2018 NIOSH® SCIENCE AWARDS

DIA
The Director's Intramural Award

Alice Hamilton Award

r2p® Bullard-Sherwood r2p Award

James P. Keogh Award

PLAIN LANGUAGE AWARD

Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health

With NIOSH Nominations for CDC's Charles C. Shepard Science Award

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NIOSH Science Awards 2018

DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health

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NIOSH Presents 2018 Awards for Significant Scientific Contributions

The National Institute for Occupational Safety and Health (NIOSH) has awarded several NIOSH researchers and partners for their significant contributions to the field of occupational safety and health in 2017.

John Howard, M.D.

NIOSH presents the annual awards to honor researchers for excellence in science that informs and supports the prevention of work-related injuries, illnesses, and deaths. The awards include the following:

- **Alice Hamilton Award,** for scientific excellence of technical and instructional materials by NIOSH scientists and engineers
- **Bullard-Sherwood Research-to-Practice Award**, for exceptional efforts by NIOSH researchers and partners in applying occupational safety and health research to the prevention of workplace fatalities, illnesses, or injuries
- **Director's Intramural Award for Extraordinary Science** for outstanding contributions by intramural scientists and support staff to science excellence at NIOSH.
- **Plain Language Award,** for NIOSH fact sheets, brochures, or web pages that exemplify the content and design principles of the Plain Writing Act of 2010
- **James P. Keogh Award**, for outstanding service by an individual in the occupational safety and health field

"The annual NIOSH Science Awards provides an opportunity to acknowledge the outstanding contributions NIOSH staff and partners have made to the field of occupational safety and health," said NIOSH Director John Howard, M.D. "The award ceremony is placed purposefully before Workers Memorial Day as both share a mission to remember and honor the safety and health of workers in all that we do."

Alice Hamilton Awards

Named after Dr. Alice Hamilton, a pioneering researcher and occupational physician, NIOSH presents the Alice Hamilton Award for exceptional contributions in the areas of biological sciences, engineering and physical sciences, human studies, and educational

materials. The submissions go through a rigorous review by panels of scientific experts, including peers from both outside and inside NIOSH.

The work of this year's award recipients reflects the key to occupational safety and health—prevention. NIOSH research contributed to new crash test methods and improvements to ambulance design, in order to reduce the risk of injuries to the patients and workers from loose equipment and supplies due to high speed and movement. The effects of disinfecting ambulances using ultraviolet germicidal irradiation instead of traditional wipe-downs has also been explored by researchers, determining the efficacy of this method in reducing the infectious microorganisms shed by patients during transport.

Additionally, researchers contributed to the understanding of the commonly known theory coined as the Heinrich Safety Triangle and its implications for occupational safety and health policy and management. Researchers investigated the contamination of firefighters' turnout gear and skin following controlled residential fire responses and their exposures to combustion byproducts. And the science would not be complete without looking at the potential toxicity of materials that are smaller than what the human eye can see. Scientists sought to better understand the lifecycle of carbon nanotubes and the potential health effects on the lungs of workers, beyond their pure native form.

James P. Keogh Award

The James P. Keogh Award for Outstanding Service in Occupational Safety and Health recognizes a current or former NIOSH employee whose career "exhibits respect and compassion for individual workers, with tireless leadership, courage, and a fierce determination to put knowledge into practice to enhance their well-being."

For 2018, NIOSH honors Peter Kovalchik, currently the Branch Chief of the Electrical & Mechanical Systems Safety Branch in Pittsburgh, for his 40 years of service to mining science. His strategic direction to the mining program at NIOSH, as well as his focus on diversity, transparency, workforce development and collaborative partnership within the mining industry has been instrumental to ensuring relevant and timely research. His experience in mining research has driven work in hearing loss prevention for miners, looking at noise controls for mining equipment, and he has engaged in a similar focus around disaster preparedness, prevention, and response. One of Mr. Kovalchik's key accomplishments has been promoting workforce development through formal training, mentoring, and job shadowing, where employees have enhanced their skills and improved their career opportunities. The impact of these efforts are evident in the development of researchers into formal leadership positions, adding to the value, depth and expertise of the mining program.

Bullard-Sherwood Research-to-Practice Award

The Bullard-Sherwood Research-to-Practice Award, named for the inventor of the hard hat, Edward W. Bullard, and the inventor of the personal industrial hygiene sampling pump, R. Jeremy Sherwood, recognizes recipients for outstanding contributions in three categories: Knowledge, Interventions, and Technology.

This year's awards honor outstanding projects to protect miners and individuals who work in extreme heat or hot environments. In the Knowledge category, NIOSH researchers were honored for their efforts to design proximity detection systems to help prevent miners from becoming struck or pinned by underground mobile mining equipment. In the Interventions category, research that led to safer refuge chambers to provide miners with a place to take shelter in the event of a mine disaster took top honors. A redesigned mobile app that provides life-saving information to protect workers from heat stress, the OSHA-NIOSH Heat Safety Tool, received the award in the Technology category.

Plain Language Award

NIOSH added a new award category for 2018—the NIOSH Plain Language Awards recognizing products that demonstrate excellence in using clear communication that the public can use and understand. Awards are given in two categories: Original, which honors a product that was created using plain language principles, and Before-and-After, which honors a product that was redesigned using plain language principles. The Original award was given to the Heat Stress: Hydration fact sheet, and the redesigned World Trade Center Health Program website received the Before-and-After award.

Director's Intramural Award for Extraordinary Science

The Director's Intramural Award for Extraordinary Science recognizes outstanding collective contributions to science excellence at NIOSH by individual intramural scientists and support staff. Dr. Anna Shvedova, an internationally recognized leader in nanotoxicology, received the Distinguished Career Scientist award for her pioneering work in the field, which has been instrumental in paving the way toward a better understanding of the occupational safety and health implications and applications of nanotechnology. Dr. Matthew Wheeler received the Early Career Scientist award for his innovations in a broad array of statistical modeling techniques for use in quantitative risk assessment. His work has improved NIOSH risk assessments and the NIOSH authoritative recommendations that they support. Mr. Glenn Doyle, a distinguished and key member of the NIOSH web and new media program who oversees website operations, received the Scientific Support award for his innovative work and

commitment to excellence that has been vital to NIOSH's mission to deliver high quality research to those who can affect worker safety and health.

For more information about the NIOSH Science Awards, including winners and nominees for all categories, or for more information about NIOSH research activities, visit the NIOSH website.

NIOSH is the federal institute that conducts research and makes recommendations for preventing work-related injuries, illnesses, and deaths. For more information about NIOSH visit The National Institute for Occupational Safety and Health (NIOSH).

Alice Hamilton Award for Occupational Safety and Health

The Alice Hamilton Award for Occupational Safety and Health recognizes the scientific excellence of technical and instructional materials by NIOSH scientists and engineers in the areas of Education and Guidance, Engineering and Control, Epidemiology and Surveillance, Exposure and Risk Assessment, and Methods and Laboratory Science.

The award honors Dr. Alice Hamilton (1869–1970), a pioneering researcher and occupational physician, and it is presented each year by NIOSH following reviews by panels of scientific experts from inside and outside the institute.

Education and Guidance

Winner

Improving EMS worker safety through ambulance design and testing

Green J, Webb S, Marshall J, Spata S

NIOSH [2017]. Improving EMS worker safety through ambulance design and testing. Video. Morgantown, WV: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 2017-143.

Abstract

This 7-part video series, jointly funded by the National Institute for Occupational Safety and Health and the Department of Homeland Security's Science and Technology Directorate, covers new crash test methods to improve worker and patient safety in an ambulance patient compartment. The series also provides viewers with an overview of the many changes impacting ambulance design, testing, and manufacture. These changes impact the: (1) layout of the ambulance patient compartment; (2) contents housed in the ambulance patient compartment (seating, patient cot, equipment mounts, storage devices); and (3) the outside or body of the ambulance. Ambulance builders, major ambulance component suppliers, and those responsible for designing and purchasing

ambulances will benefit from viewing this video series, which aims to keep Emergency Medical Services workers and their patients safe during ambulance transport.

Honorable Mention

“Nurses eat their young”: a novel bullying educational program for student nurses

Gillespie GL, Grubb PL, Brown K, Boesch MC, Ulrich DH

Gillespie GL, Grubb PL, Brown K, Boesch MC, Ulrich DL [2017]. “Nurses eat their young”: a novel bullying educational program for student nurses. J Nurs Educ Pract *7*(7):11–21.

Abstract

Bullying is a known and ongoing problem against nurses. Interventions are needed to prepare nursing students to prevent and mitigate the bullying they will experience in their nursing practice. The purpose of this article is to describe the development process and utility of one such intervention for use by nursing faculty with nursing students prior to their students’ entry into the profession. The educational program was critiqued by an advisory board and deemed to be relevant, clear, simple, and nonambiguous, indicating the program to have adequate content validity. The program then was pilot tested on five university campuses. Faculty members who implemented the educational program discussed (1) the program having value to faculty members and students, (2) challenges to continued program adoption, and (3) recommendations for program delivery. The proposed multicomponent, multiyear bullying educational program has the potential to positively influence nursing education and ultimately nursing practice. Findings from the pilot implementation of the program indicate the need to incorporate the program into additional nursing courses beginning during the sophomore year of the nursing curricula.

Engineering and Control

Winner

Ambulance disinfection using ultraviolet germicidal irradiation (UVGI): effects of fixture location and surface reflectivity

Lindsley WG, McClelland TL, Neu DT, Martin SB Jr., Mead KR, Thewlis RE, Noti JD

Lindsley WG, McClelland TL, Neu DT, Martin SB Jr., Mead KR, Thewlis RE, Noti JD [2017]. Ambulance disinfection using ultraviolet germicidal irradiation (UVGI): effects of fixture location and surface reflectivity. J Occup Environ Hyg: Epub ahead of print, 2017 October.

Abstract

Ambulances are frequently contaminated with infectious microorganisms shed by patients during transport that can be transferred to subsequent patients and emergency medical service workers. Manual decontamination is tedious and time-consuming, and persistent contamination is common even after cleaning. Ultraviolet germicidal irradiation (UVGI) has been proposed as a terminal disinfection method for ambulance patient compartments. However, no published studies have tested the use of UVGI in ambulances. The objectives of this study were to investigate the efficacy of a UVGI system in an ambulance patient compartment and to examine the impact of UVGI fixture position and the UV reflectivity of interior surfaces on the time required for disinfection. A UVGI fixture was placed in the front, middle, or back of an ambulance patient compartment, and the UV irradiance was measured at 49 locations. Aluminum sheets and UV-reflective paint were added to examine the effects of increasing surface reflectivity on disinfection time. Disinfection tests were conducted using *Bacillus subtilis* spores as a surrogate for pathogens. Our results showed that the UV irradiance varied considerably depending upon the surface location. For example, with the UVGI fixture in the back position and without the addition of UV-reflective surfaces, the most irradiated location received a dose of UVGI sufficient for disinfection in 16 seconds, but the least irradiated location required 15 hours. Because the overall time required to disinfect all of the interior surfaces is determined by the time required to disinfect the surfaces receiving the lowest irradiation levels, the patient compartment disinfection times for different UVGI configurations ranged from 16.5 hours to 59 minutes, depending upon the UVGI fixture position and the interior surface reflectivity. These results indicate that UVGI systems can reduce microbial surface contamination in ambulance compartments, but the systems must be rigorously validated before deployment. Optimizing the UVGI fixture position and increasing the UV reflectivity of the interior surfaces can

substantially improve the performance of a UVGI system and reduce the time required for disinfection.

Honorable Mention

Evaluation of postural sway and impact forces during ingress and egress of scissor lifts at elevations

Pan CS, Chiou S, Kau T-Y, Wimer B, Ning X, Keane P

Pan CS, Chiou SS, Kau T-Y, Wimer BM, Ning X, Keane P [2017]. Evaluation of postural sway and impact forces during ingress and egress of scissor lifts at elevations. Appl Ergon *65*:152–162.

