has continued to promote sharing of resources, educational materials, and research reports and results among faculty and other constituencies throughout Region IX.

Developing an ‘r2p roadmap that can be used by researchers to plan their r2p strategies.

Future Plans

Developing and integrating Occupational Safety and Health curricula into existing academic and other training programs

High school:
LOHP will continue to work with partner organizations in the education and youth employment training arenas to institutionalize OSH education into school- and community-based programs for high school-aged youth.

Colleges and Universities:
We will continue to work with faculty throughout the region to encourage them to incorporate OSH content into their courses, LOHP will conduct outreach to faculty in Northern California in order to arrange **at least 10 class presentations per year** to undergraduate and graduate students. We will also make our powerpoint presentation

available to instructors outside of the bay area, including in other region IX states, through announcements in Bridges, COEH's newsletter. We have developed a semester long class, "Social Justice and Worker Health", which we will offer at least every other year to students at UC Berkeley's School of Public Health. The syllabus for this class with be shared with other educational institutions in our region.

Facilitating the translation of research findings to practice

Over the next year, LOHP will adapt a 'research to practice' road map, developed as part of a CPWR initiative for construction, to be used by faculty researchers to connect with the community and plan for dissemination of research results. LOHP will then reach out to faculty throughout the region to offer assistance and support in using the r2p roadmap. Our goal will be to identify one or two faculty project per year interested in working with LOHP to explore integration of the r2p road map and collaborative assistance with active dissemination.

Promoting A Regional Network

As described above, LOHP will continue to ensure that it's resources, including materials, power point presentations, course syllabi, r2p roadmaps, etc., are disseminated throughout region IX, through email networks and reports in the COEH newsletter.

LOHP will also continue to work to develop an on-going network and community of practice among ERC faculty and other OSH researchers throughout Region IX with the goal of connecting OSH researchers, communities and practitioners to facilitate the sharing of research results and help move research into practice

Building on results of this survey, we will identify 2-3 academic partners from Arizona, Nevada, or Hawaii to form an on-going working group to further define the network goals and structure.

In addition to the organized outreach activities of LOHP on behalf of the ERC, individual COEH faculty also will continue to make significant outreach contributions, through curriculum development, speaking, consulting and conducting other projects that bring an occupational health perspective to professionals in other fields and to the community.

Attachment I

PROGRAM GRADUATES AND CONTINUING STUDENTS
Years 29-33
July 1, 2010 – June 30, 2015
** Indicates Student Without NIOSH Funding

OCCUPATIONAL MEDICINE RESIDENTS GRADUATES, UCSF

Sunita Hirani, 2011
Occupational Medicine Physician
Jaykar Medical Group
Mountain View, Ca

Jashree Chander, 2011
Physician Specialist
City and County of San Francisco-DPH
San Francisco, CA

Eric Dinenberg, 2012
Chief Medical Officer
Viridian Health Management
Phoenix, AZ

Thanijira Jiranantakan, 2012
Lecturer/Clinical Instructor
Siriraj Hospital
Faculty of Medicine
Mahidol Université, Thailand

Julia MacIsaac, 2012
Staff Physician
Vancouver Infectious Diseases Centre
Vancouver, Canada

Timur Durrani, 2012
Asst. Clinical Professor
University of California,
San Francisco, CA

Xing Yang, 2012
Associate Physician
Kaiser Permanente
Southern California
Gardena, CA

Yu (Anita) Zhao, 2012
Associate Physician
Kaiser Permanente
Northern California
Cupertino, Ca

Maijeh Berenji, 2013
Assistant Professor
Occupational and Environmental Medicine
Duke School of Medicine
Durham, NC

Lan Nguyen, 2013
Associate Physician
Kaiser Permanente
Northern California

Scott Petersen, 2013
Associate Physician
Kaiser Permanente
Northern California
Oakland, CA

Krystal Yi Lin, 2015
Associate Physician
Kaiser Permanente
Northern California
Redwood City, CA

Lien Quoc Tran, 2015
Flight Surgeon
US Air Force

Lafitaf Apatira, 2015
Associate Physician
Kaiser Permanente
Northern California
San Bruno, Ca

OCCUPATIONAL MEDICINE RESIDENTS CONTINUING STUDENTS, UCSF

Abdullah Khafagy**, MPH 2015
San Francisco

Rajan Puri, MPH 2015
San Francisco, CA

Erin McLaughlin, MPH 2016
San Francisco, CA

OCCUPATIONAL HEALTH NURSING GRADUATES, UCSF

Dal Lae Chin**, PhD
Post-doc fellow and Junior Specialist,
UCSF, SON, Occupational & Environmental Health program

Karen Hill, PhD
NP, Bayview Clinic, Primary Care,
San Francisco, CA

Wonju Hwang**, PhD
Assistant Professor
Kyung University
College of Nursing Science
Korea

Rasheda Jones, PhD
Doctoral student, dissertation focus is studying foster youth safety issues
UCSF, SON, APHN program

Kevin Joiner, PhD 2015**
Post Doc
Yale University, School of Nursing,
New Haven, CT

