NORA

Symposium 2011

Achieving Impact through Research and Partnerships

July 12-13, 2011
Hyatt Regency Cincinnati
Cincinnati, Ohio

Department of Health & Human Services · USA

CDC Workplace Safety and Health

National Institute for Occupational Safety and Health NIOSH

University of Cincinnati

Table of Contents

Welcome....3
Award Winners....6
Agenda....8
RAPID Presentations Agenda....10
Abstracts/Poster Session 1....21
Abstracts/Poster Session 2....69
Abstract Author Index....117

DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

Centers for Disease Control
and Prevention (CDC)
National Institute for Occupational
Safety and Health (NIOSH)
395 E Street, SW
Washington, DC 20201

July 12, 2011

NORA Symposium Attendees

It is my pleasure to welcome you to the 2011 National Occupational Research Agenda (NORA) Symposium: Achieving Impact through Research and Partnerships. This is the seventh NORA Symposium. Like its predecessors, the 7th NORA Symposium will showcase excellence in occupational safety and health research, and the application of that research to prevent work-related injury and illness. This year we are focusing on research and partnerships. The sector-based structure of the second decade of NORA has fostered the creation of many exciting partnership opportunities among many diverse organizations.

New partnerships with practitioners have significantly enhanced the NIOSH Research-to-Practice (r2p) initiative, which helps us assure that the products of our research ultimately benefit the health and well-being of workers. These benefits extend as well to workers' families, their communities, businesses, and society as a whole.

In addition to recognizing 15 years of NORA, 2011 also marks the 40th anniversary of NIOSH and the Occupational Safety and Health Administration (OSHA) under the Occupational Safety and Health Act of 1970. Please join us Tuesday evening for a reception in commemoration of this important date in history.

Finally, I would like to thank our co-sponsor, the University of Cincinnati, for their efforts in organizing this year's symposium as well as each of our participants and attendees for joining us here in Cincinnati for the 2011 NORA Symposium. I wish each of you a successful Symposium.

John Howard, M.D.
Director

UNIVERSITY OF Cincinnati

College of Medicine

Department of Environmental Health
University of Cincinnati
PO Box 670056
Cincinnati, OH 45267-0056

July 11, 2011

Welcome!

The University of Cincinnati Department of Environmental Health, College of Medicine, and the NIOSH-supported Education and Research Center that brings together faculty and students in the Colleges of Engineering, Medicine and Nursing, welcome you to Cincinnati, the Queen of the West and a wonderful city on a river.

Cincinnati is a center for industry, labor, government and education: an ideal location for a meeting of stakeholders representing the broadest aspects of worker health and safety to discuss achieving impact through research and partnership. Few achievements in workplace improvement result from singular effort; this team science requires partnerships at all levels: concept, research, translation to practice, feedback from practice for improvement in concept. Ultimately, we hope that prevention through design will reduce the number of exposures causing injury and illness in the workplace.

The University of Cincinnati has a long history of research and education in core disciplines of workplace improvement. The College of Engineering initiated the highly regarded concept of co-op education in 1906. The Department of Environmental Health was formed about 80 years ago as an interdisciplinary team of physicians, analytical chemists, toxicologists, industrial hygienists, engineers and librarians to study occupational and environmental health problems in the auto industry. For many years, the UC occupational medicine mini-residency was a recognized mechanism for practicing physicians to enhance skills in this important field during summer and off-campus experience. The Nursing program was started in 1889, and joined UC as its eighth college in 1938. The College of Nursing was one of the first to offer BSN (1916) and MSN (1956) degrees.

Enjoy the world-class art museums while you are here. Visit Music Hall. just to see the hall even if the orchestra is away. Sit in Fountain Square to discuss new ideas with colleagues and watch the locals. Eat some Graeter's ice cream on a hot summer night. (Unfortunately, this is All Star game week, and the Reds participants are in Phoenix.) Cincinnati offers a bridge some of you may have seen in Brooklyn and architecture with a European flavor. Findlay Market is a special place for coffee and browsing.

Wishing you a productive meeting, and a great stay in our city,

Shuk-Mei Ho, PhD
Professor and Chair

Carol Rice

Carol Rice, PhD, CIH
Professor and ERC Director

An affirmative action/equal opportunity institution

2011 NORA Innovative Research Award

The National Occupational Research Agenda (NORA) Liaison Committee is pleased to present the 2011 NORA Innovative Research Award to recognize innovative and creative NORA-related occupational safety and health research for

Effectiveness of Training and Reinforcement on HPD Use Among Construction Workers

Noah Seixas, PhD
University of Washington

Richard Neitzel, PhD
University of Washington

Hendrika Meischke
University of Washington

William Daniell, MD
University of Washington

Lianne Sheppard, PhD
University of Washington

Jane Edelson, MS
University of Washington

2011 NORA Partnering Award

The National Occupational Research Agenda (NORA) Liaison Committee is pleased to present the 2011 NORA Partnering Award to recognize organizations working together in NORA-related research to protect worker health and safety for

Rollover Protective Structure (ROPS) Rebate Program

The Northeast Center for Agricultural and Occupational Health

John May, MD
Julie Sorensen, PhD

The Small Crop and Livestock Farmer Advisory Group

Bruce Banks
David Collins
Jim Judski
Jeff Martin
John Pronko
Steve Sinniger
Ted Teletnick
Richard Carrier
Ed Gates
John Lyons
James Minn
Alan Pullis
Carl Taber

The Northeast Equipment Dealers Association

Ralph Gaiss

Farm Family Insurance

Rosemary Shader

Pennsylvania State University

Dennis Murphy, PhD
Aaron Yoder, PhD

The University of Vermont Extension

George Cook
Matt Myers

The New Hampshire Department of Agriculture, Markets and Food

Lorraine Merrill

The New York Farm Bureau

Julie Suarez

John Deere and Company

Mike DeSpain

National Agricultural Statistics Service

King Whetstone

Academy for Educational Development (AED) Center for Social Marketing and Behavior Change

Bithiah Lafontant
John Strand

AGENDA

Tuesday, July 12

7:00 **Registration Desk Open** ..... **3rd Floor**

8:30-8:45 **Welcome** ..... **Regency A**
John Howard, MD, MPH, Director, National Institute for Occupational Safety and Health

8:45-9:15 **Keynote: NORA and Lessons Learned from the Diffusion of Innovations** ..... **Regency A**
Jim Dearing, PhD, Kaiser Permanente

9:15-9:45 **NORA Awards Presentation: Updates from the 2008 Winners** ..... **Regency A**
David C. Deubner, MD MPH, Vice President, Occupational and Environmental Medicine, Materion Brush Inc., Mrs. Kellie R. Fowler, Lead Operator, Materion Brush Inc. and Christine R. Schuler, PhD, Research Epidemiologist, Division of Respiratory Disease Studies, National Institute for Occupational Safety and Health.

William S. Shaw, PhD, Principal Research Scientist, Liberty Mutual Research Institute for Safety

Thomas R. Waters, PhD, CPE, Research Safety Engineer, Division of Applied Research and Technology, National Institute for Occupational Safety and Health

9:45-10:00 **2011 NORA Awards Announced on Behalf of the NORA Awards Committees** ..... **Regency A**
Bonnie Rogers, DrPH, The University of North Carolina at Chapel Hill

10:00-10:30 **Break** ..... **Corridor D**

10:30-11:30 **Plenary: Impact Successes** ..... **Regency A**

The Joint Commission and NORA: Identifying Synergies
Barbara Braun, Joint Commission

In the Trenches and On the Steel: Construction Research Making a Difference
Janie Gittleman, The Center for Construction Research and Training (CPWR)

Developing Partnerships with the Wholesale and Retail Trade Sector
Vern Anderson, National Institute for Occupational Safety and Health

11:30 - 12:00 **Update on Mid-Decade Review of NORA** ..... **Regency A**
Chia-Chia Chang, National Institute for Occupational Safety and Health

12:00-1:30 **Lunch/Buffet provided for registrants** ..... **Sungarden**

1:30-3:00 **Plenary - Partnership Experiences in Achieving Impact** ..... **Regency A**

Approaches to Research Translation: A Snapshot of NIOSH Researcher Proposals Submitted for the 2010 Bullard-Sherwood Award
Max Lum, National Institute for Occupational Safety and Health

NIOSH Education and Research Centers (ERCs) – What, Where, and How?
Carol Rice, University of Cincinnati

1:30-3:00 **Universities and NORA: Examples Involving the University of Massachusetts at Lowell**
Margaret Quinn, University of Massachusetts at Lowell

Community-University Partnerships for Worker Justice
Pam Tau Lee, Retired

3:00-3:30 **Break** ..... **Corridor D**

3:30-5:00 **Rapid Poster Session R1 (listing on page 10)** ..... **Regency E**

Rapid Poster Session R2 (listing on page 11) ..... **Regency F**

Rapid Poster Session R3 (listing on page 13) ..... **Regency G**

5:00-7:00 **Poster Session 1 and Reception** ..... **Regency B**

Brief Commemoration of 15 Years of NORA and 40 Years of NIOSH and OSHA
John Howard, MD, MPH, Director, National Institute for Occupational Safety and Health

A Day in the Life of an Industrial Hygienist 1971 … and 2011
Teresa Seitz, MPH, CIH, Supervisory Industrial Hygiene Team Lead, National Institute for Occupational Safety and Health

Wednesday, July 13

7:00 **Registration Open** ..... **3rd Floor**

8:30-9:15 **Keynote: Workplace Safety and Health, The Next 40 Years** ..... **Regency A**
Jordan Barab, Deputy Assistant Secretary of Labor for Occupational Safety and Health, Occupational Safety and Health Administration

9:15-9:30 **Break** ..... **Corridor D**

9:30-11:00 **Rapid Poster Session R4 (listing on page 15)** ..... **Regency E**

Rapid Poster Session R5 (listing on page 17) ..... **Regency F**

Rapid Poster Session R6 (listing on page 18) ..... **Regency G**

11:00-1:00 **Poster Session 2 / Box Lunch provided for registrants** ..... **Regency B**

1:00-3:00 **Platform Sessions and Roundtables Covering Topics of Special Interest**

Using the Tools of Social Media to Build our Community of Practice ..... **Regency A**

NIOSH Total Worker Health™: Integrated Approaches to Health Protection and Health Promotion ..... **Regency C**

Unions as Research Collaborators ..... **Regency E**

Understanding Trade Associations ..... **Regency F**

The Business Case for Prevention ..... **Regency G**

Building Healthy Workplaces: State of the Art Research and Practice in Work Organization and Stress ..... **Bluegrass AB**

NIOSH-University Partnerships: Attaining and Sustaining Evidence-Based Solutions ..... **Buckeye AB**

RAPID PRESENTATIONS AGENDA

RAPID Poster Session R1.....Regency E

Training

1.101 **Making Computer-Based Safety Trainings Accessible to Latino Immigrant Trench Workers: Evaluation of a Spanish-Language Mouse Training for Workers with Limited Computer Experience**
Sheli DeLaney
NIOSH Education and Information Division, Cincinnati, OH, USA

Agriculture, Forestry and Fishing

1.102 **The Social Marketing of Tractor Rollover Protection: Exporting an Intervention Model and Expanding Partnerships**
Julie Sorensen[1], John May[1], Aaron Yoder[2], Dennis Murphy[2], George Cook[3], Matt Meyers[3]
[1]Northeast Center, Cooperstown, NY, USA, [2]Pennsylvania State University, University Park, PA, USA, [3]University of Vermont Extension, Morrisville, VT, USA

1.103 **Adoption of Cost-effective Roll Over Protective Structures (CROPS) on Farm Tractors: A r2p Perspective**
David Hard, E. A. McKenzie, Jr., Doug Cantis
NIOSH Division of Safety Research, Morgantown, WV, USA

1.104 **Signaling and Mayday: Training Vietnamese Shrimp Fishermen of the Gulf Coast**
Jeffrey Levin[1], Karen Gilmore[1], Ann Carruth[2], Amanda Wickman[1], Sara Shepherd[1], Gilbert Gallardo[3], William Evert[3], James Elliott[3], Mang Vo[4], Matthew Nonnenmann[1]
[1]The University of Texas Health Science Center at Tyler, Tyler, TX, USA, [2]Southeastern Louisiana University, Hammond, LA, USA, [3]United States Coast Guard, Eighth Coast Guard District, USA, [4]Retired Captain, Houston, TX, USA

1.105 **Work Safety Climate, Musculoskeletal Discomfort, Working While Injured, and Depression among Migrant Farmworkers**
Heather O'Hara[1], Sara Quandt[2], Joseph Grzywacz[2], Scott Isom[2], Haiying Chen[2], Thomas Arcury[2]
[1]Meharry Medical College, Nashville, TN, USA, [2]Wake Forest University School of Medicine, Winston-Salem, NC, USA

1.106 **Extending Pesticide Safety Training to Farmworker Families: Evaluation of an r2p Demonstration Project**
Sara Quandt[1], Joseph Grzywacz[1], Maria Mirabelli[1], Jennifer Talton[1], Grisel Trejo[1], Janeth Tapia[2], Ralph D'Agostino Jr[1], Thomas Arcury[1]
[1]Wake Forest University School of Medicine, Winston-Salem, NC, USA, [2]North Carolina Farmworkers Project, Benson, NC, USA

1.107 **Chronic Back Pain among Hispanic Adolescent Farmworkers**
Eva Shipp[1], Sharon Cooper[2], Deborah del Junco[3], Charles Cooper[2]
[1]Texas A&M School of Rural Public Health, College Station, TX, USA, [2]The University of Texas Health Science Center at Houston School of Public Health San Antonio Regional Campus, San Antonio, TX, USA, [3]The University of Texas Health Science Center at Houston, Houston, TX, USA

Authoritative Recommendations, Guidance or Standards

1.108 **Developing an Updated NIOSH REL for Hexavalent Chromium Compounds**
Kathleen MacMahon[1], Robert Park[1], Faye Rice[1], Kevin Ashley[2], Leo Michael Blade[3], Thomas J. Lentz[1], Chris Sofge[1], Paul Schulte[1]
[1]NIOSH Education and Information Division , Cincinnati, OH, USA, [2]NIOSH Division of Applied Research and Technology, Cincinnati, OH, USA, [3]Private Consultant, Cincinnati, OH, USA

Construction

1.109 **Evaluation of Safety in Nighttime Highway Work Zones**
Ali Mostafavi, Vanessa Valentin, Dulcy Abraham
Purdue University, West Lafayette, USA

1.110 **Measuring the Impact of Green Jobs on Construction Worker Safety and Health**
Sue Dong, Xuanwen Wang, Christina Daw
The Center for Construction Research and Training (CPWR), Silver Spring, MD, USA

1.111 **Tracking Safety and Health in the Construction Industry**
Sue Dong, Xuanwen Wang, Christina Daw
The Center for Construction Research and Training (CPWR), Silver Spring, MD, USA

1.112 **Safety and Health among Older Construction Workers**
Sue Dong, Xuanwen Wang, Christina Daw
The Center for Construction Research and Training (CPWR), Silver Spring, USA

1.113 **Active and Passive Tobacco Smoke Exposures: A Construction Workplace Health Assessment Pilot Study**
Alberto Caban-Martinez, David Lee, Tainya Clarke, Evelyn Davila, John Clark III, Manuel Ocasio, Lora Fleming
University of Miami, Miller School of Medicine, Miami, Florida, USA

Engineering Controls

1.114 **Metal Arc Welding Hazard Reduction by Selection of the Best Combination of Shield Gas and Metal Transfer Mode**
Michael Keane, Bean Chen, Sam Stone
NIOSH Health Effects Laboratory Division, Morgantown, WV, USA

1.115 **Assessing Control Measures for Mitigating Exposures during the Production of Carbon Nanotubes**
Li-Ming Lo[1], Kevin Dunn[1,2], Duane Hammond[1], Daniel Almaguer[1], Isaac Bartholomew[1], Jennifer Topmiller[1]
[1]NIOSH Division of Applied Research and Technology, Cincinnati, OH, USA, [2]University of Massachusetts-Lowell, Lowell, MA, USA

RAPID Poster Session R2.....Regency F

Hearing Loss

1.201 **Identifying and Promoting Excellence in Hearing Loss Prevention through the Safe-in-Sound Award**
Thais Morata, Pamela Graydon
NIOSH Division of Applied Research and Technology, Cincinnati, OH, USA

1.202 **Establishing Valid Sound Pressure Level Measurement Methods in Orchestra Musicians**
June Romeo[1], D. Martin Raymond[2], Peter Landgren[1]
[1]Baldwin-Wallace College, Berea, Ohio, USA, [2]Eastern Michigan University, Ypsilanti, MI, USA

1.203 **Hearing Loss: Towards Knowledge, Competency, and Accountability Among Music Professionals**
Kris Chesky, Kamakshi Gopal, Amyn Amlani, Yan Huang, Vijay Vaidyanathan
University of North Texas, Denton, Texas, USA

1.204 **Evaluation of Noise Exposures at an Aluminum Beverage Can Manufacturer**
Scott E. Brueck
NIOSH Division of Surveillance, Hazard Evaluations and Field Studies, Cincinnati, OH, USA

Intervention Effectiveness Research or Evaluation

1.205 **Implementation and Process Evaluation of a Participatory Ergonomics Program in Floor Layers**
Lisa Jaegers[1,3], Ann Marie Dale[1], Laura Welch[2], Nancy Weaver[3], Bryan Buchholz[4], Bradley Evanoff[1]
[1]Washington University School of Medicine, St. Louis, MO, USA, [2]The Center for Construction Research and Training (CPWR), Silver Spring, MD, USA, [3]Saint Louis University School of Public Health, St. Louis, MO, USA, [4]University of Massachusetts Lowell, Lowell, MA, USA

Musculoskeletal Disorders

1.206 **Intervention Effectiveness in Reducing Risk of Musculoskeletal Disorders in Airport Baggage Screeners and Handlers**
Ming-Lun Lu, Thomas Waters, Robert Dick
NIOSH Division of Applied Research and Technology, Cincinnati, OH, USA

1.207 **Improving Ergonomics at Electric Power Generation Utilities: A Story of a Successful Partnership**
Karen Cooper[1,2], Naira Campbell-Kyureghyan[1,2]
[1]University of Wisconsin-Milwaukee, Department. of Industrial and Manufacturing Engineering, Milwaukee, WI, USA, [2]University of Wisconsin-Milwaukee, CARGI, Milwaukee, WI, USA

1.208 **Ergonomic Injury Surveillance, Evaluation and Intervention for Electric Utility Substation Workers in the USA**
Sharan Campleman, Gabor Mezei, Ximena Vergara
Electric Power Research Institute, Palo Alto, CA, USA

1.209 **Lifting at the Right Height: Adjustable Height Cart Reduces Low Back Disorder Risk**
Kermit Davis[1], Lida Orta Anés[2]
[1]University of Cincinnati, Cincinnati, OH, USA, [2]University of Puerto Rico, Puerto Rico, USA

1.210 **The Effect of a Systematic, Participatory Computer Workstation Redesign on Musculoskeletal Symptoms**
Nancy Baker
University of Pittsburgh, Pittsburgh, PA, USA

1.211 **Surveillance of Work-Related Musculoskeletal Pain (WMSP) using Employee Input**
Madiha Ahmed[1,2], Naira Campbell-Kyureghyan[1,2]
[1]CARGI at the University of Wisconsin-Milwaukee, Milwaukee, WI, USA, [2]I&ME Department at the University of Wisconsin-Milwaukee, Milwaukee, WI, USA

Public Safety

1.212 **Health Disparity in an Occupational Context: Law Enforcement**
John Violanti[1], Michael Andrew[2], Diane Miller[3], Luenda Charles[2], Tara Hartley[2], Desta Fekedulegn[2], Anna Mnatsakanova[2], Jack Gu[2], Cathy Tinney-Zara[2], Cecil Burchfiel[2]
[1]State University of NY at Buffalo, Buffalo, NY, USA, [2]Biostatistics and Epidemiology Branch, Health Effects Laboratory Division, NIOSH, CDC, Morgantown, WV, USA, [3]Toxicology and Molecular Biology Branch, Health Effects Laboratory Division, NIOSH, CDC, Morgantown WV, USA

1.213 **Early Criteria for Evaluating the Cardiovascular and Psychophysical Effects of Heat Stress on Firefighters**
Kristin Musolin[1], Ashutosh Mani[1], Annie Hamilton[1], Denise Miller[1], Barbara Alaxander[1], Diane Busch[1], Todd Ramsey[1], Peter Sandwall[1], William A. Jetter[2], William Lovett[2], Kermit Davis[1], Tiina Reponen[1], Amit Bhattacharya[1]
[1]University of Cincinnati, Cincinnati, OH, USA, [2]Sycamore Fire Station, Sycamore, Cincinnati, OH, USA

1.214 **Cops and Cars: Reducing Motor Vehicle Related Fatalities among Law Enforcement Officers**
Hope Tiesman[1], Rebecca Heick[2]
[1]NIOSH Division of Safety Research, Morgantown, WV, USA, [2]Walden University, Davenport, IA, USA

1.215 **Developing Customized Job Stress Products for Correction Officers: A Needs Assessment**
Rashaun Roberts
NIOSH Division of Applied Research and Technology, Cincinnati, OH, USA

1.216 **WorkLife Interventions in Corrections Personnel: The HITEC Study**
Martin Cherniack[1,3], Jeffrey Dussetschleger[1,3], Pouran Faghri[2,3], Robert Henning[2,3], Timothy Morse[1,3], Nicholas Warren[1,3]
[1]University of Connecticut Health Center, Farmington, CT, USA, [2]University of Connecticut, Storrs, CT, USA, [3]Center for the Promotion of Health in the New England Workplace (CPH-NEW), Lowell, MA, Farmington, CT, Storrs, CT, USA

RAPID Poster Session R3..... Regency G

History

1.301 **History of Occupational Safety and Health: What led to the creation of NIOSH?**
Susan Afanuh
NIOSH Education and Information Division, Cincinnati, OH, USA

Participatory Action Research

1.302 **p-2-r - How Our Partners Can Drive the Research Process**
Ted Scharf[1], Joe Hunt, III[2], Michael McCann[3], Carol Stephenson[4], G.T. Lineberry[5], Steve Isaacs[5], Henry Cole[5], Ron Stinson[6], Pamela Kidd[7]
[1]NIOSH Division of Applied Research and Technology, Cincinnati, OH, USA, [2]International Association of Bridge, Structural, Ornamental and Reinforcing Iron Workers, St. Louis, MO, USA, [3]CPWR - The Center for Construction Research and Training, Silver Spring, MD, USA, [4]NIOSH Education Information Division, Cincinnati, OH, USA, [5]University of Kentucky, Lexington, KY, USA, [6]Kentucky Roofing Contractors Association, Louisville, KY, USA, [7]Arizona State University, Tempe, AZ, USA

Research to Practice/Partnerships

1.303 **Maximizing Workplace Safety and Health Impact Through Successful Partnerships**
Kathleen Goedel, Amanda Harney, Truda McCleery
NIOSH Office of the Director, Cincinnati, OH, USA

Surveillance

1.304 **Chronic Disease Data from the National Occupational Mortality Surveillance System (NOMS): Occupational Lung Cancer in U.S. Women, 1984–1998**
Cynthia Robinson[1], Patricia Sullivan[2], Jia Li[1]
[1]NIOSH Division of Surveillance, Hazard Evaluations and Field Studies, Cincinnati, Ohio, USA, [2]NIOSH Division of Respiratory Disease Studies, Morgantown, WV, USA

1.305 **The 2010 Occupational Health Supplement to the National Health Interview Survey (NHIS)**
Sara Luckhaupt
NIOSH Division of Surveillance, Hazard Evaluations and Field Studies, Cincinnati, OH, USA

1.306 **NORA Mortality Monograph: National Health Interview Survey 1986–2004**
Manuel Ocasio[1], Lora Fleming[1], William LeBlanc[1], Evelyn Davila[1], David Lee[1], Alberto Caban-Martinez[1], Kathryn McCollister[1], Kristopher Arheart[1], John Sestito[2]
[1]University of Miami, Miller School of Medicine, Miami, Florida, USA, [2]NIOSH Division of Surveillance, Health Evaluations, and Field Studies, Cincinnati, Ohio, USA

1.307 **NORA Morbidity and Disability: The National Health Interview Survey (NHIS) 1986–1996 and 1997–2007**
David Lee[1], Evelyn Davila[1], William LeBlanc[1], Lora Fleming[1], Kathryn McCollister[1], Sharon Christ[1], Alberto Caban-Martinez[1], Tainya Clarke[1], Manuel Ocasio[1], Kristopher Arheart[1], John Sestito[2]
[1]University of Miami, Miller School of Medicine, Miami, Florida, USA, [2]NIOSH Division of Surveillance, Health Evaluations, and Field Studies, Cincinnati, Ohio, USA

1.308 **Lead Exposure Surveillance in the U.S.: The Adult Blood Lead Epidemiology and Surveillance (ABLES) Program**
Walter Alarcon, Janet Graydon
NIOSH Division of Surveillance, Hazard Evaluations and Field Studies, Cincinnati, Ohio, USA

1.309 **County-level Indicators for Occupational Health: An Example Using Fatal Occupational Injuries**
Matthew Groenewold, Jeff Shire
NIOSH Division of Surveillance, Hazard Evaluations and Field Studies, Cincinnati, OH, USA

1.310 **The Western States Occupational Network (WestON) — Maximizing Partnerships for Occupational Safety and Health Surveillance in the Western US**
Karen Mulloy[1], Yvonne Boudreau[2], Robert Harrison[3], Erin Simms[4]
[1]Mountain and Plains Education and Research Center, Denver, CO, USA, [2]NIOSH Western States Office, Denver, CO, USA, [3]California Department of Public Health, San Francisco, CA, USA, [4]Council of State and Territorial Epidemiologists, Atlanta, GA, USA

Respiratory Diseases

1.311 **Development of In Vitro vs. In Vivo Models to Evaluate Fibrogenic and Carcinogenic Potential of Carbon Nanotubes**
Liying Wang[1,2], Anurag Mishra[1,2], Todd Stueckle[1], Raymond Derk[1], Yon Rojanasakul[2], Vincent Castranova[1,2]
[1]NIOSH Health Effects Laboratory Division, Morgantown, WV, USA, [2]West Virginia University, Morgantown, WV, USA

1.312 **Calcite as a Preventive Agent for Coal Workers' Pneumoconiosis**
Xi Huang, Meena Aladdin, Qing Yang, Jinlong Jian, Lung Chi Chen
New York University School of Medicine, New York, NY, USA

1.313 **Complex Profile of Mechanical Responses of Guinea-Pig Isolated Airways to the Popcorn Butter Flavorings, Diacetyl and 2,3-Pentanedione**
Jeffrey Fedan[1], Janet Thompson[1], Eric Zaccone[1,2], Ann Hubbs[1]
[1]NIOSH Health Effects Laboratory Division, Morgantown, WV, USA, [2]Department of Basic Pharmaceutical Sciences, West Virginia University, Morgantown, WV, USA

1.314 **Mechanical Responses to COREXIT® EC9500A in Rat Trachea In Vitro**
Michael Shimko[1], Eric Zaccone[1], Janet Thompson[2], Michael Kashon[2], Giovanni Piedimonte[1], Jeffrey Fedan[2]
[1]West Virginia University, Morgantown, WV, USA, [2]NIOSH Health Effects Laboratory Division, Morgantown, WV, USA

1.315 **Advances in Techniques for Mineral Fiber Classification**
Leonid Turkevich, Gregory Deye
NIOSH Division of Applied Research and Technology, Cincinnati, OH, USA

1.316 **Respiratory Diseases Research Program: Some Recent Products for our Stakeholders**
Ainsley Weston, Christine R. Schuler, Lu Ann Beeckman-Wagner, Michelle R. Martin, Jean M. Cox-Ganser, Ju-Hyeong Park, Eileen Storey, Kathleen Kreiss, David N. Weissman
Division of Respiratory Disease Studies, Morgantown, WV, USA

RAPID Poster Session R4.....Regency E

Healthcare and Social Assistance

2.101 **The Prevalence and Work-Related Factor Neck and Shoulder Pain Among Critical Care Nursing Personnel in Ramathibodi Hospital, Bangkok**
Wasana Lavin
Mahidol University, Bangkok, Thailand

2.102 **Relief Work and Mental Health: a Critical Review**
Ellen Connorton[1,2], Melissa J. Perry[1,3], David Hemenway[1], Matthew Miller[1]
[1]Harvard School of Public Health, Boston, MA, USA, [2]Dana-Farber Cancer Institute, Boston, MA, USA, [3]George Washington University, Washington, DC, USA

2.103 **The Effects of Bullying on the Productivity of the Novice Nurse**
Peggy Berry, Gordon Gillespie, Donna Gates, John (Chuck) Schafer
Univeristy of Cincinnati, Cincinnati, Ohio, USA

2.104 **Planning for the NIOSH Occupational Health Safety Network (OHSN): Foundation for Monitoring and Protecting Workers in the Healthcare Sector and Beyond**
Sara Luckhaupt, Ahmed Gomaa
NIOSH Division of Surveillance, Hazard Evaluations and Field Studies, Cincinnati, OH, USA

2.105 **A Partnership Between Academic Researchers and Hospitals for Reducing Violence Against Healthcare Workers**
Tammy Mentzel[1], Donna Gates[1], Gordon Gillespie[1], Kimberly Vance[2], Katherine Staubach[2], Maria Sanker[1]
[1]University of Cincinnati, College of Nursing, Cincinnati, OH, USA, [2]The University Hospital, Cincinnati, OH, USA

2.106 **Alarmingly Low Influenza Vaccination Rates Among Child Care Workers: Assessing Knowledge, Attitudes, and Behaviors**
Marie de Perio, Douglas Wiegand, Stefanie Evans
NIOSH Division of Surveillance, Hazard Evaluations and Field Studies, Cincinnati, OH, USA

2.107 **Web-based Health and Safety Practices Survey of Healthcare Workers**
Jim Boiano[1], Andrea Steege[1], Martha Stapleton[2], Jocelyn Newsome[2], Marie Haring Sweeney[1]
[1]NIOSH Division of Surveillance, Hazard Evaluations and Field Studies, Cincinnati, OH, USA, [2]Westat, Inc, Rockville, MD, USA

2.201 **Investigation of Power-Drive as an Effective Intervention to Reduce Caregiver Back, Shoulder, and Upper Extremity Effort during Transferring of Hospital Beds**
Susan Kotowski[1,2], Kermit Davis[1]
[1]College of Allied Health Sciences, University of Cincinnati, Cincinnati, OH, USA, [2]Low Back Biomechanics and Workplace Stress Laboratory, University of Cincinnati, Cincinnati, OH, USA

2.202 **Characterization of Occupational Bloodborne Pathogen Exposures in Health Care Workers at a University Hospital: A Three Year Retrospective Study**
Ronda Brewer McCarthy, Judith Green-McKenzie
Occupational and Environmental Medicine, The Hospital at the University of Pennsylvania, Philadelphia, PA, USA

2.203 **Occupational Exposure to Anesthetic Gases, Antineoplastic Drugs, Antiviral Drugs, Sterilizing Agents, and X-rays and Risk of Spontaneous Abortion Among Nurses**
Christina Lawson[1], Carissa Rocheleau[1], Elizabeth Whelan[1], Eileen Hibert[2,3], Barbara Grajewski[1], Donna Spiegelman[4], Janet Rich-Edwards[2,3]
[1]NIOSH Division of Surveillance, Hazard Evaluations and Field Studies, Cincinnati, OH, USA, [2]Brigham and Women's Hospital, Boston, MA, USA, [3]Harvard Medical School, Boston, MA, USA, [4]Harvard School of Public Health, Boston, MA, USA

2.204 **H1N1 Influenza and Respiratory Protection Programs in California Acute Care Hospitals**
Stella Beckman[1,2], Lisa Brosseau[3], Maryann D'Alessandro[4], Suzi Goldmacher[1], John Halpin[4], Janice Kim[1], Barbara Materna[1], Jennifer McNary[1], Debra Novak[4], Charles Oke[4], Jennifer Zipprich[1], Robert Harrison[1]
[1]California Department of Public Health, Occupational Health Branch, Richmond, CA, USA, [2]Council of State and Territorial Epidemiologists, Applied Epidemiology Fellowship Program, Atlanta, GA, USA, [3]University of Minnesota School of Public Health, Minneapolis, MN, USA, [4]NIOSH National Personal Protective Technology Laboratory, Pittsburgh, PA, USA

2.205 **Improving Respiratory Protection Programs in California**
Kate Durand[1], Barbara Materna[1], Debra Novak[2], Edward Fries[2], Maryann D'Alessandro[2]
[1]Califorinia Department of Public Health, Califorinia, USA, [2]NIOSH National Personal Protective Technology Laboratory, Pittsburgh, PA, USA

2.206 **A Research-to-Practice Partnership for Worker Health in the Long-Term Care Sector**
Laura Punnett[1], Marian Flum[1], Rebecca Gore[1], Yuan Zhang[1], Alicia Kurowski[1], Supriya Lahiri[1], Yaritza Roberts[1], Gabriela Kernan[1], Robert Henning[2]
[1]University of Massachusetts-Lowell, Lowell, MA, USA, [2]University of Connecticut, Storrs, CT, USA

Transportation, Warehousing and Utilities

2.214 **Kentucky Semi Truck Transportation Fatality Investigations: Contributing Factors**
Terry Bunn, Medearis Robertson
University of Kentucky, Lexington, KY, USA

2.215 **Occupational Safety and Health In A Mobile And Hard-To-Reach Worker Population: National Survey Of U.S. Long-Haul Truck Driver Injury and Health**
W. Karl Sieber[1], Jan Birdsey[1], Guang-Xiang Chen[2], Edward Hitchcock[3], Jennifer Lincoln[2], Akinori Nakata[3], Cynthia Robinson[1]
[1]NIOSH Division of Surveillance, Health Evaluations, and Field Studies, Cincinnati, OH, USA, [2]NIOSH Division of Safety Research, Cincinnati, OH, USA, [3]NIOSH Division of Applied Research and Technology, Cincinnati, OH, USA