Abstract

Workers are at risk when entering (ingress) or exiting (egress) elevated scissor lifts. In this study, we recorded ground impact forces and postural sway from 22 construction workers while they performed ingress and egress between a scissor lift and an adjacent work surface with varying conditions: lift opening designs, horizontal and vertical gaps, and sloped work surfaces. We observed higher peak ground shear forces when using a bar-and-chain opening, with larger horizontal gap, with the lift surface more than 0.2 m below the work surface, and presence of a sloped (26 degree) work surface. Similar trends were observed for postural sway, except that the influence of vertical distance was not significant. To reduce slip/trip/fall risk and postural sway of workers while ingress or egress of an elevated scissor lift, we suggest scissor lifts be equipped with a gate-type opening instead of a bar-and-chain design. We also suggest the lift surface be placed no more than 0.2 m lower than the work surface and the horizontal gap between lift and work surfaces be as small as possible. Selecting a non-sloped surface to ingress or egress a scissor lift is also preferred to reduce risk.

Epidemiology and Surveillance

Winner

Examining factors that influence the existence of Heinrich's Safety Triangle using site-specific H&S data from more than 25,000 establishments

Yorio PL, Moore SM

Yorio PL, Moore SM [2017]. Examining factors that influence the existence of Heinrich's safety triangle using site-specific H&S data from more than 25,000 establishments. Risk Anal: Epub ahead of print, 2017 August.

Abstract

In the 1930s, Heinrich established one of the most prominent and enduring accident prevention theories when he concluded that high severity occupational safety and health (OSH) incidents are preceded by numerous lower severity incidents and near misses. Seventy-five years of theory expansion/interpretation includes two fundamental tenets: (1) the ratio of lower to higher severity incidents exists in the form of a "safety-triangle," and (2) similar causes underlie both high and low severity events. Although used extensively to inform public policy and establishment-level health and safety priorities, recent research challenges the validity of the two tenets. This study explored the validity of the first tenet, the existence of the safety triangle. The advantage of the current study is the use of a detailed, establishment-specific data set that evaluated more than 25,000 establishments over a 13-year period, allowing three specific questions to be explored: (1) Are an increased number of lower severity incidents at an establishment significantly associated with the probability of a fatal event over time? (2) At the establishment level, do the effects of OSH incidents on the probability of a fatality over time decrease as the degree of severity decreases—thereby taking the form of a triangle? and (3) Do distinct methods for delineating incidents by severity affect the existence of the safety triangle form? The answer to all three questions was yes, with the triangle form being dependent upon how severity was delineated. The implications of these findings in regard to Heinrich's theory and OSH policy and management are discussed.

Honorable Mention

Young worker injury deaths: a historical summary of surveillance and investigative findings

Perritt KR, Hendricks KJ, Goldcamp EM

NIOSH [2017]. Young worker injury deaths: a historical summary of surveillance and investigative findings. By Perritt KR, Hendricks KJ, Goldcamp EM. Morgantown, WV: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 2017-168.

Abstract

Youth deserve a safe introduction into the working world, but evidence suggests that young workers are at increased risk for work-related fatalities and injuries. The National Institute for Occupational Safety and Health (NIOSH) plays a lead role in advancing workplace safety for young workers through surveillance efforts, fatality investigations, risk factor research, curriculum development, intervention evaluations, and training and education. This document focuses on the surveillance and investigation efforts, providing a historical summary of NIOSH findings related to fatal injuries incurred by workers who are under the age of 18 years. The document begins with summaries of data from the Census of Fatal Occupational Injuries of young worker fatalities that occurred between 1994 and 2013. The findings are presented by demographic characteristics, employer characteristics, incident circumstances, and temporal patterns. This section concludes with detailed surveillance findings for four selected industries, focusing on two that commonly employ youth—services and retail trade—and two known to have higher risks—construction and agriculture production. Next, the document summarizes case information from investigations of young worker fatalities that occurred between 1982 and 2010. In addition to presentations similar to those in the surveillance section, this section includes findings related to regulatory coverage of the employer, employer compliance with regulations on work time and work hours, and employer compliance with work task regulations. As with the surveillance section, this section ends with detailed investigative findings for four selected industries: agriculture production, services, construction, and retail trade. The surveillance data allow for a high-level assessment of the issues but lack the specificity needed to get to the root causes of these issues. The investigative data provide a richness of detail not available from the surveillance data, but they cannot be used to make generalizations about the population being studied. Collectively, though, findings from the two sets of data provide insight for

identifying issues affecting youth in the workplace, recommending prevention measures, and assessing the effectiveness of child labor laws. The document concludes with a section discussing general strategies for injury prevention among young workers, including roles for employers, parents, youth, educators, researchers, and federal and state agencies.

Exposure and Risk Assessment

Winner

Contamination of firefighter personal protective equipment and skin and the effectiveness of decontamination procedures

Fent KW, Alexander B, Roberts J, Robertson S, Toennis C, Sammons D, Bertke S, Kerber S, Smith D, Horn G

Fent KW, Alexander B, Roberts J, Robertson S, Toennis C, Sammons D, Bertke S, Kerber S, Smith D, Horn G [2017]. Contamination of firefighter personal protective equipment and skin and the effectiveness of decontamination procedures. J Occup Environ Hyg 14(10):801–814.

Abstract

Firefighters' skin may be exposed to chemicals via permeation/penetration of combustion byproducts through or around personal protective equipment (PPE) or from the cross-transfer of contaminants on PPE to the skin. Additionally, volatile contaminants can evaporate from PPE following a response and be inhaled by firefighters. Using polycyclic aromatic hydrocarbons (PAHs) and volatile organic compounds (VOCs) as respective markers for non-volatile and volatile substances, we investigated the contamination of firefighters' turnout gear and skin following controlled residential fire responses. Participants were grouped into three crews of 12 firefighters. Each crew was deployed to a fire scenario (one per day, four total) and then paired up to complete six fireground job assignments. Wipe sampling of the exterior of the turnout gear was conducted pre- and post-fire. Wipe samples were also collected from a subset of the gear after field decontamination. VOCs off-gassing from gear were also measured pre-fire, post-fire, and post-decon. Wipe sampling of the firefighters' hands and neck was conducted pre- and post-fire. Additional wipes were collected after cleaning neck skin. PAH levels on turnout gear increased after each response and were greatest for gear worn by firefighters assigned to fire attack and to search and rescue activities. Field decontamination using dish soap, water, and scrubbing was able to reduce PAH contamination on turnout jackets by a median of 85%. Off-gassing VOC levels increased post-fire and then decreased 17–36 minutes later, regardless of whether field decontamination was performed. Median post-fire PAH levels on the neck were near or below the limit of detection (< 24 micrograms per square meter [microg/m2]) for all positions. For firefighters assigned to attack, search, and outside ventilation, the 75th percentile values on the neck were 152, 71.7, and 39.3 microg/m2, respectively. Firefighters assigned to attack and search had higher post-fire median hand contamination (135 and 226 microg/m2, respectively) than other

positions (< 10.5 microg/m2). Cleansing wipes were able to reduce PAH contamination on neck skin by a median of 54%.

Honorable Mention

Development of ergonomics audits for bagging, haul truck and maintenance and repair operations in mining

Dempsey PG, Pollard J, Porter WL, Mayton A, Heberger JR, Gallagher S, Reardon L, Drury CG

Dempsey PG, Pollard J, Porter WL, Mayton A, Heberger JR, Gallagher S, Reardon L, Drury CG [2017]. Development of ergonomics audits for bagging, haul truck and maintenance and repair operations in mining. Ergonomics *60*(12):1739–1753.

Abstract

The development and testing of ergonomics and safety audits for small and bulk bag filling, haul truck, and maintenance and repair operations in coal preparation and mineral processing plants found at surface mine sites is described. The content for the audits was derived from diverse sources of information on ergonomics and safety deficiencies including: analysis of injury, illness, and fatality data and reports; task analysis; empirical laboratory studies of particular tasks; field studies and observations at mine sites; and maintenance records. These diverse sources of information were utilized to establish construct validity of the modular audits that were developed for use by mine safety personnel. User and inter-rater reliability testing was carried out prior to finalizing the audits. The audits can be implemented using downloadable paper versions or with a free mobile NIOSH developed Android application called ErgoMine. Practitioner Summary: The methodology used to develop ergonomics audits for three types of mining operations is described. Various sources of audit content are compared and contrasted to serve as a guide for developing ergonomics audits for other occupational contexts.

Methods and Laboratory Science

Winner

In vivo toxicity assessment of occupational components of the carbon nanotube life cycle to provide context to potential health effects

Bishop L, Cena L, Orandle M, Yanamala N, Dahm MM, Birch ME, Evans DE, Kodali VK, Eye T, Battelli L, Zeidler-Erdely PC, Casuccio G, Bunker K, Lupoi JS, Lersch TL, Stefaniak AB, Sager T, Afshari A, Schwegler-Berry D, Friend S, Kang J, Siegrist KJ, Mitchell CA, Lowry DT, Kashon ML, Mercer RR, Geraci CL, Schubauer-Berigan MK, Sargent LM, Erdely A

Bishop L, Cena L, Orandle M, Yanamala N, Dahm MM, Birch ME, Evans DE, Kodali VK, Eye T, Battelli L, Zeidler-Erdely PC, Casuccio G, Bunker K, Lupoi JS, Lersch TL, Stefaniak AB, Sager T, Afshari A, Schwegler-Berry D, Friend S, Kang J, Siegrist KJ, Mitchell CA, Lowry DT, Kashon ML, Mercer RR, Geraci CL, Schubauer-Berigan MK, Sargent LM, Erdely A [2017]. In vivo toxicity assessment of occupational components of the carbon nanotube life cycle to provide context to potential health effects . ACS Nano 11 (9):8849–8863.

Abstract

Pulmonary toxicity studies on carbon nanotubes focus primarily on as-produced materials and rarely are guided by a life cycle perspective or integration with exposure assessment. Understanding toxicity beyond the as-produced, or pure native material, is critical, due to modifications needed to overcome barriers to commercialization of applications. In the first series of studies, the toxicity of as-produced carbon nanotubes and their polymer-coated counterparts was evaluated in reference to exposure assessment, material characterization, and stability of the polymer coating in biological fluids. The second series of studies examined the toxicity of aerosols generated from sanding polymer-coated carbon-nanotube-embedded or neat composites. Postproduction modification by polymer coating did not enhance pulmonary injury, inflammation, and pathology or in vitro genotoxicity of as-produced carbon nanotubes, and for a particular coating, toxicity was significantly attenuated. The aerosols generated from sanding composites embedded with polymer-coated carbon nanotubes contained no evidence of free nanotubes. The percent weight incorporation of polymer-coated carbon nanotubes, 0.15% or 3% by mass, and composite matrix utilized altered the particle size distribution and, in certain circumstances, influenced acute in vivo toxicity. Our study provides perspective that, while the number of workers and consumers increases along the life

cycle, toxicity and/or potential for exposure to the as-produced material may greatly diminish.

Honorable Mention

Characterization of pulmonary responses in mice to asbestos/asbestiform fibers using gene expression profiles

Yanamala N, Kisin ER, Gutkin DW, Shurin MR, Harper M, Shvedova AA

Yanamala N, Kisin ER, Gutkin DW, Shurin MR, Harper M, Shvedova AA [2017]. Characterization of pulmonary responses in mice to asbestos/asbestiform fibers using gene expression profiles. J Toxicol Environ Health, A: Epub ahead of print, 2017 December.

Abstract

Humans exposed to asbestos and/or asbestiform fibers are at high risk of developing many lung diseases including asbestosis, lung cancer, and malignant mesothelioma. However, the disease-causing potential and specific metabolic mechanisms and pathways associated with various asbestos/asbestiform fiber exposures triggering different carcinogenic and non-carcinogenic outcomes are still largely unknown. The aim of this study was to investigate gene expression profiles and inflammatory responses to different asbestos/asbestiform fibers at the acute/sub-acute phase that may be related to delayed pathological outcomes observed at later time points. Mice were exposed to asbestos (crocidolite, tremolite asbestos), asbestiform fibers (erionite), and a low pathogenicity mineral fiber (wollastonite) using oropharyngeal aspiration. Similarities in inflammatory and tissue damage responses, albeit with quantitative differences, were observed at days 1 and 7 post treatment. Exposure to different fibers induced significant changes in regulation and release of a number of inflammatory cytokines/chemokines. Comparative analysis of changes in gene regulation in the lung on day 7 post exposure were interpretable in the context of differential biological responses that were consistent with histopathological findings at days 7 and 56 post treatment. Our results noted differences in the magnitudes of pulmonary responses and gene regulation consistent with pathological alterations induced by exposures to four asbestos/asbestiform fibers examined. Further comparative mechanistic studies linking early responses with the long-term endpoints may be instrumental to understanding triggering mechanisms underlying pulmonary carcinogenesis that is lung cancer versus mesothelioma.