Sahar Nouredini, PhD 2015
UCSF clinical instructor

Julia Buss, PhD 2015
Research Scientist
Oakland, CA

Heather Greysen, PhD 2015
Quality Scholar
VA Health Care System
San Francisco, CA

Abbley, Enora, MS 2011
OH Specialist
Nurse Case Manager, Sacramento, CA

Katrina Bjuhr, MS 2011 OHNP
Relocated to LA, CA (no contact)

Beverly Bovey Garber, MS 2011 OHNP
NP, UC Davis, ENT Clinic

Angelina Caserta, MS 2011 OHNP
Nurse Practitioner
Concentra OH Clinic, San Francisco

Matt DeAngelis, MS 2011 OHNP
NP, Occupational Health
SLAC National Accelerator Lab

Toni Enriquez, MS 2011 OH Specialist
RN Perioperative

Dawn Lejarde, MS 2011
RN White Memorial Medical Ctr, Los Angeles, CA

Tala Montoya, MS 2011 OHNP
No contact
Benjamin Quintos, MS 2011 OHNP
NP Liver Clinic, Kaiser Permanente,
Santa Clara, CA

Theresia Soetjipto, MS 2011 OHNP
UCSF, Clinical Nurse, Intensive Care, Cardiac ICU

Kelly Thomas, MS 2011 OHNP
UCSF, Clinical Nurse, Intensive Care

Sumi Wong-Yap, MS 2011 OHNP
NP, Asian Health Services Primary Care Clinic, Oakland, CA

Danielle Bautista, MS 2012
ReMedy Medical Group
Redwood City, CA

Derek Kordenbrock, MS 2012
Adjunct faculty instructor, Southern Adventist Univ

Arlie Stern, MS 2012
Ergonomist, Pixar, Emeryville, CA
NP at Concentra, Occupational Health Clinic, Oakland, CA.

Deborah Taormina, MS 2012
OHN Veteran's Administration Occupational Health Clinic, Las Vegas, NV

Marja Alaniva, MS 2013
Primary Care Clinic
Eureka, CA

Amelia Atalig, MS 2013
NP, California Pacific Medical Center
Occupational Health Clinic
San Francisco, CA

Jana Duncan, MS 2013
ANP, Corizon Health, Boise, Idaho

Maia Entropo, MS 2013
Emeryville Occupational Medicine Clinic,
Santa Cruz, CA

Christy Feigenbutz, MS 2013
UCSF Medical Center
Mechanical Circulatory Support
San Francisco, CA
Susan Geremia, MS 2013
UCSF Medical Center
Women's Primary Care Clinic
San Francisco, CA

David King, MS 2013
Mayo Clinic, Orthopedic Surgery
Rochester, MN

Vivian Lee Park, MS 2013
Primary Care/Urgent Care Clinic
Berkeley, CA

Angela Massoni, MS 2013
Adult Nurse Practitioner
Unity Health Care
Washington, DC

Yecenia Zamora, MS 2013
San Mateo County Public Health Dept.
San Mateo, CA

Nellyda Anslow, MS 2014
Adult Gerontology Nurse Practitioner
Yachats, Oregon

Jasmin Chang, MS 2014
Dermatology Telemedicine Start-Up Company, San Diego, CA

Rachel Chev Dizon, MS 2014
Job searching

Alyssa Powell Jaffe, MS 2014
Job searching
Pamela Jomo, MS 2014
Director, Patient Care Services
Silverado Bay Area Hospice

Nichole Kendall, MS 2014
Job seeking

Kelly Wong McGrath, MS 2014
UCSF Medical Center
Chest Clinic
San Francisco, CA

Kathleen Noonan, MS 2014
Lawrence Livermore National Laboratory
Health Services Dept.
Berkeley, CA

Fidelia Pineda, MS 2014
Clinical Nurse
Ronald Reagan UCLA Hospital
Los Angeles, Ca

Jeremy Verango, MS 2014
Job seeking

Marina Yuan, MS 2014
RN, UCSF Medical Center

Erin Davis, MS 2015
Stanford Campus Occupational Health Clinic, Stanford, CA

Lina Gao, MS 2015
Job seeking

Lizbeth Gibson, MS 2015
UCSF Liver Transplant Unit
San Francisco, CA

Catherine O'Connor, MS 2015
UCSF Occupational Medicine Clinic
San Francisco, CA

Kelly Pratt, MS 2015
Nurse Practitioner
Coastside Medical

Candice Teague, MS 2015
NP –Gastroenterology Clinic
Swedish Hospital, Seattle, Washington

Becky Tse, MS 2015
Care Onsite, placed at Chevron
Occupational Health Clinic
Richmond, CA