2.216 **Assessing the Burden of Work-Related Musculoskeletal Disorders in Air Transportation**
Ed Watt[1], Robin Mary Gillespie[2]
[1]Transport Workers Union of America, Washington DC, USA, [2]State University of New York - Downstate, Brooklyn, USA

RAPID Poster Session R5 ..... Regency F

Exposure Assessment

2.108 **Exposure Assessment at an Electrolytic Manganese Dioxide (EMD) processing plant**
Srinivas Durgam
NIOSH Division of Surveillance, Hazard Evaluations and Field Studies, Cincinnati, OH, USA

2.109 **Measurement of Near-road Black Carbon Exposure from Traffic Sources in a Midwestern Urban Area**
Mingming Lu[1], Jiangchuan Hu[1], M. Eileen Birch[2], Jeffery Yang[3], Tim Keener[1], Heng Wei[1]
[1]University of Cincinnati, Cincinnati, OH, USA, [2]NIOSH Division of Applied Research and Technology, Cincinnati, OH, USA, [3]US EPA, Cincinnati, OH, USA

2.110 **Interlaboratory Evaluation of Inductively Coupled Plasma - Mass Spectrometry for the Determination of Trace Elements in Workplace Air Filter Samples**
Kevin Ashley[1], Stanley Shulman[1], Michael Brisson[2], Alan Howe[3]
[1]NIOSH Division of Applied Research and Technology, Cincinnati, OH, USA, [2]Savannah River Nuclear Solutions, Aiken, SC, USA, [3]Health and Safety Laboratory, Buxton, England, UK

2.111 **Urinary S-Benzylmercapturic Acid and S-Phenylmercapturic Acid: Development of an Effective Test Method for Quantification**
Clayton B'Hymer
NIOSH Division of Surveillance, Hazard Evaluations and Field Studies, Cincinnati, OH, USA

2.112 **Research on Assessment of Exposure to Fibers**
Martin Harper, Emily Lee
NIOSH Health Effects Laboratory Division, Morgantown, WV, USA

2.113 **Exposures to Pill Dust at a Mail Order Pharmacy**
Kenneth Fent, Srinivas Durgam
NIOSH Division of Surveillance, Hazard Evaluations and Field Studies, Cincinnati, OH, USA

2.114 **Novel Approach for Analysis of Fine and Ultra-fine Aerosol Particles Using Laser Induced Breakdown Spectroscopy**
Prasoon Diwakar, Pramod Kulkarni, Eileen Birch
NIOSH Division of Applied Research and Technology, Cincinnati, OH, USA

2.115 **Method Development for Wipe Sampling and Analysis of Antineoplastic Drugs in Hospital Operating Rooms**
Thomas H. Connor, Jack R. Pretty, Jeffrey L. McLaurin
NIOSH Division of Applied Research and Technology, Cincinnati, OH, USA

Wholesale and Retail Trade

2.211 **Occupational Health Overview for the Wholesale and Retail Trade Industry in US**
HeeKyoung Chun[1], Vern Anderson[1], Paul Schulte[1], John Sestito[2]
[1]NIOSH Educational Information Division, Cincinnati, OH, USA, [2]NIOSH Division of Surveillance Health Evaluations and Field Studies, Cincinnati, OH, USA

Vibration

2.212 **NIOSH Evaluation of Riveting Hammer Hand-Transmitted Vibrations for Tinker Air Force Base**
Thomas W McDowell, Christopher Warren, Daniel E Welcome, X Sherry Xu, Renguang G Dong
NIOSH Health Effects Laboratory Division, Morgantown, WV, USA

2.213 **The U.S. Naval Supply Systems Command/Navy Clothing and Textile Research Facility (NAVSUP/ NCTRF) and National Institute for Occupational Safety and Health (NIOSH) Partnership for Improving Protection from Work-Related Hand-Arm Vibration Syndrome (HAVS)**
Ren Dong[1], Daniel Welcome[1], Xueyan Xu[1], Christopher Warren[1], Thomas McDowell[1], Susan Krantz[2], Mark Geiger[3], Gavin Burdge[4]
[1]NIOSH Health Effects Laboratory Division, Morgantown, WV, USA, [2]U.S. Navy Clothing and Textile Research Facility, Natick, MA, USA, [3]Naval Safety Center Liaison Office, Arlington, VA, USA, [4]BMT Designers & Planners, Inc., Arlington, VA, USA

Small Business

2.305 **An Agenda for Research Related to Occupational Safety and Health in Small Businesses**
Raymond Sinclair, Thomas Cunningham, Paul Schulte
NIOSH Education Information Division, Cincinnati, Ohio, USA

Services

2.314 **Partnering with Education Unions for the Purposes of Workplace Violence Research**
Hope Tiesman[1], Scott Hendricks[1], Srinivas Konda[1], Dan Mercer[2], Darryl Alexander[3], Harlan Amandus[1]
[1]NIOSH Division of Safety Research, Morgantown, WV, USA, [2]Pennsylvania State Education Association, Harrisburg, PA, USA, [3]American Federation of Teachers, New York, USA

Personal Protective Equipment and Technologies

2.315 **Laboratory Study to Assess Causative Factors Affecting Temporal Changes in Filtering-Facepiece Respirator Fit: Part II - One Year Assessment of Fit Changes**
Ziqing Zhuang[1], Andy Palmiero[2], Stacey Benson[1], Michael Bergman[2], Raymond Roberge[1], Jessica Williams[1]
[1]NIOSH National Personal Protective Technology Laboratory, Pittsburgh, PA, USA, [2]URS Corp., Pittsburgh, PA, USA

2.316 **Evaluation of Impact Resistant Gloves**
Derick Tucker Jr.[1], Naira Campbell-Kyureghyan[1,2], Sai Vikas Yalla[2]
[1]CARGI at the University of Wisconsin-Milwaukee, Milwaukee,WI, USA, [2]I&ME Department at the University of Wisconsin-Milwaukee, Milwaukee,WI, USA

RAPID Poster Session R6..... Regency G

Work-Life Issues

2.207 **A Research-to-Practice Toolkit for Promoting Participatory Health Promotion and Protection**
Robert Henning[1,3], Nicholas Warren[1,3], Michelle Robertson[2,3], Martin Cherniack[1,3]
[1]University of Connecticut, Storrs, CT, USA, [2]Liberty Mutual Research Institute for Safety, Hopkington, MA, USA, [3]Center for the Promotion of Health in the New England Workplace, New England, USA

2.208 **The NIOSH Total Worker Health Program: An Evolution of Research and Partnerships**
Jeannie Nigam[1], L. Casey Chosewood[2], Teri Palermo[3], Steven Sauter[1], Anita Schill[4]
[1]NIOSH Division of Applied Research and Technology, Cincinnati, OH, USA, [2]NIOSH, Atlanta, GA, USA, [3]NIOSH Division of Respiratory Disease Studies, Morgantown, WV, USA, [4]NIOSH Office of the Director, Washington DC, USA

Stress-Related Issues

2.209 **The Effects of Occupational Stress on Worker Health Behaviors**
Jeannie Nigam, Naomi Swanson, Robin Dunkin
NIOSH Division of Applied Research and Technology, Cincinnati, OH, USA

2.210 **Ocupational Stress and Coping Strategies Among Employees of Esfahan Steel Company, Iran**
Masoud Lotfizadehdehkordi, Noor Hassim, Ehsan Habibi
Shahre-Kord University of Medical Sciences, Shahre-Kord, Iran

Communications and Information Dissemination

2.301 **The Encyclopaedia of Occupational Health and Safety: Creating An Online International Resource**
Jeanne Mager Stellman[1], Robin Mary Gillespie[2]
[1]Mailman School of Public Health, Columbia University, New York, NY, USA, [2]RMGillespie Consulting and Department of Environmental and Occupational Health Sciences, SUNY-Downstate Medical Center, Brooklyn, NY, USA

2.302 **Ensuring the Health Hazard Evaluation Program is Responsive to Customers' Needs**
Stefanie Evans, Kenneth Wallingford, Allison Tepper
NIOSH Division of Surveillance, Hazard Evaluations and Field Studies, Cincinnati, OH, USA

2.303 **A Partnership with the Mexican Consulates to Improve Immigrant Workers' Knowledge of Occupational Safety and Health Risks, Rights, and Resources**
Michael Flynn[1], Pietra Check[2], Liz Garza[2], Donald Eggerth[1], Josana Tonda[3]
[1]NIOSH Education Information Division, Cincinnati, OH, USA, [2]NIOSH Office of the Director, Washington, DC, USA, [3]Institute for Mexicans Abroad, Mexico City, Mexico

2.304 **Communication and Information Dissemination at NIOSH: Outcomes and Opportunities**
Leslie Nickels[1], Heidi Hudson[2], Tanya Headley[3], Donna Van Bogaert[4], Fred Blosser[1], Ted Teske[5]
[1]NIOSH Office of the Director, Washington, DC, USA, [2]NIOSH Division of Applied Research and Technology, Cincinnati, OH, USA, [3]NIOSH Office of the Director, Morgantown, WV, USA, [4]NIOSH Education and Information Division, Cincinnati, OH, USA, [5]NIOSH Alaska Pacific Regional Office, Spokane, WA, USA

Prevention Through Design

2.306 **Moving NIOSH Engineering Design Solutions into Practice: Assessment of a Diffusion Process**
John Sheehy[1], Elyce Biddle[1]
[1]NIOSH Division of Applied Research and Technology, Cincinnati, OH, USA, [2]NIOSH Division of Safety Research, Morgantown, WV, USA

2.307 **Variability in Business Case Results Associated with Adopted PtD Design Solutions**
Elyce Biddle[1], John Sheehy[2]
[1]NIOSH Division of Safety Research, Morgantown, WV, USA, [2]NIOSH Division Applied Research and Technology, Cincinnati, OH, USA

Economics

2.308 **Health-Adjusted Life Years and Burden of Disease by NORA Sectors: The National Health Interview Survey (NHIS) 1986-1996**
Kathryn McCollister[1], Peter Muennig[2], Evelyn Davila[1], David Lee[1], William LeBlanc[1], Lora Fleming[1], Alberto Caban-Martinez[1], Manuel Ocasio[1], Tainya Clarke[1], Kristopher Arheart[1], John Sestito[3]
[1]University of Miami, Miller School of Medicine, Miami, Florida, USA, [2]Columbia University, Mailman School of Public Health, New York, New York, USA, [3]NIOSH Division of Surveillance, Health Evaluations, and Field Studies, Cincinnati, OH, USA

2.309 **Incidence and Cost of Depression following Occupational Injury**
Abay Asfaw, Kerry Souza
NIOSH Division of Surveillance, Health Evaluations, and Field Studies, Washington, DC, USA

2.310 **Paid Sick Leave and Nonfatal Occupational Injury**
Abay Asfaw, Regina Pana-Cryan, Roger Rosa
NIOSH Office of the Director, Washington, DC, USA

Cardiovascular Disease

2.311 **Examining the Role of Occupation in Cardiovascular Disease: A Collaboration between NIOSH and REasons for Geographic and Racial Differences in Stroke (REGARDS) Study**
Leslie MacDonald[1], Virginia Howard[2], Sherry Baron[3], LeaVonne Pulley[4]
[1]NIOSH Division of Surveillance, Health Evaluations, and Field Studies, Cincinnati, OH, USA, [2]School of Public Health, University of Alabama at Birmingham, Birmingham, AL, USA, [3]College of Public Health, University of Arkansas for Medical Sciences, Little Rock, AR, USA

2.312 **The Migrant Adolescent WorkLife Study**
Sharon Cooper[1], Eva Shipp[3], Deborah del Junco[2], Charles Cooper[1], Jeffrey Levin[4]
[1]The University of Texas Health Science Center at Houston School of Public Health San Antonio Regional Campus, San Antonio, TX, USA, [2]The University of Texas Health Science Center at Houston, Houston, TX, USA, [3]Texas A&M School of Rural Public Health, College Station, TX, USA, [4]The University of Texas Health Science Center at Tyler, Tyler, TX, USA

2.313 **Public Health Partnerships to Address Workplace Stress and Cardiovascular Disease**
Nicole Champagne[1], Laura Punnett[1], Martin Cherniack[2], Suzanne Nobrega[1]
[1]University of Massachusets-Lowell, Lowell, MA, USA, [2]University of Conneticut Health Science Center, Farmington, CT, USA

Poster Session 1

Tuesday, July 12th

1.101

Making Computer-Based Safety Trainings Accessible to Latino Immigrant Trench Workers: Evaluation of a Spanish-Language Mouse Training for Workers with Limited Computer Experience

Sheli DeLaney
National Education and Information Division, Cincinnati, OH, USA

Abstract

Objectives: An interactive tutorial on using a mouse for first-time computer users was developed as part of a training CD-ROM tailored for Latino immigrant workers in trenching and excavation.

Methods: The tutorial was designed for Spanish-speaking users with varying levels of formal education. It was tested in focus groups with Spanish-speaking immigrant workers with experience in trenching who had little or no previous experience using a computer.

Results: Findings revealed that users with low literacy levels and/or low proficiency in Spanish struggled to complete the tutorial; however, native Spanish speakers who could read at a sixth grade level (the majority of participants) completed it with minimal assistance and scored 80-100% on the performance evaluation.

Conclusions: Based upon results of the performance evaluation, some revisions to the tutorial are necessary in order to make it accessible for the users with the lowest levels of formal education and/or proficiency in Spanish. These revisions should include, among other things, the visual presentation of instructions and prompts in a bold, eye-catching format that relies less upon text and audio.

1.102

The Social Marketing of Tractor Rollover Protection: Exporting an Intervention Model and Expanding Partnerships

Julie Sorensen[1], John May[1], Aaron Yoder[2], Dennis Murphy[2], George Cook[3], Matt Meyers[3]
[1]Northeast Center, Cooperstown, NY, USA, [2]Pennsylvania State University, University Park, PA, USA, [3]University of Vermont Extension, Morrisville, VT, USA

Abstract

In the U.S. farming has the highest fatality rate of any other industry. The most frequent cause of work-related death is tractor overturns. Rollover protection structures (ROPS) are 99% effective in preventing overturn fatalities and injuries, however, approximately half of the U.S. tractor fleet have ROPS. In 2005, researchers from New York laid the groundwork for a social marketing intervention aimed at increasing ROPS installation activity amongst New York farmers. This intervention employed cost-sharing (rebates for 70% of the entire cost to retrofit), carefully tailored messages and promotional activities, as well as a toll-free hotline. Considerable efforts were also made to develop partnerships with equipment dealers, insurance providers, Farm Bureau, and state legislators who provided money for financial incentives, political support, promotional and networking opportunities. The intervention resulted in a ten-fold increase in ROPS sales, a significant shift in farmer's readiness to install ROPS, selection as one of the Centers for Disease Control's High Impact studies, demonstrated cost-savings in year three of the program and 53 reported close calls or overturns by program participants. Based on the success of this program in NY, partnerships with researchers and agricultural representatives in other states have been developed to launch similar programs in VT, PA and NH. This poster presentation will highlight the process used to develop ROPS intervention programs in the three expansion states and will also present the research data that has been gathered to date. This data will include the proportion of ROPS protection in different farm segments, farmer's relative readiness to retrofit, proportion of child operators and prominent barriers and motivators to retrofitting. It will also highlight the most considerable challenges facing these programs.

1.103

Adoption of Cost-effective Roll Over Protective Structures (CROPS) on Farm Tractors: an r2p Perspective

David Hard, E. A. McKenzie, Jr., Doug Cantis
NIOSH/Division of Safety Research, Morgantown, WV, USA

Abstract

Objectives: Cost-effective Roll Over Protective Structures (CROPS) were designed to meet identified needs of the end users (farm tractor owner/operators). CROPS addresses identified barriers to ROPS retrofitting: less costly than many commercial ROPS and "hassle factors," i.e., having to take the tractor to a dealer, trying to find a retrofit ROPS for a tractor, the complexity of the retrofit modification, usability of the tractor after retrofit, and storage of the tractor with a ROPS. To overcome these, NIOSH designed prototypes of a CROPS. Projected retrofit costs were $450, compared to an average of $1,000 and the installation complexity was significantly reduced. NIOSH developed CROPS prototype designs for four tractor models: Ford 3000 series, Ford 4000 series, Ford 8N and Massey Ferguson 135. These four tractor models account for over 1/3 of the tractors which are estimated to not have ROPS on farms. Additionally, these CROPS designs can be cross referenced and likely installed on 37 other tractor models, increasing their scope of coverage. CROPS epitomize the research to practice (r2p) process. In total, this has been an eight year undertaking from the conceptualization process to getting the CROPS into the field.

Methods: With the assistance of state partners, the demonstration phase of the project identified the study population-farmers in two selected states who use tractors which a NIOSH CROPS prototype fits. New York and Virginia were selected because of their high number of tractor roll over fatalities and well established relationships with NIOSH, its partners, and their states' farm population. These state partners/collaborators were essential to the success of the project. They identified the study population, arranged the dates/times for the installation and provided support at the sites. All twenty-five farm tractor owner/operators self-selected in each state to participate in demonstrating retrofitting a CROPS onto their tractor, identifying and allowing friends and neighbors to observe the process at their farm and completing surveys regarding the process. NIOSH personnel were on-site to provide tools, retrofit assistance and deliver the specific model of CROPS.

Results: CROPS retrofitting in New York state was completed in the fall of 2010 with 25 CROPS demonstrators participating and 45 observers attending the CROPS demonstrations (Observers: range=0 - 5, mean=1.8, median=2, mode=0). The NY state farm tractor owner/operators were grateful to be included in the CROPS program and pleased with the outcome of the CROPS installation. Virginia is scheduled to conduct 25 retrofits during spring/summer of 2011.

Conclusions: Adopting safety interventions such as ROPS in agricultural communities has proven to be difficult. The NIOSH designed CROPS were in response to stakeholder input and a step in overcoming identified barriers. If enough demand is created for the CROPS, then it is feasible they will become a commercially viable option. Direct interaction with the study participants/farmers in an actual field setting provided valuable information not obtainable in a laboratory setting (i.e., feedback from the farmers has already improved the installation instructions).

1.104

Signaling and Mayday: Training Vietnamese Shrimp Fishermen of the Gulf Coast

Jeffrey Levin[1], Karen Gilmore[1], Ann Carruth[2], Amanda Wickman[1], Sara Shepherd[1], Gilbert Gallardo[3], William Evert[3], James Elliott[3], Mang Vo[4], Matthew Nonnenmann[1]
[1]The University of Texas Health Science Center at Tyler, Tyler, TX, USA, [2]Southeastern Louisiana University, Hammond, LA, USA, [3]United States Coast Guard, Eighth Coast Guard District, USA, [4]Retired Captain, Houston, TX, USA

Abstract

Background: The commercial fishing trades are among the most dangerous jobs in the world. In the United States, the Eighth Coast Guard District has the second highest level of vessel losses and crew fatalities among commercial fishermen. Preparation of commercial fishermen for emergencies aboard fishing vessels can enhance crew survival.

The current study examines how occupational morbidity and mortality among commercial fishermen along the U.S. Gulf Coast may be influenced by cultural factors and attitudes/beliefs toward occupational exposures and workplace risk factors. During the study it became apparent that language was a significant barrier among Vietnamese shrimp fishermen learning sound signals and making mayday calls. The U.S. Coast Guard (USCG) has reported multiple navigational incidents resulting from failure to properly signal or communicate ship-to-ship via VHF radios. Poor outcomes from emergencies have been the result of failure to effectively perform a mayday call.

Methods: Two key skills identified by the USCG for training are sound signaling and executing a mayday call. Reported training obstacles have been lack of knowledge and language barriers. A model was built replicating a vessel's steering wheel, speed control, horn blast, and radio, in order to simulate the bridge of a fishing vessel. Professional video/audio footage of approaching freighters was produced. Using this footage, vessel captains were instructed by an experienced mariner in Vietnamese how to listen to and signal approaching vessels with the horn. A tip card, with English and Vietnamese instructions, guides practice of the mayday call.

Results: This training has been well received by Vietnamese shrimp fishermen along the Texas and Louisiana Gulf Coast. From 2004-2010, over 500 fishermen were trained (including repeats). The Coast Guard Authorization Act of 2010 has since introduced a new provision requiring individuals in charge of the vessel to pass a training program which includes, among other things, collision prevention, navigation, and ability to communicate in an emergency situation. In response to this prior experience and these new regulatory requirements, the NIOSH Southwest Center for Agricultural Health, Injury Prevention, and Education, in collaboration with USCG Commercial Fishing Vessel Safety, has developed an interactive CD to teach captains critical information about navigational sound signals and the execution of a mayday call. It has been produced in three languages (English, Vietnamese, and Spanish).

Conclusions: The findings of a larger study pointed to an important cultural barrier thought to have an impact on occupational morbidity and mortality. The resulting hands-on training module and CD serve as examples of research to practice (r2p), coincident with new regulation which mandates certification of these competencies or skills. It further illustrates the importance of partnerships and considering cultural factors, including language, in the design and delivery of workplace safety training interventions.

With support from NIOSH Cooperative Agreement 2 U50 OH07541.

1.105

Work Safety Climate, Musculoskeletal Discomfort, Working While Injured, and Depression among Migrant Farmworkers

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Abstract

Objectives: Research documents the association of worker safety climate and health outcomes, including pain and mental health. However, this association has not been examined for migrant farmworkers. Migrant farmworkers experience significant occupational exposures, including chemical, mechanical, and environmental. The aims of this analysis are to (1) describe farmworker perceived work safety climate, and (2) document the association of work safety climate with musculoskeletal discomfort, depression, and working while sick or injured.

Methods: Data are based on interviews conducted with 300 Latino migrant farmworkers recruited from 52 labor camps in three contiguous North Carolina counties. Data collection was part of larger community-based participatory research (CBPR) project. Interviewer administered questionnaires elicited information on perceptions of work associated risks, employer concern for safety, work safety climate, musculoskeletal discomfort, working while injured/sick, and depression.

Results: Participants were largely male (95.0%), over age 30 (68.7%), with <7 years education (53.7%), had worked in farming >2 years (86.3%), and spoke Spanish (100.0%). Over one-quarter (26.3%) of the participants felt that their employer was more concerned with doing the job quickly and cheaply rather than as safe as possible. The majority (71.6%) of farmworkers perceived their work safety climate to be unsafe (>2.5 safety climate score). Most (60.7%) reported having low vs. elevated musculoskeletal discomfort (MSD), 95% not working while injured/sick, and 70.6% found not to be depressed (CES-D <10). MSD was shown to be correlated to perceived grower lack of concern ($p < 0.0001$). Both MSD ($p < 0.0003$) and working while injured/sick ($p = 0.0226$) were found to be correlated with perceived poor work safety climate. In multivariate analysis, depression was found to be more likely in less safe work climates (OR=1.75, CI 1.07-2.86).

Conclusions: This study suggests that a safe work environment is associated with MSD and working while injured/sick among migrant farmworkers, as well as with elevated depressive symptoms. Safety on farms employing migrant farmworkers must be improved. Safety policies and education need to be provided for employers and workers. Further research on work safety climate is needed to help improve the safety of migrant farmworkers.

1.106

Extending Pesticide Safety Training to Farmworker Families: Evaluation of an r2p Demonstration Project

Sara Quandt[1], Joseph Grzywacz[1], Maria Mirabelli[1], Jennifer Talton[1], Grisel Trejo[1], Janeth Tapia[2], Ralph D'Agostino Jr[1], Thomas Arcury[1]
[1]Wake Forest University School of Medicine, Winston-Salem, NC, USA, [2]North Carolina Farmworkers Project, Benson, NC, USA

Abstract

Objective: The Worker Protection Standard (WPS) mandates pesticide safety training for migrant and seasonal farmworkers. Components of the training are pertinent for other family members who may be exposed through take-home pesticides and drift and who may need to implement the home sanitation and hygiene practices prescribed by WPS training. However, no safety training is required or generally provided for family members unless they also are employed as farmworkers. There have been no studies to establish the need for such training. Although several limited studies have demonstrated the effectiveness of pesticide education programs for farmworker families, there have been no large, carefully evaluated demonstration projects to establish the need for training families and the effectiveness of educational programs in improving pesticide safety knowledge. This project translates an effective intervention to improve farmworker family knowledge of pesticide safety to a broader public health context. The goals of this paper are to evaluate (1) the need for such training by measuring family knowledge prior to the intervention, and (2) the change in knowledge following implementation of the intervention.

Methods: Under the supervision of a community-based organization, six public health agencies in eastern North Carolina recruited women from the farmworker community to serve as lay health advisors (promotoras de salud). Promotoras were trained to enroll families with a child ≤12 years and administer a culturally and educationally appropriate curriculum of six lessons in the home. Prior to the beginning of these lessons, a university-based team of interviewers conducted pre-tests to evaluate knowledge related to 18 learning objectives. Post-tests were completed within a month of the last lesson. The program lasted for 18 months.

Results: Adults (usually mothers) in 658 families were enrolled. Most were from Mexico; 62% had <9th grade education; 90% reported 5 or more promotora visits. At the pre-test, fewer than 25% of participants could list long-term consequences of pesticide exposure, describe ways pesticides from farm work enter the home, identify places in the home children can be exposed to pesticides, list cleaning and laundry practices to protect the family from pesticides, and describe ways to eliminate pests from the home without using pesticides. Attrition was low, with 610 participants completing the program. At the post-test, significant increases in knowledge occurred across all 18 learning objectives.

Conclusions: This demonstration project found that farmworker family members lacked knowledge of pesticide safety. The promotora-delivered curriculum produced improvements in knowledge of ways to protect farmworker families from pesticide exposure. The project also demonstrated that women from the farmworker community, with limited training, can effectively deliver pesticide safety training.

1.107

Chronic Back Pain among Hispanic Adolescent Farmworkers

Eva Shipp[1], Sharon Cooper[2], Deborah del Junco[3], Charles Cooper[2]
[1]Texas A&M School of Rural Public Health, College Station, TX, USA, [2]The University of Texas Health Science Center at Houston School of Public Health San Antonio Regional Campus, San Antonio, TX, USA, [3]The University of Texas Health Science Center at Houston, Houston, TX, USA

Abstract

Background: Agricultural tasks require postures, repetitive actions, and heavy lifting that could substantially increase the risk of back injury. Despite their major role in the agricultural economy and the known consequences of back injury, very little is known about prevention of musculoskeletal symptoms among farmworkers especially adolescent farmworkers. These youth could be more vulnerable to such injury since their musculoskeletal symptoms are not fully developed.

Methods: The Migrant Adolescent Health Research Study, through a partnership with the Weslaco Independent School District Migrant Education Department, is a combined cross-sectional/cohort project designed to examine chronic disease risk factors, including back pain, among high school students from Weslaco, TX.

Results: From 2007-2008, 257 migrant education students and 251 of their non-migrant peers enrolled in the study (n=508; 50.0% female; 96.7% Hispanic/Latino; median age of 15.3 years). Currently, baseline data analyses are underway and preliminary findings are available. During the prior twelve months 8.2% of those who did farm work during the same time period reported chronic low back pain (lasting more than three months) compared to 4.9% of non-workers. The prevalence of this pain was higher for those 16 years of age and older (10.5%) versus those under age 16 years (4.6%). The prevalence was also higher among those who performed common farm work tasks compared to those who did not: twisting repeatedly from the waist (25.6% vs. 3.0%), lifting heavy loads repeatedly (16.7% vs. 4.3%), working harder and faster than preferred (13.9% vs. 6.1), and repeatedly bending/stooping (11.8% vs. 3.4%). Data also provide evidence that disordered sleep is also associated with this condition.

Conclusions: Preliminary findings support additional and more rigorous analyses that are forthcoming. This study addresses the Agriculture, Forestry, and Fishing Sector Strategic Goals 2.2 and 5.1.

1.108

Developing an Updated NIOSH REL for Hexavalent Chromium Compounds

Kathleen MacMahon[1], Robert Park[1], Faye Rice[1], Kevin Ashley[2], Leo Michael Blade[3], Thomas J. Lentz[1], Chris Sofge[1], Paul Schulte[1]
[1]NIOSH Education and Information Division, Cincinnati, OH, USA, [2]NIOSH Division of Aplied Research and Technology, Cincinnati, OH, USA, [3]Private Consultant, Cincinnati, OH, USA

Abstract

Objectives: NIOSH evaluated the available scientific information about occupational exposure to hexavalent chromium (Cr(VI)) compounds to update its recommendations for protecting Cr(VI)-exposed workers, including the development of a revised recommended exposure limit (REL). A quantitative risk assessment of human health effects data indicated that workers were at considerable risk of death from lung cancer at the NIOSH REL. The basis of these updated recommendations is being documented in a NIOSH Cr(VI) Criteria Document Update. The audience for this policy document is the occupational safety and health community and employers in all industry sectors with potential Cr(VI) exposure including manufacturing, utilities, and construction.

Methods: An interdisciplinary cross-Institute team of NIOSH experts evaluated the available scientific research and peer-reviewed literature about occupational exposure to Cr(VI) compounds. The draft NIOSH Cr(VI) Criteria Document Update provides a comprehensive overview of this assessment. Much of the critical research evaluated was conducted by NIOSH and its partners including: the toxicologic effects of Cr(VI) in the laboratory, variables affecting exposures, field investigations of exposures and engineering controls, and validated analytical chemistry laboratory and field methods. A quantitative risk assessment was conducted for a cohort of chromate production workers to characterize the risks of lung cancer at a range of exposure levels. The draft document was presented at a NIOSH public meeting and has undergone external peer and public review. It is currently being revised to respond to the external review comments submitted to NIOSH.

Results: The NIOSH Cr(VI) Document Team developed a draft Criteria Document Update which provides the bases for the updated NIOSH policies and recommendations for preventing and controlling Cr(VI) exposure. Based on the results of the NIOSH risk assessment, a proposed REL of 0.2 µg Cr(VI)/m3 8-hour time-weighted average (TWA) exposure during a 40-hour workweek is recommended. This proposed REL has an estimated working lifetime risk of death from lung cancer of approximately one in 1000. Site visits and exposure data indicate that this proposed REL is achievable in some but not all workplaces. NIOSH analytical methods can accurately measure this level of Cr(VI) in the workplace. Engineering controls are recommended to help prevent and control exposures.

Conclusions: The NIOSH evaluation of occupational exposure to Cr(VI) compounds indicated that the NIOSH REL should be revised to better protect workers. Based on the NIOSH quantitative risk assessment a proposed REL of 0.2 µg Cr(VI)/m3 8-hr TWA is recommended to decrease workers' risk of lung cancer death. Work practices and control processes are recommended based on the research of NIOSH and its partners. The draft Criteria Document Update is going through the final steps required for the publication of a highly influential scientific assessment. NIOSH will collaborate with trade associations, labor organizations, and others in the occupational safety and health community to disseminate these updated recommendations to employers in those industry sections with Cr(VI)-exposed workers including manufacturing, utilities, and construction.

1.109

Evaluation of Safety in Nighttime Highway Work Zones

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Abstract

Safety of nighttime highway construction work zones has become a major concern for state transportation agencies due to the increase in the number of nighttime projects being performed at night for reducing traffic congestion created by highway work during the day. The work presented in this poster covers two key outcomes of a five-year research study on the assessment of safety of nighttime highway construction work zones. These include: i) the results of experimental and analytical methods implemented for improving safety of nighttime highway construction work zones; and ii) the research-to-practice tools for transferring the findings into practice. The findings are presented in four major areas: (a) causes of fatal occupational accidents in work zones, (b) effectiveness of speed control strategies, (c) effectiveness of high-visibility garments, and, (d) impacts of qualitative nighttime factors on productivity of the operation. In addition, this poster also discusses examples of the tools that can be used for translating the results of research studies related to safety of workers and safety planning of nighttime work zones into practice. A web-based training tool and decision support system related to safety of nighttime work zones are presented in the poster. The objectives, functionalities (i.e., what the tools can do for the users), the components (e.g., knowledge base, data base and interfaces), the structures (i.e., how the components of the tools are organized to meet the objectives) and the evaluation of each of these tools are explained. Finally, further research efforts for translating research results into practice for safety improvement of nighttime construction work zones are discussed.

1.110

Measuring the Impact of Green Jobs on Construction Worker Safety and Health

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Abstract

Objectives: To assess new and excess hazards related to green jobs in the construction industry and address the NIOSH emerging priority of "making green jobs safe" in order to meet the needs of construction stakeholders.

Methods: We will analyze multiple years of data from six large, nationally representative data sources, including the new BLS Green Goods and Services (GGS) survey, Census of Fatal Occupational Injuries (CFOI), Survey of Occupational Injuries and Illnesses (SOII), Occupational Employment Statistics (OES), Quarterly Census of Employment and Wages (QCEW), and the O*NET. To quantify safety and health risk attributed to green construction, we will create a Green Relevance Scores (GRS), which is the proportion of green jobs in detailed construction industries and occupations. Using the GRSs we created, we will calculate the attributable risk of green jobs for construction industries and occupations by time series analysis of the BLS surveys and the green occupational categories developed by the O*NET.

Initial Results: Using the definition of green industry from the Bureau of Labor Statistics, we estimate that up to 91% of the construction workforce could be directly or indirectly involved in green jobs. Regarding potential exposure to hazards, our initial findings indicate that approximately 432,000 construction workers could have increased fall risk from solar or wind power construction, skylights, or atriums; more than 22,000 could be exposed to hazardous materials from weatherization. In addition, about 155,000 cement masons, concrete finishers, and terrazzo workers, and nearly 25,000 insulation workers could be exposed to hazards such as silica, coal ash, or toxic nanomaterials from green building materials. Moreover, as many as 682,000 construction laborers could be exposed to injury hazards (e.g., sprain and "struck-by" hazards) as well as hazardous materials due to increased recycling at construction sites. We expect to obtain detailed measures and statistics when the BLS GGS survey data are available in 2012.