Alice Hamilton Award Top Finalists for 2018

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Engineering and Control

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Methods and Laboratory Science

Bishop L, Cena L, Orandle M, Yanamala N, Dahm MM, Birch ME, Evans DE, Kodali VK, Eye T, Battelli L, Zeidler-Erdely PC, Casuccio G, Bunker K, Lupoi JS, Lersch TL, Stefaniak AB, Sager T, Afshari A, Schwegler-Berry D, Friend S, Kang J, Siegrist KJ, Mitchell CA, Lowry DT, Kashon ML, Mercer RR, Geraci CL, Schubauer-Berigan MK, Sargent LM, Erdely A [2017]. In vivo toxicity assessment of occupational components of the carbon nanotube life cycle to provide context to potential health effects. ACS Nano *11*(9):8849–8863.

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View the previous Alice Hamilton Award Winners and Honorable Mentions.

Alice Hamilton Award
Research Updates for Previous Winning Projects

Education and Guidance 2017 Update

Addressing infection prevention and control in the first U.S. community hospital to care for patients with Ebola Virus Disease: context for national recommendations and future strategies

Cummings KJ, Choi MJ, Esswein EJ, De Perio MA, Harney JM, Chung WM, Lakey DL, Liddell AM, Rollin PE

> Cummings KJ, Choi MJ, Esswein EJ, De Perio MA, Harney JM, Chung WM, Lakey DL, Liddell AM, Rollin PE [2016]. Addressing infection prevention and control in the first U.S. community hospital to care for patients with Ebola Virus Disease: context for national recommendations and future strategies. Ann Intern Med *165*(1):41–50.

The transmission of Ebola virus disease (EVD) to two nurses in a Dallas hospital in 2014 was a stunning event that captured the attention of the country and the world. It demonstrated that despite awareness, intention, and technology, a highly lethal infectious disease was a threat to the U.S. healthcare workforce and the general public. The ensuing efforts to prevent further transmission of EVD to healthcare personnel caring for their ill colleagues were extensive, involving hospital staff, local and state public health officials, and experts from NIOSH and other CDC centers. This paper described how the team, working in a charged environment, applied sound, fundamental occupational safety and health principles including the hierarchy of controls. This resulted in a comprehensive system of occupational safety and health controls for direct patient care, handling of clinical specimens, and managing regulated medical waste. Additionally, the authors developed and implemented a comprehensive worker training program and recommendations that enhanced employer and worker confidence, knowledge, skills, and the motivation necessary to improve safety and health and halt EVD transmission.

In the United States, patients with emerging infectious diseases such as EVD are likely to first seek care at a community hospital. The experience at the community hospital in Dallas that was described in this paper contributed to changes in national policies for EVD, such as new guidance for personal protective equipment, introduction of a rapid system for deploying CDC staff to assist hospitals ("Ebola Response Team"), and development of a framework for a tiered national and state approach to hospital preparedness. In addition, the paper's detailed description of infection prevention and

control measures implemented at the Dallas community hospital has implications for national preparedness not just for EVD, but also for other high-consequence emerging infectious diseases. The work demonstrated the importance of including occupational health and safety professionals in response activities for emerging infections, which has been implemented in subsequent responses, including the response to the Zika virus outbreak.

Engineering and Control 2017 Update

Tool-specific performance of vibration-reducing gloves for attenuating fingers-transmitted vibration

Welcome DE, Dong RG, Xu XS, Warren C, McDowell TW

> Welcome DE, Dong RG, Xu XS, Warren C, McDowell TW [2016]. Tool-specific performance of vibration-reducing gloves for attenuating fingers-transmitted vibration. Occup Ergon 13(1):23–44.

For the millions of workers regularly exposed to hand-transmitted vibration, the simplest preventative and, generally, initial defense against hand-arm vibration syndrome is to supply them with gloves. Often, the gloves supplied are not even vibration reducing or certified anti-vibration gloves. The International Standard Organization (ISO) has set forth a standard to define and classify anti-vibration gloves [ISO 10819, 2013]. The standardized screening process is based on the amount of vibration transmitted through the gloves to the palm of the subjects tested in controlled conditions in a lab over specific frequency ranges. Our work has shown that the palm and fingers respond very differently to the same vibration. It is very difficult to carry out a controlled assessment of gloves in workplaces, especially for exposures at the fingers. This study applied the analytical 3D transfer function method we developed to test combinations of tools and gloves at the fingers. Using a 3D laser vibrometer, we measured the responses of the gloved and bare fingers of subjects to vibration generated simultaneously in the three directions from our 3D test system. We measured the responses for two more classes of gloves, in addition to the transfer functions of two types previously tested. We then combined the glove transfer functions with the spectra of 79 tools collected in the lab and at workplaces to get an estimate of the tool-specific effectiveness of the gloves. The method allowed us to estimate the effectiveness of a wide variety of tool and glove combinations that would have been expensive and time consuming to do otherwise. This study showed the efficacy of using a database of tool and glove spectra for a preliminary assessment of the interventions.

Because the effectiveness of gloves can be very different at the fingers and palm, as well as different for different tools on each side, we decided we needed to find a way to simplify and standardize the screening process for gloves at the fingers. The 3D laser vibrometer is too expensive for routine use for most labs, and most labs use uniaxial shakers to generate the standardized exposures. Therefore we needed to adapt our methods for use with equipment that is more ubiquitous. We have since developed a new finger adaptor equipped with a miniature tri-axial accelerometer, which can directly measure the response at the glove-fingers interface—similar to the adaptor approach used at the palm

side, but with a much smaller, less obtrusive adaptor. The preliminary results on six subjects with five different gloves are very promising. We are submitting a Small NORA Initial Funding Request to further develop the measurement method and a general guideline for the testing, evaluation, and application of vibration-reducing gloves. Specifically, we will measure the transfer functions for several more gloves with more subjects and then use the tool spectra from our earlier work and tools in our lab to assess the tool specific effectiveness of the gloves at the fingers and palm for the gloves. We will also use a 3D laser vibrometer and our 3D shaker to test the validity of the finger side adaptor method. We are expecting three to four peer-reviewed publications from these studies. More importantly, we will propose a major revision of ISO 10819, the glove screening standard, and write the above-mentioned guidelines, which will be useful not only for the glove users but also for the glove developers and manufacturers to develop more effective tool-specific anti-vibration gloves.

Epidemiology and Surveillance 2017 Update

Hearing Impairment among Noise-exposed Workers —United States, 2003−2012

Masterson EA, Bushnell PT, Themann CL, Morata TC

> Masterson EA, Bushnell PT, Themann CL, Morata TC [2016]. Hearing impairment among noise-exposed workers—United States, 2003–2012. MMWR 65(15):389–394.

Hearing loss is one of the most common work-related illnesses. Twelve percent of the U.S. working population has hearing difficulty, with 24% attributable to occupational exposures, which include hazardous noise and ototoxic chemicals (chemicals causing damage to the inner ear). Approximately 22 million workers are exposed to hazardous noise each year, about 10 million are exposed to solvents, and an unknown number are exposed to other ototoxicants. Hearing loss can have a profound impact on quality of life. It is associated with cognitive decline and cardiovascular outcomes such as hypertension and elevated cholesterol. It is also strongly associated with depression. Tinnitus, which often co-occurs with hearing loss, can disrupt sleep and concentration and is associated with both depression and anxiety. Although the total cost of worker hearing loss is unknown, annual workers compensation claims in the private sector for hearing loss alone cost hundreds of millions of dollars. This cost approaches $1 billion in the U.S. Department of Veterans Affairs. Workers with hearing loss pay for hearing aids and clinical rehabilitation, which includes fitting hearing aids, learning lip-reading, and adopting other compensation strategies to optimize hearing. Workers who cannot effectively communicate are less likely to be promoted, and the hearing-impaired often suffer career decrements. Workers with profound hearing loss must often leave the workforce entirely. Other costs include healthcare for associated conditions, such as cardiovascular outcomes (e.g., hypertension, elevated cholesterol), tinnitus, cognitive decline, and depression.

Noise-exposed workers with hearing loss have been identified in every industry. This study identified, for the first time, the prevalence of noise-exposed workers at each level of hearing loss severity in each industry, age-group, and gender. More importantly, it quantified the impact on quality of life for these workers by calculating disability-adjusted life years (DALYs) interpreted as healthy years lost overall and by industry, hearing loss severity, age-group, and gender. It applied validated methodology from the Global Burden of Disease Study to a unique data cohort. Study data were collected via the

NIOSH Occupational Hearing Loss Surveillance Project. Quantifying the loss and being able to compare these losses in healthy years across industries and hearing loss severity levels helps stakeholders target hearing loss prevention efforts and evaluate whether the Healthy People 2020 objectives are being achieved, including "Reduce new cases of work-related, noise-induced hearing loss" (OSH-10).

This study was featured on the cover of the CDC *Morbidity and Mortality Weekly Report* Worker Memorial Day issue, and it achieved an Altmetric score (a measure of online attention) of 273, which is among the highest at NIOSH. Study results were also presented at the American Public Health Association annual meeting, via press and social media and on the NIOSH OHL Surveillance Project web page. Following this award, the Project was awarded NIOSH Occupational Research Agenda intramural project funding for fiscal years 2018–2021 to increase outreach for occupational hearing loss surveillance. Project research continued, and three subsequent papers were published:

> Kerns E, Masterson EA, Themann CL, Calvert GM [2018]. Cardiovascular conditions, hearing difficulty, and occupational noise exposure within U.S. industries and occupations. Am J Ind Med: Epub ahead of print, 2018 March.
>
> Masterson EA, Themann CL, Calvert GM [2018]. Prevalence of hearing loss among noise-exposed workers within the healthcare and social assistance sector, 2003 to 2012. J Occup Environ Med *60*(4):350–356.
>
> Masterson EA, Themann CL, Calvert GM [2018]. Prevalence of hearing loss among noise-exposed workers within the agriculture, forestry, fishing and hunting sector, 2003–2012. Am J Ind Med, *61*:42–50.

There were also significant additions to the NIOSH Occupational Hearing Loss (OHL) Surveillance web page. It includes nine new pages that provide information on noise exposure, hearing protection use, and hearing loss prevalence for the United States overall, and for each industry sector. These new pages also include modified charts showing the trends in prevalence, incidence, and adjusted risk for hearing loss.

A new CDC Feature, Worker Hearing Loss, was posted that discusses the benefits of prevention and provides instructions for how workers can identify a loud noise environment and protect their hearing.

Several new papers are also in development:

- "Workers' compensation costs for hearing loss claims in the United States, 2009–2013"
- "Prevalence of hearing loss among noise-exposed workers within the services sector, 2006–2015"

- "Prevalence of hearing loss among noise-exposed workers within the mining sector, 2006–2015"
- "Prevalence of hearing loss among noise-exposed United States Air Force civilian and military workers, 2004–2013" (tentative title, early stage).

Exposure and Risk Assessment 2017 Update

Criteria for a recommended standard: occupational exposure to heat and hot environments

Jacklitsch B, Williams WJ, Musolin K, Coca A, Kim J-H, Turner N

> NIOSH [2016]. Criteria for a recommended standard: occupational exposure to heat and hot environments—revised criteria 2016. Criteria document. By Jacklitsch B, Williams WJ, Musolin K, Coca A, Kim J-H, Turner N. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 2016-106.

Occupational exposure to heat can result in injuries, disease, reduced productivity, and death. Workers who are exposed to extreme heat or work in hot environments indoors or outdoors, or even those engaged in strenuous physical activities, may be at risk for heat stress. Exposure to extreme heat can result in occupational illnesses caused by heat stress, including heat stroke, heat exhaustion, heat syncope, heat cramps, heat rashes, or death. Heat can also increase workers' risk of injuries, as it may result in sweaty palms, fogged-up safety glasses, dizziness, and may reduce brain function responsible for reasoning ability, creating additional hazards. Other heat injuries, such as burns, may occur because of contact with hot surfaces, steam, or fire. To address this hazard, the National Institute for Occupational Safety and Health evaluated the scientific data on heat stress and hot environments and published an updated Criteria for a Recommended Standard: Occupational Exposure to Heat and Hot Environments. The revised criteria document included additional information about the physiological changes that result from heat stress; updated information from relevant studies, such as those on caffeine use; evidence to redefine heat stroke and associated symptoms; and updated information on physiological monitoring and personal protective equipment and clothing that can be used to control heat stress.