OCCUPATIONAL HEALTH NURSING CONTINUTING STUDENTS, UCSF

Stephanie Phelps, PhD 2016**

Alicia (Ross-Beck) Swartz, PhD 2016

Deborah Phillips, PhD 2017

Victoria Flores, MS, June 2016

John Fors, MS, June 2016

Judy Langlois, OEHS, June 2016

Jennifer Low, MS, June 2016

Katrina Lu, MS, June 2016

Brianna Singleton, MS, June 2016

Robert Scott Tamblin, MS, June 2016

Diane Teng, MS, June 2016

Dawn Surratt, MS, June 2016

INDUSTRIAL HYGIENE GRADUATES UC BERKELEY

Trevor Bausman, MPH 2011
Sr. Health & Safety Specialist
EORM Consulting

Fraser Gaspar, MPH 2011
PhD Student
Environmental Health Sciences
UC Berkeley

Jacob Hooper, MPH 2011
U.S. Coast Guard

Nisha Parikh, MPH 2012
Consultant Specialist EORM
Environmetnal Health & Safety
Sustainability Consulting
California

Alexandra Rodionova, MPH 2011
Industrial Hygienist
Pacific Gas & Electricity Company
California

Michelle Stewart, MPH 2011
Industrial Hygienist
Chevron Corporation

Nina Townsend, MPH 2011
Industrial Hygienist
Chevron Corporation

Stanley Wu, MPH 2012
Industrial Hygienist
Tesla Motors
Fremont, CA

Sa Liu, PhD 2010
Researcher/Asst IH program Director
UC Berkeley

Brook Donovan, MPH 2013
Consultant
Cardno/Chemrisk
San Francisco, CA

David Moore, MPH 2013
Industrial Hygienst
Environmental Health & Safety
UC Berkeley

Heather Papinchak, PhD 2012
Self-employed

Julia Varshavsky, MPH 2012
PhD Student
UC Berkeley

Byron Hu, MPH 2014
Industrial Hygienist,
UCSF Medical Center

Rachel Blyth, MPH 2015
EH&S Engineer
Intel Corporation

Tina Hoang, MS 2015
Environmental Scientist
GSI Environmental

INDUSTRIAL HYGIENE STUDENTS
UC BERKELEY, Currently In-Training

Kat Navarro, PhD 2016

Rachel Sklar, MPH 2015

Marley Zaley, MPH 2016

Amee Raval, MS 2016

EPIDEMIOLOGY PROGRAM
GRADUATES , UC BERKELEY

Erika Garcia, MPH 2011
PhD Student
Environmental Health Sciences
UC Berkeley

Dan Brown, PhD 2014
Research Data Analyst
UC Berkeley

Elizabeth Wang, MPH 2013
Senior Business Associate
Pharmaceutical Consulting
Xelay Acumen, Inc.

Marie Tysman, MPH 2015
Post Doctoral student
University of Turku, Finland

Michael Guarnieri, MD MPH 2014
Associate Physician
Kaiser Permanente Medical Group
Northern California

EPIDEMIOLOGY STUDENTS
UC BERKELEY, Currently In-Training

Stella Beckman, PhD 2015

Eunice Lee, PhD 2017

Erika Garcia, PhD 2017

Jennifer Ames, PhD 2017

Monika Izano, PhD 2016

ERGONOMICS PROGRAM GRADUATES
BERKELEY/UCSF

Peiyi Ko, 2013
Consultant
Occupational Risk Management, Inc.

Anna Pereira, 2013
Hardware Design UX
Microsoft Corp.

Doohee You, 2013
Consultant
World Heath Org

Amer Abdullah, 2011
Medical Student
UCLA

Siddarth Satish, 2011
Chairman & CTO
Gauss Surgical, Inc.

Charles Zhao, 2011
PhD Student
Georgia Inst. Tech.

Lydia Feng, 2013
Project Manager
Forensic Analytical Consulting
Services

Lee-Huang Chen, 2013
PhD Student
UC Berkeley

Nicholas Errico, 2014
PhD Student
UC Berkeley

Logan Van Engelhoven, 2014
PhD Student
UC Berkeley

Heather Madison 2014
Health & Safety
Lawrence Berkeley National Lab

ERGONOMICS STUDENTS CURRENTLY IN-TRAINING

Nate Poon, MS 2016
Environmental Health Sciences
University of California
Berkeley, CA

Logan Van Engelhoven, PhD 2018
Environmental Health Sciences
University of California
Berkeley, CA

Attachment 2

LIST OF TRAINEE PUBLICATIONS

The following is a list of publications, by program, on which residents are authors. The residents'/trainees' names are in **bold.**

Occupational and Environmental Medicine Program

1. **Schwilk E**, Zhang L, Smith MT, Smith AH, Steinmaus C. Formaldehyde and leukemia: an updated meta-analysis and evaluation of bias. J Occup Environ Med. 2010; 52:878-86.

2. Gerona RL, **Jiranantakan T**, Armenian P, Blanc PD, Olson K, Wu AH. "Determination of 5-Oxoproline and Other gamma-Glutamyl Cycle Metabolites in Acute and Chronic Acetaminophen Intoxication Using LC-MS/TOF." Am J Clin Path 2010; 134: 506-507.

3. **Jiranantakan T**, "Methotrexate"; Jiranantakan T, Anderson IB, "Ethylene Glycol and Other Glycols"; Jiranantakan T, Benowitz NL, "Lithium." In: *Poisoning & Drug Overdose*, 6th ed, KR Olson and IB Anderson (Eds), McGrawHill, New York, 2011.