Conclusion / Expected Outcomes: A growing proportion of construction workers are performing green-related activities. Nevertheless, current critical criteria of "green jobs" and "green construction" do not include measures of worker safety and health. Through this study, we expect to identify new and excess risks associated with green jobs in construction; provide information and insight to support current and future construction safety and health interventions in the green economy; contribute to developing standards to measure green and safe jobs in construction; and contribute novel research methodologies to the literature by integrating economic indicators into safety and health measures.

1.111

Tracking Safety and Health in the Construction Industry

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Abstract

Objectives: Track construction safety and health to provide a basis for more effectively targeting injury- and illness-prevention efforts. This poster is a summary of recent findings from our ongoing project funded by NIOSH.

Methods: A multitude of data sources were analyzed for this project, including the Census of Fatal Occupational Injuries, Survey of Occupational Injuries and Illnesses, Current Population Survey, Medical Expenditure Panel Survey, and County Business Patterns.

Results:

Trends in Fatal and Nonfatal Injuries in Construction, 1992-2009: We tracked work-related fatal and nonfatal injuries among construction workers in 1992-2009, focusing on recent trends during the economic downturn. Construction employment dramatically increased in 1992-2007, and then declined by more than 2 million from 2007 to 2009. The employment change was reflected in construction injuries: fatal injuries increased from 963 in 1992 to 1,297 in 2006, and then declined to 859 in 2009[1]. Such fluctuations were striking for Hispanic construction workers: Hispanic employment grew from 600,000 to 3 million in 1992-2007 and shrank to 2.3 million in 2009. The number of Hispanic fatalities in construction was 360 in 2006 and dropped to 218 in 2009. Although nonfatal injuries consistently declined over time, the injury rate in construction was still nearly 50% higher than across all industries in 2009. From 2003-2009, construction laborers had the highest number of fatalities across construction occupations; while ironworkers, electrical power installers, and roofers had the highest fatality rates. The nonfatal injury rate for sheet metal workers was the highest in construction.

Injury Underreporting among Small Construction Establishments: We analyzed fifteen years of data from five large, nationally representative data sources. The analyses were stratified by establishment size and Hispanic ethnicity. Our findings suggest pervasive injury underreporting in the construction industry, and small construction establishments were most likely to underreport injuries, especially for Hispanic workers. We estimated that SOII captured only 25% of severe injuries among Hispanic workers, and 60% among white workers in small (1-10 employees) construction establishments. A paper with these findings was recently published in the American Journal of Industrial Medicine (PMID 21246588).

Fatal Falls among Construction Workers, 1992-2009: Injuries from falls continued to be the No. 1 cause of fatalities in construction - a total of 6,589 deaths over 1992-2009. The proportion of fatal falls went up from 28% in 1992 to 36% in 2007. Although total construction fatalities dropped, falls still caused 32% of the fatal injuries in 2009. Falls from roofs accounted for one third of all fatal falls in construction in 2003-2009. Hispanic immigrant workers had a higher risk of fatal falls than other workers. In addition, work-related fatal falls were more likely to occur in residential construction sites than other locations. More than half of fatal falls in residential construction were from below 16 feet height.

Conclusions: The construction industry still faces higher injury risk despite the recent housing downturn. Nonfatal injuries are underreported in construction, particularly among small establishments. The results also support the recent OSHA fall protection enforcement in residential construction.

1.112

Safety and Health among Older Construction Workers

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Abstract

Objective: To share our recent findings on safety and health among older construction workers from the Lifespan project funded by NIOSH.

Methods: We performed a variety of empirical data analyses to examine health and injury trends in aging construction workers. Our longitudinal analyses used data from the Health and Retirement Study (HRS, 1998-2008), a nationally representative longitudinal survey of U.S. residents age >=50. To study fatal fall trends, we used data from Census of Fatal Occupational Injuries (CFOI) and Current Population Survey (CPS) from 1992 to 2008. Further, we are developing an estimate of the lifetime probability of a construction worker, when reaching age of 60, having a fatal or nonfatal occupational injury, and of developing a chronic health disorder using multiple types of data.

Results:

Chronic Diseases and Functional Limitations (Health and Retirement Study, 1998-2008): Compared to white-collar workers, workers whose longest job was in construction trades were more likely to have functional limitations, arthritis, back problems, chronic lung disease, or stroke at the 10-year follow-up. Disparities in health outcomes between construction and white-collar workers increased over time, as construction workers experienced exacerbated aging-related declines. (A paper with the findings will be published in the Journal of Occupational and Environmental Medicine).

Fatal falls among Older Construction Workers: Older construction workers (age >=55) had higher rates of fatal falls than younger workers, significant in 11 of 14 occupations. The fatal fall rate for older roofers (the highest risk occupation) was 60.5 per 100,000 FTEs, nearly triple the rate of 23.2 per 100,000 FTEs for younger roofers. Older decedents had a 50% higher likelihood that work-related death was caused by a fall, after controlling for major demographic and employment factors. Falls from roofs accounted for nearly one-third of construction fatal falls overall, while ladder falls caused a larger proportion of deadly falls in the older decedents than in younger decedents.

Lifetime Risk of Injury/Illness: We are developing an estimate of the lifetime probability of a construction worker having a fatal or nonfatal occupational injury, and of other health problems. Multiple years of data from several large national data sources will be used. Preliminary estimates indicate that a 60 year old construction worker today has a lifetime probability of approximately 0.60% for a fatal injury, at least one (>110%) lost time injury event, and about 35% for a lost-time MSD. In addition, we observed probability of about 20% for any pneumoconiosis, 20% for COPD, and 50% for NIHL among some construction trades and worksites. We will present a range of estimates for outcomes described above.

Conclusion: Construction workers are at increased risk of chronic diseases and functional limitations as they age. Older workers have higher likelihood of fatal falls. An estimate of lifetime risk for injury will help define the scope of the problem. As the construction workforce ages, there is urgent need to enhance fall prevention efforts, provide work accommodations, and match workability to jobs.

1.113

Active and Passive Tobacco Smoke Exposures: A Construction Workplace Health Assessment Pilot Study

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Abstract

Objective: Despite high smoking rates, there has been limited development of tobacco assessment and smoking cessation outreach strategies targeting construction workers. Strategies to reach high-risk worker groups in the construction sector may vary depending on the union status of the State. In the present study we report the prevalence of active and passive tobacco smoke exposure from a convenience sample of non-unionized construction workers in Miami, Florida patronizing construction site lunch trucks.

Methods: A workplace tobacco smoke assessment was undertaken with a convenience sample of 54 workers (91% are of Hispanic ethnicity) employed at two large construction sites in South Florida. While visiting these two construction sites during scheduled breakfast and lunchtime breaks, a language sensitive questionnaire preloaded onto handheld devices was used to record questionnaire data captured from the construction workers. The interview was administered in either English or Spanish to suit the preferences of the interviewees. Salivary and hair samples for cotinine and nicotine assays were collected (reflecting short- and long-term smoke exposure, respectively). A telephone callback survey was administered 2 weeks after the construction site visit to assess use of smoking cessation resources provided during the assessment.

Results: Thirty-five percent of construction workers were self-reported never smokers, 28% former smokers and 37% current smokers. Thirty-seven percent of never smokers and 40% of former smokers had biological samples suggesting passive tobacco smoke exposure (cutoff >3.0ng/mL for saliva and >0.23ng/mg for hair). Among smokers, 60% reported their intent to stop smoking in 30 days, and at follow-up virtually all smokers reported reviewing the smoking cessation materials 2 weeks after the site visit (95%), and 85% of the smokers shared and discussed the provided cancer risk and smoking cessation materials with family members.

Conclusion: We found evidence of passive tobacco smoke exposure among never and former smokers, as well as interest among current smokers for smoking cessation resources. Workplace smoke cessation strategies that reduce tobacco use and exposure via innovative engagement methods (e.g. lunch truck) particularly among non-unionized construction trade workers are highly needed.

1.114

Metal Arc Welding Hazard Reduction by Selection of the Best Combination of Shield Gas and Metal Transfer Mode

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Abstract

The primary goal of the proposed project is to identify and develop ways in which the best current common gas metal arc welding practices may be selected to reduce worker exposure to welding fumes. The understanding of how process conditions influence fume profiles can significantly contribute to creating strategies for minimizing fume exposures and selecting engineering controls to avert adverse health effects.

A welding chamber was designed and fabricated based on an American Welding Society chamber, and was adapted for use with a 102 mm filter holder and external monitors for ozone and total particulate matter. The welding piece is rotated with a motorized turntable, and flow was upward through a 102 mm electrets filter at 200 liters/min. The system was validated in the AWS specification test using mild steel axial spray mode with 100% CO2. Monitoring with both the DataRAM for TSP and a UV-ozone monitor, ozone was cleared in <2 minutes from the chamber, and TPM generally within 3 minutes after the arc time was completed.

1.115

Assessing Control Measures for Mitigating Exposures during the Production of Carbon Nanotubes

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Abstract

The purpose of this study is to investigate the effectiveness of control measures used by a company which produces carbon nanotubes (CNTs). This facility uses ventilated enclosures connected to air handling units (AHUs) to control their workplace. Based on the toxicology research on CNTs, workplace controls have been recommended to prevent or minimize exposure to workers. The use of engineering controls in nanomanufacturing workplaces has been reported, but there is a dearth of detailed information regarding their effectiveness. This site survey was conducted by the NIOSH Control Technology Team, collaborating with the Center for High-Rate Nanomanufacturing (CHN) at the University of Massachusetts Lowell. NIOSH and CHN have established an official partnership to work on the evaluation of potential exposure to nanomaterials in the workplace and provide recommendations to improve safety and health.

Ventilated enclosures were used to contain the production furnaces for synthesizing the carbon nanotube products at the study site. Two AHUs equipped with prefilters and main filters were used to remove airborne contaminants from exhaust air taken from the enclosures prior to exhausting the air to the outside. Real time measurement instruments including the Fast Mobility Particle Sizer (FMPS), Aerodynamic Particle Sizer, and DustTrak aerosol monitor. Measurements were made during a range of work activities including normal operation, maintenance, and product harvesting. Air velocities at each furnace enclosure were measured using a thermal anemometer to access contaminant capture velocity. The filtration efficiency of the AHUs was evaluated by measuring the upstream and downstream particle number concentrations using dual FMPS instruments.

The total background concentrations in the production room were in the range of 4.2E4 to 9.1E4 particles/cm^3. The test results showed that maintenance of furnaces generated nanoparticles two times higher than background, and product harvesting released nanoparticles at least one order of magnitude higher than background. Moreover, it was found that the sampling results of an enclosure were influenced by the nanoparticles migrating from the maintenance task performed for the adjacent furnace. The enclosure doors of some furnaces were kept open for easy access and to abate excess heat during production. This work practice degrades the performance of the ventilated enclosures. The filtration efficiency of the AHU serving two large furnaces was 99.92%, while the other AHU handling seven furnaces was only 83.17%.

Better containment design was recommended. Enclosures should be improved to accommodate access for workers and to address excess heat buildup while maintaining good containment of nanoparticles. At this study site, maintaining higher exhaust flowrates to obtain adequate face and capture velocities at enclosure openings should provide better protection for production workers.

The use of a pressurization scheme and production area isolation should be considered. Further, it is important to use separate ventilation systems for office and production areas to reduce the risk of exposure to non-production workers in other areas such as laboratories and offices.

1.201

Identifying and Promoting Excellence in Hearing Loss Prevention through the Safe-in-Sound Award

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Abstract

In both the health care and the occupational health arenas, recognition of benchmarks, awards, and incentive schemes are receiving increasing attention for their role in promoting excellence and adoption of preventive programs. Specifically, regarding the prevention of occupational hearing loss, few awards or incentive programs exist worldwide. Some incentives exist, however, to control noise or chemical exposures. Little has been published regarding the effectiveness of hearing loss prevention interventions. In its review of the National Institute for Occupational Safety and Health (NIOSH) Hearing Loss Research Program, the National Academy of Sciences recommended that NIOSH place greater emphasis on identifying the effectiveness of hearing loss prevention measures on the basis of outcomes that are as closely related as possible to reducing noise exposure and work related hearing loss. Once this need was identified by the National Academy, funds from the National Occupational Research Agenda (NORA) were awarded to a Public Health Practice project that established an award for excellence in hearing loss prevention. The Safe-in-Sound Award™ was created in 2008 to formally recognize and disseminate the methods of organizations that have demonstrated excellence and innovation in hearing loss prevention programs. Three "Excellence in Hearing Loss Prevention" awards were created, one for each of the three economic sectors providing funding for the project (construction, manufacturing and service) and one "Innovation in Hearing Loss Prevention" award open to any industrial sector or individual. In the past five years, NIOSH partnered with the National Hearing Conservation Association (NHCA) for the management of the award, contracted for its name definition and logo design, trademarked the name, developed nomination and evaluation criteria for the award, had it reviewed externally, created the website www.safeinsound.us, monitored visits to the website to quantify interest and evaluate the drawing power of different advertisements placed in various channels, and developed communication materials. Three rounds of awards have been completed, with awards being given to all participant sectors. A wealth of information on best practices for hearing loss prevention has been obtained through the award winning nominations. A description of the key elements that contributed to each success story is available online, and communication products have been published. Feedback received from stakeholders indicate that the awards are seen as a useful tool for raising awareness of risks and potential solutions, for promoting and encouraging the adoption of good hearing loss prevention practices and the proposal and evaluation of innovations. NIOSH and NHCA have been able to partner with award recipients and are currently reaching out to users of the new products for their feedback, as well as support from other industrial sectors to expand its reach.

1.202

Establishing Valid Sound Pressure Level Measurement Methods in Orchestra Musicians

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Abstract

Introduction: More people are afflicted with noise-induced hearing loss than all other occupational injuries combined, making it the leading occupational disease and a serious public health issue. Ten million Americans have permanent hearing impairment attributable to workplace noise exposure, and although it has been documented in symphony orchestra musicians, little is known about actual workplace sound pressure levels to which orchestra musicians are exposed, leading to difficulties in educating about prevention.

Objective: The difficulty of evaluating the risk of NIHL for orchestra musicians is more complex and problematical than for other industrial exposure due to the significant variation in sound levels and exposure times. Because sound itself is the workplace product, musicians have vocational hearing demands much greater than those required in most professions. They must be able to do more than understand conversational speech. Consequently, the music performance environment poses not only critical hearing demands, but also noise hazards. A musician is subjected to two noise sources: his own instrument as well as those of others in close proximity.

Methods: This study utilized a custom designed wireless personal noise dosimeter, not currently available to the public, to measure noise exposure at the level of the ear, resulting in data heretofore available. The device is the size of a standard behind-the-ear hearing aid, and logs sound pressure levels in 3 decibel increments, resolving time values in one second intervals. This pilot study was conducted using professional musicians performing a work from the standard repertoire, in a performance venue.

Results and Conclusions: Results demonstrated significant exposure levels and daily dose within small time frames, and significant difference in exposure according to seat within the ensemble and placement of instrument. This pilot study demonstrates the need for individual noise exposure assessment in orchestral musicians and provides evidence of exposure in excess of NIOSH guidelines. These data aid in the establishment of risk of NIHL in this little studied workforce population.

1.203

Hearing Loss: Towards Knowledge, Competency, and Accountability Among Music Professionals

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Abstract

Music is implicated as an important causal factor to wide-spread occupational and public health-related problems stemming from sound exposure that reach across and beyond occupational sectors, and into educational arenas and virtually all social contexts. This is a complex societal problem because, whereas occupational noise is often undesirable, music is a highly valued art form that contributes to the quality of life for millions of Americans. Adding to this complexity, virtually all music professionals, including those that work as teachers, performers, and producers, lack awareness, knowledge, and competency to manage risk related to musical behaviors. Music professionals are not sufficiently knowledgeable to recognize hazardous conditions, speak up about occupational safety, teach these concerns to others, adjust their professional practices to meet these concerns, or to engage in preventative and protective behaviors. Furthermore, there are no federal guidelines or regulations for music-related activities, certification standards for public school music educators that ensure knowledge or competency to manage risk, related national accreditation standards for tertiary level training institutions, or effective exposure assessment or intervention methods designed for understanding or responding to risky situations. The purpose of the poster is to describe an interdisciplinary university-based research agenda designed to address this problem.

Participants include researchers from several disciplines including music, audiology, engineering, public health, and others in coordinated efforts to develop 1) safety policies designed to protect teachers and students, 2) occupational health courses for music professionals in training, 3) the largest exposure database of music-related activities, 4) first-ever field studies of so-called "musician" hearing protectors, 5) technological advances for continuous surveillance and direct assessment of risks, 6) novel algorithms for analyzing sound levels produced by musical events, and 7) ongoing efforts to influence national agencies that accredit tertiary-level institutions that train music professionals. The results of this ongoing research highlight the need to create and impart knowledge, facilitate widespread change, institute competency, and most importantly, help cultivate a culture of responsibility and accountability throughout the music disciplines. Outcomes from this research agenda have attracted the attention of numerous professional organizations in and beyond music, regional and national media outlets, and numerous schools of music around the world. The National Institutes of Occupational Safety and Health, together with the National Hearing Conservation Association, bestowed the 2010 Safe in Sound Award to this effort. Unprecedented technical, logistical, practical, and policy-related gains are possible when music-related occupational health problems are addressed through interdisciplinary research teams involving musicians, in the context where musicians are trained, and on behalf of fellow musicians.

1.204

Evaluation of Noise Exposures at an Aluminum Beverage Can Manufacturer

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Abstract

Investigators from the NIOSH health hazard evaluation program assessed noise exposures and hearing loss at an aluminum beverage can manufacturer. We used personal noise dosimeters to measure full-shift noise exposures of 26 workers. All monitored workers' noise exposures exceeded the NIOSH Recommended Exposure Limit and some exposures exceeded 100 dBA. Based on our review of 1182 audiograms from 1988 to 2008, for 104 production employees, more than 40% of the workers had a hearing threshold shift since their hire date and 14% of employees had enough hearing loss to meet the NIOSH definition of material hearing impairment. The baseline audiogram for 17% of the workers had been completed more than 1 year after hire, and the time between successive audiograms was more than 1 year for 73% of the audiograms. Workers wore hearing protection, but some did not wear foam insert hearing protectors correctly. We recommended installing engineering controls to reduce noise, wearing dual hearing protection when exposures exceed 100 dBA, providing additional instruction on proper use of hearing protection, completing baseline audiograms upon hire, and using NIOSH criteria to determine hearing threshold shift.

1.205

Implementation and Process Evaluation of a Participatory Ergonomics Program in Floor Layers

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Abstract

The construction industry continues to experience high rates of musculoskeletal injuries despite the widespread promotion of ergonomic solutions. It is critical to address the existing barriers to implementing recommended ergonomic modifications to assist workers and employers in adoption of solutions. Participatory ergonomics (PE) has been suggested as one approach to engage workers and employers, although a recent systematic review of PE programs using health outcome measures showed inconclusive results.[1] Limited documentation in previous studies included insufficient program description, unclear implementation strategies, and lack of detailed process measures.[1,2,3] In order to gain a clearer interpretation of intervention findings, the use of process evaluation[1] with a variety of process measures is needed.

Objectives: In this study we will: 1. provide a description of a PE training for floor layers and its process evaluation using a proposed logic model, 2. describe the development of a variety of quantitative and qualitative process evaluation approaches and the process measures being gathered, 3. present preliminary findings from the process evaluation, and 4. consider potential facilitators and barriers to the program for improvement of the PE program delivery in future groups of floor layers.

Methods: A pilot group of eight floor layers was recruited from a partnering contractor to participate in ergonomics training and group meetings for a four-month period. Before training, researchers conducted physical exposure assessments to identify the high-risk work tasks. Initial training presented general ergonomic principles using video examples from the exposure assessments. Subsequent training guided workers in identifying solutions to the highest risk tasks. Process measures were collected to assess the degree of fidelity of program implementation including 1. workers' opinions about their training, job performance, work organization, safety culture, and willingness to change work behaviors, 2. researcher training notes, 3. PE group meeting logs, and 4. researcher observations on compliance with proposed solutions.

Results: Our preliminary results show that floor layers were active participants in the ergonomics team and identified problem tasks and potential solutions. We will present the initial results including workers' perceptions of the training, job factors, safety culture and willingness to change, researchers' description of the training context and implementation, group meeting attendance and number of identified problems and solutions, and the number of proposed ergonomic solutions performed by workers. We invite colleagues to provide input to this ongoing project.

Conclusions: Workers were interested in the participatory process, willing to participate, and appeared actively engaged. Participatory ergonomics programs, though suggested as an ideal way for infusing ergonomics into a construction cohort, have shown inconsistent results in other industries. Development of useful and measurable process indicators can guide the delivery and evaluation of a PE program to determine if PE is an effective intervention to improve worker health.

1.206

Intervention Effectiveness in Reducing Risk of Musculoskeletal Disorders in Airport Baggage Screeners and Handlers

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Abstract

Musculoskeletal disorders (MSDs) associated with manual baggage screening and handling account for a large proportion of the workers' compensation costs for the Transportation Security Administration (TSA) and airline companies. In 2004-2008, the average annual 20% MSD rate in the airport baggage screeners and handlers were among the highest MSD rates in the 600 occupational groups tracked by the US Bureau of Labor Statistics. TSA spends approximately $20-47M per year for MSDs-related workers' compensation claims. For the US airline companies, the estimated total annual costs for MSDs exceed $100 M. In the recent two decades, many risk reduction technologies used in other industries have been adapted to solve the great health problem in the aviation industry; however, implementation of interventions based on the new risk reduction technologies has been slow and unsupported by the management. The main reason for the management's unwillingness to use the interventions is due to absence of objective information about the effectiveness of the interventions. The secondary reason is lack of information dissemination on the new risk reduction technologies. Therefore, the objective of the study is to assess interventions based on new technologies that are available for TSA and airline companies to use for reducing MSDs. NIOSH has been partnering with TSA and a large airline company to promote the risk reduction technologies and some best work practices. Two interventions were identified and evaluated. They included a vacuum baggage lifting assist device and an automatic baggage moving system, which were assessed at two separate airports. Operational hand force and posture data for the interventions were collected from mock-up operations using a force gauge and a digital video camcorder. Risk data (i.e. back compression force at L4/L5) associated with the interventions was analyzed by a video analysis employing the University of Michigan's 3D biomechanical model. Using 50 lb baggage weight for risk calculations, the average back compression forces for using the vacuum lifting device and baggage moving system were 289 and 453 lbs, respectively. The reductions in the back compression force were about 60% and 37% for the vacuum lifting device and baggage moving system, respectively. Pros and cons of using the interventions are discussed. Findings of the evaluations suggest that the interventions have a great potential for reducing long-term MSD rates and costs related to manual baggage lifting and handling. In 2011, two NIOSH documents pertinent to airport baggage screening and handling are planned to be published and disseminated to TSA and the airline industry for injury prevention.

1.207

Improving Ergonomics at Electric Power Generation Utilities: A story of a successful partnership

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Abstract

Introduction: Power Utility workers suffer a fatal injury rate of 3.9, the fifth highest of all industry sectors, with a non-fatal Incidence Rate (IR) of 3.3. Many of these injuries are preventable. The focus of this paper is on the screening of tasks performed by Electric Power Generation utility workers in order to determine and prioritize tasks for improvement.

Objectives: The goal of entire project was to (1) evaluate ergonomic risk factors for power generation utility workers, (2) propose changes to reduce workplace injuries, and (3) prioritize the job/tasks for improvement.

Methods: A safety-conscious company with a low incidence rate aimed to further improve their safety and ergonomics, and has partnered with the research team since 2008 to develop and implement ergonomic improvements. The research team videotaped employees performing various tasks. The video was then analyzed using qualitative and semi-quantitative ergonomic assessment tools such as PLIBEL, REBA and RULA. Productivity and cost-benefit analyses were estimated using facility layout evaluation methods (Relationship-charts and Spaghetti diagrams).

A retrospective analysis was performed for the data provided by the company for injuries incurred between 2004-2009.

The job/tasks were categorized into low/medium/high priority based on a) previous injury reports, b) ergonomic evaluation results, and c) proposed engineering and administrative controls categorized as no cost/low cost or capital investment.

Results: The top injury categories were: struck by/caught by an object (30%), overexertion (15%), and falls (10%).

Twenty-four tasks were observed in eight different locations. The observed tasks were spread evenly over two main employee groups: maintenance and operations, and consisted of various manual material handling activities including lifting, carrying, pushing, and pulling. Ergonomic evaluation scores from PLIBEL, RULA or REBA indicated that all observed tasks need improvement.

Since all observed tasks could be improved, and both maintenance and operations incurred injuries, the proposed solutions were the deciding factor for prioritizing improvements. The proposed improvements for operation employee's tasks included more low-cost, no cost solutions than for maintenance tasks. For example, one task, coal sampling is completed nearly every day, and received a moderate or higher injury risk score in ergonomic evaluations. Examples of recommendations included:

Modifying facility layout: reduces travel distance and improves productivity by ~30%

Use lighter materials in tools: reduces lifted weight by 11.8%

Limit loads carried/lifted to less than 40 pounds: reduces risk of overexertion injury

Installation of automated equipment: reduce lifting/carrying ~80%

Summary: The company began implementation of the low-cost/no-cost solutions for the coal sampling process. From a combination of efforts, including this ergonomic project and other safety initiatives, the company continues to excel in safety. The company's 2010 (IR=1.5) was far below the national non-fatal IR of 3.3, and they received a safety award in 2009 and 2010.

1.208

Ergonomic Injury Surveillance, Evaluation and Intervention for Electric Utility Substation Workers in the USA

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Abstract

The Electric Power Research Institute (EPRI) Occupational Health Surveillance Database (OHSD), started in 1999, provides information on the occurrence of workplace injury and illness among workers in the electric energy industry. The objectives of the OHSD are to: 1) monitor trends of injury and illness over time, job characteristics, and demographic factors; 2) identify occupations that have higher work-related injuries and illnesses rates; 3) quantify costs and lost time due to work-related injuries and illnesses; 4) evaluate the effectiveness of prevention programs; 5) establish specific benchmark standards for injury/illness monitoring purposes; and 6) provide a reliable basis for establishing specific occupational health research priorities. To do so, personnel, injury, and occupational health and safety data were collected from eighteen electric utility companies. Seven of these utilities provided data for the entire study period, 1995 - 2009, with the remaining eleven utilities contributed data for portions of the 15-year period. The database currently includes 1,620,941 employee-years of follow-up and 58,786 reported individual injuries among the eighteen participating electric utility companies that voluntarily supply OHSD information. The workforce in this database is predominantly male between 41-50 years of age. The most common injuries were sprains and strains (26.9 to 44.8%) across the ten year age group distributions. Using 1995-2009 data from eighteen utilities, the highest percent of full-time equivalent lost were back/trunk injuries (21.6%), followed by neck and shoulder injuries (12.9%) and upper extremities injuries (7.0%). As the majority of the injuries were strains and sprains, the Occupational Health and Safety (OH&S) Program of EPRI has an initiated a large-scale ergonomics project which has developed ergonomic interventions for various tasks performed by workers in generation, transmission and distribution sectors of the electric power industry. More recent efforts have been geared toward substation workers. Workers with a primary job location of 'substation' represent 2.3% of the OHSD workforce; common job classifications include maintenance workers and plant equipment operators. At this primary location assignment, the overall injury rate remains near 4 injuries per 100 employee-years, with one-third due to overexertion or body motion, most commonly involving the back or trunk; hand or fingers; and, neck or shoulder. To better understand specific tasks to target interventions and assess workplace factors, researchers visited five large utilities across the U.S. The research team took measurements of workspace dimensions, weight, and force required to perform tasks, and range of adjustability of tools and equipment used. Specific ergonomic recommendations were made for improvement of various tasks requiring excessive force and/or repetition. Current EPRI OH&S ergonomics work focuses on evaluation of the effectiveness of the recommended interventions for transmission and distribution workers.

1.209

Lifting at the Right Height: Adjustable Height Cart Reduces Low Back Disorder Risk

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Abstract

Background: In the retail and trade industry, workers have a high prevalence of musculoskeletal disorders, especially low back injuries. Item stockers in grocery stores are typically exposed to lifting significant weight each day, oftentimes from low positions such as lifting from the shelf in the storage room to low bed cart to the shelves in the store. One potential intervention is the use of an adjustable height cart that allows items to be placed on the cart to be at or above waist height. The objective of the study was to conduct a real-world simulation in a grocery store of stocking items with a flat bed cart and adjustable height cart.

Methods: Fifteen male Spanish-speaking workers at a grocery store in Puerto Rico completed stocking tasks with two types of carts: traditional and adjustable height cart or Ergo Cart. There were four different selecting tasks evaluated in the warehouse: 1) loading cart with 2-liter bottles of soda pop, 2) loading cart with bags of dog food, 3) loading cart with 12-can boxes of soup, and 4) unloading cart of 12-cans packages of soda pop. The dependent variables included three-dimensional trunk position and velocity, LBD Risk index, and subjective ratings.

Results: The Ergo Cart significantly reduced the amount of sagittal trunk flexion (23% difference) but increased twist trunk position by (26% difference) as compared to the flat bed cart. Similar trends were found for sagittal and twist trunk velocity (17% and 11% difference, respectively). These differences resulted in a minimal overall drop in the LBD risk index (2.5%) for the Ergo Cart but larger reductions were seen for the 2-liters of soda and bags of dog food (around 5%).

Discussion: The current study investigated a potential intervention (adjustable height cart) for a task that continues to plague many workers in the Wholesale and Retail Trade sector. The adjustable cart allowed the worker to place the products at waist height, thus reducing the need to lift from a forward flexed posture. The reduction of the forward trunk flexion would potentially reduce the risk of low back injuries, particularly for bulky and heavy products.

Potential Impact on Industry: The adjustable cart was found to be effective in reducing the sagittal trunk flexion when loading and unloading products. However, this intervention targeted only part of the potential problem. Additional interventions (e.g. leveling pallet table) could further reduce the impact of poor lifting conditions by raising product stored on pallets or storage racks that are low to the ground.

1.210

The Effect of a Systematic, Participatory Computer Workstation Redesign on Musculoskeletal Symptoms

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Abstract

Musculoskeletal symptoms (MSS), such as pain or numbness, are common and distressing occurrences during computer use. One common method to reduce MSS is workstation redesign which aims to "fit the workstation to the worker" and thereby reduce awkward postures. However, recent systematic reviews have reported that this method may not be effective [1]. This pilot study tested if a systematic method of workstation redesign which focused on 19 areas where mismatch could occur combined with active involvement of the worker in the development of the workstation redesign intervention plan (participatory ergonomics) would reduce or eliminate MSS one month after intervention.

Method: This was a pre/post cohort study that examined 26 computer operators with self-reported computer related MSS of at least 2 in one body area (neck/shoulder, arm/wrist, hand) on a scale of 0 to 10 (with 0 being no pain and 10 the worst possible). Workers completed an MSS survey, as well as a self-assessment of their workstation set-up, the Computer Ergonomic Survey (CES), and were photographed in their computer workstations. An expert in workstation redesign used the results of the CES and photographs to identify in which of the 19 areas mismatch occurred. The expert and the computer operator then developed an intervention plan to rectify these mismatches. Workers implemented this plan over a one month period. Workers then completed the MSS survey again. They also rated their satisfaction with the workstation redesign process.

Results: The 26 computer operators mean age was 46.4 (±10.5). They were primarily female (92%) and used a computer, on average, 6.0 (±1.2) hours per day. There were significant reductions in MSS for all body areas on both the left and right sides. Reductions in MSS achieved clinically important levels of at least 1 point for the neck/shoulder (left -1.23; right - 1.08), and right hand (1.01). Many subjects reported complete elimination of MSS at follow-up: neck/shoulder - left 35%, right 31%; arm/wrist - left 27%, right 46%; hand - left 27%, right 35%. This change was significant for the left arm/wrist and both hands. The changes reported to have the greatest effect on MSS were: adjusting the chair height to ensure that the feet were well supported (29%), adjusting the monitor height to reduce head tilt (18%), and adjusting the arm support height to support the arm during computer use (18%). Ninety-five percent of subjects reported that they were satisfied with the recommended changes, and 100% reported that they found the process to be helpful and they felt empowered to be able to continue to adjust their workstation to continue reducing MSS.

Discussion: This study suggests that a systematic method of computer workstation redesign combined with worker involvement lead to significant improvements in computer-related MSS.

Reference:

1. Kennedy CA, Amick BC, Dennerlein JT, et al. Systematic review of the role of occupational health and safety interventions in the prevention of upper extremity musculoskeletal symptoms, signs, disorders, injuries, claims and lost time. Journal of Occupational Rehabilitation 2010;20:127-62.

1.211

Surveillance of Work-Related Musculoskeletal Pain (WMSP) using Employee Input

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Abstract

Background: Companies implement injury prevention and safety efforts to reduce healthcare costs. Optimization of these implemented efforts relies upon correctly identifying the root cause and risks of the job. The dynamic and versatile nature of some jobs (such as those found in the utility industry) proves to be a challenge when identifying areas to focus these efforts. Employees' responses from a customized questionnaire can prove to be beneficial when targeting the focus of safety efforts by identifying work-related musculoskeletal pain (WMSP).

Objective: A collaborative effort between the University of Wisconsin-Milwaukee and a utility company was established to reduce healthcare costs at this company. From a retrospective injury analysis of the company's OSHA recordables over 5 years, maintenance mechanics were identified as the most injured job title for the power generation sector. Searching for WMSP within this dynamic job title requires input from the employees in addition to customary ergonomic evaluations. Based on field observations and focus groups conducted at the company with maintenance mechanics, a customized questionnaire was created to survey the WMSP in power plants.