Since the publication of the criteria document, 1,300 hard copies have been distributed, and there have been 22,670 page views, 19,877 page visits, and 16,801 PDF downloads from the website. In addition, OSHA reached out with interest of cobranding and updating their Heat Safety Tool app to include the newly published recommendations from the criteria document. The OSHA app was a published tool with 60,000 active users. By working with OSHA to cobrand and update the app, NIOSH recommendations could be shared with an even greater audience of safety and health professionals, employers, and workers.

Translating the technical content of the criteria document into easily digestible, to-the-point content suitable for an app and broader audience was a worthwhile exercise. In late May 2017, the newly cobranded app was available to download from both iTunes and Google Play. As of November 2017, there have been 110,597 downloads from iTunes and 21,156 downloads from Google Play. Peak downloads occurred during the summer, coinciding with Summer Heat Social Media campaign activities, where messaging was again focused on translated pieces and recommendations from the criteria document.

The criteria document continues to be of interest to OSHA and other agencies and groups. OSHA and NIOSH have had ongoing discussions about the relevance and appropriate usage of wet-bulb globe temperature (WBGT) and Heat Index. In addition, some of these discussions and how they pertain to apps have reached other interested agencies such as the Department of Defense. The National Integrated Heat Health Information System (NIHHIS) has frequently referred to the document in meetings and discussions; and many of the members are involved in authoring a manuscript that will compare heat-related recommendations across workplaces, military, and athletic programs. Finally, the recommendations found in the criteria document have been used as the backbone for much of the occupational heat-related messaging during emergency response activities, such as those during this past year's hurricane disasters. With the number of days greater than 90°F projected to increase, this criteria document will continue to be a critical resource for the ever-more-important protection of workers from heat stress.

Methods and Laboratory Science 2017 Update

Development of portable aerosol mobility spectrometer for personal and mobile aerosol measurement

Kulkarni P, Qi C, Fukushima N

> Kulkarni P, Qi C, Fukushima N [2016]. Development of portable aerosol mobility spectrometer for personal and mobile aerosol measurement. Aerosol Sci Tech *50*(11):1167–1179.

Airborne nanoparticles (particles with diameter < 100 nm) are a significant concern due to their known deleterious health effects. A conservative estimate shows that more than 2 million people in the U.S. workforce are exposed, on a regular basis, to nanoparticles in workplaces involving manufacturing and application of engineered nanomaterials, ultrafine powder manufacturing, welding operations, and diesel engine use and other combustion processes. Another rapidly growing area is the additive manufacturing (AM), such as 3D printing, that presents high potential for exposure to ultrafine and nanoparticles. Recent studies have shown that some 3D printers emit large number of ultrafine particles. The number of workers exposed to nanoparticle and ultrafine aerosols is expected to grow substantially with increasing production of functional nanomaterials and growing AM industry. This has led to increasing concerns over the health risk of occupational exposure to airborne nanoparticles.

This paper, which won the 2016 Alice Hamilton Award, describes the development and testing of a direct-reading portable aerosol mobility spectrometer (PAMS) designed to measure particle size distribution in near real-time. PAMS addresses a long-standing impediment to detection/monitoring/measurement of nanoparticles, ultrafine aerosols, and submicrometer aerosols for on-person or mobile field applications. The instrument offers major improvements with respect to analytical figures-of-merit, unrestricted field access, size, weight, and cost to allow mobile aerosol measurement for environmental and occupational health applications.

Since the publication of this paper, the instrument has been commercialized. The instrument is enabling several applications in various research fields including industrial and occupational hygiene, air pollution, atmospheric science, environmental and public health, and clinical research. The instrument's unique measurement capability is being used by researchers in universities and national laboratories in the United States and globally for studies such as the following:

1. Measurement of firefighters' exposures to ultrafine aerosols.
2. On-person measurement of respirator protection factors.
3. Exposures of commuters and pedestrians to ultrafine aerosols during rush hour traffic.
4. Measurement of ultrafine aerosol emissions from Mt. Fuji.
5. Characterization of aerosols generated during patient care activities.
6. Exposure to aerosolized nanomaterials.
7. Personal aerosol exposure from 3D printing and advanced additive manufacturing processes.
8. Air quality measurements using aerial drones.
9. Exposure to ultrafine aerosols from cook stove emissions in developing countries. Many of these studies are in progress and the publications are forthcoming.

Some published studies that describe the application of the PAMS include the following:

Hsiao T-C, Lee Y-C, Chen K-C, Ye W-C, Sopajaree K, Tsai YI [2016]. Experimental comparison of two portable and real-time size distribution analyzers for nano/submicron aerosol measurements. Aerosol Air Qual Res *16*(4): 919–929.

Leavey A, Reed N, Patel S, Bradley K, Kulkarni P, Biswas P [2017]. Comparing on-road real-time simultaneous in-cabin and outdoor particulate and gaseous concentrations for a range of ventilation scenarios. Atmos Environ (1994) *166*:130–141.

Pandey A, Patel S, Pervez S, Tiwari S, Yadama G, Chow JC, Watson JG, Biswas P, Chakrabarty RK [2017]. Aerosol emissions factors from traditional biomass cookstoves in India: insights from field measurements. Atmos Chem Phys *17*(22):13721–13729.

Alice Hamilton's Pioneering Work

Alice Hamilton, MD

(February 27, 1869–September 22, 1970)

Many of the first laws and regulations passed to improve the health of workers were the direct result of the work of one dedicated and talented woman, Alice Hamilton, MD. Born into a prominent family in Indiana (her sister was the well-known classicist, Edith Hamilton), Dr. Hamilton graduated from medical school at the University of Michigan in 1893. After accepting a teaching position at the Women's Medical School of Northwestern University in 1897, she moved into Jane Addams' Hull House in Chicago. There she opened a well-baby clinic for poor families in the local settlement house neighborhood. As she acquainted herself with the families, she learned of their pains, strange deaths, lead palsy, "wrist drop," and of the high number of widowed women. Encouraged by the reformers of Hull House, she began to apply her medical knowledge to these social problems and thus began her scientific inquiry into occupational health, for which she became known.

Dr. Hamilton quickly realized that while some progress in understanding occupational illness and disease was being made in Europe, little was written or understood about occupational disease conditions in the United States. In 1908, she published one of the first articles on occupational disease in this country and was soon a recognized expert on the topic. Starting in 1910, under the sponsorship initially of a commission of the State of Illinois, and later the Federal Bureau of Labor Statistics, she conducted a series of brilliant explorations of occupational toxic disorders. Relying primarily on "shoe leather epidemiology," and the emerging laboratory science of toxicology, she pioneered occupational epidemiology and industrial hygiene in the United States. Her findings were so scientifically persuasive that they caused sweeping reforms, both voluntary and regulatory, to improve the health of workers.

In 1919, Dr. Hamilton was appointed assistant professor of industrial medicine at Harvard Medical School and became the first female faculty member at Harvard University. There she served two terms on the Health Committee of the League of Nations. When she retired from Harvard at the age of 66, she became a consultant to the

U.S. Division of Labor Standards, and she served as president of the National Consumers League.

Alice Hamilton Laboratory for Occupational Safety and Health

On Friday, February 27, 1987, the National Institute for Occupational Safety and Health dedicated its facility at 5555 Ridge Avenue in Cincinnati to the memory of Alice Hamilton, MD. The facility is known as the "Alice Hamilton Laboratory for Occupational Safety and Health" in honor of the first American physician to devote her professional life to the practice of occupational health.

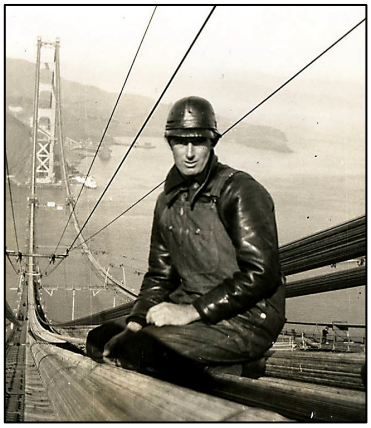
Construction of this facility began in fall 1952 and was completed in November 1954. For several years, it was used as the world headquarters and manufacturing plant of the Disabled American Veterans (DAV). In this facility, "Ident-o-Tags," miniature license plates for key chains, were manufactured by disabled veterans for distribution throughout the United States.

In the early 1960s, a portion of the facility was leased to the federal government to provide space for a small number of federal employees. From the early 1960s to the early 1970s more and more of the facility was used by the federal government. By 1973 the entire building was leased for federal offices and laboratories. In September 1974, the first employees of NIOSH were assigned to space in the facility. In December 1982, the U.S. Public Health Service purchased the facility for $3.5 million dollars. More than 200 people work there in such fields as engineering, epidemiology, general administration, industrial hygiene, and laboratory research. The facility contains some of the most-advanced laboratories and sophisticated scientific equipment in the institute.

Bullard-Sherwood Research-to-Practice Award

NIOSH presents the Bullard-Sherwood Research-to-Practice (r2p) Award to recognize outstanding efforts by its scientists and their partners in applying occupational safety and health research to prevent work-related injury, illness, and death. The award is named in honor of two distinguished inventers who made significant improvements in workplace injury and illness prevention.

Edward W. Bullard

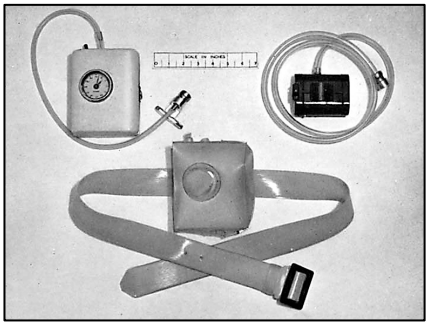


Labor Archives and Research Center, J. Paul Leonard Library, San Francisco State University

A Golden Gate construction worker wears a Bullard "hard boiled hat" in this photograph, circa 1936. This worker, Fred Dümmatzen, died on Feb. 17, 1937, when a scaffold at the bridge collapsed and killed 10 workers.

Edward W. Bullard designed the first "hard hat" as protective headgear for miners. He combined his experience with doughboy Army helmets during World War I and his understanding of customer needs to develop the "Hard Boiled Hat." The name was derived from the steam used to harden the hat as it was manufactured. Joseph Strauss, the engineer in charge of constructing the Golden Gate Bridge, requested that Mr. Bullard adapt his mineworker helmet to help protect bridge workers from falling rivets. The bridge site became the first designated "Hard Hat Construction Area." In related history, the steel used to build the bridge oxidized during transport to San Francisco from Pennsylvania, and it required sandblasting before it could be painted. As a result, Mr. Bullard designed and sold another helmet to the bridge builders to specifically protect the sandblasting workers. This helmet was similar to the Hard Boiled Hat, but it included in its design a hood or "canopy" over the hat, a window to see through, and supplied air for respiratory protection. The helmets helped to prevent death and injury during the project and have prevented countless injuries and deaths since. However, despite the exemplary safety precautions taken during the Golden Gate Bridge construction, a total of 11 workers died at the site—including 10 who were killed in 1937 when a scaffold collapsed. Today, about 6 million hard hats are sold annually throughout the world to protect workers. Bullard's family-owned company still produces many of those hard hats, as well as more-modern sandblasting helmets.

R. Jeremy (Jerry) Sherwood



Sherwood RJ and Greenhalgh DMS

The personal air sampler system designed by R. Jeremy Sherwood, as it appeared in a 1960 *Annals of Occupational Hygiene* article announcing its invention. From: Sherwood RJ, Greenhalgh DMS [1960]. A personal air sampler. Ann Occup Hyg *2*:127–132, https://doi.org/10.1093/annhyg/2.2.127.