4. **Zhao YA**, Shusterman D. Occupational rhinitis and other work-related upper respiratory tract conditions. Clin Chest Med. 2012; 33:637-47.

5. Lovallo E, Patterson, S, Erickson M, Chin C, Blanc P, **Durrani T**. When is "Pseudo-Ludwig's Angina" associated with coagulopathy also a "pseudo" hemorrhage? J Invest Med High Impact Case Rep 2013 1:

6. **MacIsaac J**, Harrison R, Krishnaswami J, McNary J, Suchard J, Boysen-Osborn M, Cierpich H, Styles L, Shusterman D. Fatalities due to dichloromethane in paint strippers: a continuing problem. Am J Ind Med. 2013;56:907-10.

7. Welling R, Beaumont JJ, **Petersen SJ,** Alexeeff GV, Steinmaus C. Chromium VI and stomach cancer: a meta-analysis of the current epidemiological evidence. Occup Environ Med. 2014 Sep 17. [Epub ahead of print]

8**. MacIsaac JK**, Gerona RR, Blanc PD, **Apatira L**, Friesen MW, Coppolino M, Janssen S. Health care worker exposures to the antibacterial agent triclosan. J Occup Environ Med. 2014;56:834-9.

9. Pereira A, Hsieh CM, **Laroche C**, Rempel D. The effect of keyboard key spacing on typing speed, error, usability, and biomechanics, Part 2: vertical spacing. Human Factors 2014; 56:752-759.

10. Darwish-Yassine M, **Berenji M**, Wing D, et. al. Evaluating long-term patient-centered outcomes following prostate cancer treatment: findings from the Michigan Prostate Cancer Survivor study. J Cancer Surviv. 2014;8:121-30.

11. **Dinenberg RE**, McCaslin SE, Bates MN, Cohen BE. Social support may protect against development of posttraumatic stress disorder: findings from the Heart and Soul Study. Am J Health Promot 2014;28:294-7.

12. Schmidt B, **Dinenberg RE**. Total worker health approach helps organizations and employees thrive. Occup Health Saf. 2014;83:72, 74, 76

13. Moitra S, **Puri R**, Paul D, Huang YC. Global perspectives of emerging occupational and environmental lung diseases. Curr Opin Pulm Med. 2015 Mar;21(2):114-20**.**

Occupational and Environmental Health Nursing Program

1. Cataldo, J.K., Slaughter, R., Jahan, T.M., Pongquan, V.L., **Hwang, WJ** (2011). Measuring Stigma in People with Lung Cancer: Psychometric Testing of the Cataldo Lung Cancer Stigma Scale. Oncology Nursing Forum, 38(1), E46-54.

2. **Hwang, W.** (2011). Philosophical and ethical perspectives on cardiovascular disease risk in low-wage workers, *Public Health Nursing.* (28(2):168-75. doi: 10.1111/j.1525-1446.2010.00922.x.

3. **Chin, D. L.**, Hong, O., Gillen, M., Bates, M. N., & Okechukwu, C. A. (2012). Cigarette smoking in building trades workers: The impact of work environment. American Journal of Industrial Medicine, 55(5), 429-439.

4. **Chin, D. L.**, Hong, O., Gillen, M**.,** Bates, M. N., & Okechukwu, C. A. (2012). Occupational factors and Smoking Cessation among unionized building trades workers. Workplace Health & Safety.60 (10), 445-452.

5. Hong, O**., Chin, D. L**., **Phelps, S. M**., Feld, J., & Vogel, S. (2012). Occupational injuries, duty status, and factors associated with injuries among firefighters. Workplace Health & Safety. 60(12), 517-523.

7. Hong, O**., Chin, D. L.,** Kerr, M. J., & Ronis, D. L. (2012). Stages of change in hearing-protection behavior, cognition, and hearing status. American Journal of Health Behavior, 36(6), 811-822.

8. Hong, O**.,** Monsen, K. A., Kerr, M. J., **Chin, D. L.**, Lytton, A. B., & Martin, K.S. (2012). Firefighter hearing health: An informatics approach to screening, measurement, and research. International Journal of Audiology. 51(10), 765-770.

9. **Hwang, W**. & Hong, O. (2012). Work-related cardiovascular disease risk factors using a socioecological approach: Implications for practice and research. Journal of European Cardiovascular Nursing, 11(1), 111-126.

10. **Hwang, W.,** Hong, O, & Kim, M, (2012). Factors associated with blue-collar workers' risk perception of cardiovascular disease. Journal of Korean Academy of Nursing, 42(7), 1095-1104.

11. **Chin, D. L.**, Hong, O., Gillen, M**.,** Bates, M. N., & Okechukwu, C. A. (2013). Heavy and light/moderate smoking among building trades construction workers. Public Health Nursing.30 (2) 128-139.

12. **Foley, M** (2013). Playing it Safe: A Look at Needlestick Injuries, *Imprint (National Student Nurses Association).* 7:(2), 38-41.

13. Hong, O**., Chin, D. L.**, & Ronis, D. L. (2013). Predictors of hearing protection behavior among firefighters in the United States. International Journal of Behavioral Medicine. 20(1), 121-130.