Methods: 54 male maintenance mechanics (average age, 44 yrs < u>+</u> 11 and median years of experience, 9 yrs) from 4 power plants voluntarily answered the customized questionnaire.

Employees rated the frequency of usage for tools typically used while on the job on a scale of 1 (rarely) to 5 (continuously). Reports of pain within the last 12 months were also collected for the neck, shoulders, elbows, wrist/hands, upper back, low back, hips/thighs/butt, knees, and ankles/feet.

Associations between frequency of tool usage and reported pain were quantified with odds ratios (OR).

Results: 75% of the population reported using 18 of the 19 listed tools at least moderately (frequency > 2) while on the job. 96% of the mechanics reported using the manual pliers and pipe wrench. Within the past 12 months, the most employees reported pain in the low back (50%) and knees (50%) followed by the shoulders (39%) and neck (39%).

Some tools were found to be associated with pain reported across multiple body regions, implying high physical requirements required to use the tool. For example, the sledgehammer was highly associated with the neck (OR = 5.38), shoulders (OR = 2.11), and low back (OR = 9.10).

Discussion: The OR scores can provide insight into how maintenance mechanics interact with tools while on the job. High associations between reported pain and tool exposure highlight which body regions the tool usage is more likely to result in pain. The same tool being highly associated with multiple body regions suggest a higher physical demand level required for the tool. Possible suggestions for improvements include modifying tool design and training on proper tool usage.

Employee input can benefit companies when investigating where to focus future safety efforts. Analyzing the relationship between work-related issues and reported pain, as presented, may also lead towards improving the employees' specific work conditions that are most vulnerable to injury.

1.212

Health Disparity in an Occupational Context: Law Enforcement

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Abstract

While health disparities are thought of as existing in different ethnic and gender populations, they may exist in groups that are strongly influenced by the context of the occupation. This presentation concerns health disparities for law enforcement. Recent research suggests that police officers exhibit higher cardiovascular disease (CVD) risk compared with the general population, which is not fully explained by traditional CVD risk factors. Police mortality studies also suggest that officer's experience increased risk for CVD at a younger age than the general U.S. population. A history of working as a police officer leads to an average age at death 10 years younger than that of the general US population.

Why such health disparities exist in a presumably healthy working population with good access to health care is an interesting question. Among factors which may contribute to this disparity are hazardous environmental exposures, stress and traumatic events, and the strong influence of occupational culture. Law enforcement officers are often exposed to chemicals or biological pathogens, including clandestine drug labs, bloodborne pathogens, decomposing bodies and traffic particles. Stress and traumatic event exposures are also commonly experienced by officers. Since such exposures are an integral part of this occupation it is difficult to avoid them. An avenue more amenable to change is the police cultural environment. Law enforcement operates within a framework of independence from the outside world. Officers dislike being probed for weaknesses and are hesitant to divulge personal information for fear that it may compromise their position or safety. Additionally, police unions resist preventive health measures such as annual physical exams in order to protect officers from administrative discipline.

How does one motivate an unwilling culture toward positive health intervention and reduce health disparity? Regular physical exams and education in lifestyle issues such as exercise, obesity, harmful substance use, and stress are examples. We addressed this issue in the Buffalo Cardio-Metabolic Occupational Police Stress (BCOPS) study, where officers were evaluated for subclinical cardiovascular and metabolic disease and queried about their lifestyle habits, psychosocial factors and risk factors. For some participants it had been ten or more years since their last physical exam. Yet, the study successfully recruited and screened over 460 officers. This was accomplished by establishing trust and proceeding with a positive tone toward the research. For example, the principal investigator for the BCOPS study is a retired police officer and academic researcher which established a trusting relationship with this population. The officer's image as leader and problem solver was not challenged. The study was projected as positive, not to find weaknesses in police officers, but to determine the types of intervention which improved their quality of life. Additionally, we successfully worked together with police administration and the union.

In sum, accessing any health care resistant population should depend heavily upon establishing trust and a positive tone toward the research. Recruiters should have ample knowledge of the profession and culture, and it may be best if persons from inside the population are involved.

1.213

Early Criteria for Evaluating the Cardiovascular and Psychophysical Effects of Heat Stress on Firefighters

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Abstract

Firefighters have potentially one of the most dangerous jobs. Heat Stress is an important risk factor for firefighters. Exposure to heat stress can cause acute health effects such as heat exhaustion, heat stroke and even death. Early detection of heat stress is important to help prevent firefighters from potentially dangerous outcomes, especially cardiovascular events (a primary cause of death in firefighters). Limited studies have documented the cardiovascular strain induced on firefighters due to heat stress.

In this ongoing pilot project, we are investigating early signs of effects of heat stress on body systems. Data were collected on 12 male and 1 female firefighters undergoing two sessions: 1) simulated fire training and 2) live fire training. Fire training sessions involved a set of three tasks including: search and rescue, hose advancement and backup, each performed for three different scenarios. Scenarios included first floor fire, second floor fire for which firefighters had to climb a flight of stairs and basement fire for which firefighters had to descend a flight of stairs. Data on vital signs were collected before training and then pre and post each scenario. During the training, continuous core body temperature (CT) and heart rate (HR) data were collected using a FDA regulated radio pill and a Polar heart rate belt, respectively. The radio pill and heart rate belt transmitted data to a receiver that was placed in the inside pocket of the firefighter's turnout coat. Psychophysical data, collected pre- and post-scenarios, included: perceptions of thermal distress, physical exertion and respiratory distress.

Our hypothesis was that there would be a significant increase from pre-training to post-training values of cardiovascular and psychophysical parameters. Data from the two training sessions were analyzed separately due to the difference in the nature of the training (live vs. non live fire).

Preliminary results show that there was a distinct increase in average heart rate (23% in live fire training), average core body temperature (0.5% i.e. +0.5° F in non-live fire training and 1.1% i.e. +1.1° F in live fire training) and perception of thermal distress (56%), Borg-exhaustion rating (107%) and respiratory distress (150%) as the training progressed. Heart rate data from non-live fire training could not be retrieved from the receiver. More data will be collected to see if the effects are statistically significant.

The firefighters will be able to use the information resulting from this project to understand the importance of protecting themselves against the detrimental effects of heat stress and improve self-assessment. The end goal is to develop early signs of effects of heat stress that can be used in a real-time remote monitoring system. Such a system would enable the Fire Chief to monitor the firefighters' condition inside a burning building and decide if it is safe for them to continue fighting fire and when to provide assistance.

1.214

Cops and Cars: Reducing Motor Vehicle Related Fatalities among Law Enforcement Officers

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Abstract

Statement of Purpose: Motor vehicle incidents remain the leading cause of occupational death among U.S. law enforcement officers (LEOs). Recent data from the National Law Enforcement Officers Memorial Fund indicate that from 2009 to 2010, traffic-related fatalities increased 43%. Reasons for this increase are unknown, but anecdotal evidence suggests that seatbelt usage may play a pivotal role. This study will use a comprehensive survey to identify the perceptions and practices of law enforcement officers with regard to motor vehicle safety and seatbelt use and will examine the policies of their agencies related to seatbelt use while in patrol vehicles.

Methods: This study will be descriptive in nature. The source population will include all sworn LEOs in the state of Iowa. A random sample of all Iowa law enforcement agencies will be drawn, stratified by type of agency (county sheriff, local/municipal/city, and state) and size of agency as determined by number of sworn officers (small, medium, large). These chosen law enforcement agencies will be recruited using a variety of methods including recruitment letters, informational flyers, personal phone calls, and face-to-face visits with current law enforcement leadership. Approximately 1,903 sworn LEOs will be enrolled in the study. Questionnaires will be distributed to officers through their agencies and will gather information on demographics, occupational characteristics, motor vehicle safety training, agency policies, driving behaviors, perceptions of risks and benefits of seatbelt use, and prior occupational motor vehicle crashes. The questionnaire will be crafted using the Health Belief Model.

Impact: Study results will be used to develop and disseminate an evidence-based toolkit. Goals of this toolkit include: (1) raising awareness of motor vehicle related mortality among LEOs, (2) enhancing the motor vehicle safety culture among LEOs and law enforcement agencies, and (3) providing direction for future research into workplace interventions aimed at increasing LEO safe driving practices, including seat belt usage.

1.215

Developing Customized Job Stress Products for Correction Officers: A Needs Assessment

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Abstract

Roughly a half million correction officers (COs) are tasked with maintaining the safety and security of 2.3 million currently incarcerated Americans. Like police and fire fighters, correction officers, who are often recruited following military service, enter their occupation more healthy than the general population, having passed a physical fitness threshold. Evidence suggests, however, that, once employed, the overall health status of this occupational group deteriorates. Stress-related illness (Stinchcomb, 2004), substance abuse (New York State Department of Corrections, 1975; Svenson, Jarvis, & Campbell, 1995), mental disorders, depression, anxiety, and job dissatisfaction have been found to be higher among COs than other workers (e.g., Cullen et al., 1989; Goldberg et al, 1996). The suicide rate among COs is also of considerable concern (e.g., Stack & Toudis, 1997). A recent analysis of 1992-2002 data from the Census of Fatal Occupational Injuries (CFOI) documented that suicides occurring in the workplace comprised 29% of all intentional deaths occurring to COs, compared with 9% occurring to all other types of law enforcement officer populations (Tiesman et al., 2010). With respect to overall mortality, data indicate that the average lifespan for COs is only 59 years (e.g., Cheek, 1984). They have the second highest fatality rate of any occupation (e.g., Steele, 2001; Criminal Justice Institute, 2003), with considerably higher in-service mortality rates than other types of public sector workers (Camp et al., 2003).

The stress inherent in correctional work is believed to contribute to many of these problematic health outcomes. There are a number of published studies on job stress as it relates to corrections work, including several indicating that job stress has a number of detrimental effects on CO health. Despite this, few products have been specifically developed to equip COs and others with a set of practical tools to prevent and/or reduce the high levels of job stress.

A unique partnership between NIOSH, the University of Connecticut (UCONN), and Center for the Promotion of Health in the New England Workplace (CPH-NEW) has been developed and will help produce these tools in a relevant, efficient, and impactful manner. Working with these partners, the NIOSH project team is currently organizing a series of focus groups with COs employed in two Connecticut Department of Correction (CDOC) prison facilities. The focus groups will be used to examine participants' perceptions of the causes of job stress and how job stress affects safety and health. Further, focus groups will identify the types of resources that would be most useful for reducing work-related stress within this working population. The groups will also identify specific target audiences- including and beyond COs –for the resources and will identify the most effective channels for disseminating the resources to target audiences.

This poster will describe the partnership with CPH-NEW, UCONN and CDOC and will discuss focus group findings. Future directions of this work will also be presented.

1.216

WorkLife Interventions in Corrections Personnel: The HITEC Study

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Abstract

Background: There are more than half a million corrections officers (COs) in the United States. Due to physical danger, low autonomy, and work-family conflict, corrections has been associated with high rates of psychological distress, and musculoskeletal and cardiovascular disease risk, despite the sparseness of OHS research literature (1-3). In the State of Connecticut, the crude death rate of COs aged 30-49 was 106 per 100,000, three times the average for the age-equivalent State of Connecticut workforce, an occurrence that was independent of education and income level.

Approach: Health Improvement through Employee Control (HITEC) compares a best practices health promotion/ workplace intervention program with an experimental program featuring employee control, through participatory design teams. Health outcomes are measured by survey, focus groups and interviews, physiologic function and performance, and by a standardized Health Risk Assessment (HRA). The best practices/professional and participatory sites were selected on the basis of size, security level, staffing, physical plant, and comparable scores on 'readiness to change' among supervisory personnel. Programs at the participatory site have included individual health coaching/counseling and professional assessment of ergonomic risks and workplace design. Programs at the participatory site have developed from a design team (DT) of COs with a study-wide labor management steering committee providing oversight and feasibility assessment.

Results: There were 310 voluntary participants between both sites (157 versus 153), with nearly identical age distributions and baseline physical findings. Despite meeting physical standards to enter the corrections workforce, there was considerable morbidity: 83% were overweight or obese, 20% were hypertensive, 56% had no regular exercise, and 31% were clinically depressed. Negative patterns appear to be established early in employment: obesity, for example, was work tenure dependent, not age dependent. Furthermore, although high levels of depression and poor physical health were documented, characterization eluded survey-based assessment(4).

Although program costs were lower, the participatory site featured higher rates of engagement than the best practices site/professional site. For example, participation rates in a DT-sponsored and lead weight loss program, that included a focus on peer safety, had three times the rate of participation as a nationally available structured program, implemented at the best practices/professional site.

Conclusions: Risk patterns in COs appear to be established early in employment. Standard survey instruments had seemingly limited application to COs. Participatory approaches may be more acceptable to COs, but long-term health effects are unknown.

References:

1. Lambert, E. G., Hogan, N. L., & Barton, S. M. (2002). Satisfied correctional staff: A review of the literature on the correlates of correctional staff job satisfaction. Criminal Justice and Behavior, 29(2), 115-143.

2. Finn, Peter. (2000). Addressing correctional officer stress: Programs and strategies. National Institute of Justice, Office of Justice, U. S. Department of Justice.

3. Schaufeli, W.B., Peeters, M. C. W. (2000). Job stress and burnout among correctional officers: A literature review. International Journal of Stress Management, 7 (1), 19-48.

4. Obidoa C, Reeves D, Warren N, Reisine S, Cherniack MG. Depression and Work Family Conflict among Corrections Officers. Submittted for publication, 2010.

1.301

History of Occupational Safety and Health: What led to the creation of NIOSH?

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Abstract

Throughout most of the 20th century, various laws were passed dealing with workplace safety, enforcement, and compensation for occupational illness and injury. Some research and surveillance activities were conducted, but there was no consistent proof to link exposure to disease. Therefore, no national, uniform standards were passed that protected all workers in all industries until the 1970 Occupational Safety and Health Act.

In the early 1900s, occupational safety concerns included black lung among coal miners, CO exposure in garment workers, phossy jaw in match factory workers, and lost limb injuries in railroad and manufacturing workers. The US Bureau of Mines was established during this time, and the Public Health Service (PHS) established the Division of Industrial Hygiene (DIH), which focused on industries in cities that later became NIOSH sites. During the next several decades, focus on the war efforts (rather than safety) and the limited budget during the depression years slowed occupational safety and health (OSH) legislation and workplace inspections. However, the National Industrial Recovery Act was passed, which was the first time employers were required to provide minimum safety, health, and hygiene standards. Unfortunately though, few provisions were made for enforcement. Also during this time, the PHS established the Malaria Control in War Areas Unit, which later became the CDC.

After the wars, occupational and environmental concerns reflected increasing industrialization and the Cold War climate (pollution, radiation exposure, reproductive effects, chemical exposures, environmental toxins, and stress). Demand increased for services of the DIH. Cincinnati was chosen as the site for the DIH field laboratory because of the large number of industries there and earlier PHS activities in the area. DIH became the Bureau of Occupational Safety and Health (BOSH) in 1960. Also in 1960, a respiratory disease research lab was established at the University of West Virginia, which later became the NIOSH Morgantown site.

The late 1960s saw the development of the Frye Report, which was the first time OSH goals were established for a national program. The goals were to eliminate workplace factors that affect the workers' life or health, promote the nation's economy by correcting workplace safety and health issues to increase production, strengthen OSH programs in universities, and establish criteria to link exposures and health.

President Johnson proposed the first national OSH plan with the DOL in charge of enforcement and HEW in charge of research and education. President Nixon completed Johnson's proposal, and NIOSH was established in 1971 under CDC. NIOSH Divisions were organized around different functions, and one of the first actions of NIOSH was to establish the Toxic Substances List as a guide for research. NIOSH is still the leading agency for setting research guidelines, recommending standards, and conducting workplace health hazard evaluations.

1.302

p-2-r - How Our Partners Can Drive the Research Process

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Abstract

Where do research hypotheses come from?

Participatory action research (PAR) has its roots in Lewin (1946), Friere (1970), and Israel, (e.g., Israel, et al. 1998), among others. Dr. Howard's demand that NIOSH emphasize research-to-practice (r2p) is congruent with the tradition of PAR, once we realize that r2p can be viewed as a classic Hegelian dialectic. Sometimes we use the phrase:" r-2-p-2-r," as a quick shortcut to express the continuum. However, r2p as implemented within NIOSH tends to de-emphasize the scientific role that can be played by our partners. By contrast, the PAR model promotes a collaboration in which our partners determine the course of research and intervention studies. NIOSH, university, and NGO scientists are engaged as the technical consultants, bringing the expertise in research methodology to implement the studies. Our partners are the principal investigators (PI).

This poster reports a few collaborative studies that have attempted to solicit ideas and specific research hypotheses from our partners.

In the early 1990's, Prof. Pamela Kidd conducted focus groups with farmers to explore risks for injury on family farms. Kidd and her colleagues were able to develop a model of stress and risks for injury in farming (Kidd, et al., 1996). Every box in the model represents a concept described by the farmers; every arrow in the model represents a relationship between the concepts.

The 1998-2002 project, "Cross-cutting Research and Interventions in Hazardous Work Environments," explicitly attempted to use farmers and construction workers to develop relevant safety interventions for these two industries. The results of this work are the Livestock Handling Checklist for routine and emergency conditions (Isaacs, et al., 2008), and the Extension Ladder Set-up and Use Checklists (Lineberry, et al., 2006).

In the recently concluded project, "Hazard recognition: preventing falls and close calls," apprentice and journeymen ironworkers described the barriers to reporting injuries and to preventing unsafe work practices, (Scharf, et al., in press). The conclusion from the journeymen is:

> "**2.k.** Until there is a no-fault system for reporting hazards and improving safety on the job, there will always be too many barriers to reporting hazards and injuries and to improving safety. Only the most serious OSHA-recordable injuries will be reported with any degree of reliability."

One group of apprentice trainers suggested the idea of anonymous surveys of their own apprentices within their own locals, collected by the trainers only. The trainers can guarantee anonymity of reporting in a way that no other system can do. Subsequent focus groups of journeymen trainers confirmed this idea as a realistic solution to the current situation.

Note: **it is the Ironworkers who are driving the research.** NIOSH and colleagues are providing technical support for this project. It is the Ironworker apprentice trainers who are controlling and directing this effort, monitoring the direction of the work, and who will ultimately decide if we have been successful or not.

This poster will report the details of these selected attempts at PAR and p2r with our colleagues in agriculture and construction.

1.303

Maximizing Workplace Safety and Health Impact Through Successful Partnerships

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Abstract

The National Institute for Occupational Safety and Health (NIOSH) has historically recognized the value and key role that partners play in achieving workplace safety and health impact. In 1996, NIOSH and its partners in the public and private sectors developed the National Occupational Research Agenda (NORA). This Agenda provided a framework to guide occupational safety and health research for the upcoming decades. NIOSH continues to build on these efforts and seek greater involvement of partners through the NORA Sector Programs, NIOSH Cross Sector Programs, and NIOSH intramural and extramural research projects. In 2004, NIOSH launched the Research to Practice (r2p) initiative. The r2p initiative focuses on ensuring that NIOSH's research findings achieve maximum impact on worker health and safety, partly through the development of effective partnerships and the inclusion of key stakeholders. This poster presentation will define the "gold standard" for a successful partnership by demonstrating how to engage partners throughout the r2p continuum, the impact of successful partnerships on achieving maximum impact, and lessons learned. Transferring and translating research findings, technologies, and information into highly effective strategies, practices and products that assist the prevention of injury and illness of workers is crucial. NIOSH works to maximize impact and promote change, collaborate with many parties, including labor, industry, academia, private organizations and government entities during all phases of the r2p continuum. As NIOSH moves forward with the next decade of NORA and the r2p program, the greatest opportunities for improving worker safety and health will depend upon its ability to maximize impact through well developed partnerships.

1.304

Chronic Disease Data from the National Occupational Mortality Surveillance System (NOMS): Occupational Lung Cancer in U.S. Women, 1984-1998

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Abstract

Objectives: The National Occupational Mortality Surveillance System is a population-based system that collects, analyzes, and disseminates data on multiple cause of death, age, race, gender, ethnicity, education, date of death, usual or longest-held occupation, and industry. It provides an up-to-date source of mortality surveillance data that can be used to estimate the relative magnitude of acute and chronic occupational disease mortality risks for all sectors. Lung cancer is the leading cause of cancer death in U.S. women, accounting for 72,130 deaths in 2006. In addition to smoking cessation, further reduction of the burden of lung cancer mortality can be made by preventing exposure to occupational lung carcinogens. Data on occupational exposures and health outcomes of U.S. working women are limited.

Methods: Population-based mortality data for 4, 570,711 women who died between 1984 and 1998 in 27 U.S. states were used to evaluate lung cancer proportionate mortality over time by the usual occupation and industry reported on death certificates. Lung cancer proportionate mortality ratios were adjusted for smoking using data from the National Health Interview Survey (NHIS) and the American Cancer Society's Cancer Prevention Study II.

Results: Analyses showed that 194,382 white, 18,222 Black and 1,515 Hispanic women died 1984-1998 with lung cancer reported as the underlying cause of death. Following adjustment for smoking, significant excess proportionate lung cancer mortality was observed among U.S. women that worked in the U.S. manufacturing; transportation; retail trade; agriculture, forestry and fishing; and nursing/personal care industries. Women employed in precision production, technical, managerial, professional specialty, and administrative occupations experienced some of the highest excess proportionate lung cancer mortality during 1984-1998.

Conclusions: The results of our study point to significantly elevated risks for lung cancer after adjustment for smoking among women in several occupations and industries. Because 6-17% of lung cancer in U.S. males is attributable to known exposures to occupational carcinogens, and since synergistic interactions between cigarette smoke and other occupational lung carcinogens have been reported, it is important to continue research into the effects of occupational exposures on working men and women.

Recent Developments: U.S. death data for 2007 through 2010 are being collected from the National Center for Health Statistics for 7 states and from 10 state health departments. New states are continuously being recruited to participate. NIOSH adds value to state data by coding and quality checking industry and occupation statements on death certificates and makes the resulting data available to states. The new NIOSH desktop/autocoder systems are helping to increase the number of states that contribute data to the National Occupational Mortality Surveillance System. In order to improve the accuracy of industry and occupation, a guidelines document is being developed in collaboration with funeral directors who collect industry and occupation statements from survivors.

Pre-calculated NOMS PMRs for over 500 occupations, 300 industries and 350 causes of death may be accessed at the NOMS internet site along with newly released charts that portray the ten highest significantly elevated chronic disease risks by industry for each sector at http://www.cdc.gov/niosh/topics/surveillance/NOMS/default.html.

1.305

The 2010 Occupational Health Supplement to the National Health Interview Survey (NHIS)

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Abstract

Surveillance is vital to achieving healthy workplaces because we need to determine the magnitude and correlates of workplace hazards and work-related health conditions before we can address them. Unfortunately, currently available employer-based sources of occupational health surveillance data are limited, especially with regards to work-related illness.

Through NORA funding, the National Institute for Occupational Safety and Health (NIOSH) sponsored an occupational health supplement (OHS) to the 2010 National Health Interview Survey (NHIS) to collect information on the prevalence and correlates of work-related health conditions and exposures to potential psychological and physical occupational hazards in the US working population. The last NHIS-OHS was conducted in 1988. With the dramatic changes in the workplace environment and associated hazards, exposures, and health outcomes that have occurred since 1988, an occupational health supplement to the NHIS was desperately needed in 2010.

The NHIS is a cross-sectional in-person household survey conducted annually by the National Center for Health Statistics (NCHS) to monitor the health of the United States population through the collection and analysis of data on a broad range of health topics. The sampling plan follows a multistage area probability design that permits the representative sampling of households. NHIS data are collected annually from approximately 35,000 to 40,000 households. Basic industry and occupation information is collected from a sample adult from each household who also answers detailed health questions.

Questionnaire development began in 2006, final questions were submitted to NCHS in 2009, and data collection began in January of 2010. The data will be publicly available in June, 2011. We worked with many partners during questionnaire development. Internal (NIOSH) partners included: the Division of Respiratory Disease Studies and the Division of Safety Research. External partners included: other CDC programs, the National Institutes of Health, the Bureau of Labor Statistics, the Occupational Safety and Health Administration, the Center for Construction Research and Training, the American Academy of Dermatology, and State occupational health and safety programs.

The 2010 NHIS-OHS includes similar questions to the 1988 supplement about dermatitis, carpal tunnel syndrome and occupational asthma so that we can examine changes in the frequency of these highly prevalent conditions across industry sectors. Questions on other topics (e.g., psychosocial exposures) have been adapted from other validated survey instruments, where possible. Data from the OHS can be combined with data from the core NHIS questionnaire for analysis of relationships between occupational exposures and other common health conditions and interactions between occupational and nonoccupational factors (e.g., tobacco use, physical activity).

NIOSH and NCHS investigators will be developing communication products to disseminate the key findings from the survey, and we also hope to collaborate with partners on many different analyses to maximize the impact of this project.

Our ultimate goal is that evidence-based interventions by stakeholders will reduce work-related diseases and injuries. In addition, the results of this surveillance project will inform future hypothesis-driven research.

1.306

NORA Mortality Monograph: National Health Interview Survey 1986-2004

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Abstract

Objective: The majority of occupational health studies in the U.S. have focused on special subsets of data, not truly representative national data, and have focused primarily on morbidity rather than mortality. This Monograph describes the mortality rates for U.S. workers by National Occupation Research Agenda (NORA) sector using nationally representative U.S. data.

Methods: Pooled data from the 1986-2004 National Health Interview Survey (NHIS) with mortality follow-up through 2006 linked with the National Death Index (NDI) was examined. There were a total of 42,273 worker deaths among the 660,352 working adults who participated in the NHIS 1986-2004 surveys. After adjustment for sample weights and design effects, mortality rates were expressed as age-adjusted rates per 100,000 worker-years and categorized by the top twenty-five causes of death (i.e., overall, cancer, heart disease, stroke [cerebral vascular disease], accidents [unintentional injuries], diabetes, respiratory disease, HIV/AIDS) including those with historical associations to occupation (i.e., pneumoconiosis).

Results: The age-adjusted mortality rate for all workers was 593 per 100,000. The highest mortality rates by worker sociodemographic subgroups were males (723 per 100,000), blacks (744 per 100,000) and those with less than a high school education (844 per 100,000). Using broad cause of death groupings, cancer was the number one cause of death among all workers followed by heart disease (201 per 100,000 and 156 per 100,000). The most common single cause of death was malignant neoplasm of the trachea, bronchus and lung (63 per 100,000). Mortality rates that may be linked to various occupational exposures include: accidental poisonings and exposure to noxious substances (3.4 per 100,000), Alzheimer's disease (5.6 per 100,000) and malignant neoplasm of the bladder (4.3 per 100,000). The Agriculture, Forestry and Fishing Sector and the Construction Sector had the highest mortality rates (798 per 100,000 and 715 per 100,000. The Mining NORA Sector had the highest mortality rate for cancer (233.94 per 100,000) compared to the other NORA Sectors. Workers in the Agriculture, Forestry and Fishing sector had the highest mortality rates for various causes of death including: heart disease, stroke, unintentional injury, respiratory disease, HIV/AIDS, homicide and neurologic disease.

Conclusion: Cancer is the leading cause of death in the U.S. workforce. There was substantial variation in overall and cause-specific mortality rates across sectors, with excess burden documented in Agriculture, Forestry and Fishing workers. Lung cancer was identified as the single most common cause of death which has not only a strong association with smoking rates but is also linked to various occupational exposures (e.g., asbestos). Databases such as the NHIS linked with mortality follow-up can be used to undertake additional occupational studies for establishing priorities and tracking progress towards the elimination of preventable diseases and mortality.

1.307

NORA Morbidity and Disability: The National Health Interview Survey (NHIS) 1986-1996 and 1997-2007

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Abstract

Objective: In the United States, nationwide descriptions and comparisons of the morbidity status of adults employed in industry sector groups have been difficult to undertake due to the lack of large and nationally representative samples of workers. The objective of this Morbidity Monograph was to provide current, baseline acute and chronic disability and morbidity data for U.S. workers by the eight new National Occupational Research Agenda (NORA) Industrial Sectors using nationally representative data.

Methods: Pooled data from two survey periods of the National Health Interview Survey (NHIS) were utilized: 1986-1996 (n = 515,137) and 1997-2007 (n = 196,924). Separate pooled analyses were necessitated by a major survey redesign in 1997. Classification of workers into NORA sectors was based on participant employment status in the two-weeks prior to the interview for participants of the 1986-1996 NHIS. For the 1997-2007 NHIS participants, employment status was based on the participant employment status one-week prior to the interview. Several self-reported measures of acute and chronic disability and health morbidity reported in the NHIS were analyzed.

Results: Analyses based on both pooled survey periods indicate that among all workers, relative to whites, blacks had higher rates of self-reported fair/poor health, obesity and hypertension but had lower rates of hearing loss. In comparison to workers with more education, those with less than a high school education reported higher rates of fair/poor health, obesity and current smoking. Hypertension rates increased with older age, while younger workers had higher rates of respiratory disease. Overall disease burden based on the 1986-1996 data was generally highest in the following sectors: 1) Agriculture, Forestry and Fishing (highest rates of sensory impairment, reported fair/poor health, cardiovascular disease, arthritis); 2) Mining (highest rates of hypertension, pneumoconiosis and asbestosis); and 3) Construction (highest rates of smoking, select musculoskeletal disorders). In the 1997-2007 analysis, workers in the Mining sector tended to have more disease, impairment and poor health relative to workers in other sectors (highest rates of hearing impairment, hypertension, diabetes, and reported fair/poor health). Workers in the Construction sector had the highest rates of smoking and drinking.

Conclusion: This Monograph series has documented substantial variability in the health status of workers classified by sociodemographic status and employment in the 8 NORA sectors. The Mining sector emerged in both analyses as exhibiting a high degree of disease burden. These NHIS data provide an important baseline for monitoring worker health status. The present findings also allow for identification of priority worker populations for health prevention programs in the workplace. Such targeted activities can not only prevent future morbidity but also has the potential added benefit of enhancing worker productivity.

1.308

Lead Exposure Surveillance in the U.S.: The Adult Blood Lead Epidemiology and Surveillance (ABLES) Program

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Abstract

By the end of this session, the attendees will be able to (1) Describe surveillance of lead exposures in the U.S. as conducted by the CDC/NIOSH ABLES program (2) Identify populations at risk of lead exposures for public health actions.

Relevant industry sectors and cross-sector areas include: Manufacturing, construction, mining, and surveillance.

Exposure to lead continues to be an important health problem in the U.S. and worldwide, as adults continue to be exposed to lead at their workplaces and from other sources. In the U.S. the vast majority (95%) of reported elevated blood lead levels (BLL) have been work-related. Furthermore, recent research has caused increased concerns about the toxicity of lead at low doses. These facts stress the need to maintain lead exposure surveillance systems to identify and target interventions at populations at risk.

Since 1992 the state-based ABLES program has tracked laboratory-reported elevated BLL in adults. A unique identifier is assigned to each person to account for multiple blood lead reports across years. Follow-up is conducted to ensure completeness of information on the exposure source for elevated BLLs. CDC/NIOSH analyzes the data and disseminates the results.

An overall decreasing trend in the national prevalence rate of elevated BLL in adults has been observed. The manufacturing, construction, and mining industry sectors account for most lead exposures. Currently forty states submit data to NIOSH.

To further prevent hazardous workplace lead exposures, the ABLES program continues its efforts to build state capacity to initiate, expand, or improve adult blood lead surveillance programs; in 2009 the ABLES program updated its case definition for an elevated BLL to a BLL≥10μg/dL; it has established the ABLES coding committee and ABLES laboratory workgroup; it has provided the public health community access to lead exposure data in adults in the NIOSH ABLES Charts and Interactive Database; and will continue lead exposure surveillance in adults that can be used to identify populations at risk and for targeting public health interventions.

1.309

County-level Indicators for Occupational Health: An Example Using Fatal Occupational Injuries

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Abstract

Background: Community health indicators are measures of key characteristics-often calculated at the county level-that are intended to reflect the health status of communities. They can be used to analyze and monitor community health determinants and outcomes and provide local public health officials a tool for setting priorities and guiding intervention. Nationally, at least two different sets of community health indicators have been developed, but neither directly addresses occupational health. The Council of State and Territorial Epidemiologists has developed a set of occupational health indicators for states, but these often are not applicable at the county level. Data that could be used to measure occupational health constructs directly at the county level are often unavailable or too sparse to provide reliable estimates. Here, we present an alternate approach to the production of county-level occupational health indicators, with specific reference to fatal occupational injuries.

Method: An county-level indicator of the anticipated risk of fatal occupational injury was calculated based on expected county rates. These were estimated by applying occupation-specific rates of fatal workplace injury measured at the national level to current estimates of the local population of workers grouped into ten major occupational categories for all 3,141 US counties or county equivalents. The occupational categories were based on the Standard Occupational Classification coding system, were mutually exclusive and were comprehensive of the employed, civilian, noninstitutionalized population age 16 years and older. The categories included: management, business and financial occupations; professional and related occupations; service occupations; sales and related occupations; office and administrative support occupations; farming, fishing and forestry occupations; construction and extraction occupations; installation, maintenance and repair occupations; production occupations; and transportation and material moving occupations. For each county, the average annual population in each occupational group during the period 2005-2009, based on estimates from the American Community Survey, was multiplied by that group's national occupational fatality rate at the midpoint of the period. National rates were obtained from the 2007 Census of Fatal Occupational Injuries compiled by the Bureau of Labor Statistics. This yielded an estimated number of fatal occupational injuries for each occupational group. These estimates were summed then divided by the total employed, civilian, noninstitutionalized population age 16 years and older to produce the overall county rate, which was expressed as the expected average, annual number of deaths per 100,000 employed workers. The ratio of this rate to the overall national occupational fatality rate was also calculated and is presented as the county-level indicator. We also present the location of individual county estimates within the peer county strata developed by the Health Resources and Services Administration.