R. Jeremy (Jerry) Sherwood successfully merged research and industrial hygiene by inventing the first practical personal sampling pump in the late 1950s. He identified a need for sampling pumps that could be worn by workers and not impede their work processes. Until then, sampling was done on an area basis, or an industrial hygienist followed a worker while carrying heavy, bulky, and short-term sampling equipment. Using the newly developed personal sampling pump, he demonstrated that area sampling often severely underestimated worker exposures. Within a few years of this invention, personal sampling pumps became the staple in industrial hygiene work that they are today. He also developed a miniature sampler for sulfur dioxide that became commercially available and was widely used throughout Europe. His research on respirators led to the first fit testing. While at the International Labour Organization and later at the World Health Organization, Mr. Sherwood put his own knowledge and research experiences into practice by training others in occupational safety and health, particularly in developing countries. This became one of his greatest passions, and many workers around the world have benefitted from his efforts.

Knowledge

Winner

Design of Proximity Systems for Underground Mobile Equipment

Carr J, DuCarme J, Li J, Noll J, Zhou C, Srednicki J, DeGennaro C

Source: Pittsburgh Mining Research Division

Background: One of the leading causes of fatal injuries in underground coal mines is miners becoming stuck or pinned by mining equipment. Between 2000 and 2015, 54 miners lost their lives in underground coal mines in the United States when they were struck or pinned while operating or working near underground mobile equipment, such as continuous mining machines. To address this issue, proximity detection systems are used to send visual and audible warning signals to miners and/or automatically disable machine motion when miners are within hazardous vicinity of the operating equipment. In 2015, the Mine Safety and Health Administration (MSHA) promulgated a regulation requiring the use of proximity detection systems on all continuous mining machines in underground coal mines.

Relevance: Although proximity detection systems are expected to greatly improve the safety of underground miners, challenges remain surrounding their use. In order to examine these challenges, NIOSH organized a partnership with labor (United Mine Workers of America), industry (National Mining Association, Bituminous Coal Operators Association), manufacturer (Strata), academia (West Virginia University), and MSHA stakeholders. From this partnership, major concerns and potential research needs for the mining industry emerged, including electromagnetic interference (EMI) with other devices worn by miners causing the proximity detection systems to malfunction, and the detection systems being strongly affected by the presence of steel near the devices. In response, researchers at the NIOSH Pittsburgh Mining Research Division investigated these challenges and developed models to characterize them. As a result, recommendations and shielding strategies to minimize EMI as well as mitigation strategies for the influence of environmental effects were developed.

Through this partnership, critical concerns, challenges, and research needs were identified and addressed, and ultimately led to improved calibration of the proximity detection systems and training of the miners in the use of this life saving technology. This transfer of knowledge and implementation of the new guidelines into the design and use of this critical safety technology is expected to help prevent fatal accidents due to striking and pinning by mobile equipment in underground mines.

For more information on proximity detection, visit Mining Topic: Proximity Detection.

Intervention

Winner

The Advancement of Refuge Alternatives for Underground Coal Mines

Yantek DS, Srednicki J, Yan L, Lutz T, Reyes M, Bickson J, Damiano N, Yonkey J, Whisner B, McElhinney P

Source: Pittsburgh Mining Research Division

Background: The mining industry is among the most hazardous industries in the United States. According to Mine Safety and Health Administration (MSHA) data, 64 U.S. mine workers have been killed and 10 injured as a result of fires or explosions in underground workings since 2000. Following the tragic Sago Mine explosion in West Virginia, Congress passed the Mine Improvement and New Emergency Response Act of 2006 (MINER Act). Among other mandates, the MINER Act called for research into refuge alternatives to provide miners a safe place to take refuge when a life-threatening event occurs that makes escape impossible.

Relevance: NIOSH researchers at the Pittsburgh Mining Research Division formed a partnership with industry, labor, manufacturers, MSHA stakeholders, and academia to explore mine refuge safety concerns and determine refuge alternative research needs. Of major concern is the potential buildup of extreme heat and humidity in the chamber. Adverse conditions such as these could result in miners suffering heat stress, heat stroke, and even death. In response, NIOSH researchers investigated the effects of heat and humidity inside the refuge chamber by developing advanced thermal simulations using digital human models, calculating the temperatures that could be experienced by miners in a life-or-death situation, and validating the results using real-world data. Results indicated that modifications to the design and/or use of refuge chambers is likely needed to ensure miner safety.

Partnering with this broad array of stakeholders enabled the transfer of NIOSH research into practice for use in the mines. Resulting NIOSH recommendations have been and continue to be incorporated into state and federal regulations, as well as refuge chamber design. Additionally, this NIOSH research collaboration and results contributed to testing criteria for demonstrating that a refuge alternative design submitted for MSHA approval meets temperature requirements.

For more information on refuge alternatives, visit Mining Topic: Refuge Chambers.

Honorable Mention

Revised Hand Activity Level Threshold Limit Value and Action Limits Driven by Results from Pooled Carpal Tunnel Syndrome Cohort Studies

Burt SE, Meyers AR, Rempel D, Silverstein BA, Harris-Adamson C, Bao S, Dale AM, Eisen EA, Evanoff B, Fan J, Garg A, Gerr F, Hegmann KT, Kapellusch J, Merlino L, Thiese MS, Upper Limb Musculokeletal Disorder Consortium and Key Contributors

Source: Division of Surveillance, Hazard Evaluations, and Field Studies

Background: In the late 1990s, NIOSH, OSHA, and other government and academic occupational health stakeholders identified the need for rigorous prospective studies to understand and prevent the growing epidemic of painful, costly, and disabling work-related musculoskeletal disorders. NIOSH recognized that a large scale effort would be needed to fund and conduct rigorous research that included collecting data for detailed measured job physical risk factors, personal factors, psychosocial factors, clinical examinations, and electrodiagnostic/nerve conduction studies. Thus, in 2000, NIOSH supported the establishment of the Upper Limb Musculoskeletal Consortium (Consortium), a consortium of intra- and extramural research teams using a collaborative program model to balance the need to collect common, high quality data that could be pooled while allowing extramural researchers the freedom to design and control their own studies.

Relevance: After 17 years, a large and thriving community of individuals and research organizations remain dedicated to understanding and preventing upper extremity musculoskeletal disorders. As extramural upper extremity musculoskeletal disorder projects were funded starting in 2001, Consortium researchers collaborated to ensure that projects were implemented to facilitate data pooling later by collecting a common set of exposure, health outcome, and covariate measures. During regular meetings, Consortium members reviewed data collection methods, study designs, and data variables in order to ensure that the data could be pooled to achieve greater statistical power. At the conclusion of the studies, the Consortium's results were shared with the study participants and industry partners. Consortium findings have led to an improved and more accurate understanding of risk factors for upper extremity musculoskeletal disorders, as well as provided useful data for the design of work to reduce risks of upper extremity musculoskeletal disorders.

One example of the impact is the influence of the Consortium's findings on the American Conference of Governmental Industrial Hygienists (ACIGH®) Threshold Limit Value (TLV) for Hand Activity Level (HAL), one of the most commonly used biomechanical

risk assessment tools by U.S. industry. The Consortium results provided more precise risk estimates than prior studies and found that the TLV and Action Limit were not adequately protective. Thus, in 2017, ACIGH® announced the first proposed change in the HAL TLV and Action Limit, primarily driven by the published results from the Consortium's pooled carpal tunnel syndrome analyses.

For more information on musculoskeletal disorders, visit Ergonomics and Musculoskeletal Disorders.

For more information on the Upper Limb Musculoskeletal Disorder Consortium, visit Ergonomics and Musculoskeletal Disorders Upper Limb Musculoskeletal Disorder Consortium.

Technology

Winner

OSHA-NIOSH Heat Safety Tool App

Burnett G, Jacklitsch B, Fazio G, Schnapp K, Cauley J, Ebert T, Pingleton R, Scholtes B, Pulsifer M, Bandi G, Yao S, Stevens S, Teske T, Watson J, Williams V, Romero N, Hornback D

Source: Education and Information Division

Background: Workers who are exposed to extreme heat or work in hot environments may be at risk of heat stress. Exposure to extreme heat can result in occupational illnesses and injuries. Prevention of heat stress and heat-related illnesses is a key element to improving safety and health for many workers. The Occupational Safety and Health Administration (OSHA) Heat Safety Tool provided quick access to real-time heat-related illness risk levels and prevention guidance. It provided a heat index based on the National Oceanic and Atmospheric Administration (NOAA) temperature data and shared OSHA safety recommendations correlating with location-specific heat index. In 2016, the director of the OSHA Office of Science and Technology Assessment proposed a collaborative approach to transfer ownership of the OSHA Heat Safety Tool to NIOSH.

Relevance: By working with OSHA to cobrand and update the Heat Safety Tool app, NIOSH could share newly published recommendations from the *Criteria for a Recommended Standard: Occupational Exposure to Heat and Hot Environment* document with safety and health professionals, employers, and workers. OSHA and NIOSH heat subject matter experts worked together to update the app content. The NIOSH Research to Practice (r2p) Team worked with OSHA and Department of Labor (DOL) to transfer ownership of the app to CDC/NIOSH, while the NIOSH Education and Information Division redesigned and improved the app's user interface to make it more user-friendly. Once the redesigned, cobranded app was available, both OSHA and NIOSH made efforts to disseminate the new app and encourage previous users and new users to download the new version.

While the original app addressed the hazard of heat stress, the added NIOSH recommendations added the most up-to-date information on preventing heat-related illness and providing first aid. In late May 2017, the app was available to download from both iTunes and Google Play. The heat app had the most total page views of any other apps in the CDC storefront for May—August 2017. As of November 2017, there had been 110,597 downloads from iTunes and 21,156 downloads from Google Play. From May to November 2017, the criteria document itself was downloaded 6,397 times. With the

number of days greater than 90^{0}F projected to increase, this app will likely continue to be an important resource for the essential protection of workers from heat stress.

For more information on heat stress, visit Heat Stress and Occupational Heat Exposure.

For more information on the OSHA-NIOSH Heat Safety Tool app, visit OSHA-NIOSH Heat Safety Tool App.

Honorable Mention

NIOSH Sound Level Meter App

Kardous CA, Celestina M, McCleery T

Source: Division of Applied Research and Technology

Background: Occupational hearing loss is one of the most common work-related illnesses in the United States. Each year, about 22 million U.S. workers are exposed to hazardous noise levels at work. Measuring noise exposure is key to helping reduce potentially hazardous noise exposure at the workplace. In 2014, NIOSH conducted an evaluation of 192 sound measurement "apps" and published the findings in the Journal of the Acoustical Society of America. This was followed up with a second study in 2016 that examined the use of external, calibrated microphones with smartphones. Realizing that most of the apps on the market are oriented to the casual user and lack the accuracy and functionality necessary to conduct occupational noise measurements, NIOSH hearing loss researchers collaborated with an app developer, EA LAB, to create an iOS-based sound level meter app that measures and characterizes occupational noise exposure similar to professional instruments.

Relevance: The NIOSH Sound Level Meter (SLM) app, released January 2017, can be used by health and safety professionals to assess risks—similar to how they would use a professional sound level meter—and by workers to make informed decisions about the potential hazards to their hearing in the workplace. The NIOSH SLM app has many features. It provides a readout of the sound level using the built-in microphone (or external microphone, if used) and reports the instantaneous sound level in A, C, or Z-weighted decibels. It reports metrics that are important for proper occupational noise measurements and contains some basic information on noise and hearing loss prevention. In addition, the SLM app allows the user to save and share measurement data using the smartphone's other communication and media features. If location services are enabled, the SLM app can use the global positioning system (GPS) to provide an exact geospatial location of the noise measurement.

Several media outlets have covered and helped to promote the NIOSH SLM app. The SLM app has been downloaded over 110,000 times and achieved a 4.7 out of 5 rating on the Apple iTunes store. The topic page has received over 53,000 views, and the *NIOSH Science Blog* article on smartphone apps continues to be NIOSH's most viewed science blog article with over 264,000 views to date. Furthermore, several stakeholders have reached out to NIOSH to incorporate the app into their studies or practices.

For more information on noise and hearing loss prevention, visit Noise and Hearing Loss Prevention.

For more information on the NIOSH Sound Level Meter app, visit NIOSH Sound Level Meter App.

Bullard-Sherwood Research-to-Practice Award Finalists

Projects are listed by category, alphabetically by project name.