14. Hong, O., Eakin, B., **Chin, D. L.**, Feld, J., & Vogel, S. (2013). An internet-based tailored hearing protection intervention for firefighters: Development process and users' feedback. Health Promotion Practice. 14(4), 572-579.

15. Hong, O**., Chin, D. L**., Fiola, L., & Kazanis, A. (2013). The effect of a booster intervention to promote hearing protection behavior in operating engineers. American Journal of Industrial Medicine. 56 (2), 258-266.

16. Hong, O., **Chin, D. L**., & Samo D. G. (2013). Hearing loss and use of hearing protection among career firefighters in the United States. Journal of Occupational and Environmental Medicine. 55(8), 960-965.

17. Hong, O., **Chin, D. L.,** & Thomas, E. A. (2013). Global occupational health and safety 1ctivities by nurses in the U.S. Workplace Health & Safety. 61(7), 287-295.

18. Won, J., Hong, O, & **Hwang, W.** (2013). Actual cardiovascular disease risk and the related factors: A cross-sectional study of Korean blue-collar workers employed by small-businesses. Workplace Health & Safety; 61(4), 163-71.

19. **Buss J.**, Epel E., Havel P., Lin J., Blackburn E., Daubenmier J. (2014). Associations of ghrelin with eating behaviors, stress, metabolic factors, and telomere length among overweight and obese women: Preliminary evidence of attenuated ghrelin effects in obesity? Appetite. 76:84-94.

20. **Chin, D.,** Duffy, S., & Hong. O. Knowledge of occupational chemical exposure and smoking behavior in Korean immigrant drycleaners. *Journal of Immigrant and Minority Health. 2014 Feb 14. [Epub ahead of print]. DOI: 10.1007/s10903-014-9989-7.*

21. Ha, J. G., Kim, J. M., **Hwang, W. J**. & Lee, S. G. Impact of organizational characteristics on turnover intention among care workers in nursing homes in Korea: a structural equation model, Australian Health Review. (2014)

22. Hong, O., **Duffy, S.,** Choi, S. H., & **Chin, D. L.** (2014). The association between occupational exposures and cigarette smoking among operating engineers. Archives of Environmental & Occupational Health. 69(3), 172-179.

23. **Hwang, W**. & Lee, JY (2014). Effect of psychosocial factors on metabolic syndrome in male and female blue-collar workers *Japan Journal of Nursing Science,* 11, 23–34

24. Tomiyama, A.J., Finch, L.E., Incollingo-Belsky, A.C., **Buss J.**, Finley, C., Schwartz, M.B., & Daubenmier, J. (2014). Weight Bias in 2001 versus 2013: Contradictory attitudes among obesity researchers and health professionals. Obesity. 23(1):46-53.

25. Alkon, A., **Nouredini, S.**, **Swartz, A.**, Sutherland, A.M., Stephens, M., Davidson, N.A., Rose, R. (2015). Integrated Pest Management Intervention in Child Care Centers Improves Knowledge, Pest Control, and Practices. Manuscript submitted to Environmental Health Perspectives for publication. Department of Family Health Care Nursing, University of California, San Francisco.

26. Fukuoka, Y., Gay, C.L., **Joiner, K.L.**, Vittinghoff, E. A. Novel Diabetes Prevention Intervention Using a Mobile App: A Randomized Controlled Trial with Overweight Adults at Risk. Am J Prev Med. 2015 Aug; 49(2):223-37.

27. Hong, O., **Chin, D.**, & Kerr, M. (2015). Lifelong occupational exposures and hearing loss among Latino American elderly. *International Journal of Audiology.* 54, Supplement 1:S57-64.

28. **Hwang, W. J.**, Hong, O. S., & Rankin, S. H. (2015). Predictors of Health-Promoting Behavior Associated With Cardiovascular Diseases Among Korean Blue-Collar Workers. Asia-Pacific Journal of Public Health. Vol. 27(2) NP691–NP702.

29. Incollingo-Belsky, A.C., Finch, L.E., **Buss, J.**, Guardino, C.M., Tomiyama, A.J. (2015) An experimental field study of weight salience and food choice. Appetite. 89:215-218.

Industrial Hygiene Program

1. **S Liu** and SK Hammond (2010): "Mapping Particulate Matter at the Body Weld Department in an Automobile Assembly Plant," Journal of Occupational and Environmental Hygiene, Volume 7, 593-604.

2. **S Liu**, SK Hammond and SM Rappaport (2011): "Statistical Modeling to Determine Sources of Variability Exposures to Welding Fumes," *Annals of Occupational Hygiene, Volume 55, pp* 305-318.

3. Donovan, EP, **Donovan, BL**, McKinley, MA, Cowan, DM, Paustenbach, DJ,, 2012, Evaluation of take home (para-occupational) exposure to asbestos and disease: a review of the literature. Crit Rev Toxicol. 2012 Oct;42(9):703-31.

4. **S Liu**, SK Hammond (2012): "Gases, Vapors, and Solvents," Chapter 7, in Fundamentals of Industrial Hygiene, Sixth Edition, National Safety Council.