Conclusions: While indicators based on measurements made directly at the county level would be preferable, it is possible to produce county-level occupational health indicators in their absence, based on publically available datasets. Such indicators are comparable to many non-occupational indicators currently in use and may be of use to state and local public health agencies as a resource for assessing and monitoring occupational health at the county level.

1.310

The Western States Occupational Network (WestON) - Maximizing Partnerships for Occupational Safety and Health Surveillance in the Western US

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Abstract

Objectives: The objectives of the WestON meeting are to build capacity among Western states to conduct surveillance of work-related injuries and illnesses; increase epidemiological capacity in occupational health at the state level; develop common priorities for occupational risk assessment, applied epidemiology, worksite interventions and other prevention efforts; and promote scientific collaboration among state-based occupational epidemiologists, NIOSH, and academic colleagues in the West.

Methods: Collaborations were formed between NIOSH and partners interested in the goal of increasing occupational safety and health (OSH) surveillance capacity in the western US. Participants included staff from the NIOSH Western States Office (WSO), the Mountain and Plains Education and Research Center (MAPERC) and the Council of State and Territorial Epidemiologists (CSTE). These participants met via monthly conference calls to develop a plan to bring together colleagues from 19 western states for a 1.5 day meeting to learn about OSH issues of importance to each state and the region, network and discuss potential collaborations.

Results: This endeavor was successful and the first WestON meeting took place in September, 2008. More than 60 attendees participated in the meeting, including representatives from 18 of the 19 targeted western states; the western ERCs and Agricultural Centers; OSHA; and NIOSH representatives from DSHEFS, DSR, DRDS, OEP, SRL and the Alaska-Pacific Regional Office. Post-meeting evaluation comments from attendees indicated that the meeting provided a much-needed and desired opportunity for networking and initializing important contacts for addressing occupational health and safety needs in the West. Subsequent equally successful WestON meetings have taken place in 2009 and 2010, and a fourth WestON meeting is being planned for September, 2011. In addition, due to the success of these meetings, there is strong interest in developing a similar meeting in the southern US and initial planning for this is in process utilizing the same methods that were used for the WestON meetings.

Conclusions: Through identification of and collaboration between interested partners, such as state OSH representatives, ERCs, Agricultural Centers, CSTE and NIOSH, OSH surveillance capacity can be fostered and increased in many states and regions of the US, especially in those that currently have limited capacity and funding.

1.311

Development of In Vitro vs. In Vivo Models to Evaluate Fibrogenic and Carcinogenic Potential of Carbon Nanotubes

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Abstract

Carbon Nanotubes (CNT) possess unique physicochemical properties which exhibit different biological effects compared to micro-sized particles. The nano-scale size and dispersion status of the CNT play critical roles in their unique bio-effects. Among the adverse effects reported, CNT have been shown to induce rapid interstitial lung fibrosis and persist in the lung. This raises a human risk concern and brings up a challenge, since information and specific methods are lacking which would allow one to predict the biological activity of these new nanomaterials.

To address this issue, our objective is to determine "Nanoparticle properties and mechanisms causing lung fibrosis" which is a funded NORA project (2008-2012). Published or ongoing research results provide novel findings of unique bio-effects of CNTs and specific nano-research methods which are summarized below: 1) Survanta, a natural lung surfactant, effectively disperses single-walled CNT (SWCNT) or multi-walled CNT (MWCNT) agglomerates into small structures, which are similar in size to aerosolized SWCNT structures. Plus, at the concentration of Survanta used for the dispersion, it showed no toxic effects and did not mask surface activity of particles; 2) dispersed SWCNT or MWCNT exhibited an acute biphasic effect on cells inducing proliferation at low doses and causing toxicity at high doses, while their non-dispersed forms had no significant effects; 3) dispersed SWCNT or MWCNT upregulated collagen expression from cultured lung fibroblasts and lung tissue in a mouse model, whereas their non-dispersed forms showed a significant lesser effect; 4) well known fibrogenic mediators, such as Transforming Growth Factor beta (TGF-β1) or Matrix Metallopeptidase (MMP9), were induced by SWCNT or MWCNT *in vitro*, which is consistent with *in vivo* observation from our and other published reports. These mediators, therefore, could serve as bio-markers to evaluate early events of nanotoxicity; 5) low dose, long term exposure of lung epithelial cells to dispersed SWCNT or MWCNT caused cell transformation towards a tumorigenic phenotype.

The above data from both cell culture and animal models support our proposed hypothesis that physicochemical properties of CNT are key factors in determining their bioactivities, which leads to a novel mechanism of unique nanoparticle-induced lung fibrosis. Present developed *in vitro* models using human lung cells provides a great advantage to study mechanistic detail of nano-toxicity and may represent a potential simple, rapid, less costly, high throughput screening tool to predict the fibrogenic or carcinogenic potential of nanomaterials. This information will be useful for researchers, industry, and governmental regulatory agencies to conduct risk assessment and develop prevention strategies.

1.312

Calcite as a Preventive Agent for Coal Workers' Pneumoconiosis

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Abstract

Background: Coal remains a major energy resource worldwide. While energy costs from a new coal power plant are low, both health and environmental costs, including occupational lung disease compensation, can render coal a more expensive energy option. Underground coal miners are at risk of developing coal workers' pneumoconiosis (CWP). We have previously shown that bioavailable iron (BAI) in the coal is one of the factors responsible for coal dust toxicity, and that differences in levels of BAI probably contribute to the regional differences in the prevalence of CWP. BAI originated from oxidation of pyrite (FeS_2), a typical component of coal dusts. The stability of BAI is pH-dependent. Coals containing high levels of calcite ($CaCO_3$) have high pH but low BAI. Calcite is present in most of the Western coals, such as Utah and Colorado and workers in these mines also experience low CWP.

Objectives: In the present study, we tested a hypothesis that, when dust reduction has been maximized at the work setting by the current dust control technologies, using calcite to decrease the BAI and toxicity of coal dust effectively prevents CWP.

Methods: We determined the minimal effective doses of calcite needed to eliminate BAI in the Eastern coal dusts that also inhibited BAI-induced inflammation and fibrosis in mice.

Results: Adding calcite into water takes 5-20 min to neutralize BAI in the coal compared to calcite in buffered solution that mimics the phagolysosomes of the cells, which takes up to 4 weeks. Calcite also reduces epithelial mesenchymal transition markers such as alpha-smooth muscle actin and fibroblast specific protein-1 in mice. Although minimal doses of calcite depend upon the levels of BAI in the coals, 10% calcite (w/w) in the respirable fraction appears sufficient to reduce all BAI.

Conclusions: Based on these data, we expect that introduction of calcite to high BAI-containing coals, such as those in the Eastern coalmine region will have a long lasting protective effect on underground coalminers susceptible to CWP. Calcite is the main constituent of rock dust and widely used in underground mines for prevention of explosions and in the treatment of acid mine drainage. Hence, introduction of calcite to coal during mining causes no environmental concerns to the coal industry. Most importantly, calcite treatment could provide a cost-effective solution to prevent CWP and significantly enhance the health of underground coal workers. As a result, this could reduce coal-produced energy costs and benefit the coal industry financially. Supported by NIOSH R01 OH009771

1.313

Complex Profile of Mechanical Responses of Guinea-Pig Isolated Airways to the Popcorn Butter Flavorings, Diacetyl and 2,3-Pentanedione

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Abstract

Objectives: Inhalation of microwave popcorn butter flavorings in the workplace induces a bronchiolitis obliterans-like obstructive disease in workers, termed "popcorn workers' lung." In animal models inhalation of popcorn butter flavoring, its constituent flavoring, diacetyl (D), or diacetyl substitute, 2,3-pentanedione (2,3-P), evoke marked damage to the epithelium of upper airways and large lower airways. While the toxicity of these flavorings on airway epithelium is now acknowledged, nothing is known about the effects of D and 2,3-P on airway smooth muscle. Therefore, we investigated the pharmacological activity of D and 2,3-P on isolated airways.

Methods: The isolated, perfused trachea preparation was used; this method allows separate addition of agents to the mucosal surface [intraluminal (IL) bath] or serosal surface [extraluminal (EL) bath] of the airway. Tracheas removed from anesthetized guinea pigs were mounted on holders to allow perfusion of the lumen with modified Krebs-Henseleit solution while measuring mechanical responses, i.e., change in diameter, from inlet minus outlet pressure difference (ΔP; cm H_2O). RESULTS. In unstimulated tracheas, or in tracheas first contracted with EL methacholine (3×10^{-7} M; EL EC_{50}), D applied to the IL bath elicited contraction (1 - 3 mM); higher concentrations (10 - 30 mM) elicited contraction followed by relaxation. The relaxation component of the response could have been mediated by the release of epithelium-derived relaxing factor (EpDRF), which is triggered by elevations in IL osmolarity greater than 3 mosM. This possibility was investigated by adding D intraluminally to tracheas from which the epithelium had been removed, and by adding D to the EL bath. In both instances responses to D were obtained that did not differ from epithelium-containing tracheas following the addition of D to the IL bath. Responses to IL and EL 2,3-P mimicked those to D over the same concentration range, and were not affected by epithelium removal.

Conclusions: The concentrations of D that elicit contractile responses of the trachea have been calculated through modeling to exist in the airway wall of exposed rats, and are associated with epithelial damage. D and 2,3-P are nearly identical in their activities as bronchoconstricting and bronchodilating agents in this in vitro model. The relaxant responses to the two flavorings in higher concentrations are not attributable to the elevation in osmolarity and the release of EpDRF. The results suggest that the direct effects of the two flavorings on airway smooth muscle of workers may be comparable.

1.314

Mechanical Responses to COREXIT® EC9500A in Rat Trachea In Vitro

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Abstract

Oil dispersant COREXIT® EC9500A (CE) was used to reduce the environmental impact of the Deepwater Horizon oil spill in 2010. Little is known of the pulmonary effects of CE on airway smooth muscle and nerves. We investigated in vitro the effects of CE on rat tracheal preparations. In tracheal strips, CE (0.001 %v/v) elicited relaxation. Contraction occurred at higher concentrations (0.003-0.1 %v/v; EC_{50} 0.0031 %v/v). CE (>0.1 %v/v) elicited relaxation of methacholine (MCh; 3×10^{-5} M)-contracted strips (EC_{50} 0.39 %v/v). CE (0.003 %v/v) had no effect on MCh-induced tone but inhibited neurogenic contractile responses of strips to electrical field stimulation (10 Hz). In the isolated, perfused trachea preparation (IPT), in which agents may be applied separately to the mucosal or serosal surface, CE (0.3-10 %v/v) administered to the mucosal bath resulted in contraction. In MCh-contracted perfused tracheas, mucosal CE (0.1-10 %v/v) elicited contraction followed by relaxation. Thus, CE was less potent in the IPT compared to strips. CE produced a progressive precipitate at >0.1 %v/v. Our results indicate that CE contracts airway smooth muscle and inhibits excitatory neurotransmission. Relaxation at high CE concentrations cannot be distinguished from precipitate formation or osmotic effects.

1.315

Advances in Techniques for Mineral Fiber Classification

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Abstract

Fiber length has long been suspected (Stanton hypothesis) as being a crucial parameter which determines various toxicological responses (fibrosis, lung cancer, mesothelioma) to the presence of asbestos in the lung. Direct toxicological testing has been hampered by the inability to prepare significant quantities of length-classified asbestos samples. We report on recent work at NIOSH to classify mineral fibers by length in order to prepare asbestos samples of well-defined length for subsequent toxicological study. This paper reports on our work with model glass fibers.

The Baron aerodynamic fiber classifier has been demonstrated to successfully separate fibers at the desired length scale (Lcutoff ~ 15 microns). We now have a better understanding of the role that humidity plays in the operation of this instrument, especially at the aerosol generation stage. We have shown that tribo-charging can give rise to a 'piggy-back' effect, whereby short fibers can accompany the correctly separated fibers, thereby contaminating the length segregated sample. We also have a better understanding of the effects of aerosol concentration on fiber separation. We have recently altered the aerosol generation parameters so as to increase the input aerosol concentration; this enables the use of the Baron instrument to process sufficient quantities of short fiber material, suitable for the intended toxicological study.

In parallel with our work to improve the Baron aerodynamic fiber classifier, we are also studying the use of a cross-flow liquid filtration technique (Bauer-McNett fiber classification), which has been successfully utilized in the paper industry to characterize pulp fiber length. We report on our efforts to extend the operation of the Bauer-McNett classifier from separation at the 10^{-3} - 10^{-4} m scale (appropriate for pulp characterization) to the 10^{-5} m scale (appropriate for asbestos separation).

It is anticipated that, in order to prepare samples of length-separated asbestos fibers for toxicological study, the sample of short fibers will be isolated with the Baron aerodynamic classifier, while the sample of long fibers will be isolated with the Bauer-McNett cross-flow separator.

1.316

Respiratory Diseases Research Program: Some Recent Products for our Stakeholders

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Abstract

The Respiratory Diseases Research Program (RDRP) was reviewed by the National Academies between October 2006 and March 2008. Following delivery of their report RDRP presented an Implementation Plan to the Board of Scientific Counselors, subsequently RDRP developed five Government Performance and Results Act (GPRA) goals: transition from film-based chest radiography to digital imaging, improvement of occupational respiratory disease surveillance (e.g., use of electronic health records), flavorings related lung disease, work-related asthma, improvement of exposure assessment methods (e.g., with respect to engineered nanomaterials). In addition, RDRP has recently produced the following NIOSH Numbered Documents and materials for our stakeholders: An Alert: *Preventing Sensitization and Disease from Beryllium Exposure*; a poster: Make your spirometry tests valid every time; two OSHA-NIOSH cobranded products - *OSHA-NIOSH Info Sheet: Maximize Your Spirometry Screening and Surveillance Resources*, and *OSHA-NIOSH Worker Info: Protect Yourself - Spirometry Breathing Test*; a new Alert: *Preventing occupational respiratory diseases from exposure caused by dampness in office buildings, schools and other nonindustrial buildings* and a dampness and mold assessment tool. In addition, RDRP has continued to maintain an updated set of surveillance information on its occupational respiratory disease surveillance website, including an innovative new data query page providing information about the burden of pneumoconiosis in underground coal miners. Much of this work (beryllium epidemiology, damp buildings research, spirometry tools and asthma in healthcare) has been supported by NORA funding.

Poster Session 2

Wednesday, July 13th

2.101

The Prevalence and Work-Related Factor Neck and Shoulder Pain Among Critical Care Nursing Personnel in Ramathibodi Hospital, Bangkok

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Abstract

This study was a cross-sectional study using self-administered questionnaires to investigate the prevalence rate of work-related neck and shoulder pain and to determine factors affecting neck and shoulder pain in critical care nursing personnel at Ramathibodi hospital in Thailand. It was conducted among 205 full-time nursing personnel during 15 May to December 2009. The RULA (Rapid Upper Limb Assessment) was introduced to describe the working posture. Chi-square test is used to determine difference between the study groups of variables. Descriptive statistics was used to analyze the data such as percentage, mean, standard deviation (SD). Odds ratio and 95% confidence interval were used to determine the relationship between independent variables and neck and shoulder pain.

The results indicated that the prevalence of work related neck and shoulder pain among critical care nursing personnel was 69.4%, followed by low back pain (57.50%) and upper back pain (57%). The significantly associated factors with neck and shoulder pain were working hours per day greater than 8 (p=0.014) and high RULA score at right and left side (p=0.049). The results showed the relationship between factors and neck and shoulder pain after using a binary logistic regression model. The risk factors such as high RULA score at right and left side, more than 8 hours work per day, low decision latitude, and accepting emergency patients were significantly associated with neck and shoulder pain (p=0.026, p=0.049, p=0.047, p=0.046, respectively)

It was concluded that neck and shoulder pain was a common health problem among these nurses. Their physical workload, psychosocial and individual factors must be taken into account to improve the working conditions. The results of RULA and their work practices should be considered in guidelines for risk reduction strategies.

2.102

Relief Work and Mental Health: a Critical Review

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Abstract

Background: Humanitarian relief work is dangerous. Attacks on humanitarian workers have increased as their numbers have grown. The fatality rate of humanitarian workers exceeds that of UN peacekeepers. The danger is emotional and physical-ongoing occupational trauma exposure has implications for mental health. With complex emergencies and humanitarian crises rising, relief workers are increasingly and continually exposed to both direct dangers and secondary trauma.

Our study reviewed peer-reviewed literature on mental health of humanitarian relief workers serving in complex emergencies. Research on both relief workers and employing organizations were examined to determine if relief work is a risk factor for trauma and for related mental illness.

Methods and Analysis: Databases and relevant citations were searched for English-language peer-reviewed articles published between 1999-2010. Articles included addressed relief workers abroad during complex emergencies and trauma-related mental illness.

Information was abstracted into a standardized format. Abstraction categories include country of origin, data collection method, study population and results. Study characteristics reviewed included sampling strategy, sample size, methods and measures used, location of study subjects, and response rate.

Results:

Trauma exposure - Relief workers experience significant trauma. The five most common primary traumas were; frightening situation (55-78%), threats or being chased (16-47%), forced separation from family (40%), shelling / bombing of office or home (13-43%), and hostility of local population (10-37%).

Prevalence of and risk factors for mental illness among relief workers - Mental health of relief workers suffers subsequent to deployment. PTSD and related symptoms were the most frequent outcome of interest, with results ranging from 8-43%. A few studies examined symptoms of major depression and generalized anxiety disorder, with prevalence ranging from 8-29%. One study also estimated alcohol abuse symptoms with prevalence at 16% for ex-pat and 1.6% for Kosovar workers.

Organizational studies - NGO employers that recruit, train, and support relief workers may not adequately prepare workers for their unique occupational exposure to trauma. Support for workers in the field varies widely, and post-deployment support is largely ignored.

Implications and Conclusion: We find that 1) research on relief workers should look more broadly at mental health outcomes related to trauma, in particular assessing for depression, anxiety, and substance use in addition to PTSD; and 2) there is a need for consensus on methodology and measures used to assess for PTSD and other trauma related mental illness.

As demand for humanitarian relief work grows, continual trauma exposure has important implications for occupational mental health. Further study on post-deployment mental health status of relief workers is needed, and longitudinal study design may yield more information. Research on employing organizations is more limited and also needed.

2.103

The Effects of Bullying on the Productivity of the Novice Nurse

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Abstract

Workplace bullying is targeted negative behavior linked to a myriad of adverse psychological and physical consequences for the target of these negative behaviors. The psychological consequences to the nurse of workplace bullying include shame, self-blame, anxiety, depression, stress, burnout, avoidance, increased absenteeism, and loss of confidence. The physical consequences are somatic complaints of sleeplessness, headache, stomach ache, and increased use of alcohol and smoking. Organizational consequences are increased turnover, decreased productivity, and poor patient outcomes. Novice nurses are at higher risk for these consequences following workplace bullying. Yet, there is a fundamental gap in the workplace literature on how the power relationship between the perpetrator and the novice nurse affects the novice nurse's work productivity.

The study will describe the extent of workplace bullying and the resultant change in novice nurse work productivity to the bullying event. The specific aims for this study are: (1) Determine the prevalence of workplace bullying, (2) Determine if there is a change in work productivity of novice nurses after a workplace bullying incident, and (3) Measure the changes in work productivity relative to the position of the perpetrator, whether nurse, supervisor, preceptor, mentor, educator, other staff, physician, other staff, patient or patient family.

A descriptive, cross-sectional survey design using a web-based survey was used to collect data on workplace bullying frequency, work productivity change, and participant demographics. A random sample of novice nurses from Indiana, Kentucky, and Ohio was recruited. Descriptive statistics are reported for the prevalence and frequency of workplace bullying and change in work productivity. Correlations are computed for workplace bullying and workplace productivity in novice nurses using age, gender, educational attainment, and race as modifying variables and the perpetrator's position to the novice nurse.

The National Occupational Research Agenda (NORA; 2009) identified the need for research focused on psychosocial factors, interpersonal conflict, and work-related violence. Understanding the frequency of workplace bullying and its relationship and its effects to mental health, physical health, and work productivity of novice nurses is an essential step in recognizing the seriousness of workplace bullying.

2.104

Planning for the NIOSH Occupational Health Safety Network (OHSN): Foundation for Monitoring and Protecting Workers in the Healthcare Sector and Beyond

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Abstract

Challenges/Opportunities for Prevention in the Healthcare Sector: Healthcare is a growing industry with a substantial burden of occupational injuries and illnesses. Unique work environments place the over 15 million workers employed in this industry at risk for both infectious and non-infectious adverse events, but current occupational health surveillance systems are not designed to collect the specific information needed to identify and address the causes of non-infectious injuries and illnesses among healthcare personnel (HCP). Ongoing occupational health surveillance in the healthcare industry that is easily accessible and user-friendly can identify risks and guide and monitor interventions. When needed, evidence-based and scalable interventions already exist and can be implemented.

Purpose of the OHSN: The Occupational Health Safety Network (OHSN) is a new electronic, voluntary, and secure surveillance system to be hosted by the National Institute for Occupational Safety and Health (NIOSH). OHSN will link and integrate a wide variety of ongoing occupational health surveillance activities and facilitate more accurate and timely prevention strategies. The first version of the OHSN will be limited to the healthcare sector, but modules that address other industry sectors may be added in the future. Collecting standard data on adverse events through the OHSN will help healthcare facilities:
Establish baseline measures at the facility level
Compare internal rates and trends with aggregate measures compiled from comparable facilities
Evaluate the impact of prevention programs
Benefit from known, effective, and innovative intervention tools shared by NIOSH and other OHSN participants
Meet regulatory and accreditation requirements of OSHA and the Joint Commission
Become leaders among the occupational health professional community

Approach to Data Collection: NIOSH is working with major vendors and leaders from healthcare facilities to adapt their software so that files that contain the required data for OHSN can be exported from systems already in use, rather than requiring duplicate data entry into multiple systems from participants.

Critical Partners:
Occupational health professionals in the healthcare industry who are the intended users of the system
OSHA
Joint Commission
Other stakeholders interested in the health and safety of healthcare personnel

Initial Focus: Three types of events that can lead to injuries or musculoskeletal disorders among HCP: Patient handling and working in awkward postures (overexertion/ bodily reaction injuries); slips, trips, and falls; workplace violence.

Initially the OHSN Healthcare Sector Component will focus on these events, but it may be expanded in the future to collect data on additional outcomes of interest, such as contact dermatitis and work-related asthma.

Next Steps:
Finalize data elements to be included in the initial module based on feedback from subject matter experts and stakeholders
Complete standard occupational data architecture XML schema and implementation guidance to enable healthcare facilities to transmit data in a standard format
Develop, test, and implement the OHSN Data Import and Reporting application

How You Can Get Involved:
Provide input on the final data elements
Recruit healthcare facilities to participate in the system

2.105

A Partnership Between Academic Researchers and Hospitals for Reducing Violence Against Healthcare Workers

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Abstract

Violence against healthcare workers is a serious and growing problem. Workplace violence is a significant stressor for healthcare workers with a considerable impact on the care provided to patients and families. The purpose of this intervention study is to test the effectiveness of a multi-dimensional intervention to prevent physical violence against emergency department (ED) workers and reduce the negative consequences of violence. The primary study aim was to test the intervention's effectiveness on reducing workplace violence. The secondary study aim was to develop and implement the intervention with stakeholder's input and involvement as to ensure its sustainability. Six EDs were enrolled; three intervention sites and three control sites. The intervention EDs and researchers worked together to develop, plan implement and evaluate the intervention using an action research approach. This included the use of discussions and focus groups with the nurse executives, ED workers, physicians, security and patients. The Haddon Matrix served as the conceptual model for framing discussions regarding the contributing factors to ED Violence. Researchers worked with hospital ED Leaders and employees to conduct assessments of the environment, policies and procedures. Action research methods were again used to partner with stakeholders to develop and implement new workplace violence policies and procedures, environmental changes, and education for all employees. These interventions were adapted and customized to meet the operational needs of each institution. Education included on-line learning and tabletop discussions that required participation from multiple disciplines. Data were collected for nine months prior to intervention implementation and are currently being collected for nine months post implementation. In addition to assessing for changes in the incidence of violence, the researchers are examining changes in knowledge, feelings of safety and beliefs about confidence to prevent and manage violence. The intervention will be offered to the control EDs upon completion of the post intervention data collection. In addition to measuring whether the intervention was successful in reducing violence, it is also important that the process be evaluated. Formative evaluation of the process is currently underway with monthly assessments being conducted to evaluate the implementation of the intervention components. Summative evaluation will be completed in June 2011 and will bring together stakeholders to evaluate the study's successes and challenges in regard to the implementation strategies and the partnerships among academic researchers, hospital employees and hospital leaders. Partnership and collaboration among academic researchers, patients, healthcare employees, and hospital administration serve as an excellent model to develop and implement evidence-based programs such as those for violence prevention. A mutual respect is necessary between those who conduct the research and those who operationalize the research in order to have a sustainable positive impact. The collective expertise between the collaborators was critical to both the quality and success of the project implementation.

2.106

Alarmingly Low Influenza Vaccination Rates Among Child Care Workers: Assessing Knowledge, Attitudes, and Behaviors

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Abstract

Background: Over 1.3 million people are employed in child day care settings nationwide. Influenza can be spread quickly among children and caregivers in child day care settings. Vaccination is the most effective method to prevent influenza and serious illness and death from infection.

In response to a request for technical assistance by County A, we determined seasonal influenza vaccination rates among child care center employees, assessed their knowledge and attitudes regarding the vaccine, and determined factors associated with receipt of the vaccine.

Methods: We performed a cross-sectional survey among employees of 32 randomly selected licensed child care centers in County A. From January 30-March 1, 2010, we surveyed employees about personal and work characteristics, pertinent medical history, receipt of or intention to receive the seasonal influenza vaccine. We also included questions assessing their knowledge about and attitudes towards the vaccine, using the Theory of Planned Behavior. We then determined factors associated with vaccine receipt through bivariate and multivariate analyses.

Results: In total, 384 (95%) of 403 invited employees completed a survey. Eighty-five (22%) respondents reported having received the seasonal influenza vaccine. The most common reason for receiving the vaccine was to protect oneself or one's family (65%). Of the 299 respondents who had not yet received the vaccine, 242 (81%) reported they would definitely or probably not get it. The most common reasons cited for not intending to get the vaccine were "I don't think I need the vaccine" (31%), "I don't think the vaccine will keep me from getting the flu" (29%), and "the vaccine is not safe" (6%).

Factors independently associated with vaccine receipt included believing in the efficacy of the vaccine ($P < 0.01$), having positive attitudes towards the vaccine ($P < 0.01$), feeling external pressure to get the vaccine ($P < 0.01$), and feeling personal control over whether or not to get the vaccine ($P = 0.03$). Caring for young infants ($P = 0.02$) and having children 6-17 years old in the household ($P < 0.01$) were independently associated with not receiving the vaccine.

Conclusions: We found a low rate of seasonal influenza vaccination (22%) among employees at child care centers. The most common reasons cited for not receiving the vaccine were misconceptions about the need for, efficacy of, and safety of the vaccine. Factors strongly independently associated with receipt of the vaccine were having positive attitudes towards the vaccine and feeling external pressure from others to get the vaccine. Efforts to improve vaccination rates among this occupational group should focus on eliminating barriers and addressing anti-vaccination ideas through public health messages and training. If possible, employers should consider requiring influenza vaccination for employees as part of a comprehensive influenza prevention program.

2.107

Web-based Health and Safety Practices Survey of Healthcare Workers

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Abstract

NIOSH partnered with 21 professional healthcare organizations to conduct a web-based survey of members regarding health and safety practices in working with hazardous chemicals on the job. The purpose of the survey was to better understand the extent to which healthcare personnel may be exposed to hazardous chemicals such as antineoplastic agents, anesthetic gases, surgical smoke, high level disinfectants, chemical sterilants, and aerosolized medications, and the circumstances of potential exposures. These organizations-collectively representing over 900,000 healthcare personnel in diverse occupations-invited their members to participate voluntarily and anonymously in the 30 minute survey.

The survey instrument was modular by design but seamless to the respondent. It included a screening module, seven hazard modules covering the aforementioned chemical agents (compounding and administration of antineoplastic agents are covered in separate hazard modules), and a core module. The content of each hazard module included information on training, specific chemical agents used and frequency/duration, and use of exposure controls. The core module included information on occupation, type and size employer, work hours and shift, physical demands relative to lifting and repetitive tasks, workplace stress and violence, work related injury/illness/exposures, and demographic information. All survey respondents initially completed the screening module; eligible participants included those who routinely use or come in contact with at least one of the chemical agents. All eligible respondents were expected to complete one hazard module (for the most relevant chemical agents in terms of potential exposure) and the core module. Completion of a second hazard module, if indicated by the screening module, was optional.

Each participating organization implemented a sampling approach developed by NIOSH for surveying their members. Depending on the number of members with email addresses within each organization, the sample either consisted of all members or a random sample of members with emails. Each organization disseminated a series of NIOSH developed communications to sampled members before and during the survey. These included pre-survey announcements six weeks and two weeks before the start of the survey, an invitation letter the day the survey was launched, and three reminder letters at approximately two and a half week intervals during an eight week data collection period. The invitation and reminder letters contained a hyperlink to the survey web site and an organization-specific key to be used by the respondent during login.

Preliminary data show that over 22,700 healthcare personnel have completed the screening module, 12,682 were eligible, and 11,349 completed one or more hazard modules. The most frequently completed hazard modules include surgical smoke (n=4,770), high level disinfectants (n=4,186) and anesthetic gases (n=3,665). The least frequently completed include (compounding) antineoplastic agents (n=476) and chemical sterilants (n=530). Of those eligible, 82% of respondents completed the core module (n=10,400).

Survey results will help NIOSH to understand current practices for reducing potential exposures, to identify gaps in current knowledge about those practices, and to design further research in collaboration with our partners for addressing those gaps. Results will be made available via the CDC/NIOSH public web site, journal articles and other communication avenues.

2.108

Exposure Assessment at an Electrolytic Manganese Dioxide (EMD) processing plant

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Abstract

The ever increasing use of electronic products requires an unquenchable demand for energy to power these products. Primary batteries or alkaline cells are the most accessible and cheapest energy source. The most common alkaline cells are zinc and electrolytic manganese dioxide (EMD) batteries. Over 30 billion EMD batteries are produced worldwide, requiring 350 kilotons of EMD. In 2007 and 2008, NIOSH conducted a health hazard evaluation at a large EMD manufacturing facility to evaluate employee concerns about exposures to manganese, cobalt, nickel, and sulfuric acid mist. Over the course of three site visits, we evaluated employees' full-shift exposures to dust containing metals (manganese, cobalt, and nickel) and sulfuric acid. We also collected seven task-based PBZ air samples for metals on employees performing job tasks associated with dropping and drumming the filter mud and spray washing the filters.

We found that concentrations of manganese ranged from 0.052-1.6 mg/m^3 with two full-shift PBZ air samples exceeding the NIOSH REL of 1 mg/m^3, 16 exceeding the ACGIH TLV of 0.2 mg/m^3, and 16 PBZ air samples collected for 12-hour work shifts (certified chemical and product preparation operators) exceeding the adjusted TLV of 0.1 mg/m^3. The highest PBZ concentrations of manganese were among product preparation area operators, ore trammers, and certified chemical operators in the digest area. A 30-minute task-based sample collected when an employee was bagging the final product exceeded the ACGIH excursion limit of 0.6 mg/m^3. Employees' full-shift and task-based exposures to cobalt, nickel, and sulfuric acid were very low and below their applicable OELs.

Review of the OSHA Form 300 Log of Work-Related Injuries and Illnesses for the years 2002-2007 showed entries for chemical and thermal burns, falls, and musculoskeletal injuries such as sprains and strains. We found no cases of chronic manganese, cobalt, or nickel poisoning.

We recommended installing local exhaust ventilation (LEV) for the bag filling operation, using existing LEV when cutting and grinding parts, and wearing respirators (minimum NIOSH-approved half-mask air purifying respirator with N95 or higher filter efficiency) for those employees exceeding manganese OELs until engineering controls are implemented to reduce exposures. We also recommended using nonreactive fiber-reinforced plastic covers to reduce the amount of acid mist and steam generation and protect employees from falling into cell tanks. Additionally, we recommended revising the written respiratory protection program to address inconsistencies between the written program and the employees' current respirator use.

2.109

Measurement of Near-road Black Carbon Exposure from Traffic Sources in a Midwestern Urban Area

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Abstract

With the rapid development of sustainable communities, the concept of "Complete Streets" is being more favorably considered and implemented. This growing movement advocates redesign of roadways to encourage modes of travel other than cars, such as biking or walking to replace short driving trips. While these design changes will make roads safer for use by pedestrians and bikers, and promote more active lifestyles and fuel savings, they also may result in increased exposure to traffic generated pollutants such as "black carbon" (BC), carbon monoxide (CO), and oxides of nitrogen (NO_x), especially at road locations such as intersections, where many people wait to cross the streets and vehicles are constantly in a stop and go mode.