Knowledge

Design of Proximity Systems for Underground Mobile Equipment

Carr J, DuCarme J, Li J, Noll J, Zhou C, Srednicki J, DeGennaro C

Intervention

The Advancement of Refuge Alternatives for Underground Coal Mines

Yantek DS, Srednicki J, Yan L, Lutz T, Reyes M, Bickson J, Damiano N, Yonkey J, Whisner B, McElhinney P

NIOSH Safe • Skilled • Ready Workforce Program Partnership with the American Federation of Teachers (AFT) to Prepare the Next Generation of Workers for Safe and Healthy Employment

Guerin RJ, Okun AH, Baker DS, American Federation of Teachers, AFL-CIO

Revised Hand Activity Level Threshold Limit Value and Action Limits Driven by Results from Pooled Carpal Tunnel Syndrome Cohort Studies

Burt SE, Meyers AR, Rempel D, Silverstein BA, Harris-Adamson C, Bao S, Dale AM, Eisen EA, Evanoff B, Fan J, Garg A, Gerr F, Hegmann KT, Kapellusch J, Merlino L, Thiese MS, Upper Limb Musculoskeletal Disorder Consortium, and Key Contributors

Technology

Development of a Roof Bolter Canopy Air Curtain for Respirable Dust Control

Reed W, Joy GJ, Zheng Y, Kendall W, Bailey A

NIOSH Sound Level Meter App

Kardous CA, Celestina M, McCleery T

OSHA-NIOSH Heat Safety Tool App

Burnett G, Jacklitsch B, Fazio G, Schnapp K, Cauley J, Ebert T, Pingleton R, Scholtes B, Pulsifer M, Bandi G, Yao S, Stevens S, Teske T, Watson J, Williams V, Romero N, Hornback D

View the previous Bullard-Sherwood Research-to-Practice (r2p) Award Winners and Honorable Mentions

Director's Intramural Award for Extraordinary Science

Background

Science excellence is the foundation upon which NIOSH generates new knowledge to assure safe and healthful work for all. The Director's Intramural Award for Extraordinary Science (DIA) recognizes outstanding contributions by intramural scientists and support staff to science excellence at NIOSH. Winners of the award will receive a monetary award that augments the discretionary budget for the recipient for the following fiscal year.

The DIA honors individuals for their scientific contributions through a collective body of work. The collective body of work recognized in the DIA represents extraordinary individual performance that clearly goes above and beyond past and present basic job requirements

The award serves as a tribute to NIOSH employees whose dedication to science excellence has made significant contributions to the NIOSH mission. Award categories recognize distinguished career scientists, early career scientists, and scientific support staff.

Director's Intramural Award for Extraordinary Science

Distinguished Career Scientist

Anna A. Shvedova

Dr. Anna A. Shvedova is a research physiologist and internationally recognized leader in research on nanotoxicology at the National Institute for Occupational Safety and Health (NIOSH). At NIOSH, she has been recognized as a leader and expert in various aspects of nanotoxicology ranging from free radical biology to geno-toxicology. Dr. Shvedova's career spans more than 4 decades producing remarkable research, both in terms of its scientific depth and rigor, as well as its effectiveness and productivity, thus establishing her as an expert in molecular, cell, and whole organism toxicology, particularly as it relates to the field of nanotoxicology.

Her discoveries are vast and significant, as demonstrated by her outstanding publication records that include 172 peer-reviewed manuscripts and over 100 presentations in different areas of toxicology, particularly as they relate to occupational settings, risk assessment, and human health. Over the past 3 years, Thomson Reuters Inc. has recognized Dr. Shvedova as one of the most cited scientists in the field of toxicology/pharmacology.

Dr. Shvedova pioneered nanotoxicology research at NIOSH with her seminal paper published in the *American Journal of Physiology Lung Cell and Molecular Physiology* demonstrating the inflammatory properties of carbon nanotubules. Her research directly addresses one of the strategic research goals, to "develop a broader understanding of the important determinants of toxicity for asbestos fibers and other elongated mineral fibers," outlined in the NIOSH *Current Intelligence Bulletin 62: Asbestos Fibers and Other Elongate Mineral Particles: State of the Science and Roadmap for Research*, DHHS (NIOSH) Publication No. 2011-159. Findings from her earlier work supported by funding from the National Occupational Research Agenda (NORA) was included in the NIOSH publication, *Approaches to Safe Nanotechnology: Managing the Health and Safety Concerns Associated with Engineered Nanomaterials*, DHHS (NIOSH) Publication No. 2009-125, and the experimental data provided the avenue for risk assessment and were included in the NIOSH *Current Intelligence Bulletin 65: Occupational Exposure to Carbon Nanotubes and Nanofibers*, DHHS (NIOSH) Publication No. 2013-145.

Dr. Shvedova serves as a subject matter expert on various national and international committees, advisory boards, and counsels including the National Aeronautics and Space Administration, the Society of Toxicology (SOT), the European Committee on Graphene, the Committee on Work Place Environment in Denmark, and the Swedish Committee on Engineered Nanomaterials. She has also founded the dermal-toxicology specialty section in SOT. She is an associate editor for *Toxicology and Applied Pharmacology* and a reviewer for numerous journals, including *Toxicological Sciences*, *Chemical Research in Toxicology*, *In Vitro Toxicology*, and *Environmental Science and Technology*.

Early Career Scientist

Matthew Wheeler

Dr. Matthew Wheeler is an extremely accomplished, productive early career scientist who is recognized as a national and international leader in his field.

He joined the National Institute for Occupational Safety and Health (NIOSH) in 2003 as a statistician in the Risk Evaluation Branch of the Education and Information Division. In 2007, he was accepted into the NIOSH long-term training program and attended the biostatistics program at the University of North Carolina, Chapel Hill. He finished his Ph.D. in biostatistics in 2013.

Upon returning to NIOSH, Dr. Wheeler's research has focused on innovations in a broad array of statistical modeling techniques for use in quantitative risk assessment. His innovations have improved NIOSH risk assessments and the NIOSH authoritative recommendations they support. This allowed risk assessors to better characterize model uncertainty and rely more directly on the underlying scientific data rather than "best-fitting" statistical models.

Dr. Wheeler's pioneering work is also highly recognized and of great value to the science and practice of risk assessment in the larger scientific community. His research has improved how risk assessment is conducted through the development of innovative statistical modeling techniques to assess the adverse health effects associated with different levels of exposures, including low levels, to help determine safe levels of exposure to hazards.

Dr. Wheeler developed superior methods using extrapolation to model the exposure-response curve safe level even when the level of exposure is below the range of observed data. He has collaborated with the U.S. Environmental Protection Agency (EPA) to incorporate his novel model averaging statistical methods in the EPA Benchmark Dose Software Suite.

He serves on the Food and Agricultural Organization of the United Nations/World Health Organization Expert Committee on Food Additives, where he was asked to incorporate model averaging into their risk assessment processes, and consult on risk assessment modeling approaches. He has met with the Expert Committee recently in Portugal and has planned additional meetings. Dr. Wheeler's extraordinary accomplishments were recognized in 2016 when he was awarded the Presidential Early

Career Award for Scientists and Engineers, a prestigious national recognition acknowledged by then CDC Director Dr. Tom Frieden.

Scientific Support

Glenn Doyle

Glenn Doyle began his government career at the National Institute for Occupational Safety and Health (NIOSH) in 1991. Throughout his 27-year NIOSH career, Mr. Doyle has provided critical technological support for NIOSH scientists, communicators, and staff to ensure the development and dissemination of the highest quality science.

Over the past 10 years, particularly since 2015, Mr. Doyle has been at the center of the NIOSH 5-Year Web Expansion and New Media Initiative. He has served as the plan coordinator in addition to his duties overseeing daily operations of the NIOSH website and serving as senior staff advisor to the chief, Information Resources and Dissemination Branch, Education and Information Division.

The NIOSH website remains the centerpiece of the NIOSH information and resources dissemination strategy. Mr. Doyle has led eight major transitions in the NIOSH web architecture and technology. He manages the updates, maintenance, and organization of more than 125,000 NIOSH topic and web pages. Further, he vigilantly keeps up with the Department of Health and Human Services and Centers for Disease Control and Prevention actions and requirements and constantly follows industry and information technology thought leaders in order to keep pace with technology developments and adapt them to the NIOSH environment.

Mr. Doyle's wide institutional knowledge, high commitment to the Institute, and consistent contributions to communication and dissemination innovation have been critical to the Institute's mission to provide high quality NIOSH research to those who can affect workers' safety and health. This includes not only decision makers, employers, and workers, but also NIOSH and other scientists who use this information as the stimulus and foundation for planning new research.

His persistent commitment to excellence and innovation in the development of the NIOSH image and effectiveness of NIOSH web dissemination provides critical support to the success of the Institute's outreach efforts. Mr. Doyle has positioned himself as a critical NIOSH resource who is a distinguished and key member of the NIOSH web and new media program, having pioneered many innovations and taken the lead on many progressive program initiatives. He has demonstrated a very high level of commitment to the program, Institute mission, and service to the NIOSH staff and the public.

Director's Intramural Award for Extraordinary Science Top Finalists

Names are listed alphabetically.

Distinguished Career Scientist

Vern Anderson

Mark Hoover

Anna Shvedova

Early Career Scientist

David Blackley

Jennifer Tyrawski

Matthew Wheeler

Scientific Support

Glenn Doyle

Justin Srednicki

Brian Tift

Director's Intramural Award for Extraordinary Science Updates

Distinguished Career Scientist 2016

Captain Gayle DeBord

Since receiving the award, Captain DeBord used the funds to in-part support an ORISE student, Emily Schmick (BHAB) from Denver Colorado. During Emily's tenure with DART she took part in both laboratory and field research. Her laboratory research centered on characterizing the performance of combustible gas monitors to gas and vapor mixtures characteristic of specific shale formations. This research will contribute to several journal articles, NIOSH *Workplace Solutions* articles, and a trade journal article. The work has already contributed to an OSHA/NIOSH/National STEPS Alliance Hazard Alert and was also the foundation of Emily's research project for her Master of Science in Public Health from the Johns Hopkins School of Public Health. Emily's field research was to evaluate worker exposures in the upstream oil and gas industry. This work included two field studies in North Dakota, one focused on workers involved in production and well-servicing activities and a second to assess chemical exposures during well drilling. Emily has also recently been working on surveillance of injuries to oil and gas workers. This preliminary work, the first of its kind, has been instrumental in documenting injuries from a suspected hazard identified during field studies.

Early Career Scientist Winner 2016

Alysha R. Meyers

Since receiving the 2016 Director's Award for Extraordinary Intramural Science in the category of Early Career Scientist, Dr. Meyers continues to lead studies dedicated to preventing ergonomic-related workplace injuries and improving worker health. The $5,000 award was used to take a series of training courses at the Xavier Leadership Center. Dr. Meyers continues to serve as lead epidemiologist for the Center for Workers' Compensation Studies. She was first author on, "Applying machine learning to workers' compensation data to identify industry-specific ergonomic and safety prevention priorities—Ohio, 2001–2011," published online in 2017. This study created a third, major causation-specific U.S. occupational injury surveillance system. Dr. Meyers was a co-author on the other important article published from the same study [Wurzelbacher et al. 2016], "Development of methods for using workers' compensation data for surveillance and prevention of occupational injuries among State-insured private employers in Ohio." Results from both studies are already being used to focus prevention resources on specific occupational injury types in specific industry groups, especially in Ohio. Having a third source of surveillance data (in addition to national data from the Bureau of Labor Statistics and workers' compensation data from the state of Washington) has been a valuable resource to analyze data from all three sources to find common patterns of risk among specific industries. With these data, NIOSH has been able to prioritize intramural research to a greater degree of precision within some sectors, which can maximize impact.

Dr. Meyers serves as project officer for a large multiphase research study funded by an intramural research grant award. The study is assessing the effectiveness of the Ohio Bureau of Workers' Compensation (OHBWC) Workplace Wellness Grant Program. One purpose of the study is to improve our understanding of the impact of integrating traditional occupational safety and health programs with workplace wellness programs. As of December 2016, 288 small- to medium-sized employers were provided about $1.8 million to implement wellness programs for up to 4 years. These programs covered 26,608 employee-years of participation and over 20,000 distinct participating employees have benefited. Preliminary measurements describe encouraging evidence of integration among grantees.

Dr. Meyers is also the current project officer for the NIOSH upper limb musculoskeletal disorder prospective cohort study, aka "Big Ergo." Big Ergo is a prospective NIOSH cohort study of upper extremity musculoskeletal disorders that Dr. Meyers inherited from the original project officer, Dr. Sue Burt, after her retirement. The role of Dr.