5. **M Stewart**, T Bausman, K Kumagai, M Nicas. "Formaldehyde Exposure during Simulated Use of a Hair Straightening Product". Journal of Occupational and Environmental Hygiene, 2013: 10(8).

6. Bradman, A. Castorina, R. **Gaspar, FW**. Nishioka, M. Colón, M. Weathers, W. Egeghy, P. Maddalena, R.Williams, J. Jenkins, P. McKone, TE. "Flame Retardant Exposures in California Early Childhood Education Environments." 2013. Chemosphere.

7. Sahmel, J., C.A. Barlow, **B. Donovan Simmons,** S.H. Gaffney, H.J. Avens, A.K. Madl, J. Henshaw, R.J. Lee, D. Van Orden, M. Sanchez, M. Zock, and D.J. Paustenbach. 2014. Evaluation of take-home exposure and risk associated with the handling of clothing contaminated with chrysotile asbestos. Risk Anal. 34(8):1448-68

8. **Gaspar, FW**. Castorina, R. Maddalena, R. Nishioka, M. Williams, J. Jenkins, P. McKone, TE. Bradman, "Phthalate Exposure and Risk Assessment in California Child Care Facilities." 2014. Environmental Science and Technology.

Ergonomics Training Program

1. **Harris C**, Eisen E, Goldberg R, Krause N, Rempel D. Workplace and individual factors in wrist tendinosis among blue-collar workers - the San Francisco study (1st Place PREMUS best paper competition). Scandinavian Journal of Work and Environmental Health. 2011; 37(2):86-98. PMID:21298225

2. **Lichty MG**, Janowitz IL, Rempel DM. Ergonomic evaluation of 10 single-channel pipettes. Work 2011; 39(2):177-185. PMID:21673445

3. Rempel P, Janowitz I, **Alexandre M, Lee D**, Rempel D. The Effect of Alternative Arm Support on Shoulder and Upper Back Muscle Loading During Pipetting. Work 2011; 39(2):195-200. PMID: 21673447

4. Rempel D, **Lee D**, Dawson K, Loomer P. Effect of periodontal curette handle weight and diameter on dental practitioner arm pain: A 4-month randomized controlled trial. J Am Dental Assoc 2012; 143(10):1105-1113. PMID: 23024308.

5. **Pereira A, Lee DL**, Sadeeshkumar H, Laroche C, Odell D, Rempel D. The effect of keyboard key spacing on typing speed, error, usability, and biomechanics: Part 1. Human Factors. 2012; 55(3):557-566. PMID: 23829030.

6. Coelho D, **Harris C**, Lima T, Janowitz I, Rempel D. Correlation between Different Hand Force Assessment Methods from an Epidemiological Study. Human Factors and Ergonomics in Manufacturing & Service Industries. 2013; 23(2):128-139. PMID:

7. Dale AM, **Harris-Adamson C**, Rempel D, Gerr F, Hegmann K, Silverstein B, Burt S, Garg A, Kapellusch J, Merlino L, Thiese MS, Eisen EA, Evanoff B. Prevalence and incidence of carpal tunnel syndrome in US working populations: Pooled analysis of six prospective studies. Scand J Work Environ Health. 2013; 39(5):495-505. PMID: 23423472

8. Kapellusch J, Garg A, Bao S, Silverstein B, Burt S, Dale A, Evanoff B, Gerr F, **Harris-Adamson C**, Hegmann K, Merlino L, Rempel D. Pooling Job Physical Exposure Data from Multiple Independent Studies in a Consortium Study of Carpal Tunnel Syndrome. Ergonomics 2013; 56(6):1021-1037. PMID: 23697792.

9. **Harris-Adamson C**, Eisen EA, Dale AM, Evanoff B, Hegmann K, Thiese MS, Kapellusch J, Garg A, Burt S, Bao S, Silverstein B, Gerr F, Merlino L, Rempel D. Personal and Workplace Psychosocial Risk Factors for Carpal Tunnel Syndrome: A Pooled Study Cohort. Occup & Environ Medicine 2013; 70(8):529-37. PMID: 23645610.

10. **Pereira A**, Miller T, Huang YM, Odell D, Rempel D. Holding a tablet computer with one hand: Effect of tablet design features on biomechanics and subjective usability among users with small hands. Ergonomics 2013; 56(9):1363-75. PMID:23909815.

11. **Camilleri M**, Malige A, Fujimoto J, Rempel DM. Touch displays: The effects of palm rejection technology on productivity, comfort, biomechanics and positioning. Ergonomics 2013; 56(12):1850-62. PMID:24134774.

12. **Pereira A**, Hsieh CM, Laroche C, Rempel D. The effect of keyboard key spacing on typing speed, error, usability, and biomechanics, Part 2: vertical spacing. Human Factors 2014; 56(4):752-759. PMID:25029899.

13. **Harris-Adamson C**, You D, Eisen EA, Goldberg R, Rempel D. The impact of posture on wrist tendinosis among blue-collar workers – the San Francisco study. Human Factors 2014; 56(1):143-150. PMID: 24669549.