Increasingly, BC emissions have been studied because of BC's global warming effects on climate and adverse health effects. On-road transportation, especially truck laden traffic, is viewed as the predominant source of BC emissions in the United States and other industrialized nations. While the graphite portion of BC, called "elemental carbon" (EC), contributes to global warming, its organic carbon (OC) portion contributes to the cooling effect. The OC/EC distributions of PM tend to vary from location to location and are usually correlated with traffic conditions. In the Midwestern United States, both industrial and traffic sources contribute to BC emissions. To better understand the BC contribution from transportation, air samples were collected at a busy urban intersection and a highway site. Black Carbon was monitored by both direct reading (aethalometers) and filter-based instruments, during rush hours, non-rush hours, and on both weekdays and weekends. Traffic data, such as traffic volume, vehicle types and stop delay, were also collected. Filter samples were analyzed for OC and EC by NIOSH Method 5040. The BC emission trends of peak and non-peak hours, local and highway sites will be presented and compared with background and other ambient measurements. Preliminary results indicate that the BC emissions at the intersection are higher than the ambient values, which typically are measured either at rooftop sites or locations not near the road.

2.110

Interlaboratory Evaluation of Inductively Coupled Plasma - Mass Spectrometry for the Determination of Trace Elements in Workplace Air Filter Samples

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Abstract

Inductively coupled plasma - mass spectrometry (ICP-MS) is becoming more widely used for trace elemental analysis in the occupational hygiene field, and consequently new ICP-MS international standard procedures have been promulgated by ASTM International and the International Organization for Standardization. However, there is a dearth of interlaboratory performance data for this analytical methodology. In an effort to fill this data void, an interlaboratory evaluation of ICP-MS for determining trace elements in workplace air samples was conducted, towards fulfillment of method validation requirements for international voluntary consensus standard test methods. The interlaboratory study (ILS) was performed in accordance with an applicable ASTM International standard practice, ASTM E691, which describes statistical procedures for investigating interlaboratory precision. The evaluation was carried out using certified 37-mm diameter mixed-cellulose ester (MCE) filters that were fortified with 21 elements of concern in occupational hygiene. Elements were spiked at levels ranging from 0.025 to 10 µg/filter, with three different loadings denoted "low", "medium" and "high". Participating laboratories were recruited from a pool of over fifty invitees; ultimately twenty laboratories from Europe, North America and Asia submitted ILS results. Triplicates of each certified filter with elemental contents at three different levels, plus media blanks spiked with reagent, were conveyed to each volunteer laboratory, along with a copy of the test method which each participant was asked to follow; spiking levels were unknown to the participants. The laboratories were requested to prepare the filters by one of three sample preparation procedures, i.e., hotplate digestion, microwave digestion or hot block extraction, which were described in the test method. Participants were then asked to analyze aliquots of the prepared samples by ICP-MS, and to report their data in units of µg/filter sample. Most interlaboratory precision estimates were acceptable for the medium- and high-level spikes (RSDs <25%), but generally yielded greater uncertainties than were anticipated at the outset of the study.

2.111

Urinary *S*-Benzylmercapturic Acid and *S*-Phenylmercapturic Acid: Development of an Effective Test Method for Quantification

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Abstract

High-Performance Liquid Chromatography-Mass Spectrometric (HPLC-MS) conditions were developed and validated for use to detect and quantitate urinary levels of S-benzylmercapturic acid (S-BMA) and S-phenylmercapturic acid (S-PMA). S-BMA and S-PMA are the metabolites from toluene and benzene, respectively, and these compounds are important for occupational health studies owing to their use as biomarkers of exposure. Toluene is used extensively as a solvent in manufacturing and a component of various transportation fuels. The health hazards of benzene exposure have been well established. The developed test method included the use of the deuterated analog of both analytes for use as internal standards. Spiked urine specimens were passed through solid-phase extraction cartridges; then the analytes were removed by acetone washes. The liquid volume was reduced by evaporation, and the dry extracts were reconstituted in mobile phase solvent for introduction into the liquid chromatograph. A triple quadrupole mass spectrometer (MS/MS) was used as detector with gradient reversed-phase HPLC conditions to measure the target analytes. Recovery experiments using 1, 2, 6, 8 and 30 ng/ml S-BMA and S-PMA fortified urine samples demonstrated good accuracy and precision. Recovery of both target analytes varied between mean values of 99 to 110% of theory for the various spiked levels. Linearity of response was verified for concentrations of 0.5 to 50 ng/ml, and correlation coefficients of 0.98 or greater were obtained for all standard curves. This method offers a valid test for the determination of the urinary levels of both of these biomarkers of exposure as demonstrated by the accuracy and precision of the recovery studies.

Disclaimers: Mention of company names and/or products does not constitute endorsement by the National Institute for Occupational Safety and Health (NIOSH). The findings and conclusions in this poster have not been formally disseminated by NIOSH and should not be construed to represent any agency determination or policy.

2.112

Research on Assessment of Exposure to Fibers

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Abstract

The Exposure Assessment Branch of HELD has been the recipient of two NORA awards (927Z1LX Research Proof of Concept for Fiber Thoracic Sampling; 927ZJFM New Standard Reference Materials for Tremolite - Actinolite Asbestos) and one PHP award (927Z8UQ Improvements in Assessing Exposures to Fibers in Mining) pertaining to research into the assessment of exposures to fibers. In the first NORA project we performed a field evaluation of different thoracic samplers at three mining sites where mineral fibers are encountered compared to the standard sampling method. In the PHP project we initiated a round-robin to determine the performance of a new ASTM Standard method (D7200) procedure for distinguishing asbestos fibers from cleavage fragments through phase-contrast microscopy. As an additional component to these two projects we also tested various sample mounting methods, Walton-Beckett and RIB graticules, and the use of re-locatable grid slides in testing counting proficiency. In the latest NORA project we are searching for asbestos standard reference materials to replace SRMs that are no longer available. For the thoracic sampler study, we proved an effect previously described of fiber loading on fiber-counts, but we were unable to show that using a thoracic sampler was an improvement compared to the current method. For the ASTM round-robin, we showed the discriminatory counting rules of D7200 to be inadequate, because only very long asbestos fibers tend to show asbestiform characteristics and because there is substantial overlap in the length dimension of asbestos fibers and cleavage fragments. We showed the two graticules to be equivalent, we showed the amount of triacetin used in mounting to be critical to the long-term stability of samples, and we showed re-locatable grid slides gave better discrimination in the performance of microscopists than did the standard proficiency test program, especially for chrysotile asbestos. Finally, we have begun to collect asbestos samples from old mining and milling sites in collaboration with USGS to identify sources for reference materials, and we successfully identified in southern California the source site for a reference tremolite asbestos used in the United Kingdom. It is expected that research efforts will continue to meet the needs spelled out in the NIOSH Current Intelligence Bulletin: Asbestos Fibers and Other Elongate Mineral Particles: State of the Science and Roadmap for Research.

2.113

Exposures to Pill Dust at a Mail Order Pharmacy

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Abstract

NIOSH received a health hazard evaluation request from management at a mail order pharmacy concerning employee exposures to pill dust. A multi-metric exposure assessment was performed to determine whether pill dust was released into the air, which activities resulted in the release of pill dust, and the concentration of dust (on a mass basis) and presence of active pharmaceutical ingredients (APIs) in the personal breathing zones (PBZs) of employees. Using direct-reading particle meters, we identified releases of pill dust during the cleaning and filling of canisters containing tablets. PBZ dust concentration ranges were 0.064-0.81 mg/m^3 for inhalable dust, 0.031-0.53 mg/m^3 for total dust, and <0.021-0.033 mg/m^3 for respirable dust. These results suggest that particles greater than 4 µm in diameter contributed substantially to the mass on the filters. Lactose, a common excipient in tablets, was measured (0.001-0.063 mg/m^3) on the inhalable dust samples and several APIs were identified on the total dust samples using desorption electro-spray ionization mass spectrometry. These findings suggest that the dusts collected on the PBZ air samples originated from pharmaceuticals. Most of the pharmaceuticals do not have occupational exposure limits (OELs) and OELs for particles not otherwise specified do not apply because pharmaceuticals are biologically active and typically soluble in water. We are currently in the process of quantifying specific APIs on the PBZ air samples we collected and identifying industry specific OELs for these APIs. In the interim, we recommended the installation of a tabletop cross-draft booth with particulate filters that employees can use when cleaning canisters. Our ultimate goal is to characterize exposures to APIs and provide recommendations to minimize these exposures.

2.114

Novel Approach for Analysis of Fine and Ultra-fine Aerosol Particles Using Laser Induced Breakdown Spectroscopy

Prasoon Diwakar, Pramod Kulkarni, Eileen Birch
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Abstract

Near real-time analysis of elemental composition of aerosol particles is of significant importance in environmental and workplace pollution monitoring. Laser Induced Breakdown Spectroscopy (LIBS) has been successfully used for multi-elemental analyses in solids, liquids, and gases, including aerosols. However, the characterization of aerosols using LIBS is particularly challenging due to small plasma volume and inferior sampling statistics, often leading to poor detection limits and precision. To address these issues, a new approach has been developed for semi-continuous monitoring and analysis of fine and ultrafine aerosols using LIBS. The technique includes a novel design of aerosol collection unit which involves electrostatic collection of electrically charged particles on a Tungsten needle with a flat tip. The method allows collection of miniscule particle mass (pg to ng) directly from the sampled aerosol stream onto a tip of the needle which is of smaller dimension as compared to the LIBS plasma thereby allowing entire mass available for analysis which in turn improves the precision and accuracy of measurements. Capture efficiency of more than 97% was achieved on the collection needle for particles of different sizes ranging from 40-900 nm. A pulsed laser beam (Nd:YAG, 532 nm, 3-5 ns, ~20 mJ) was used to create a plasma that fully engulfs the needle tip and ablates the mass deposited on it. The resulting atomic emission spectra were measured using a broadband spectrometer. The system was calibrated using particles of various diameters ranging from 50 - 400 nm and containing various elements including Cu, Cr, Cd, Mn, Ti, and Na. Sample collection times varied from a few seconds to minutes. The mass detection limits for the above elements were found to be in the range of 18 pg - 5 ng. The technique, owing to its simplicity and robustness, offers many advantages over other similar substrate-based techniques involving collection on a filter or focused deposition using an aerodynamic lens. First, the particle mass is concentrated over a very small area that is smaller than the spatial extent of the laser plasma, thus making the entire mass available for analysis, thereby resulting in improved repeatability and precision of the measurement. Second, the collection technique involves very low pressure drop thereby allowing higher sample flow rates with much smaller pumps making this approach very suitable for portable instrumentation. Detection limits in the range of 1 - 200 ng/m^3 can be easily achieved for most elements studied at flow rates of 5 lpm and sampling times of 1-10 minutes, respectively, thereby allowing measurement of trace element concentrations in ppt levels.

2.115

Method Development for Wipe Sampling and Analysis of Antineoplastic Drugs in Hospital Operating Rooms

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Abstract

As part of the current NORA project, "Operating Room Personnel Exposure to Chemotherapy Drugs," methods are being developed in order to sample and analyze drug concentrations in surface wipe and air samples. Method development has been conducted to validate sampling efficacy and subsequent analysis of cisplatin and mitomycin C, two antineoplastic drugs used in the intraperitoneal administration of these drugs in the operating room. In this procedure, the antineoplastic drugs are heated to 42 °C and introduced into the abdominal cavity via incision for direct application to destroy residual cancer cells following debulking of affected tissue, and later siphoned from the cavity. Little data currently exists regarding the levels of antineoplastic drug contamination of the operating room environment that may result from this procedure. Surface wipe and air sampling strategies are being developed to quantify typical levels of antineoplastic drug contamination. Extraction of cisplatin from swab wipe media, and efficiency of cisplatin sampling from assorted surfaces typical of health care workplaces, have been examined. Quantification of cisplatin (as platinum) is performed via ICP-MS (LOD 50 pg/sample). Extraction of mitomycin C from filter paper wipe media and efficiency of sampling from surfaces has also been evaluated with analysis via LC-MS (LOD <10 ng/sample). Cisplatin and mitomycin C extraction from respective wipe media has been essentially quantitative over a wide range of concentration test levels. Efficiency of surface sampling has shown some concentration dependence for both compounds, with lower levels exhibiting substantial recovery loss. For cisplatin this seems to be mitigated partly by using acidified solvent for wipe sampling. This concentration dependence was not observed in earlier research on surface sampling of several other antineoplastic drugs. The effect of surface material does follow the pattern from earlier wipe sampling research, with surface porosity sharply impacting overall recovery values (stainless steel > Formica® > vinyl floor tile). Air sampling has also been explored for mitomycin C using porous Teflon filters which will permit use of fast flow rates and high sample volumes. Using the same extraction solvent employed for surface wipe media and LC-MS detection, recovery from spiked filters again exhibits marked concentration dependence, which was not observed for several other antineoplastic drugs previously evaluated in air sampling validation studies. If unresolved, these losses will compromise efforts to conduct meaningful sampling for the low levels of suspended mitomycin C aerosol which might be expected in the field. Efforts to improve mitomycin C recovery from air sampling media are presently underway.

2.201

Investigation of Power-Drive as an Effective Intervention to Reduce Caregiver Back, Shoulder, and Upper Extremity Effort during Transferring of Hospital Beds

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Abstract

Background: Nursing continues to be a leading industry sector for the prevalence of low back and shoulder injuries. Nurses are often faced with very physically demanding tasks involving handling patients and medical equipment. One task that requires great effort is the manual pushing of hospital beds and stretchers to transfer patients around the hospital. The objective of the current study was to measure the muscle responses of the trunk, shoulder, forearm muscles, and hand forces while performing transfer tasks with several beds and stretchers with and without the power-drive feature. Power-drive is a mechanical motorized system that when engaged aids the caregiver in moving the bed.

Methods: Twelve participants (6 males, 6 females) completed the study with an average age of 24.5yrs, weight of 75.9kg, and height of 1.74m. Independent variables were bed types-general hospital bed and stretcher; power-drive conditions-with and without; transfer task-pushing straight, pushing around a corner, pushing down ramp, and pushing up ramp; and patient weight-no patient, 90.9kg, and 227.3kg. The dependent variables were normalized muscle activities of the major trunk, shoulder, and forearm muscles and hand forces. All combinations of conditions were completed in random order but blocked on bed type. Repeated measures ANOVA were used to identify significant power-drive effects for each dependent variable.

Results: The use of the power-drive was found to significantly lower the activity for all ten trunk muscles - a decline of 7% to 16% MVC for agonistic (primary movers) and 5% to 9.7% MVC for antagonistic muscles. Larger reductions (5-fold) resulted from power-drive for the left erector spinae and right internal oblique muscles when transferring the stretcher as compared to the hospital bed without power assist. Exertion levels in the majority of the shoulder muscles (left and right trapezius, and left deltoid) were also lower with power-drive as compared to without (7.6%, 17.3%, and 12.8%, respectively). There were no significant differences between with and without power-drive for the forces in either hand.

Discussion: The overall reduction in trunk and shoulder muscle effort indicates significant reductions in stress on these regions. These reductions in the trunk muscles are even more impressive when considering that there was no difference between beds with and without power-drive for the trunk postures, indicating the biomechanical load would actually be reduced. The lack of significant hand forces between with and without power-drive suggests a complex grasp-push interaction.

Potential Impact on Industry: Transferring patients in a bed routinely occurs in most healthcare settings. Given these types of tasks potentially place significant stress on the low back and shoulder of the nurse, there is a need for an effective intervention. One such device, a mechanical power-drive, was found effective in reducing the muscular exertion level during typical transfer tasks.

2.202

Characterization of Occupational Bloodborne Pathogen Exposures in Health Care Workers at a University Hospital: A Three Year Retrospective Study

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Abstract

Bloodborne pathogen exposures (BBPEs) are an important occupational hazard to health care workers (HCWs). The National Occupational Research Agenda and the National Institute for Occupational Safety and Health developed the National Health Care and Social Assistance (HCSA) agenda for high impact injury and illness issues. Strategic Goal 4: Sharps Injuries- seeks to reduce sharps injuries and their impact on all healthcare workers. Various measures have been instituted to help prevent these exposures. The purpose of this study is to characterize the nature of BBPEs to HCWs during a three year period of reported BBPEs at a University hospital and to examine the role of factors modulating these exposures, specifically shiftwork, extent of use of mandated safe work practices and barriers to their use, identifying highest risk procedures and barriers to the use of safety devices.

Existing data was extracted from two pilot tested questionnaires completed by university hospital HCWs who reported to Occupational Medicine with a BBPE. A Needlestick/Sharp form was completed for percutaneous body fluid exposure (BFE) and the Splash form for eye and mucous membrane BFE. The questionnaire ascertained characteristics of the BFE; whether a sharp safety mechanism or personal protective equipment(PPE)/barrier garment was used and barriers to their use, shift duration, time to exposure, job category and location of injury. The data was entered into an Excel database. Standard descriptive statistics were used to describe the data.

Our sample size was 513 for the study period, June 2006 - July 2009. Preliminary descriptive analysis of the data show that approximately 70% of BFE were sharp injures and 30%, splash injuries. Of the sharp BFE, over 50% of HCWs reported no safety mechanism on the sharp device. 50% of these HCWs gave "no safety mechanism existed for the device" as reason. For splash BFE, goggles were used 9% of the time, while exposure occurred to the eyes 69%. If PPE/barrier garment was not used, 67% of HCWs responded that a protocol for the activity involving the exposure requiring PPE/ barrier garment was not in place. The most frequent activities at injury were suturing and disposing of needle for sharp injuries, and direct patient care for splash injuries.

The data show sharps injuries to be the most frequent BFE for the university HCWs. Despite needle safety legislation, over half of the sharp devices at injury did not have a safety mechanism. The data also suggest that a protocol for goggles during at risk procedures may decrease splash BFE to eyes.

In line with the Sharps Injuries Strategic Goal 4 of HCSA agenda, the information gained from this study will enable us to track progress using measurable outcomes, achieve an improved understanding of factors that contribute to or mitigate these BBPEs, and make viable recommendations to prevent these vexing exposures.

2.203

Occupational Exposure to Anesthetic Gases, Antineoplastic Drugs, Antiviral Drugs, Sterilizing Agents, and X-rays and Risk of Spontaneous Abortion Among Nurses

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Abstract

Background: Previous studies have suggested increased risks of adverse reproductive outcomes among female health care workers exposed to several candidate reproductive toxicants, but study samples sizes have limited definitive linkages with specific exposures.. To clarify preliminary reports, we investigated the association between self-reported occupational exposure to antineoplastic drugs, anesthetic gases, antiviral drugs, sterilizing agents, and X-rays and the risk of spontaneous abortion (SA) in U.S. nurses.

Methods: Information about pregnancy outcome, occupational exposures, work schedule, and lifestyle factors were collected retrospectively from 8,461 participants of the Nurses' Health Study II who reported having worked as a nurse during the first trimester of pregnancy. Of these, 7,482 women had a pregnancy that was eligible for analysis. Log binomial regression was used to estimate relative risks (RRs) and 95% confidence intervals (95% CI).

Results: Participants reported 6,707 live births, and 775 (10%) SAs (<20 weeks gestation), 74% of which occurred before the 12th week of pregnancy. After adjusting for age, parity, shift work, and hours worked per week, reported exposure to antineoplastic drugs was associated with an increased risk of SA (RR= 1.86, 95% CI = 1.27-2.73), and particularly with early SA of <12 weeks gestation (RR=2.04, 95% CI = 1.33-3.13). Exposure to sterilizing agents was associated with a 2-fold increased risk of late SA (12-20 weeks gestation) (95% CI = 1.28-3.93), but not with early SA. There was a suggested increase in risk of early SA with X-ray exposure (1.29 (0.99-1.68)). Neither antiviral drugs nor anesthetic gases were associated with SA.

Conclusion: This study suggests that occupational exposures to antineoplastic drugs and sterilizing agents are related to an increased risks of SA in nurses.

2.204

H1N1 Influenza and Respiratory Protection Programs in California Acute Care Hospitals

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Abstract

Objectives: During the H1N1 pandemic of 2009-2010, the California Department of Public Health (CDPH), Occupational Health Branch collaborated with the National Institute for Occupational Safety and Health (NIOSH) on a public health practice initiative to perform an evaluation of respiratory protection programs in a sample of California hospitals. The objectives of this evaluation were to assess the implementation of respiratory protection programs (RPP) in acute care hospitals in California in the context of H1N1, and to identify common barriers and successes in effective program implementation.

Methods: As part of the collaborative effort, a representative sample of hospitals was randomly selected to participate, and interviews of hospital managers, unit managers, and healthcare workers (HCW) were conducted in each hospital using standardized survey instruments. Interviews included questions about the facility's RPP and program implementation, knowledge and beliefs regarding respirators, and safety climate of the facility. Written RPP materials were collected from each facility. In a parallel effort, CDPH distributed an anonymous online survey about respirator practices, knowledge, and beliefs via union email lists to HCW throughout California. Descriptive statistics were used to identify best practices and limitations of hospital respiratory protection programs.

Results: A total of 297 interviews were conducted with hospital managers, unit managers, and HCW in January-February 2010 during visits to 16 participating facilities in the San Francisco Bay Area.

The results reveal that implementation of respiratory protection programs is feasible, including the use of N95 respirators by HCW in close contact with suspected or confirmed pandemic influenza patients. All of the facilities had implemented use of N95 respirators by HCW in close contact with H1N1 influenza patients, and 78% of HCW reported that respirators were always available when needed. 94% of hospital managers reported that fit tests were always performed before use of respirators by HCW, and 96% of HCW strongly agreed or agreed that wearing an N95 respirator was protective against on-the-job exposure to influenza. However, several common shortcomings in hospital respiratory protection programs were identified, most frequently in the areas of recordkeeping, training, fit testing, and program evaluation.

Conclusions: The results of this evaluation have informed ongoing efforts by CDPH and NIOSH to provide useful and timely guidance to healthcare facilities regarding respiratory protection for healthcare workers. A follow-on intervention effort is underway in California in which targeted hospitals will receive tools and assistance to improve their RPP, with the objective of soliciting feedback from the hospitals to improve tools that can be used to assist hospitals nationwide in implementing effective programs.

2.205

Improving Respiratory Protection Programs in California

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Abstract

Objectives: The primary goal of this project is to provide hospitals across the state of California with useful tools to improve their respiratory protection programs. In order to accomplish this goal, the following objectives were addressed:

- Identify the specific program components that are the weakest;
- Develop useful tools that could be implemented by hospital respiratory protection program administrators;
- Evaluate the usefulness of the tools; and
- Adapt the tools for widespread distribution.

Methods:

Recruitment of Hospital Participants
Intervention Development
Intervention Distribution and Pilot Testing
Stakeholder Evaluation of Interventions
Adaptation of Interventions for Wider Distribution

Results:

- All sixteen REACH hospitals and one additional hospital agreed to participate in pilot testing the interventions developed in this project.
- Pre-assessment questionnaires revealed numerous areas for improvement in implementing RPPs.
- During the first two months of pilot testing, CDPH industrial hygienists have provided additional technical support to five of the participating hospitals.

Conclusions:

- Based on progress to date, it is clear that many hospitals rely on staff with no formal training in occupational health and safety to administer their respiratory protection programs. Therefore, there is a significant need for user-friendly interventions to develop and implement respiratory protection programs in hospitals. This need will be addressed through adaptation of the best practice interventions based on the results of pilot testing and stakeholder input, followed by widespread distribution throughout California.
- These interventions will be made available for modification and implementation nationwide.

Preliminary feedback from participants and stakeholders has indicated that the guide and accompanying interventions will likely be very useful to many hospitals.

2.206

A Research-to-Practice Partnership for Worker Health in the Long-Term Care Sector

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Abstract

"ProCare" (Promoting Mental and Physical Health of Caregivers through Transdisciplinary Intervention) is a project of CPH-NEW, a Center for Excellence in the NIOSH Work-Life Initiative. We have used mixed methods to evaluate a safe resident handling or "no-lift" program (NLP) and worksite health promotion (WHP) activities in a large chain of nursing homes, and an investigator-facilitated participatory intervention team process underway in three selected centers within the same company. The NLP resulted in increased use of resident handling equipment and nursing assistants spending less work time in resident handling activities with less need for non-neutral back and shoulder postures. Biomechanical modeling confirmed an overall decrease in physical workload, although with notable variation among centers.

Direct care workers and managers had very different perceptions of opportunities for staff input and decision-making. In the centers with participatory teams, team members reported higher employee engagement and more attention to organizational issues such as teamwork, respect, communication and locus of decision-making.

In 18 nursing homes surveyed by questionnaire, adverse working conditions were associated with cigarette smoking, leisure-time exercise, obesity, and sleep quality, as well as intention to leave the current job. WHP activities had no effect on average body mass index, self-rated health, or exercise habits. Disappointingly, high-fat diet and current smoking (but also former smoking) were more prevalent in centers with well-developed programs. Intention to leave work was slightly lower and decision latitude, coworker and supervisor support were slightly higher in centers with well-developed programs.

Workers' compensation claims decreased post- vs pre-intervention (2003-09) in 86 of 129 centers (mean ratio 0.94, median 0.88). Net-cost analyses showed an overall benefit-to-cost ratio of 1.68, again with substantial variation by facility; savings were higher where there was also a WHP, despite no evidence of health benefits (above). This suggests that WHP centers might have other positive organizational features which were manifested by the initiative to pursue employee health programs.

Driven by this center variability in outcomes, future plans involve more comprehensive assessment of employee health in relation to organizational characteristics. We will take a systems approach to the question of defining "WorkLife" quality, examining the extent of correlation among key domains: NLP effectiveness, worksite health promotion, disability management and return-to-work after injury, employee retention, resident health outcomes, and employee perceptions of psychosocial working conditions and job stress. Primary aims are to determine the organizational features of a nursing home with high "WorkLife" quality and how the company could carry out cost-effective, routine surveillance of key indicators in order to identify problem centers for early intervention.

Other aims include continued evaluation of the NLP with particular attention to the effects of recent program hand-off from a third party to the employer (with implications for understanding the dimensions of organizational support for program success); analysis of compensation claims, survey data and return-to-work experiences after back claims to determine whether the NLP improves the return-to-work process; quantitative and qualitative evaluation of benefits and sustainability of the participatory health teams, and pilot expansion of the teams to mid-level manager level.

2.207

A Research-to-Practice Toolkit for Promoting Participatory Health Promotion and Protection

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Abstract

Researchers in the Center for the Promotion of Health in the New England Workplace (CPH-NEW; http://www.uml.edu/centers/cph-new/), a research-to-practice center supported by the NIOSH WorkLife Initiative, have been conducting field studies with a common main goal:
To evaluate the effectiveness of a grass-roots, participatory approach to worker health improvement, linking health promotion (helping employees adopt healthier lifestyles) with workplace health and safety interventions (using ergonomics to improve tools, equipment, procedures, and work organization).
The CPH-NEW R2P Toolkit represents a translation of CPH-NEW research instruments, methods and findings into practical instruments, training programs, and protocols useful to practitioners such as public health professionals, consultants, insurance loss-control representatives, in-house company program champions, and well-developed human resources departments and health and safety programs.

The CPH-NEW R2P Toolkit provides step-by-step instructions, instruments and guides for assessing and addressing a range of work environment, work organization, and personal health concerns. Methods used in participatory ergonomics are combined with health promotion approaches to form a more integrated and sustainable approach than conventional workplace wellness programs (see Henning, R.A., Warren, N.D., Robertson, M., Faghri, P., Cherniack, M. Workplace health protection and promotion through participatory ergonomics: An integrated approach. Public Health Rep 2009; 124 S1:26-35). Whereas most wellness programs available to employers focus exclusively on products and services aimed at impacting smoking, nutrition, and physical activity, this approach allows a more comprehensive set of work-related topics and concerns to be addressed including work organization factors that drive unhealthy behaviors or work-related stressors that impede wellness program participation. The CPH-NEW R2P Toolkit explicitly targets the combination of workplace and individual health promotion efforts for greater health improvement impact.

The CPH-NEW R2P Toolkit is currently being tested at four field sites representing public and private sectors, including large and small companies, blue collar and white collar workers. Qualitative and quantitative workplace assessment instruments have produced congruent and complementary results that provide sufficient data for participatory intervention planning and evaluation. Start-up guides have been used successfully by facilitators to establish a participatory design team made up of line-level employees, and also a steering committee for made-up of upper management and union leaders. Experience drawn from these worksites and those of the other CPH-NEW research projects provide a strong foundation for disseminating the CPH-NEW R2P Toolkit, and establishing self-sustaining participatory processes within organizations that are consistent with the NIOSH WorkLife approach.

The newest addition to the CPH-NEW R2P Toolkit, the Business Decision Scorecard Tool, introduces additional macroergonomics approaches into the intervention design and evaluation process. This tool enhances the employee design process by introducing a systematic root cause analysis and also provides a stepwise business decision process as intervention alternatives are being developed and later reviewed by the program steering committee for possible implementation. A distinguishing feature is the participatory design of some components of the Business Decision Scorecard Tool itself, building a sense of ownership by both the program steering committee and employee design team that is critical for long-term program sustainability.

2.208

The NIOSH Total Worker Health Program: An Evolution of Research and Partnerships

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Abstract

This poster will introduce the new NIOSH Total Worker Health (TWH) Program, an expansion and evolution of the former NIOSH WorkLife Initiative. The TWH concept promotes a balanced approach to integrating the principles of traditional occupational health and safety protection programs with proven, innovative health promotion and wellness interventions.

Partnerships are a high priority for the TWH Program and are integral to its success in advancing safety and health research. The TWH Program has collaborated and worked closely with partners and organizations representing industry, labor, government and academia since its inception in 2004.

The poster will present the rationale for integrating health protection and health promotion in the workplace and describe the TWH framework and strategy. We will provide a historical account of the WorkLife Initiative, its products and conferences, and describe the transition to TWH. Additionally, we will emphasize the role of partners in the development of our program and its products in each of the following areas:

Intramural NIOSH research. Overview intramural projects and activities that address both individual and work-related (physical or organizational) risks for illness, injury and associated outcomes.

Intramural Collaborations. NIOSH has partnered with the Office of Management and Budget and the Office of Personnel Management on the Federal Employee Worksite Health and Wellness Initiative which is currently under development and the Veteran's Administration's "Wellness is Now" pilot program. These pilot projects and ongoing collaborations with the Centers for Disease Control and Prevention and other federal agencies will be described in more detail.

Extramural Program. NIOSH has funded three WorkLife Centers of Excellence to support and expand multi-disciplinary research, training, and education in integrated approaches to health protection and health promotion. These Centers are conducting research on the benefits of integrated approaches (i.e., participatory ergonomics, psychosocial and health promotion interventions) in a range of settings including healthcare, construction, manufacturing, and the public sector. Each center is also engaging in a number of translation, education, and dissemination efforts that will be described.

Program Products and Practitioner Tools. The poster will provide credible resources for further action from NIOSH (e.g., Essential Elements of Successful Worksite Health and Wellness Programs), CDC (e.g., Guide to Community Preventive Services) and other sources, ideally suited to launch or improve effective worker protection and wellness programs. In addition, we will provide concrete and practical examples of ways to integrate health protection and health promotion in the workplace.

Across each of these points, concepts of culture-building, novel strategies for engaging workers, and mechanisms to permanently sustain programs will be emphasized. We will close with a description of next steps for the program and present opportunities for collaboration.

2.209

The Effects of Occupational Stress on Worker Health Behaviors

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Abstract

Introduction: Stress and work problems are correlated more strongly with health complaints than any other life stressor and can result in increased risk for cardiovascular disease, weight problems, musculoskeletal disorders, mental health problems and can interfere with an individual's ability to take care of oneself. Work stress contributes to poor self care (e.g., high fat diet, infrequent exercise, tobacco use, Ng & Jeffery, 2003; alcohol use, Siegrest & Model, 2006), which is a concern because individual risk behaviors (such as smoking, inactivity) can put people at increased risk for developing chronic health conditions while also exacerbating any existing health problems. Organizations offer a range of programs that can help employees manage their stress (e.g., stress management, flexibility programs) and health (e.g., worksite health promotion, health insurance). However, research on the benefits of such programs is inconclusive with some studies failing to effect significant change (Wilson et al., 1996), in part because many such programs pay little attention to contextual factors in the work environment. The current research examines a comprehensive set of work environment stressors and their contribution to employees' self care (e.g., health behaviors), physical, and mental well-being. In addition, this research explores whether having supportive policies mitigates the harmful effects of stress on employees' health behaviors and other health outcomes.

Method: Data for this study come from a NORA project that focused on examining work organization factors as predictors of depression. Participants included 314 men (25%) and women (75%) from 17 different organizations.

Results: Preliminary results indicate an association between occupational stressors (e.g., role conflict, work-interference-with-family, family-interference-with-work, poor social relations at work, and poor organizational climate) with increased poor health behaviors (e.g., tobacco use, lack of physical activity, alcohol and substance abuse) and poor mental and physical health. Telework correlates with employee physical activity, and stress management correlates with better general health.

Hierarchical regressions will be used to further examine the data and determine whether supportive organizational programs such as flextime, telework, child care assistance, counseling services and stress reduction have a protective effect that reduces the association between occupational stress and poor health. We would expect that programs designed to improve individual responses to occupational risk factors (i.e., stress management, counseling) and flexible scheduling would be beneficial and that employees who have access to those programs would, despite the presence of stress, exhibit better overall mental and physical well-being. However, a previous study (Nigam et al., 2006) conducted with a sample of 1700 retail employees found that even for employees who had several supportive mechanisms in place in their worksite (e.g., strong safety culture, flexible scheduling), experiencing high levels of occupational stress was linked to increased depression, alcohol and tobacco use.

Discussion: This study will add to the literature by identifying work organization factors that can compromise individual health behaviors; has additional implications for the health promotion field, and provides empirical evidence supporting Siegrest & Model's (2006) recommendation for expanding the scope of worksite health promotion to include reducing stressful work experiences.