Meyers on Big Ergo includes serving as the NIOSH member of the Upper Limb Musculoskeletal Disorders Consortium. The Consortium is a group of seven study sites that have been working together since 2001. The most recent active field data were collected in 2010. To date, the Consortium has already had a huge impact through conducting analyses and publishing articles based on a pooled cohort used to study carpal tunnel syndrome. In the past 2 years, Dr. Meyers has been collaborating on a research project with Rob Radwin, PhD, University of Wisconsin, Madison, and two other Consortium research sites. The Radwin team is creating a method for automatically assessing ergonomic risk for jobs using a smartphone app. For this study, additional health outcome data have been pooled for five other upper limb musculoskeletal diagnoses. Video data of workers and pooled data on six health outcomes, physical exposures to ergonomic hazards, and covariates are being used to validate the computer program. Preliminary results from the study will be shared beginning this year.

In January 2017, Dr. Meyers joined the NIOSH NORA Manufacturing Council and Manufacturing Program leadership team as co-assistant coordinator with Pranav Rane.

Scientific Support Winner 2016

Barbara Cromer

Barbara Cromer started her government career in 1980 at the Cincinnati Veteran's Administration Medical Center. Ms. Cromer had a 2-year break in service (1989–1991) when she worked at the University of Cincinnati in the Molecular Genetics Department. She started working for the National Institute for Occupational Safety and Health (NIOSH) in 1991. She has worked in the administrative field to support scientific staff throughout her 35 years of government service.

Ms. Cromer continues to provide critical administrative support for the development of NIOSH scientific research and guidance in her position as the program operations assistant in the Translation Research and Evaluation Branch (TREB), Education and Information Division (EID). In TREB, not only are there multiple active field research projects underway, the branch is also home to leaders of five significant NIOSH research programs: the Safe, Skilled and Ready Workforce Initiative; the Small Business Assistance Program; the National Center for Productive Aging and Work; the Occupational Health Equity Program; and the Wholesale and Retail Trade Sector Program. In addition to Ms. Cromer's regular duties in TREB, the branch chief of TREB continues to receive emails of praise from the division program management official for her efforts in facilitating the myriad administrative processes that support TREB scientific staff activities. Ms. Cromer is also an active member of the NIOSH Human Subjects Review Board.

In a government research environment of ever-increasing accountability, Ms. Cromer makes it possible for scientific staff to perform the activities that truly move translation research forward and not become overwhelmed by the administrative processes that must be adhered to in order to maintain the public's trust.

Use of award:

Ms. Cromer was able to use the award money to attend the International Association of Administrative Professionals (IAAP) Conference, where she was able to attend a variety of training sessions to help her stay abreast of ever-changing administrative tasks.

View the previous winners of the Director's Intramural Award for Extraordinary Science (DIA)

Plain Language Award

Background

Eight years ago, President Obama signed the Plain Writing Act of 2010. The law requires that federal agencies use "clear Government communication that the public can understand and use." NIOSH encourages plain language in all of its communication products but puts special emphasis on fact sheets, brochures and web pages. The NIOSH Plain Language Award, established in 2017, recognizes NIOSH communication products that demonstrate excellence in applying plain language principles on these types of communication products.

Awards for winner and honorable mention are given in two categories:

Original recognizes a NIOSH webpage, brochure or fact sheet created originally using plain language principles.

Before and After recognizes a revised NIOSH webpage, brochure or factsheet that includes both an original, difficult to read document, and the revised version that uses plain language principles. Judges considered the improvements.

Original Product

Winner

Heat stress: hydration (fact sheet)

Tristan Victoroff, Kristin Yeoman, Brittney Bragg

Many miners employed at surface and underground mines in the United States are exposed to excessive heat. As mining technology permits expansion into deeper, hotter environments, and with summer temperatures increasing in many regions of the country, heat exposure in mining is likely to increase.

This fact sheet is part of a series of fact sheets designed to highlight key information from the *NIOSH Criteria for a Recommended Standard: Occupational Exposure to Heat and Hot Environments*. Most published heat stress guidance documents are lengthy technical documents or other informational products that are not ideal for a mining audience. Although brief heat stress fact sheets exist, they do not provide enough detail to meaningfully guide workers in the complex industrial settings unique to mining.

The fact sheets were designed to be presented as brief toolbox talks or other educational activities by individual miners, mining supervisors, or mining health and safety officers. Each fact sheet provides information relevant to miners and uses calls to action for specific activities to prevent heat strain.

Key components of the hydration fact sheet include:

- Key message at the top of the page on hyrdration
- Highlighted box of "things you need to know" and "points to remember" that summarize the most important information presented on the fact sheet
- Mining-relevant case studies section that highlights important information on the topic

The CDC Clear Communication Index was used to evaluate and revise the fact sheet during development.

In 2017, the fact sheet web page was viewed 547 times. The fact sheet (as part of a larger fact sheet series) was used at a metal mine to train approximately 200 miners on heat stress for their annual MSHA refresher training; miners referred to the fact sheet to answer questions during the interactive training session. In that capacity, the fact sheet was also used as the basis for development of a Pittsburgh Mining Research Division (PMRD) heat stress training module that is currently being tested.

Honorable Mention

Emergency medical services workers: how employers can prevent injuries and exposures (fact sheet)

Audrey Reichard, Suzanne Marsh, Rebecca Olsavsky

This fact sheet highlights key results from a 4-year study capturing data from emergency medical services (EMS) workers treated in hospital emergency departments for occupational injuries and exposures. The fact sheet provides recommendations for prevention that are specific to the injury events and exposures identified in the study.

The project team used the occupational supplement to the National Electronic Injury Surveillance System (NEISS-Work) to collect data on nonfatal injuries and exposures among EMS workers. The study found that more than 22,000 EMS workers visited emergency departments annually for work-related injuries from July 2010 to June 2014. To help EMS employers prevent the types of worker injuries found in this study, the project team created a fact sheet cobranded with partners to visually portray key results and outline a checklist of actionable recommendations.

The following highlight core components of the fact sheet:

Key message – Employers can prevent EMS worker injuries and exposures.

Key graphic element – Who/What/When/How summary of study results.

Call to action – promote a culture of safety by implementing training and work practices designed to help keep EMS workers safe. Use a reporting system to capture and monitor injuries and near misses in order to effectively target prevention efforts.

Elements identified in the CDC Clear Communication Index (e.g., calls to action, bulleted lists, visuals that support the main message) were incorporated into the fact sheet during the product's development.

While limited data is available at this time, the project team did track metrics for a targeted launch of the fact sheet during Emergency Preparedness Month. These efforts resulted in 1,132 HTML cover sheet page views and 742 PDF downloads in September 2017. Earned media mentions included articles in Safety+Health Magazine, EMS1.com, and Occupational Health & Safety. Further, CDC used the fact sheet during response to hurricanes Harvey, Irma, and Maria.

Before and After

Winner

World Trade Center Health Program website redesign

Chris Ellison, Randall Grizzle, Melissa Van Orman, Ian Spring, Emily Hurwitz, Levi Robinson, Alyssa Llamas

The World Trade Center Health Program (WTCHP) provides medical monitoring and treatment services to those directly affected by the September 11th terrorist attacks at the World Trade, the Pentagon, and in Shanksville, Pennsylvania. The program was established by the James Zadroga 9/11 Health and Compensation Act of 2010 and is administered by NIOSH.

In 2017, a multi-discipline team worked to redesign the WTCHP website to increase the clarity of content, improve the site's navigation, and meet CDC's responsive design standards. When redesigning the website, the team first considered the unique needs of the many audiences that would use the site: applicants, current members, medical professionals, policy makers, and researchers. The team created a site structure that organized content based on audience type, and it implemented a navigational structure featuring drop-down mega-menus so audiences could locate relevant information quickly and easily. In addition, an "I Want To" section was created to further guide audiences towards their desired information by targeting their intended action.

The team conducted web usability testing with an internal audience not directly affiliated with the WTCHP. This research was conducted prior to the launch of the redesign process. It identified areas of confusion and set priorities for new features to include in the redesign. The WTCHP team also queried its outreach partners on their priorities for the site's redesign and new features.

Measureable impact is not yet available. However, site visitors being able to locate essential information quickly and easily on the new site positively impacts the program in many ways. Applicants will better understand application requirements and documentation needs, reducing follow-ups by the medical team during the review process. Members will be able to find program information more quickly, reducing calls to the call center. With better design, the website will hopefully see an increase in visitors and usage, opening the door for development of more cost-effective digital communication products.

Honorable Mention

Fatality Assessment & Control Evaluation (FACE) Program Fact Sheet

Sydney Webb, Nancy Romano

This 1-page (front-back) informational fact sheet creates awareness about the NIOSH Fatality Assessment and Control Evaluation (FACE) and State FACE Programs. The fact sheet provides high-level information about both programs, their investigations, and reports. It provides a link to access the FACE and State FACE reports.

This fact sheet replaces the existing Fatality Assessment and Control Evaluation Program brochure. The authors revised content in the brochure following plain language best practices as well as included new text to better address questions someone new to the FACE or State FACE Programs may have, such as: "Who are the investigators?" and "How do the Programs conduct investigations?"

Likewise, the authors used this as an opportunity to think about dissemination of the product, which is primarily via web. Knowing web was the main mechanism for product dissemination it became clear that a fact sheet was a better product type. When viewing the brochure online, viewers read text across three columns with the brochure cover appearing on the second page, which is not user friendly. In addition to changing the format, the authors also overhauled the design of the fact sheet. The fact sheet has a much more modern look, uses images that better represent the intended target audience, easy-to-understand icons, and is easily printed in color or black and white on any standard printer.

The fact sheet was evaluated in several ways including using CDC Clear Communication Index Score Sheet. To eliminate any bias, the authors requested a health communications specialist outside the originating DLO who is trained in plain language to score the fact sheet. The fact sheet earned a passing score, which shows that it complies with the Plain Writing Act of 2010.

A review of web metrics shows that the What's New—2017 page received 3,829 page views from May to October 2017.

Plain Language Award Top Finalists

Original Product

Emergency medical services workers: how employers can prevent injuries and exposures (fact sheet)

Audrey Reichard, Suzanne Marsh, Rebecca Olsavsky

Heat stress: hydration (fact sheet)

Tristan Victoroff, Kristin Yeoman, Brittney Bragg

NIOSH reproductive health webpages

Carissa Rocheleau, Albeliz Santiago-Colón, Maria C. Kander, Christina Lawson, Candice Johnson, Greg Hartle

Before and After

Fatality Assessment and Control Evaluation (FACE) program (fact sheet)

Sydney Webb, Nancy Romano

Young drivers in the workplace: how employers and parents can help keep them safe on the road (fact sheet)

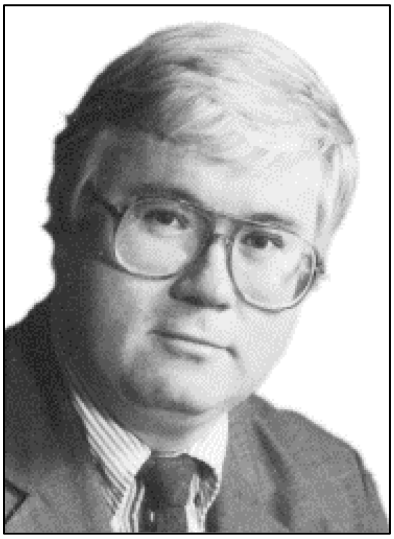
Rosa Rodríguez-Acosta, Stephanie Pratt, Rebecca Olsavsky

World Trade Center Health Program website redesign

Chris Ellison, Randall Grizzle, Melissa Van Orman, Ian Spring, Emily Hurwitz, Levi Robinson, Alyssa Llamas

James P. Keogh Award for Outstanding Service in Occupational Safety and Health

A tireless advocate for worker safety and health



The National Institute for Occupational Safety and Health is pleased to recognize one current or former NIOSH employee each year for exceptional service to the field of occupational safety and health. This award honors the contributions made by public health workers who fight long odds to achieve safer and healthier workplaces.