14. **You D**, Smith A, Rempel D. Meta-analysis: association between wrist posture and carpal tunnel syndrome among workers. Safety and Health at Work (SH@W) 2014; 5(1):27-31. PMID: 24932417

15. **Ko P**, Mohapatra A, Bailey I, Sheedy J, Rempel D. Effect of font size and glare on computer tasks in young and older adults. Optometry and Vision Science 2014; 91(6):682-689. PMID: 24830373

16. Rempel D, **Lee DL**, **Camilleri M**. The design of gestures for human-computer interaction: Lessons from sign language interpreters. International Journal of Human-Computer Studies 2014; 72:728-735. PMID:

17 Kapellusch JM, Gerr F, Malloy EJ, Garg A, **Harris-Adamson C**, Bao S, Burt S, Dale AM, Eisen EA, Evanoff B, Hegmann KT, Silverstein B, Thiese MS, Rempel D. Exposure-response relationships for the ACGIH TLV for hand activity level: results from a pooled data study of carpal tunnel syndrome. Scand J Work Environ Health. 2014 (In press).

18. **Pereira A**, Wachs JP, Park K, Rempel D. A User Developed 3D Hand Gesture Set for Human-Computer Interaction. Human Factors 2014.

19. Thiese MS, Gerr F, Hegmann KT, **Harris-Adamson C**, Dale AM, Evanoff B, Eisen E, Kapellusch J, Garg A, Burt S, Bao S, Silverstein B, Merlino L, Rempel D. Effects of Varying Case Definition on Carpal Tunnel Syndrome Prevalence Estimates in a Pooled Cohort. Archives of Physical Medicine & Rehabilitation 2014; 95(12):2320-6. PMID: 25175160

20. Kapellusch JM, Gerr F, Malloy EJ, Garg A, **Harris-Adamson C**, Bao S, Burt S, Dale AM, Eisen EA, Evanoff B, Hegmann KT, Silverstein B, Thiese MS, Rempel D. Exposure-response relationships for the ACGIH TLV for hand activity level: results from a pooled data study of carpal tunnel syndrome. Scand J Work Environ Health. 2014; 40(6):610-20. PMID:25266844.

21. Rempel D, **Lee DL, Camilleri M**. The design of gestures for human-computer interaction: Lessons from sign language interpreters. International Journal of Human-Computer Studies 2015; 72(10-11):728-735. PMID: 26028955.

22. Rempel D, Gerr F, **Harris-Adamson C,** Hegmann KT, Thiese MS, Eisen EA, Kapellusch J, Garg A, Burt S, Bao S, Silverstein B, Merlino L, Dale AM, Evanoff B. Personal and workplace factors and median nerve function in a pooled study of 2396 US workers. Journal of Occupational and Environmental Medicine 2015; 57(1):98-104. PMID:25563546.

23**. Harris-Adamson C**, Eisen EA, Kapellusch J, Garg A, Hegmann K, Thiese MS, Dale AM, Evanoff B, Burt S, Bao S, Silverstein B, Merlino L, Gerr F, Rempel D. Biomechanical Risk Factors for Carpal Tunnel Syndrome: A Pooled Study of 2474 Workers. Occup & Environ Medicine 2015; 72:33-41. PMID:25324489

24. Bao S, Kapellusch J, Garg A, Silverstein B, **Harris-Adamson C**, Burt SE, Dale AM, Evanoff B, Gerr FE, Hegmann K, Merlino L, Thiese MS, Rempel D. Developing a pooled job physical exposure dataset from multiple independent studies: an example of a consortium study of carpal tunnel syndrome. Occupational & Environmental Medicine 2015; 72(2):130-137. PMID:25504866.

25. Dale AM, Zeringue A, **Harris-Adamson C**, Rempel D, Bao S, Thiese MS, Merlino L, Burt S, Kapellusch J, Garg A, Gerr F, Hegmann KT, Silverstein B, Eisen EA, Evanoff B. General population job exposure matrix (JEM) applied to a pooled study of carpal tunnel syndrome. American Journal of Epidemiology 2015; 181(6):431-9. PMID:25700886.

26**. Pereira A**, Wachs JP, **Park K,** Rempel D. A User Developed 3D Hand Gesture Set for Human-Computer Interaction. Human Factors 2015; 57(4):607-621. PMID:25977321.

27. Fan ZJ, **Harris-Adamson C**, Gerr F, Eisen E, Hegmann K, Bao S, Silverstein B, Evanoff B, Dale AM, Thiese MS, Garg A, Kapellusch J, Burt S, Merlino L, Rempel D. Associations between workplace factors and carpal tunnel syndrome: A multi-site cross-sectional study. American Journal of Industrial Medicine 2015; 58(5):509-518. PMID:25778111.

28. **Edsfeldt S**, Rempel D, Kursa K, Diao E, Lattanza L. In vivo flexor tendon forces generated during different rehabilitation exercises. J Hand Surg (Europe) 2015; 40(7):705-10. PMID:26115682.

29. **Madison H, Pereira A,** Korshoj, M, Taylor L, Barr A, Rempel D. Mind the gap: The effect of keyboard key gap and pitch on typing speed, accuracy, and usability, Part 3. Human Factors 2015 (in press). PMID:26002872.