2.210

Ocupational Stress and Coping Strategies Among Employees of Esfahan Steel Company, Iran

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Abstract

Stress is defined as a state of tension that is created when a person responds to the demands and pressures that come from work, family and other external sources. It has been about half a century that occupational stress has been associated with worker alienation, job dissatisfaction, mental health problems, concerns originating from the industrial revolution, mass production technologies, and the re-design of jobs. Job stress is defined as the harmful physical and emotional responses that occur when the requirements of the job do not match the capabilities, resources, or needs of the worker. Occupational stress may bring about economic and health problems. Work-related stress is estimated to be the commonest occupational health problem and workers are highly vulnerable to the risk of occupational stress in Iran.

This study was conducted to determine the factors that contribute to occupational stress and coping strategies of the employees of Esfahan Steel Company (ESCO), which is the big manufacturing part of the steel industry (with about 6000 employees) in Iran. This was a cross-sectional study conducted on 664 ESCO employees. The DASS questionnaire was selected since it is reasonably short and easy for the respondents, and type of coping with stress was assessed by using the brief cope questionnaire.

The prevalence of stress was 54.2%. The prevalence of stress among operational and non-operational employees was not significantly different. There was no significant relationship between stress with age, marital status, experience, literacy and shift work, but income (financial problem) had a highly significant relationship with stress. Being religious, acceptance, emotional use, self-blame, self-distraction, behavior disengagement and venting had a significant relationship with stress in comparison with active coping, substance use and instrument support. It is apparent that financial problems was the most common reason for stress, among the employees and the main contributors to stress were work environment, task type, financial problems, behaviour disengagement and self-blame. Multivariate logistic regression showed that employees with low income, task type, work environment, emotional use, behavior disengagement and self-blame (p=0.0001), were predictors of stress.

Based on this study, it can be concluded that about half of the ESCO employees suffered from stress. This result concurs with the findings in other similar studies in Iran. In comparison with other industrialized countries, Iranian employees appeared to have a much higher prevalence of stress. This result calls for appropriate planning of the workplace and condition to improve the quality of life and reduce stress.

2.211

Occupational Health Overview for the Wholesale and Retail Trade Industry in US

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Abstract

The wholesale and retail trade (WRT) is the second largest sector and it has been shown to account for occupational fatality, injury, and illness disproportionate to its size. However, little is known about the information on type of workplace health problems among older workers in the WRT industry.

Select data sets from the Bureau of Labor Statistics from 2005 through 2009 were used to identify fatalities, injuries and illnesses burden in various subsectors of WRT described by NAICS codes of the 4 or 5 digit levels. Additionally, the burden was studied based on the ages of each WRT subsector. Age distribution was determined using the Current Population Survey data. Various high burden subsectors also were characterized by the amount of lost work time, nature, event or exposure, and source of injury and illness.

The results revealed that most injuries occurred in the top 5 high risk subsectors that included Beer/wine/liquor merchant wholesalers; Grocery and related product wholesalers; Home centers; Warehouse clubs and superstores; and Other building material dealers. The most common events and exposures associated with nonfatal injury and illness include overexertion, contact with objects, and falls. During the past 5 years, MSDs account for 31.6~34.2% of all lost time injuries and illnesses. The incidence rates (IRs) of MSDs (37.1-47.5 per 10,000 full time workers) were much higher in the WRT sector, compared with IRs for all industries (31.3-38.6/10,000 FTE). Specific sources include containers (28.4-139.5), parts and materials (7.8-26.6) and worker motion or position (17.9-34.1), compared with IRs for private industry (12.6, 9.4 and 14.4, respectively). Moreover, the WRT has a larger percentage of older workers (15.6 -17.8% of older workforce) who may be at immense risk for these outcomes. Older workers required more days away from work to recover from a workplace injury and illness than younger workers. The median days away from work for all WRT workers was 10 days ; 17 days for those aged 55-64; 12 days for workers 65 years and older.

To focus intervention in this large sector, it is useful to identify high-risk subsectors and role of age in those subsectors. NIOSH's Prevention through Design (PtD) application in the specific subsector level identifies design-oriented solutions for workplace hazards. Programs targeted to high risk tasks in the WRT will also help reduce ergonomic hazards if applied in other industries. Proper equipment and ergonomically well-designed tasks are keys to improving occupational safety and health.

2.212

NIOSH Evaluation of Riveting Hammer Hand-Transmitted Vibrations for Tinker Air Force Base

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Abstract

NIOSH's Physical Effects research Team (PERT) entered into a research collaboration with the U.S. Air Force 72nd Aerospace Medicine Squadron (72 AMDS) at Tinker Air Force Base (AFB) in Oklahoma. The Air Force identified Sheet Metal Mechanics as having a high risk of experiencing upper extremity ergonomic illnesses. It is presumed that a major ergonomic stressor for sheet metal mechanics is hand-transmitted vibration from powered hand tools such as riveting hammers. The 72 AMDS is interested in protecting its workers against potentially harmful exposures to hand-transmitted vibration (HTV) and in developing means to improve the process it uses in selecting powered hand tools for workers at Tinker AFB. One of the criteria 72 AMDS intends to use in the tool selection process is a ranking of prospective tools by vibration level. In an initial collaborative effort, the NIOSH group tested eight riveting hammer models supplied by 72 AMDS. NIOSH researchers employed six tool operators to run the tools against the loading device specified in the international standard for the measurement of tool handle vibrations (ISO 8662-2, 1992). NIOSH researchers rank-ordered the tools based on accelerations measured at the tool handle. Following the lab study, PERT suggested that the collaboration continue with a field study to evaluate riveting hammer vibration emissions during actual riveting tasks regularly performed by sheet metal mechanics at Tinker AFB. Three riveting tasks were identified by 72 AMDS for the field evaluation. Vibrations were evaluated based on the ISO 5349-1, 2001 and ANSI S2.70-2006 standards. Daily HTV exposures, or A(8) values, were also estimated for the Tinker AFB riveting hammer operators.

There were three major findings of this collaborative study: 1) Tools rankings were fairly consistent regardless of tool operator, work task, or acceleration weighting (ISO-weighted or unweighted). 2) Vibration magnitudes during the laboratory study were higher than those of the field study at Tinker AFB. However, the rank orders of the tools were fairly consistent, especially for the lower-vibration tools. This indicates that the ISO laboratory-based standard is appropriate for identifying tools that could be expected to exhibit lower vibrations in workplace environments. 3) None of the A(8) exposure estimations for the tools and tasks evaluated in this field study approach the ANSI S2.70-2006 Daily Exposure Action Value (DEAV) of 2.5 m/s^2.

Based on the study, PERT recommended that tool selection should not be based entirely on laboratory or field vibration measurements. Other criteria such as productivity, tool versatility, worker acceptance, initial cost, and maintenance costs should also be considered during tool selection.

It is important to note that rivet bucking bar vibration exposures were not evaluated in this study. It is likely that bucking bar hand-transmitted vibration exposures are considerably higher than exposures to riveting hammer operators. Unfortunately, there are no US or International standardized procedures for evaluating bucking bar vibrations, and there are several technical difficulties associated with bucking bar vibration measurements. Thus, bucking bar vibration measurement remains an important topic for future research.

2.213

The U.S. Naval Supply Systems Command/Navy Clothing and Textile Research Facility (NAVSUP/NCTRF) and National Institute for Occupational Safety and Health (NIOSH) Partnership for Improving Protection from Work-Related Hand-Arm Vibration Syndrome (HAVS)

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Abstract

To help reduce the incidence of HAVS in Department of Defense (DoD) heavy equipment/aircraft maintenance facilities and shipyards for workers using vibratory tools, NAVSUP/NCTRF entered into an agreement with the NIOSH Physical Effects Research Team, Engineering and Control Technology Branch, Health Effects Laboratory Division to study hand-transmitted vibration exposure. The agreement involves developing a means to improve the process the DoD uses in selecting powered hand tools and anti-vibration gloves, which can help minimize the risk of HAVS, a debilitating neuro-sensorial and vascular occupational disease.

As a part of the agreement, NIOSH completed a laboratory study to identify effective ommercially-available gloves which can reduce hand-transmitted vibration exposure during the use of vibratory tools. Specifically, this study measured the vibration transmissibility functions of eight glove models relative to different vibratory frequencies. Results were used to identify the gloves that meet the testing criteria of the international standard ISO 10819 (1996). In addition, this study also measured the magnitude of the reduction in grip strength associated with the use of the tested gloves.

The results of this study confirmed that the vibration isolation effectiveness of the gloves was frequency-specific. While the gloves did not significantly reduce vibrations at frequencies below 25 Hz, they provided some reduction of the vibration transmitted to the palm of the hand. Glove effectiveness generally increased with the increase in vibration frequency. Effectiveness also varied significantly among the glove models, primarily depending on the isolation materials of the gloves. This study also found that these gloves reduced grip strength by more than 33%, compared with the bare-hand grip strength.

A reduction in grip strength would require a more forceful tool grip, which has been associated with an increased potential for carpal tunnel syndrome and other disorders. Thus, it is highly desirable for anti-vibration gloves to significantly reduce vibration without substantially increasing the grip effort. Based on this expectation, the tested gloves were ranked in terms of vibration attenuation and grip strength reduction, and the most effective models were identified. The results of this study also suggest that anti-vibration gloves should not be recommended for the operation of low-frequency tools such as sand rammers, tampers, and vibratory forks.

As another important output, the study led to some substantial improvements of the standardized method for testing anti-vibration gloves, which have been adopted in the revised version of ISO 10819/CD (2010). Furthermore, the transmissibility functions measured in this study can help facilitate decisions for selecting gloves for use with specific tools.

A proposed follow-on study will look at the powered hand tools used at four DoD equipment maintenance facilities and determine recommendations for ways to minimize HAVS risks.

2.214

Kentucky Semi Truck Transportation Fatality Investigations: Contributing Factors

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Abstract

Objective: From 2000-2010, there were 103 semi truck transportation fatalities in Kentucky. The Kentucky Fatality Assessment and Control Evaluation (FACE) program began investigating semi truck fatalities in 2005; 14 semi truck fatality investigations have been completed. The objective of the study was to determine the root cause of the fatalities, and to identify additional risk factors that may have contributed to the driver or passenger fatality.

Methods: A Haddon matrix analysis was performed on the 14 Kentucky FACE reports assessing the pre-event, event, and post-event phases of the fatal incidents. Administrative, engineering, and behavioral controls that were recommended to prevent future occurrences were compiled; preliminary impact of these reports was assessed.

Results: Of the 14 semi truck transportation fatality investigations, falling asleep at the wheel was considered a primary contributing factor for six of the fatal crashes but falling asleep at the wheel is difficult to prove. In one of the fatality cases, the driver told EMS personnel that he fell asleep at the wheel before he died. The long-haul company driver was transporting canned tomatoes from a northern state to a southern state. He had initiated his route six days before the incident. At approximately 4am, the semi truck drifted off the interstate, and traveled down an embankment behind a guard rail into a stand of trees. A witness was traveling behind him, saw dust from the crash and called 911. The driver was awake and cognizant, told EMS personnel his name, date of birth, and stated that he fell asleep at the wheel. The driver was pinned in the seat and died twenty minutes later of internal injuries while EMS personnel were extracting him from the semi tractor. The coroner arrived and declared the driver dead at the scene.

Other contributing factors for the fatal collisions included: obstacles in the roadway (n=2), drugs (n=2), speed (n=2), faulty brakes and bad tires, (n=1), inattention (n=1), and alcohol use by a passenger vehicle driver (n=1).

Impact: Three preliminary impacts have been demonstrated to date: 1) A report recommendation to restrain semi truck occupants in the sleeper berth while the vehicle is in motion was adopted by a company as standard operating procedure; 2) Based on a fatality report recommendation to include openings in highway median barriers, the KY Transportation Cabinet now includes openings every two to three miles for emergency vehicle access; 3) A recommendation to develop a fuel shut-off valve prototype on refrigerated trailers was developed by University of Kentucky engineering students.

Conclusions: FACE fatality investigations are useful to determine root causes of semi truck transportation fatalities and the recommendations within the reports are used by stakeholders and companies to develop engineering, administrative, and behavioral controls.

2.215

Occupational Safety and Health In A Mobile And Hard-To-Reach Worker Population: National Survey Of U.S. Long-Haul Truck Driver Injury and Health

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Abstract

The approximately 1.5 million U.S. heavy- and tractor-trailer truck drivers experience high rates of injury and illness. In 2008, workers in this occupation accounted for 14% of all fatal occupational injuries. They had a nonfatal injury rate three times higher than that of the general worker population. Truck drivers have also been shown to be at increased risk for a number of chronic diseases and health conditions, but little is known about the prevalence of specific health conditions or the factors suspected to place drivers at increased risk. Operational characteristics of the trucking industry (e.g., long work hours and irregular schedules) predispose truck drivers to fatigue, which is implicated in transportation accidents, and may contribute to stress and chronic disease.

Stakeholders have called for further research targeting health and safety issues such as fatigue and sleep disorders, and for improvements in injury and illness data collection. These needs are also related to the safety mission and goals of NIOSH's partner safety agency in the U.S. Department of Transportation, the Federal Motor Carrier Safety Administration (FMCSA). FMCSA's mission is to save lives and reduce injuries by preventing truck and motorcoach crashes.

NIOSH, in partnership with the FMCSA, conducted a national survey of long-haul truck drivers' injury and health to address these issues. The purpose of the national survey was to provide current occupational safety and health data on truck drivers. Results of this research will: 1) provide critical baseline data on a high-risk worker population, including prevalence of selected health conditions; 2) describe the prevalence of risk factors associated with health outcomes within the long-haul truck driver population; 3) provide information to drivers, the trucking industry, and the transportation research community to guide health and safety promotion, interventions, and future research directions, and 4) assist regulatory agencies in focusing rulemaking and inform policies related to driver health and fitness.

Data collection took place at 32 truck stops along major U.S. transportation corridors selected to be geographically representative. Randomly selected truck drivers entering truck stops were given a screening questionnaire to ensure survey eligibility. Data collected from eligible consenting drivers included: 1) a personal interview on demographics, truck driving practices, work history, health conditions, crashes and non-fatal injuries, training, and safety; 2) a 48-hour sleep and activity diary; and 3) measurements of the driver's height, weight, and neck size. Information about individual truck stop sites was also collected. Individuals who declined participation were given the opportunity to participate in a short interview designed to compare respondents to non-respondents.

Additional research associated with the survey effort has included: means of disseminating OSH information to truck drivers and managers, alternative methods for conducting research in this hard-to-reach population, healthy lifestyle options available at truck stops, and development of a sleep awareness campaign. Areas for future research, such as increasing participation of female truck drivers, medical coverage, and workers' compensation practices, have also been recognized.

2.216

Assessing the Burden of Work-Related Musculoskeletal Disorders in Air Transportation

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Abstract

Workers in the air transportation industry are subject to a wide range of physical, chemical and organizational workplace hazards. Air transportation (Industry code 481) experienced 8.5 non-fatal injuries per 100 full-time workers, producing an estimated 40,000 recordable injuries in 2009 (Bureau of Labor Statistics, U.S. Department of Labor, October 2010). In contrast, the rate for all private industry was 3.6 per 100.

Reliably defining injuries and illnesses in this population is difficult, as they are regulated by several agencies and work under many different conditions. Understanding the extent and distribution of musculoskeletal disorders is especially a challenge. To quantify the burden of work-related musculoskeletal disorders (WMSDs) in the aviation subsector, NORA Transport Warehousing and Utilities Sector council members have collaborated with labor, industry, and academic partners to gather and explore available data, and to begin to generate new data. Activities have included:

Conducting a review of world-wide research and industry literature concerning WMSDs in flight attendants, baggage handlers, service representatives, and mechanics (facility maintainers, automotive and aircraft mechanics).

Establishing a network of partners for data sharing and input

Characterization of the sources of existing data from government, industry and labor sources

Identifying key variables and data gaps

Submitting a request to the Bureau of Labor Statistics for WMSD detailed occupation, event or exposure, nature of the injury or illness, body part affected, and source of the injury or illness in Air Transportation

A preliminary exploration of OSHA 300 log data available to employers and worker representatives

A symptoms and exposure survey of 170 Fleet Service Clerks in New York and California.

The proposed poster will briefly describe the literature, summarize the BLS data, provide survey results and outline the value and limitations of workplace injury data. This will set the stage for a discussion of the feasibility of collaboration among stakeholders, an exploration of methods for enhancing and coordinating data collection, an assessment of potential research and intervention targets, and the proposal of steps needed for prevention. This work has implications for other hazards, injuries and illness in this sector.

2.301

The Encyclopaedia of Occupational Health and Safety: Creating An Online International Resource

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Abstract

This poster will describe and illustrate the structure and functions of the online version of the 4th Edition of the International Labour Organization's (ILO) *Encyclopaedia of Occupational Health and Safety*. The aim is to create a user-friendly, updated and easily revised and maintained basic reference work that serves as the centerpiece of a portal to worldwide occupational health and safety resources and provides a tool for international technical social networking.

The major goals for the online *Encyclopaedia* website are to:

- Have user-friendly and attractive design;
- Retain authoritativeness by relying upon expertise drawn from around the world to:
- Update existing information to reflect state-of-the-art knowledge;
- Identify key informational and institutional worldwide resources to link on a chapter- by-chapter basis
- Add new areas of knowledge that have an impact on OSH
- Archive outdated files to a searchable historical database on the site;
- Have high web visibility to maximize its impact;

The *Encyclopaedia* functions as the central core of the new website, and appropriate linkages are made between the *Encyclopaedia's* chapters and other ILO and external OSH resources. In addition, there will be important intra-*Encyclopaedia* cross-reference links, operationalized through advanced searches and tag clouds, that will provide the reader with related information in the *Encyclopaedia*. Other features in development include:

1. External links to reference abstracts and complete text where possible
2. Linked current literature searches via US National Library of Medicine's PubMed and/or CISDOC or other appropriate abstracting service, depending on the subject matter.
3. Training materials, checklists and other resource links
4. Options for searching, printing and exporting Encyclopedia articles
5. A directory of collaborating institutions, professional societies, international organizations
6. A 'find an expert' link to individuals willing to provide technical support to users around the world.

The development of an online edition of the classic ILO *Encyclopaedia of Occupational Health and Safety* is both a great challenge and great promise. The update will retain the Encyclopaedia's coherence, accuracy and readability; it will remain accessible and useful to readers from around the world; and it will be drawn from the ILO's tripartite constituency, including national OSH agencies, trade unions and employer organizations, as well as professional OSH bodies and the academic and research communities. Engaging the support and enthusiastic cooperation of these ILO stakeholders will be the key to the success of the *Encyclopedia* as an ever up-to-date reference and as a successful portal to worldwide occupational health and safety resources.

2.302

Ensuring the Health Hazard Evaluation Program is Responsive to Customers' Needs

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Abstract

Objectives: The HHE Program Customer Survey Project was initiated to assess customer awareness and understanding of the HHE Program; understand perceived barriers and motivators to using the Program; test marketing messages and materials; and use collected data to inform the development of a targeted marketing campaign to increase awareness of and access to HHE Program services.

Methods: We conducted a situational analysis to identify gaps in use of the HHE Program and used that information to construct the HHE Program customer survey. We pre-tested and then launched the web-based survey, with paper surveys available upon request. Following the survey, four focus group sessions were held to conduct materials and concept testing on an informational brochure. The last data collection phase, usability testing of the HHE Program webpages, was done using eye-tracking technology.

Results: Results of the customer survey indicated that 70% of Food and Beverage Manufacturing respondents and 87% of Services to Buildings and Dwellings respondents had never heard of the Health Hazard Evaluation Program. When asked what factors would make respondents more or less likely to request an HHE we found that having federal government employees visit the workplace made most respondents neither less nor more likely; when asked whether having a report with the name of a company evaluated be published 45% of Food and Beverage Manufacturing respondents and 29% of Services to Buildings and Dwellings respondents said it would make them much less likely to request an HHE.

Focus group testing of informational brochures found that employers did not understand the benefits of using the Program and thought that having their company name on a final report identifying that an investigation had been done at their facility would reflect negatively on them. Employers also thought the fact that HHEs are done at no cost was a motivator that wasn›t stressed enough. Employees thought that the brochure was «too industry specific» and «too technical» and that information on the Program›s ability to keep a requestor›s name confidential should be moved to the front of the brochure and emphasized in multiple places. Employees also expressed that the opportunity to talk to someone prior to submitting a request was important.

Eyetracking showed that most web users have only one page of attention and only scan web text. Participants had difficulty locating the HHE request form, HHE contact information, and could not locate or successfully use the Search function.

Conclusions: This research has provided data rich with ideas on ways that HHE Program materials and website can be improved to better meet the needs of our customers. These results are being used to direct the development and implementation of a targeted marketing campaign to increase awareness of and access to HHE Program services.

2.303

A Partnership with the Mexican Consulates to Improve Immigrant Workers' Knowledge of Occupational Safety and Health Risks, Rights, and Resources

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Abstract

Foreign-born Latinos experience a disproportionate burden of fatal work-related injury in the U.S. In 2006, the fatal work-related injury rate for foreign-born Latinos was 5.9 per 100,000, compared to 3.5 for U.S.-born Latinos and 4.0 for all workers. Workers born in Mexico made up approximately 70% of foreign-born Latinos who died on the job from 2003-2006 (CDC, 2008). One of the biggest challenges to promoting occupational safety and health (OSH) among Latino immigrant workers is ensuring their access to relevant information, resources, and services. Partnership is essential to overcoming barriers to access.

This poster describes a NIOSH pilot project to develop and distribute culturally tailored OSH materials through the *Ventanillas de Salud* (VDS, "Health Windows") program at the Mexican consulates around the U.S. Through this pilot project, NIOSH has developed a close collaboration with several agencies in the U.S. and Mexican government, local consular personnel, and non-profit health promotion organizations. These relationships are central to the current project as well as the promise of future NIOSH education and training initiatives for immigrant workers.

Fifty Mexican consulates across the United States serve more than one million Mexican immigrants annually. The VDS program is a partnership between the Mexican consulate and local governmental and non-governmental organizations to provide health information, basic screening, and referrals to Mexican nationals who come to the consulate for a variety of services such as obtaining a passport. For this pilot project, NIOSH developed a series of culturally tailored interventions adapted to the range of models of health information dissemination that the VDS programs use. Input from local stakeholders and workers themselves helped ensure cultural relevance and responsiveness. This demonstration project also developed methods for testing the effectiveness of these interventions at encouraging VDS participants to seek more OSH information, referrals, or services. Both the materials and the evaluation methodology will be pilot tested in three consulates as part of this study.

Establishment and maintenance of the partnerships through this demonstration project has established infrastructure for NIOSH and its partners to continue to communicate with a broad segment of a population often labeled as "hard-to-reach". Future NIOSH efforts should include an evaluation of this project with a purposive sample of consulates. NIOSH researchers and others can build on this partnership infrastructure and the cultural tailoring process to create, disseminate, and evaluate effective materials on industry-specific topics relevant to this population. The authors plan to continue building and expanding the partnership's scope to improve coordination between the occupational safety and health education and legal, advocacy, and referral services functions at the Consulates, as well as to enhance the capacity of Consular staff to respond to anticipated demands for OSH-related services.

2.304

Communication and Information Dissemination at NIOSH: Outcomes and Opportunities

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Abstract

Transfer of research knowledge into prevention practices into the workplace is fundamental to the mission of the National Institute for Occupational Safety and Health (NIOSH). The NIOSH Communication and Information Dissemination Cross-sector (CID) Program overlays **all** NIOSH Sector and Cross-sector programs as an interdisciplinary, service-oriented program with a keystone of transferring research into practice. The program mission is to ensure the delivery of effective occupational safety and health communication for total worker health that drives the adoption of safe work practices to improve workplace safety and health. The purpose of the proposed poster abstract is to: 1) Inform NORA and NIOSH stakeholders of the program's approach for increased effectiveness of, and support for, incorporation of health communication activities into Institute programs; 2) Share goals, activities, outputs, and intermediate outcomes of the program; and, 3) Identify opportunities to interact with partners for creating, communicating, and delivering value to our customers.

Approach: The program's five strategic goals are based upon research translation principles and provide guidance to project officers and program leaders. Program goals are to ensure the timely dissemination and translation of evidence-based research; support and promote the adoption of evidence-based practices; foster strategic partnerships and collaborations to disseminate and diffuse evidence-based practices; evaluate communication materials, strategies, and interventions; and advance communication research to drive the effective dissemination, diffusion, and adoption of evidence-based practices. The NIOSH CID Program portfolio is aligned to provide assistance and build the capacity of NIOSH researchers and partners by providing tools and techniques to reach their intended audiences. The CID Program is led by a core group and coordinated by an internal steering committee with representation from the divisions, laboratories and offices. Implementation of the program's portfolio is supported through the CID Program Council, comprised of workgroups and an internal steering committee, which includes approximately 60 NIOSH health communication specialists, visual information specialists, researchers, and managers from across the Institute.

Results: In 2008, the Program enhanced its leadership role within the public health community by placing priority in implementing Web 2.0 applications. In 2010, the CID Program established a set of priorities to increase the Institute's use in social media, expand reach, engage in new networks, and promote NIOSH program outcomes. For example, NIOSH is actively using various social media tools to reach diverse audiences with safety and health information. This includes two social networking sites (Facebook, 7,500 "likes"; MySpace, 151 fans); eight microblogs (i.e., Twitter) with over 100,000 "followers"; a blog (i.e., NIOSH Science Blog) with nearly 25,000 subscribers; and, an online newsletter (i.e., NIOSH eNews) with over 43,000 subscribers.*

Conclusions: The NIOSH CID Program is committed to creating, communicating, and delivering value to its customers and encourages and assists Institute staff to employ well-designed health communication approaches to improve intervention effectiveness. The NIOSH CID Program efforts are also aligned to work with partners to transfer evidence-based knowledge into relevant routine practice.

Future Directions: Communication science and translational research have long been applied to the public health field for informing research and developing impactful interventions. The CID Program faces challenges, such as new technologies, to expand this field of knowledge and apply the lessons and recommendations to related work in the occupational safety and health setting.

*Numbered as of April 2011

Reference: http://www.cdc.gov/niosh/programs/cid

2.305

An Agenda for Research Related to Occupational Safety and Health in Small Businesses

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Abstract

Small businesses are recognized as vital to the economic health of societies. The vast majority of businesses in the U.S. (and many other Western countries) are small. Their occupational illness and injury rates are high, and they have few resources to devote to prevention efforts. Small business managers must spread their efforts across so many different activities that technical issues like employee safety and health are often a low priority, so they tend to not seek assistance, and lapse into reactive management. Since they often manage in isolation from technical expertise and peers in their industry, it is difficult to instill small business managers with the knowledge and motivation to adequately provide a safe and healthful workplace for their employees. Further, public health surveillance and OSHA enforcement efforts suffer from disproportionate undercounting of injuries and illnesses in small businesses compared to larger ones. Public health infrastructure in the U.S. is inadequate to effect significant improvements in injury and illness prevention in the Nation's six million small businesses that have employees, and other countries have a similar public health resource deficit.

Small teams and individual researchers are studying occupational safety and health in small businesses throughout the industrialized world, and especially in the E.U. and Canada. However, they resemble the small business owner/operators they often study: isolated from their peers and lacking in resources. Their body of research is largely descriptive, repetitious, and lacking consideration of characteristics that are exclusive to small enterprises. Research to inform injury, illness, and fatality prevention is lacking because there is neither a coherent agenda nor coordinated groups of research projects due to worldwide lack of institutional support.

Based on reviews of the published literature, the following agenda for future research regarding small businesses is provided. The agenda articulates research questions in seven areas:

Conceptual and operational definitions of "small business"

Surveillance

The extent of safety and health activity in small businesses

The relationship between characteristics of small businesses and safety and health activities

The relationship between characteristics of the owner/operators of small businesses and safety and health activities

The influence of societal factors such as government regulation and workers' compensation systems on small business safety and health

Intervention effectiveness and diffusion

The large-employer orientation of occupational safety and health professionals, government, and insurance systems are barriers to such an agenda. However, a broad and sustained program of globally-coordinated research such as described here holds promise to prevent workplace illnesses and injuries in the long-neglected majority of workplaces: small ones.

2.306

Moving NIOSH Engineering Design Solutions into Practice: Assessment of a Diffusion Process

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Abstract

NIOSH researchers have developed and assessed an array of engineering design solutions to minimize workplace hazards. These solutions have been disseminated through scientific and trade journals and presented at symposia, but many are not widely implemented by industry. The goal of this study is to evaluate and identify diffusion strategies that lead to the adoption of engineering solutions to reduce worker safety and health risks. The first aim was to review engineering design solutions demonstrated to be technologically effective and select those solutions where the greatest opportunities exist for testing and developing diffusion strategies. The second aim was to examine the motivators and barriers that influenced the adoption of the selected design solutions. This paper discusses 1) the methods used to select engineering solutions for testing diffusion strategies, and 2) the results from the assessment of the diffusion process for one of the design solutions, a reduced-size tub used in grape harvesting.

Initially, a list of 70+ technologically effective engineering design solutions drawn from NIOSH sponsored research in construction, healthcare, agriculture and manufacturing was compiled. Using criteria developed by NIOSH researchers, the identified solutions were scored to develop a final list of five engineering solutions. The list was assessed to ensure that only design solutions that were current, effective in reducing safety/health risks, and affected significant numbers of workers, were selected for testing diffusion strategies. The final list consisted of: a roof guardrail assembly, the reduced-size tub for grape harvesting, work zone barriers, patient lifting devices, and wet cleaning (substitution for dry cleaning).

Secondly, this presentation describes the results of the assessment of the diffusion process for the grape harvesting "tub". In the late 1990's, the University of California-Davis, AgSafe, and NIOSH partnered to develop an ergonomic picking tub to minimize winegrape harvest-related injuries among farm workers. A health record review of vineyards showed that 69% of injuries were back injuries associated with lifting during harvest. Introduction of the smaller tub led to an 80 % reduction in reports of pain and injuries among farm workers during harvesting. A decade later, AgSafe and NIOSH, evaluated the winegrape growing industry, determining the use and impact of the smaller picking tub. These results revealed a number of factors impacting the tubs' adoption, including economic factors and employee productivity. Survey results showed 81% of vineyard operators using the smaller tub did so because it was safer for employees. Reasons for adopting the "smaller tub" cited by focus groups are fewer aches and pains, less tired after work, and makes workers happy. The diffusion results for the smaller tub were positively correlated to five key attributes affecting the speed and extent of an innovation's diffusion: relative advantage, compatibility, complexity, trialability, and observability.

This study's results will be incorporated into a dissemination strategy to encourage other growers to adopt the technology for both fiscal and occupational benefits. Lastly, the project's outcomes can be incorporated into diffusion strategies to promote the adoption of underused design solutions.

2.307

Variability in Business Case Results Associated with Adopted PtD Design Solutions

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Abstract

Background: A greater focus on the diffusion of design solutions (engineering research products) to industry is a recognized goal for the Institute and is reflected in its research-to-practice (r2p) plans. It is not sufficient to develop innovative design solutions and stop there. They need to be marketed to and adopted by their respective industries to have maximum impact on CDC's strategic goal: to promote and protect the health and safety of people who work by preventing workplace-related fatalities, illnesses, and injuries.

There are likely many reasons that explain why design solutions that are successful in an engineering sense (i.e., they significantly reduce an OSH hazard or risk and they are practical and cost-effective) are not widely adopted in practice. However, no one has systematically examined the factors that acted as motivators or barriers to the adoption of these designs. This project begins to fill the research gap by developing business cases for companies that have either adopted one of the design solutions or are thinking of adopting one of the design solutions and by identifying those factors that contributed to (motivators) or hindered (barriers) the successful adoption of the engineering design solutions within the participating companies.

Methods: Initially, a list of over 70 technologically effective design solutions drawn from NIOSH sponsored research in construction, healthcare, agriculture and manufacturing was compiled. Using criteria developed by NIOSH researchers, the identified solutions were scored to develop a final list of five design solutions for use in this study. The list was assessed to ensure that only design solutions that were current, effective in reducing safety/health risks, and affected significant numbers of workers, were selected for testing diffusion strategies. The final list consisted of: a roof rail assembly, the reduced-size tub for grape harvesting, work zone barriers, patient lifting devices, and wet cleaning (substitution for dry cleaning).

Results: This presentation provides the resulting business cases for three of these design solutions-reduced-size tub for grape harvesting, patient lifting devices, and wet cleaning. The business cases included quantitative and qualitative measures of the impacts associated with adoption of each intervention. Financial metrics including the net present value, return on investment, and payback period were derived based on the quantitative measures. The study demonstrated that motivators and barriers for a company to adopt or an individual to use these design solutions varied substantially.

2.308

Health-Adjusted Life Years and Burden of Disease by NORA Sectors: The National Health Interview Survey (NHIS) 1986-1996

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Abstract

Objective: As the traditional types of occupational exposure have been reduced among U.S. workers in recent years, several health problems related to functional capabilities, medical conditions, and self-perceived health are receiving increasing focus. The development of health-related quality of life measures such as quality adjusted life expectancy (QALE) and disability-adjusted life years (DALYs) provide a common metric for the comparison of worker populations by simultaneously incorporating both morbidity and mortality effects. The estimation of quality of life for the US Worker population, using nationally representative data, has never been undertaken. The objective of this monograph is to provide a measure of disease burden using health- and disability-adjusted measures of mortality for U.S. workers by the eight new National Occupational Research Agenda (NORA) industrial sectors.

Methods: This study uses 1986-1996 NHIS data (n = 513,532 representing an estimated 115,038,541 US workers) to estimate and compare QALE (i.e., the remaining years of "perfect health") and DALYs for seven chronic health conditions that are prevalent among workers. These data are presented for all workers as well as by NORA industry sector subgroups and by age, gender, race, ethnicity, and education.