James P. Keogh, MD, was a tireless advocate for worker safety and health who died in June 1999 at the age of 49. His earliest work in academic medicine identified dimethylaminopropionitrile as the causal agent in an outbreak of bladder neuropathy in the 1970s. Dr. Keogh could determine this because—unlike many of the clinicians initially contacted by the workers—he took their complaints seriously and applied clear public health principles to his investigation. Throughout his life, he listened carefully to workers, characterized hazards and diseases, and then fearlessly worked to identify compensation for the individual and prevention strategies for others. Dr. Keogh was instrumental in including construction workers in the Maryland Occupational Safety and Health lead standard, a full decade before the federal standard included them. He was a leading medical educator who always focused on the need to incorporate clinical compassion with public health prevention. His most outstanding legacy, however, was his fierce determination to put knowledge into practice to benefit the worker.

James P. Keogh Award Winner for 2018

Pete Kovalchik

In his 40-year career as a federal employee, Mr. Pete Kovalchik has crafted a vision and strategic plan to ensure that research conducted within the NIOSH Pittsburgh Mining Research Division is relevant, impactful, timely, and scientifically sound. Mr. Kovalchik has developed a holistic approach to fulfilling the NIOSH mission by focusing on diversity, transparency, workforce development, and collaborative partnership within the mining industry. He exemplifies the fierce determination to put knowledge into practice to benefit mine workers. Mr. Kovalchik has developed an effective and efficient program centered on quality research, transparency, and stakeholder engagement.

Mr. Kovalchik conducted a variety of investigations and analysis related to mine electrical systems under the Bureau of Mines (BOM). He led studies examining electrical cables used in underground mining to reduce electrical cable handling injuries. This research resulted in safer mine operations by reducing the risk of cable fires that are a major cause of injury, equipment damage, and coal dust fires and explosions. Mr. Kovalchik was also instrumental in developing a research program focusing on hearing loss prevention for mine workers when the BOM transitioned into NIOSH. In 1999, MSHA passed new regulations that shifted the focus of hearing loss prevention from personal protection to development of engineering noise controls. Mr. Kovalchik was responsible for cultivating personnel and technical resources to develop noise controls for mining equipment that caused worker overexposure. His efforts led to the development of several noise controls that reduced mining equipment noise levels, improving the health and safety of mine workers.

One of Mr. Kovalchik's key accomplishments has been promoting workforce development strategies to facilitate the organization's ability to meet the mining stakeholder's needs. Through Mr. Kovalchik's use of strategies such as formal training, mentoring, and job shadowing, employees have enhanced their skills and improved their career opportunities. Examples of this are evident in the development of researchers into formal leadership positions within the Electrical and Mechanical Systems Safety Branch (EMSSB), and across the division. In his current role as branch chief of EMSSB, Mr.

Kovalchik has fostered a group of engineers, scientists, and support staff to develop a highly motivated, cohesive, professional, and energetic team.

Mr. Kovalchik has been instrumental in developing a strategic direction for research that revolves around disaster preparedness, disaster prevention, and disaster response. Most recently, the disaster preparedness research developed guidance on integrating refuge alternatives in underground coal mines. Mr. Kovalchik has also led the research focused on integrating lifesaving applications with regards to the buildup of heat and humidity inside an occupied chamber, which can lead to heat stress related illnesses; the structural integrity of the chambers and their ability to withstand high pressures generated during explosions; and maintaining safe breathable levels of air by monitoring and purging contaminated air that enters the chamber as miners enter. The findings from this research have been instrumental in guiding the mining industry and have been cited in guidance and criteria documents.

Another area in which Mr. Kovalchik has led life-saving research has been in proximity detection, bringing new technologies to mining to solve a problematic cause of fatalities and severe injuries to mine workers. In his current role, Mr. Kovalchik has led the development of technology that can be installed on mining equipment, which can sense the location and proximity of mine workers and warn the miner or de-energize the equipment when the miner is in danger. This technology is now being mandated for use by the Mine Safety and Health Administration.

Mr. Kovalchik has also focused on fostering partnerships to improve the transfer of this knowledge to the industry to achieve greater relevance and impact by establishing workshops to present research findings to key stakeholders. Mr. Kovalchik has championed using these workshops to reach a wide variety of stakeholders and promoting a dynamic environment where researchers can fully engage with the stakeholders they are committed to serve.

In conclusion, Mr. Kovalchik has leveraged workforce development initiatives to lead relevant and impactful research. His exceptional leadership and technical expertise have contributed to develop a program that is recognized among the mining community for its ability to conduct timely research to influence regulations and practices to enhance health and safety. Mr. Kovalchik has tirelessly advocated for the mining industry throughout the course of his career, and his exceptional track record of service in occupational safety and health has created a legacy rooted on scientific excellence and stakeholder engagement.

Previous James P. Keogh Award Winners

2017: Diane Porter

2016: Thomas R. Waters

2015: Kathleen Kreiss

2014: Albert E Munson

2013: Michael Attfield

2012: Alice Suter

2011: Linda Rosenstock

2010: James W Collins

2009: John Howard

2008: Mitch Singal

2007: Steven Sauter

2006: Marilyn Fingerhut

2005: Rosemary Sokas

2004: Dawn Castillo

2003: James A. Merchant

2002: Philip J. Landrigan

2001: William Edward Halperin

2000: Richard A Lemen

NIOSH Nominations for the Charles C. Shepard Science Award

CDC/ATSDR established the Charles C. Shepard Science Award in 1986 in honor of Dr. Charles C. Shepard, MD, an internationally recognized microbiologist whose career was marked by a pursuit of scientific excellence. He served as chief of the Leprosy and Rickettsia Branch at CDC for more than 30 years, until his death on February 18, 1985. The Charles C. Shepard Science Award recognizes scientists who have made important research contributions to public health. The awards are given in five categories: one individual award (Lifetime Scientific Achievement), and four for journal articles during the previous year in the following categories:

- Assessment
- Data Methods and Study Design
- Laboratory Science
- Prevention and Control

NIOSH Nominations for the Charles C. Shepard Science Award for 2018

Scientific Publications

Assessment

Frasch HF, Barbero AM [2017]. In vitro human epidermal permeation of nicotine from electronic cigarette refill liquids and implications for dermal exposure assessment, J Expo Sci Environ Epidemiol *27*:618–624, https://doi.org/10.1038/jes.2016.68.

Park RM, Berg SL [2017]. Manganese and neurobehavioral impairment. A preliminary risk assessment. Neurotoxicology *64*:159–165, https://doi.org/10.1016/j.neuro.2017.08.003.

Violanti JM, Fekedulegn D, Andrew ME, Hartley TA, Charles LE, Miller DB, Burchfiel CM [2017]. The impact of perceived intensity and frequency of police work occupational stressors on the cortisol awakening response (CAR): findings from the BCOPS study. Psychoneuroendocrinology *75*:124–131, https://doi.org/10.1016/j.psyneuen.2016.10.017.

Laboratory Science

Hettick JM, Law BF, Lin C-C, Wisnewski AV, Siegel PD [2018]. Mass spectrometry-based analysis of murine bronchoalveolar lavage fluid following respiratory exposure to 4,4'-methylene diphenyl diisocyanate aerosol. Xenobiotica *48*(6): 626–636, https://doi.org/10.1080/00498254.2017.1344791.

Othumpangat S, Bryan NB, Beezhold DH, Noti JD , [2017] Upregulation of miRNA-4776 in influenza virus infected bronchial epithelial cells is associated with downregulation of NFKBIB and increased viral survival. Viruses *9*(5):94, https://doi.org/10.3390/v9050094.

Stefaniak AB, LeBouf RF, Duling MG, Yi J, Abukabda AB, McBride CR, Nurkiewicz TR [2017]. Inhalation exposure to three-dimensional printer emissions stimulates acute hypertension and microvascular dysfunction. Toxicol Appl Pharmacol, *335*(2017), https://doi.org/10.1016/j.taap.2017.09.016.

Prevention and Control

Bell JL, Taylor MA, Chen G-X, Kirk RD, Leatherman ER [2017]. Evaluation of an in-vehicle monitoring system (IVMS) to reduce risky driving behaviors in commercial drivers: comparison of in-cab warning lights and supervisory coaching with videos of driving behavior, J Saf Res *60*:125–136, https://doi.org/10.1016/j.jsr.2016.12.008.

Brady TM, Strauach AL, Almaguer CM, Niezgoda G, Shaffer RE, Yorio PL, Fisher EM [2017]. Transfer of bacteriophage MS2 and fluorescein from N95 filtering facepiece respirators to hands: measuring fomite potential, J Occup Environ Hyg *14*(11):898–906, https://doi.org/10.1080/15459624.2017.1346799.

MacDonald LA, Bertke S, Hein MJ, Judd S, Baron S, Merritt R, Howard VJ [2017]. Prevalence of cardiovascular health by occupation: a cross-sectional analysis among U.S. workers aged ≥ 45 years, Am J Prev Med *53*(2):152–161, https://doi.org/10.1016/j.amepre.2017.02.022.

Lifetime Scientific Achievement Award for 2018

Paul A. Schulte

This year, NIOSH is proud to nominate Dr. Paul A. Schulte for the Charles C. Shepard Lifetime Scientific Achievement Award. Since joining NIOSH in 1975, Dr. Schulte has made significant contributions to the field of occupational safety and health, public health, and the protection and well-being of the workforce worldwide. He has been at the leading edge of advancing scientific knowledge and occupational safety and health (OSH) policy in numerous areas while at NIOSH, including molecular epidemiology, genetics in the workplace, risk communication, prevention through design, and nanotechnology.

In addition to Dr. Schulte's scientific achievements, he has served in several increasingly responsible management positions within NIOSH, leading to his current post as Director of the Education and Information Division (EID).

He was an early and strong proponent of workers' "right to know" their risks from workplace exposures and identified this as an important emerging public health issue in 1984. His work was the basis of NIOSH and national practice to notify subjects of epidemiologic research of the results of the studies and actions that may be taken to reduce any subsequent risks.

Dr. Schulte was one of the pioneers in opening the new field of molecular epidemiology, and his papers published over three decades include his seminal 1993 article, "Molecular Epidemiology: Principles and Practices," which defined the emerging field that utilized biological markers in epidemiologic research. In addition to developing the field of molecular epidemiology in general, Dr. Schulte particularly focused on four areas of molecular epidemiology: ethical issues, use of biomarkers in medical surveillance, use of biomarkers in occupational cancer research, and use of genetic biomarkers in occupational health. He has presented and published broadly on the topic, culminating with a major role in developing the NIOSH publication "Genetics in the Workplace".

In the past decade, Dr. Schulte has been instrumental in protecting the workforce, and by extension the whole population, as the new field of nanotechnology emerged and potentially hazardous nanomaterials became increasingly used in all commercial sectors from materials to medicine. In 2005, Dr. Schulte became manager of the NIOSH

Nanotechnology Research Center (NTRC), and since then, NIOSH research and guidance have been critical to the world's knowledge of hazards of nanomaterials. He has led a conscientious program of research on nanomaterials in the midst of calls to either ban these materials or, in the other extreme, not regulate them at all.

In 2006, Dr. Schulte and colleagues developed a national initiative known as Prevention through Design (PtD). The objective of the initiative was to effect a culture of change that would incorporate protecting workers in the designs of buildings, processes, equipment, tools, organization of work, molecules, and products. This initiative led to developing a national consensus standard on Prevention through Design by the American Society of Safety Engineers, and incorporating PtD principles in 14 other consensus standards, including the revised American National Standards Institute consensus standard on Occupational Safety and Health Management Systems.

The current work of Dr. Schulte involves efforts to identify and utilize measures of well-being of the workforce. His paper on well-being at work in 2010 reflects the current state of thinking about well-being at work. This concept was expanded in 2013 at a keynote address to the International Conference on Culture of Prevention in Finland. Dr. Schulte has initiated a project to evaluate how to operationalize the concept of well-being in occupational risk assessments. Dr. Schulte also developed a new approach to improve estimates of work-related health burden in a series of papers in the *American Journal of Public Health*.

Dr. Schulte is also leading the Safe, Skilled, and Ready Workforce Initiative to promote the eight core competencies to be taught to high school and younger students so they understand the broad concepts of hazard/risk identification and control that would be of value to them in work, as well as in all aspects of life. As part of this effort, core competencies for work issued by the Employment Training Administration (DOL) have included NIOSH input for young workers.

Dr. Schulte's nomination for this prestigious award recognizes not only his outstanding contribution to occupational safety and health, but also his dedication and commitment to the NIOSH mission.

View the previous NIOSH Nominations for the Charles C Shepard Science Award

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