Occupational Epidemiology Program

1. Costello, S., **Brown, DM**., Hammond, SK., Cullen, MR., & Eisen, EA. (2013). Pathway analysis for healthy worker survivor bias in a cohort of actively employed aluminum fabrication workers. Am J Epidemiol;177:S75-S75).

2. Costello, S., **Brown, DM.,** Noth, EM., Cantley, L., Slade, MD., Tessier-Sherman, B, Hammond SK, and Cullen, MR. (2013). Incident ischemic heart disease and recent occupational exposure to particulate matter in an aluminum cohort. *Journal of Exposure Science and Environmental Epidemiology*, *24*(1), 82-88.

3. Picciotto, S., **Brown, DM.,** Chevrier, J., & Eisen, EA. (2013). Healthy worker survivor bias: implications of truncating follow-up at employment termination. *Occupational and environmental medicine*, *70*(10), 736-742

4. Costello, S., **Garcia, E**, Hammond, SK., & Eisen, EA. (2013). Ischemic heart disease mortality and PM3. 5 in a cohort of autoworkers. *American journal of industrial medicine*, *56*(3), 317-325.

5. Neophytou, A. M., Costello, S., **Brown, DM**., Picciotto, S., Noth, EM., Hammond, SK. and Eisen, EA. (2014). Marginal Structural Models in Occupational Epidemiology: Application in a Study of Ischemic Heart Disease Incidence and PM2. 5 in the US Aluminum Industry. *Am J Epidemiol*.

6. **Brown DM**, Petersen M, Van der laan M, SK Hammond, Costello S, Cullen MR, Eisen EA. (2015). Occupational Exposure to PM2.5 and Incidence of Ischemic Heart Disease: Longitudinal Targeted Minimum Loss Based Estimation. *Epidemiology*

7. **Beckman S**, Eisen EA, Liu S, Bates M, Haegerstrom-Portnoy G, Hammond SK. Acquired color vision defects and exposure to hexane; a study of Bay Area automotive mechanics. A J Epidem 2015 (In Press).

Targeted Research Training Program

1. **Harris C**, Eisen E, Goldberg R, Krause N, Rempel D. Workplace and individual factors in wrist tendonosis among blue-collar workers - the San Francisco study. *Scandinavian Journal of Work and Environmental Health*. 2011; 37(2):86-98. (1st Place PREMUS best paper competition).

2. Coelho D, **Harris C**, Lima T, Janowitz I, Rempel D. Correlation between Different Hand Force Assessment Methods from an Epidemiological Study. *Human Factors and Ergonomics in Manufacturing & Service Industries.* 2013; 23:128-139.

3. Costello S, **Garcia E**, Hammond SK, Eisen EA. Ischemic heart disease mortality and PM(3.5) in a cohort of autoworkers. *Am J Ind Med*. 2013;56(3):317-25..

4. **Pereira A**, Miller T, Huang YM, Odell D, Rempel D. Holding a tablet computer with one hand: effect of tablet design features on biomechanics and subjective usability among users with small hands. *Ergonomics*. 2013;56(9):1363-75.

5. **Stewart M, Bausman T**, Kumagai K, Nicas M. Formaldehyde exposure during simulated use of a hair straightening product. *J Occup Environ Hyg*. 2013;10(8):D104-10.

6. **Dinenberg RE**, McCaslin SE, Bates MN, Cohen BE. Social support may protect against development of post-traumatic stress disorder: findings from the Heart and Soul Study. American Journal of Health Promotion. 2014;28(5):294-7.

7. Costello S, **Brown DM**, Noth EM, Cantley L, Slade MD, Tessier-Sherman B, Hammond SK, Eisen EA, Cullen MR. Incident ischemic heart disease and recent occupational exposure to particulate matter in an aluminum cohort. J Expo Sci Environ Epidemiol. 2014 Jan-Feb;24(1):82-8.

8. **Brown D**, Petersen M, van der Laan M, Costello S, Noth E, Hammond K, Cullen M, Eisen E. 0124 PM2.5 and Heart Disease in a Cohort of Aluminium Workers: An Application of Longitudinal Targeted Maximum Likelihood-based Estimation (TMLE). Occup Environ Med. 2014 Jun;71 Suppl 1:A14.

9. Neophytou AM, Costello S, **Brown DM**, Picciotto S, Noth EM, Hammond SK, Cullen MR, Eisen EA. Marginal structural models in occupational epidemiology: application in a study of ischemic heart disease incidence and PM2.5 in the US aluminum industry. Am J Epidemiol. 2014 Sep 15;180(6):608-15.

10. **Ko P**, Mohapatra A, Bailey IL, Sheedy J, Rempel DM. Effect of font size and glare on computer tasks in young and older adults. *Optom Vis Sci*. 2014; 91(6):682-9.

11. **Pereira A**, Hsieh CM, Laroche C, Rempel D. The effect of keyboard key spacing on typing speed, error, usability, and biomechanics, Part 2: Vertical spacing. *Hum Factors*. 2014; 56(4):752-9.