Results: Based on QALE, U.S. workers in the Wholesale and Retail Trade and Healthcare and Social Assistance sectors had a lower burden of disease (greater QALE) than workers in other sectors. Workers in the Agriculture, Forestry and Fishing sector had the lowest QALE. Among demographic subgroups, males had four fewer years of optimal health than females, white workers had slightly lower QALE than other race groups, and Hispanics had higher QALE than non-Hispanics. Additionally, higher educational attainment was associated with a higher QALE. Workers with asthma had the fewest DALYs among the conditions we examined. Hypertension had the greatest DALYs followed by visual impairment and ischemic heart disease. With the exception of visual impairment, males had greater DALYs than females; Hispanics had greater DALYs than non-Hispanics for all conditions except asthma.

Conclusion: These findings represent the first comprehensive examination of worker quality of life in important demographic sub-populations and among NORA sectors. This information gives a sense of which sectors and subgroups have relatively better/worse health-related quality of life (burden of disease). Hypertension generated the greatest burden of disease across all workers; this was especially pronounced for black workers across all NORA sectors and within sectors (except for Mining and Transportation, Warehousing, and Utilities). The summary QALE and DALY measures provide a starting point to examine differences in health-related quality of life in US workers for the identification of priority groups for disease prevention/health promotion interventions, as well as provide baseline information for future investigators seeking to document changes in the health status of the US workforce.

2.309

Incidence and Cost of Depression following Occupational Injury

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Abstract

Background: Occupational injuries influence workers' psychological and physical wellbeing, increasing their risk of suffering from depression related illnesses. The costs of treating post-injury depression are typically not included in estimates of the economic burden of occupational injuries. Workers' Compensation (WC) does not cover these costs.

Objectives: The current analysis was conducted to determine if injured workers were more likely to be treated for depression than non-injured workers within three months following occupational injury, and to estimate the cost of post-injury depression paid by group medical insurance.

Data and Method: We used the 2005 Thomson Reuters Medstat MarketScan Health and Productivity Management (HPM) and Commercial Claims and Encounter (CCAE) data sets. These data sets contain information on both workplace injuries and group medical health insurance records (outpatient cases, date of service, ICD-9 codes, total payments, etc.). We linked these data sets to obtain information on work-related and general health for all workers during the calendar period 2005. Nearly 368,000 workers, of whom 1.77 percent were injured, were included in the final analysis. Descriptive statistics and two-part models (models that predict costs only for likely users of care) were used to examine differences in the incidence and cost of depression between injured and non-injured workers. Non-injured workers were assigned an index date (i.e., 'date of injury') at random.

Results: The likelihood of injured workers to be treated for outpatient depression within three months following occupational injury was 43 percent higher than that of non-injured workers ($t = 3.50$, $p < 0.001$) during the same period. The logistic regression results also showed that after controlling for several demographic and workplace characteristics, the odds of injured workers being treated for depression within three months following an occupational injury was 44 percent higher than that of non-injured workers [95% CI = 1.17 - 1.78]. The conditional and the unconditional average outpatient medical costs of depression of injured workers were higher than that of non-injured workers. The two-part model results revealed that after controlling for covariates, the unconditional average outpatient depression cost for injured workers was 63 percent higher than that for non-injured workers. We estimate that outpatient medical treatment of post-injury depression results, nationally, in $8 million within three months after injury that are not compensated by WC.

Conclusion: Injured workers were more likely than non-injured workers to suffer from depression within the study period. In this data, depression costs were not covered by WC, (as is typical of WC systems). This work produced an estimated cost of $8 million (nationally) for outpatient treatment of depression in the first three months post-injury.

2.310

Paid Sick Leave and Nonfatal Occupational Injury

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Abstract

Objective: Despite the advantages of paid sick leave for both employees and employers, the number of private sector employees who have access to it remains low. For example, between 1996 and 1998 nearly 90% of workers in state and local governments had access to paid sick leave compared to only 45% of workers in the private sector. Additional empirical evidence about the advantages and costs of paid sick leave would help inform employer decisions about offering or expanding paid sick leave to employees. The present study examined the hypothesis that offering paid sick leave would be associated with a lower incidence of nonfatal occupational injuries. We also examined whether this association varied by occupation and industry sector, with the expectation that greater differences would be observed in occupations and sectors where workers are at higher risk of suffering occupational injuries. To our knowledge, this is the first U.S. study to empirically examine these issues.

Data and method: We developed a theoretical framework to examine the business value of offering paid sick leave. The 2005-2008 National Health Interview Survey was used to empirically test our hypotheses. We estimated a multivariate logit model using data on 38,000 working adults.

Results: The results of the study showed that, holding all other variables constant, the likelihood of workers with access to paid sick leave to be injured was 28% (OR = 0.72, p = 0.045, 95% CI = 0.52-0.99) lower than that of workers without access to paid sick leave. The association between the availability of paid sick leave and the incidence of injury varied across sectors and occupations, with the greatest differences occurring in high-risk sectors. For instance, ceteris paribus, a construction worker without access to paid sick leave had a 21% higher predicted probability of suffering a nonfatal occupational injury than a construction worker with access to paid sick leave. The differences were small in sectors that did not have a high overall incidence rate of injury. Similar variations were observed across occupations with a high risk of occupational injury, such as health care support, installation, maintenance, and repair, construction, production, and protective services.

Conclusion: These findings suggest that, similar to other investments in worker safety and health, introducing or expanding paid sick leave programs might help businesses to reduce the incidence of nonfatal occupational injuries, particularly in high-risk sectors and occupations.

2.311

Examining the Role of Occupation in Cardiovascular Disease: A Collaboration between NIOSH and REasons for Geographic and Racial Differences in Stroke (REGARDS) Study

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Abstract

Evidence since the 1980s links workplace conditions, such as work organization (e.g., job strain, shift work) to increased risk of hypertension and heart disease among workers, and evidence has recently expanded to include stroke. However much of the evidence is cross-sectional, and these studies are often small, limited to a single industry sector, and under-represent racial minorities. Community-based cardiovascular disease (CVD) research increasingly extends beyond traditional risk factors in an effort to understand socio-demographic differences in risk, but progress has been limited by reliance on overly-simplistic global measures of socioeconomic status (SES). A review by MacDonald and colleagues at NIOSH showed that while occupational data are collected in a majority of these studies, the data are often descriptive and used to represent SES rather than occupational exposure, affecting conclusions about where and how to direct prevention efforts. Collaborative research between occupational and nonoccupational health investigators can enhance our understanding of the social and environmental determinants of CVD to inform how and where to direct prevention efforts.

With FY2010 intramural NORA funding support, a research collaboration was established between NIOSH investigators and Principle Investigators of the NIH-funded REasons for Geographic and Racial Differences in Stroke (REGARDS) Study at University of Alabama Birmingham's School of Publish Health. Through this collaboration, an occupational survey will be administered by Computer-Assisted Telephone Interview (CATI) to obtain current and historical occupational data among all active participants of the REGARDS Study to characterize the cohort's exposure to adverse working conditions (e.g., shift work, job strain) previously linked to cardiovascular disease. The occupational survey data will augment the study's extensive clinical (e.g., blood pressure, blood assays), genetic, and lifestyle data collected during initial enrollment and follow-up. Pilot testing of the occupational survey with a small sample of the REGARDS Study cohort was recently completed, and the two-year data collection is scheduled to begin in spring, 2011. Planned analyses will include examination of multiple pathways (social, behavioral, physiologic, and environmental) through which working conditions are hypothesized to be associated with traditional CVD risk factors and chronic disease.

2.312

The Migrant Adolescent WorkLife Study

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Abstract

Background: Little published data describe chronic disease indicators among migrant farmworker adolescents, a vulnerable working population.

Methods: To address this gap and through a partnership with the Weslaco Independent School District and Migrant Education Department, we are conducting a 5-year combined cross-sectional/cohort study (2006-2011) to examine the prevalence of and risk factors for hypertension, overweight, hyperinsulemia, and back symptoms among students from two South Texas high schools. Along with physical examinations, we administered a questionnaire soliciting information on work history, health risk behaviors, acculturation, and other factors.

Results: Among 628 sampled students, 508 participated (80.9%) after completing consent procedures. Of these, 257 were migrant education students and 251 were their nonmigrant counterparts. Approximately, 96.7% of participants are Hispanic and 50.0% are male. Initial analyses of data from the fourth year (2010) of the project, comparing migrant and nonmigrant students, show a prevalence of 36.9% vs. 26.6% for acanthosis nigricans (AN, a marker of hyperinsulemia); 7.7% vs. 13.9% for high normal or high blood pressure (>90th percentile for age, height, and gender), and 40.0% and 41.5% for overweight or obese. Among males and females, the prevalence of AN was 31.6% and 31.9%, the prevalence of high normal or high blood pressure was 12.1% and 9.7%, and the prevalence of overweight/obese was 50.0% and 33.3%, respectively.

Conclusions: These preliminary results suggest a compelling need for a comprehensive intervention to prevent significant chronic disease in this high-risk Hispanic adolescent population. This study addresses the Agriculture, Forestry, and Fishing Sector Strategic Goal 2.2.

2.313

Public Health Partnerships to Address Workplace Stress and Cardiovascular Disease

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Abstract

"Stress@Work" is a project of CPH-NEW, a Center for Excellence in the NIOSH Work-Life Initiative. It is an outreach, translation, and dissemination project to increase awareness of health professionals about the causal association between job strain and cardiovascular disease (CVD), with the long term goal of incorporating occupational safety and risk reduction into broader CVD public health risk reduction programs. A secondary goal was to identify opportunities for broader integration and collaboration between Occupational Safety and Health and Chronic Disease prevention within public health structures.

Building on a long history of partnership between the University of MA Lowell, Department of Work Environment and the Massachusetts Department of Public Health Occupational Health Surveillance Program, we identified cardiovascular disease (CVD) as one public health priority of mutual interest. Expanding our partnership to include the MDPH Chronic Disease division, we leveraged the MDPH state heart disease coalition (The Partnership for a Heart-Healthy, Stroke-Free MA) as an opportunity to lead a statewide initiative to raise awareness among health professionals about work related stress as an important risk factor for CVD. A CPH-NEW researcher joined the coalition executive committee, and took responsibility for a formal objective in the MA Statewide Heart Disease plan to "increase awareness among health and occupational professionals of the causal relationship between work-related stress and the development of heart disease and stroke."

We interviewed a broad range of professionals in public health, clinical and workplace settings to understand their knowledge about and perceptions of the role of job stress (also known as job strain) in the development of cardiovascular disease. We also assessed perceived barriers to intervening at the level of the organization to reduce or prevent sustained excessive exposures to psychosocial workplace stressors, such as unmanageable workload, low decision making, and low social support. Among state public health program personnel we found low collaborations between OHS and chronic disease and wellness programs, low attention to workplace hazards (including stress) and very low awareness in regards to work organization interventions. Low knowledge generally of occupational health and safety and OHS interventions was an important theme for a range of health professionals, and one that was frequently cited as barriers to professionals' belief they could intervene in a preventive way to control exposure to workplace stressors in their professional roles to reduce risks for chronic diseases.

The interview findings informed educational messages and formats used when collaborating on MA state heart disease prevention coalition meetings and conferences. CPH-NEW researchers also educated Massachusetts employers with stress intervention education through the state health department's workplace wellness training initiative for employers.

MDPH and CPH-NEW have partnered on developing and publishing findings from a survey of employer practices in OHS and health promotion. Future collaboration in the areas of intervention studies, educational outreach, and joint research are planned for the Spring of 2011 and beyond.

2.314

Partnering with Education Unions for the Purposes of Workplace Violence Research

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Abstract

Statement of Purpose: Prior workplace violence (WPV) studies in education have used workers' compensation records to describe WPV. Unfortunately, these studies excluded educational support staff, such as teacher's aides, and were limited to physical WPV events that resulted in an injury. Collecting data on non-physical WPV events or among educational support staff has been difficult because of the lack of appropriate data sources. However, partnering with education unions is a feasible method to assemble a comprehensive sampling frame. The purpose of this study was to measure the prevalence, characteristics, and impact of physical and non-physical WPV in a state-based cohort of teachers and educational support staff using de-identified union membership lists.

Methods: A state-wide sample of 6,450 workers was drawn using union membership lists provided by Pennsylvania's state based educational unions. The population based sample was stratified on gender, occupation, and school location. A cross-sectional survey on demographics, work history, frequency of WPV, and characteristics of WPV events was mailed to selected participants. Prevalence proportions and standard errors were calculated using Proc SURVEYFREQ in SAS. Chi-square and T-test statistics were used to determine differences in stress and health variables.

Results: 2,518 workers returned a survey, for an adjusted response rate of 39%. Unadjusted analyses indicate that 8% (95% CI = 6.7% - 9.3%) of education workers were physically assaulted in the prior year. A slightly higher proportion of females reported a physical assault (females=8.6%, males=6.2%). Special education teachers had the highest proportion of workers reporting a physical assault (22.7%). Most physical assaults were perpetrated by students (88%) and did not involve a weapon (91%). Disciplining students (33%) and dealing with special education students (33%) were the leading reasons for physical assaults. Those who experienced a physical assault were more likely to view their work as stressful ($p<0.0001$) and be less satisfied with their job ($p<0.0001$). Over a quarter of education workers reported experiencing non-physical WPV in the prior year (28.7%; 95%CI=26.1%-31.2%). The most frequent type of non-physical WPV was verbal abuse (24.2%), followed by threats (14.7%), workplace bullying (8.3%), and sexual harassment (2.4%). Females reported more non-physical WPV events than males (female=29.5%, males=25.7%). Special education teachers experienced the highest proportion of non-physical WPV (42.1%). Those who experienced non-physical WPV were also more likely to view their work as stressful ($p<0.0001$) and be less satisfied with their job ($p<0.0001$). Physical and non-physical WPV impacted workers self-reported health. Those who experienced physical or non-physical WPV were significantly more likely to report having 'fair' or 'poor' health ($p<0.0001$).

Conclusions: This study provides knowledge on the frequency and impact of WPV among a large and diverse sample of Pennsylvania unionized education workers. Disciplining of students and dealing with special education students were the activities associated with the highest WPV risk. Access to education union databases allowed for the inclusion of educational support personnel. Researchers should attend to data sensitivity issues when working with labor groups.

2.315

Laboratory Study to Assess Causative Factors Affecting Temporal Changes in Filtering-Facepiece Respirator Fit: Part II - One Year Assessment of Fit Changes

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Abstract

The first year of a three year study to assess changes in respirator fit and facial dimensions as a function of time to improve the scientific basis for the periodicity of fit testing has been completed. A representative sample of 229 subjects was initially enrolled in the study with 199 continuing to participate. On each visit, subjects performed three fit tests each on three different respirator samples from the same model for a total of nine fit tests. Inward leakage and filter penetration were measured for each donned respirator, permitting the calculation of face seal leakage (FSL). At each visit, 3-D scans of subjects were captured and height, weight and 13 traditional anthropometric facial dimensions measured.

The mean FSL for Visit 1 was 0.69% (SD=0.36) with a range of 0.11% to 2.13%. The mean change in FSL between Visits 1 (baseline) and 2 (six months later) was 0.36% (SD=1.39), and between Visits 1 and 3 (one year later) was 0.25% (SD=0.82). For Visit 2, 8.4% of the subjects had unacceptable fit (90th percentile FSL > 0.05%). For Visit 3, 10.3% of the subjects had unacceptable fit. These preliminary results suggest that many subjects experienced a significant change in fit during the first year. Anthropometric data and 3-D scans of subjects for these first three visits are still being analyzed. Data collection for year 2 has begun.

2.316

Evaluation of Impact Resistant Gloves

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Abstract

Introduction: Gloves are used to protect the hand from different types of injuries such as cuts and bruises. While many types of protective gloves exist, there are few standards for determining their effectiveness against physical hazards. For example, several gloves are marketed as being "impact resistant", but to date there has been no research aimed at determining the level of protection provided by the gloves. The goal of this study was to quantitatively evaluate and compare the quality of protection of commercially available impact resistant gloves.

Methods: Seven commercially available "impact resistant" gloves were selected for testing, and coded as: E1, E2, I, M1, M2, R, and S. A weight of 7.62 kg (16.8 lbs) was dropped from a height of 0.2 m, creating forces ranging from 2,000 to 7,000 N, onto the three high injury risk zones previously identified (Tucker et al., 2010): Zone 1 - fingers, Zone 2, knuckles, Zone 3 - dorsal palm. The gloves were placed on wooden hand or ballistic gel manikins and three trials were completed for each zone both with and without gloves. Overall deformation and force were measured using a displacement sensor and force plate (AMTI, USA), and the pressure inside the glove was measured with a FlexiForce® Sensor (Tekscan, USA). Larger deformations and differences between the external and internal forces indicated higher levels of protection against impact.

Results: The average deformation for Zone 1 was 23 mm, 14 mm for Zone 2, and 12 mm for Zone 3. However, there were clear differences between the gloves. For Zones 1 and 2, Glove S clearly provided better protection, with deformations 50% and 10% greater than any other glove for the two zones respectively. Glove M1 underwent the largest deformations for Zone 3 by a slight amount. The average reduction in force due to the gloves was 53% for Zone 1 (range: 17-89%), 75% for Zone 2 (range: 53-95%), and 66% for Zone 3 (range: 30-92%). Glove S was the most efficient at reducing the impact force for all three Zones.

Discussion: The results show that specially designed gloves can reduce the impact load on hands. However, there is a large range of protection provided by the gloves, with some gloves virtually eliminating the impact force and absorbing large deformations, while other gloves transmitted most of the force directly to the hands. It is clear that testing gloves provides insight into their effectiveness, and allows for comparisons between gloves. Further work is needed to develop the testing methodology to allow the results to be used to design gloves with even better protective properties while maintaining their functionality.

References: Tucker,et al. (2010). Gloves or No Gloves? CEAS Annual Poster Competition, April 17, UWM, Milwaukee, WI.

Abstract Author Index

The abstract's program number is underlined, if the author is the presenter of that poster.

Abraham, Dulcy 1.109
Afanuh, Susan 1.301
Ahmed, Madiha 1.211
Aladdin, Meena 1.312
Alarcon, Walter 1.308
Alaxander, Barbara 1.213
Alexander, Darryl 2.314
Almaguer, Daniel 1.115
Amandus, Harlan 2.314
Amlani, Amyn 1.203
Anderson, Vern 2.211
Andrew, Michael 1.212
Arcury, Thomas 1.105, 1.106
Arheart, Kristopher 1.306, 1.307, 2.308
Asfaw, Abay 2.309, 2.310
Ashley, Kevin 1.108, 2.110
Baker, Nancy 1.210
Baron, Sherry 2.311
Bartholomew, Isaac 1.115
Beckman, Stella 2.204
Beeckman-Wagner, Lu Ann 1.316
Benson, Stacey 2.315
Bergman, Michael 2.315
Berry, Peggy 2.103
Bhattacharya, Amit 1.213
B'Hymer, Clayton 2.111
Biddle, Elyce 2.306, 2.307
Birch, Eileen 2.114
Birch, M Eileen 2.109
Birdsey, Jan 2.215
Blade, Leo Michael 1.108
Blosser, Fred 2.304
Boiano, Jim 2.107
Boudreau, Yvonne 1.310
Brewer McCarthy, Ronda 2.202
Brisson, Michael 2.110
Brosseau, Lisa 2.204
Brueck, Scott E 1.204
Buchholz, Bryan 1.205
Bunn, Terry 2.214
Burchfiel, Cecil 1.212
Burdge, Gavin 2.213
Busch, Diane 1.213
Caban-Martinez, Alberto 1.113, 1.306, 1.307, 2.308
Campbell-Kyureghyan, Naira 1.207, 1.211, 2.316
Campleman, Sharan 1.208
Cantis, Doug 1.103
Carruth, Ann 1.104
Castranova, Vincent 1.311
Champagne, Nicole 2.313
Charles, Luenda 1.212
Check, Pietra 2.303
Chen, Bean 1.114
Chen, Guang-X 2.215

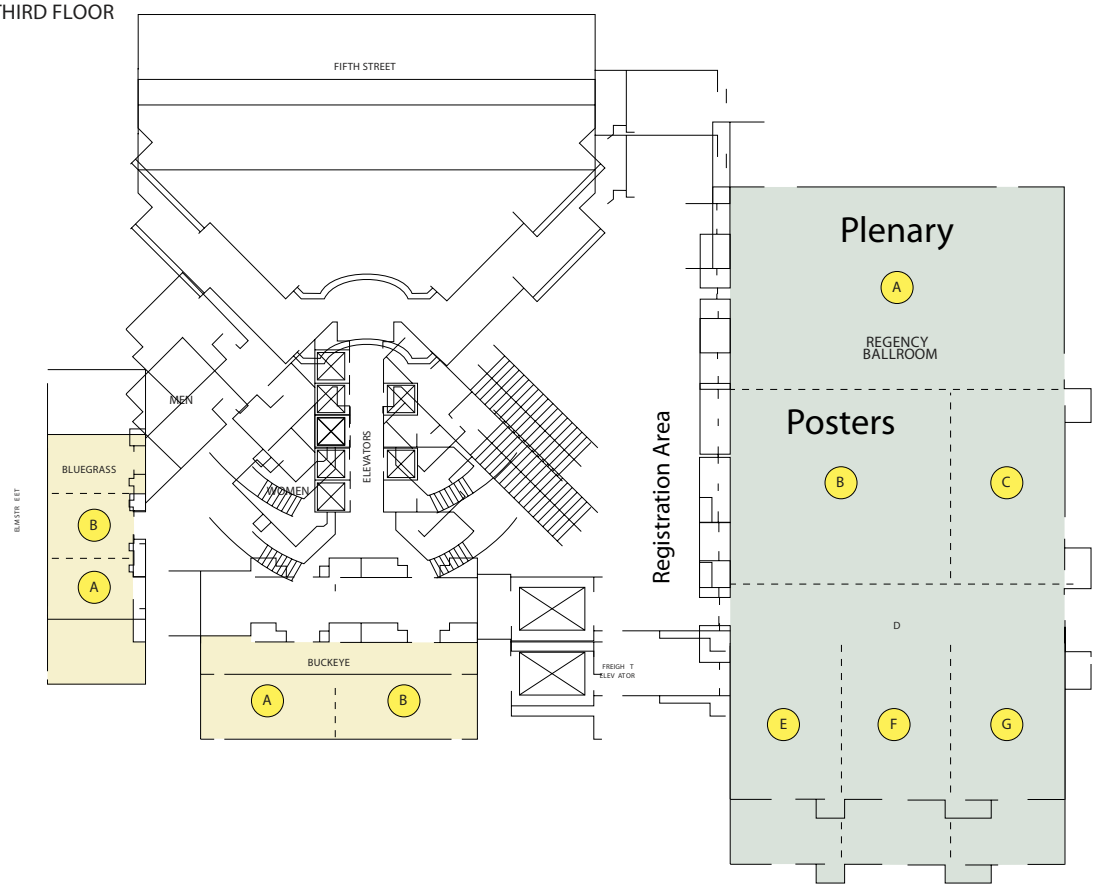
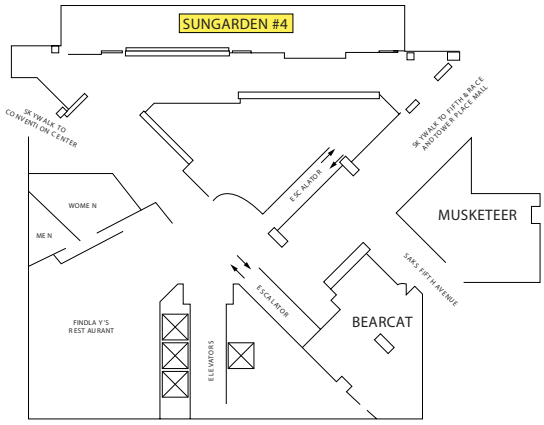
Chen, Haiying 1.105
Chen, Lung Chi 1.312
Cherniack, Martin 1.216, 2.207, 2.313
Chesky, Kris 1.203
Chosewood, L Casey 2.208
Christ, Sharon 1.307
Chun, HeeKyoung 2.211
Clarke, Tainya 1.113, 1.307, 2.308
Clark III, John 1.113
Cole, Henry 1.302
Connor, Thomas H 2.115
Connorton, Ellen 2.102
Cook, George 1.102
Cooper, Charles 1.107, 2.312
Cooper, Karen 1.207
Cooper, Sharon 1.107, 2.312
Cox-Ganser, Jean M 1.316
Cunningham, Thomas 2.305
D'Agostino Jr, Ralph 1.106
Dale, Ann Marie 1.205
D'Alessandro, Maryann 2.204, 2.205
Davila, Evelyn 1.113, 1.306, 1.307, 2.308
Davis, Kermit 1.209, 1.213, 2.201
Daw, Christina 1.110, 1.111, 1.112
DeLaney, Sheli 1.101
del Junco, Deborah 1.107, 2.312
de Perio, Marie 2.106
Derk, Raymond 1.311
Deye, Gregory 1.315
Dick, Robert 1.206
Diwakar, Prasoon 2.114
Dong, Ren 2.213
Dong, RG 2.212
Dong, Sue 1.110, 1.111, 1.112
Dunkin, Robin 2.209
Dunn, Kevin 1.115
Durand, Kate 2.205
Durgam, Srinivas 2.108, 2.113
Dussetschleger, Jeffrey 1.216
Eggerth, Donald 2.303
Elliott, James 1.104
Evanoff, Bradley 1.205
Evans, Stefanie 2.106, 2.302
Evert, William 1.104
Faghri, Pouran 1.216
Fedan, Jeffrey 1.313, 1.314
Fekedulegn, Desta 1.212
Fent, Kenneth 2.113
Fleming, Lora 1.113, 1.306, 1.307, 2.308
Flum, Marian 2.206
Flynn, Michael 2.303
Fries, Edward 2.205
Gallardo, Gilbert 1.104
Garza, Liz 2.303
Gates, Donna 2.103, 2.105
Geiger, Mark 2.213
Gillespie, Gordon 2.103, 2.105
Gillespie, Robin Mary 2.216, 2.301
Gilmore, Karen 1.104
Goedel, Kathleen 1.303
Goldmacher, Suzi 2.204
Gomaa, Ahmed 2.104
Gopal, Kamakshi 1.203
Gore, Rebecca 2.206
Grajewski, Barbara 2.203
Graydon, Janet 1.308
Graydon, Pamela 1.201
Green-McKenzie, Judith 2.202
Groenewold, Matthew 1.309
Grzywacz, Joseph 1.105, 1.106
Gu, Jack 1.212
Habibi, Ehsan 2.210
Halpin, John 2.204
Hamilton, Annie 1.213
Hammond, Duane 1.115
Hard, David 1.103
Haring Sweeney, Marie 2.107
Harney, Amanda 1.303
Harper, Martin 2.112
Harrison, Robert 1.310, 2.204
Hartley, Tara 1.212
Hassim, Noor 2.210
Headley, Tanya 2.304
Heick, Rebecca 1.214
Hemenway, David 2.102
Hendricks, Scott 2.314
Henning, Robert 1.216, 2.206, 2.207
Hibert, Eileen 2.203
Hitchcock, Edward 2.215
Howard, Virginia 2.311
Howe, Alan 2.110
Huang, Xi 1.312
Huang, Yan 1.203
Hubbs, Ann 1.313
Hudson, Heidi 2.304
Hu, Jiangchuan 2.109
Hunt, III, Joe 1.302
Isaacs, Steve 1.302
Isom, Scott 1.105
Jaegers, Lisa 1.205
Jetter, William A 1.213
Jian, Jinlong 1.312
Kashon, Michael 1.314
Keane, Michael 1.114
Keener, Tim 2.109
Kernan, Gabriela 2.206
Kidd, Pamela 1.302
Kim, Janice 2.204
Konda, Srinivas 2.314
Kotowski, Susan 2.201
Krantz, Susan 2.213
Kreiss, Kathleen 1.316
Kulkarni, Pramod 2.114
Kurowski, Alicia 2.206
Lahiri, Supriya 2.206
Landgren, Peter 1.202
Lavin, Wasana 2.101
Lawson, Christina 2.203
LeBlanc, William 1.306, 1.307, 2.308
Lee, David 1.113, 1.306, 1.307, 2.308

Lee, Emily 2.112
Lentz, Thomas J 1.108
Levin, Jeffrey 1.104, 2.312
Li, Jia 1.304
Lincoln, Jennifer 2.215
Lineberry, GT 1.302
Lo, Li-Ming 1.115
Lotfizadehdehkordi, Masoud 2.210
Lovett, William 1.213
Luckhaupt, Sara 1.305, 2.104
Lu, Ming-Lun 1.206
Lu, Mingming 2.109
MacDonald, Leslie 2.311
MacMahon, Kathleen 1.108
Mani, Ashutosh 1.213
Martin, Michelle R 1.316
Materna, Barbara 2.204, 2.205
May, John 1.102
McCann, Michael 1.302
McCleery, Truda 1.303
McCollister, Kathryn 1.306, 1.307, 2.308
McDowell, Thomas 2.213
McDowell, TW 2.212
McKenzie, Jr., E A 1.103
McLaurin, Jeffrey L 2.115
McNary, Jennifer 2.204
Mentzel, Tammy 2.105
Mercer, Dan 2.314
Meyers, Matt 1.102
Mezei, Gabor 1.208
Miller, Denise 1.213
Miller, Diane 1.212
Miller, Matthew 2.102
Mirabelli, Maria 1.106
Mishra, Anurag 1.311
Mnatsakanova, Anna 1.212
Morata, Thais 1.201
Morse, Timothy 1.216
Mostafavi, Ali 1.109
Muennig, Peter 2.308
Mulloy, Karen 1.310
Murphy, Dennis 1.102
Musolin, Kristin 1.213
Nakata, Akinori 2.215
Newsome, Jocelyn 2.107
Nickels, Leslie 2.304
Nigam, Jeannie 2.208, 2.209
Nobrega, Suzanne 2.313
Nonnenmann, Matthew 1.104
Novak, Debra 2.204, 2.205
Ocasio, Manuel 1.113, 1.306, 1.307, 2.308
O'Hara, Heather 1.105
Oke, Charles 2.204
Orta Anés, Lida 1.209
Palermo, Teri 2.208
Palmiero, Andy 2.315
Pana-Cryan, Regina 2.310
Park, Ju-Hyeong 1.316
Park, Robert 1.108
Perry, Melissa J 2.102
Piedimonte, Giovanni 1.314
Pretty, Jack R 2.115
Pulley, LeaVonne 2.311
Punnett, Laura 2.206, 2.313
Quandt, Sara 1.105, 1.106
Ramsey, Todd 1.213
Raymond, D Martin 1.202
Reponen, Tiina 1.213
Rice, Faye 1.108
Rich-Edwards, Janet 2.203
Roberge, Raymond 2.315
Robertson, Medearis 2.214
Robertson, Michelle 2.207
Roberts, Rashaun 1.215
Roberts, Yaritza 2.206
Robinson, Cynthia 1.304, 2.215
Rocheleau, Carissa 2.203
Rojanasakul, Yon 1.311
Romeo, June 1.202
Rosa, Roger 2.310
Sandwall, Peter 1.213
Sanker, Maria 2.105
Sauter, Steven 2.208
Schafer, John (Chuck) 2.103
Scharf, Ted 1.302
Schill, Anita 2.208
Schuler, Christine R 1.316
Schulte, Paul 1.108, 2.211, 2.305
Sestito, John 1.306, 1.307, 2.211, 2.308
Sheehy, John 2.306, 2.307
Shepherd, Sara 1.104
Shimko, Michael 1.314
Shipp, Eva 1.107, 2.312
Shire, Jeff 1.309
Shulman, Stanley 2.110
Sieber, W Karl 2.215
Simms, Erin 1.310
Sinclair, Raymond 2.305
Sofge, Chris 1.108
Sorensen, Julie 1.102
Souza, Kerry 2.309
Spiegelman, Donna 2.203
Stapleton, Martha 2.107
Staubach, Katherine 2.105
Steege, Andrea 2.107
Stellman, Jeanne Mager 2.301
Stephenson, Carol 1.302
Stinson, Ron 1.302
Stone, Sam 1.114
Storey, Eileen 1.316
Stueckle, Todd 1.311
Sullivan, Patricia 1.304
Swanson, Naomi 2.209
Talton, Jennifer 1.106
Tapia, Janeth 1.106
Tepper, Allison 2.302
Teske, Ted 2.304
Thompson, Janet 1.313, 1.314
Tiesman, Hope 1.214, 2.314
Tinney-Zara, Cathy 1.212

Tonda, Josana 2.303
Topmiller, Jennifer 1.115
Trejo, Grisel 1.106
Tucker Jr., Derick 2.316
Turkevich, Leonid 1.315
Vaidyanathan, Vijay 1.203
Valentin, Vanessa 1.109
Van Bogaert, Donna 2.304
Vance, Kimberly 2.105
Vergara, Ximena 1.208
Violanti, John 1.212
Vo, Mang 1.104
Wallingford, Kenneth 2.302
Wang, Liying 1.311
Wang, Xuanwen 1.110, 1.111, 1.112
Warren, C 2.212
Warren, Christopher 2.213
Warren, Nicholas 1.216, 2.207
Waters, Thomas 1.206
Watt, Ed 2.216
Weaver, Nancy 1.205
Wei, Heng 2.109
Weissman, David N 1.316
Welch, Laura 1.205
Welcome, Daniel 2.213
Welcome, DE 2.212
Weston, Ainsley 1.316
Whelan, Elizabeth 2.203
Wickman, Amanda 1.104
Wiegand, Douglas 2.106
Williams, Jessica 2.315
Xu, XS 2.212
Xu, Xueyan 2.213
Yalla, Sai Vikas 2.316
Yang, Jeffery 2.109
Yang, Qing 1.312
Yoder, Aaron 1.102
Zaccone, Eric 1.313, 1.314
Zhang, Yuan 2.206
Zhuang, Ziqing 2.315
Zipprich, Jennifer 2.204

Hyatt Floor Plan

THIRD FLOOR



SECOND FLOOR