Notional Operational Initiate Descent Symposium

National Occupational Injury Research Symposium

May 19-21, 2015 Camp Dawson Training Center Kingwood, West Virginia

U.S. Department of Health and Human Services Centers for Disease Control and Prevention National Institute for Occupational Safety and Health



NOIRS would not be possible without the support of our co-sponsors: American Society of Safety Engineers (ASSE); Liberty Mutual Research Institute for Safety (LMRIS); National Safety Council (NSC); and Society for Advancement of Violence and Injury Research (SAVIR).









Savir Society *for* Advancement *of* Violence *and* Injury Research

May 2015

NOIRS 2015 Participants,

I would like to welcome you to the 2015 National Occupational Injury Research Symposium (NOIRS 2015). We are proud of the high quality scientific program supporting this year's symposium theme, *Advancing Occupational Injury Research through Integration and Partnership*. NOIRS is the only forum exclusively dedicated to the presentation and discussion of the latest methods, findings, and translation activities related to traumatic occupational injury research and prevention. The conference agenda includes cutting-edge occupational injury research from leading national and international scientists. This 6th NOIRS will be the largest to date, with more than 250 participants from the multiple disciplines and fields that contribute to occupational injury research and prevention, including epidemiologists, engineers, statisticians, economists, health practitioners, and safety specialists.

NOIRS would not be possible without the support of our co-sponsors: the American Society of Safety Engineers, Liberty Mutual Research Institute for Safety, the National Safety Council (NSC), and the Society for Advancement of Violence and Injury Research. They helped plan the scientific program and, to foster research partnerships and engage students, each have sponsored networking events and/or awards. And, thanks to NSC, a special issue of the *Journal of Safety Research* will highlight research presented at NOIRS. I would like to recognize and thank each of these co-sponsors, not only for supporting NOIRS, but also for their continued support of NIOSH research and prevention programs.

As with the previous NOIRS, this year's program promises to deliver an exciting agenda that represents the breadth and diversity of occupational injury research. NIOSH continues our emphasis on moving the results of research into practice, and NOIRS 2015 will highlight numerous successes on this front, including the not-to-miss closing plenary comprising a dialogue among leaders from several diverse translation successes.

Progress is being made in reducing the toll of workplace injury and death; however, sustained, collective efforts are needed to further reduce the devastating impact that traumatic injuries have on workers, their families, and their employers. It is my hope that NOIRS 2015 will once again revitalize our energies to ensure all workers return home safely each day.

I offer my best wishes for a productive interchange of science and prevention strategies and the development of new partnerships as we work toward our common goal to prevent traumatic injuries and fatalities in the workplace.

Enjoy the NOIRS 2015 symposium!

John Howard Director, NIOSH

GENERAL INFORMATION

Symposium Goal

The goal of NOIRS is to provide a forum for researchers and other professionals to share their findings and experiences aimed at preventing occupational injury through research and prevention. In addition to presenting current research findings, NOIRS also seeks to foster collaboration among researchers from a broad range of disciplines and perspectives; showcase innovative and state-of-the-art approaches to research and prevention; demonstrate the effectiveness of transferring research results to the workplace for prevention; and promote further research that will advance the goals of the National Occupational Research Agenda.

NIOSH Symposium staff, located at the front lobby registration area, are available to assist you with logistics and other special needs or questions.

Camp Dawson Information

The main telephone number for the Camp Dawson Training Center is (304) 791-7001; their website address is: <u>http://www.wv.ngb.army.mil/campdawson</u>.

Onsite Dining Options

The Camp Dawson Dining Facility is located across from the Robert C. Byrd Auditorium. Hours of operation are: breakfast 6:00 - 7:30 a.m.; lunch 11:30 a.m. - 1:00 p.m.; and dinner 5:00 - 6:30 p.m.

The Liberty Restaurant & Lounge is located near the front lobby, and is open 7:00 a.m. – 9:00 p.m.

Fitness Center/Pool

The Fitness Center is located in the Multipurpose Building (see map); hours are 5:00 a.m. - 10:00 p.m. An Olympic size swimming pool and hot tub are located in the main hotel building across from the Post Exchange; hours are 5:00 a.m. - 10:00 p.m. Your room key is required to access the pool/hot tub area; note that no lifeguard is on duty.

Internet Access

Free Wi-Fi internet is available in common areas; hotspots are identified on the facility map. Access to the internet in lodging rooms requires an Ethernet cable, available at the front desk.

Speaker Room

A speaker preparation area is available in Robert C. Byrd (RCB) Classroom 004 for presenters to preview their audio-visual materials.

Concurrent Sessions

All concurrent sessions will be held in the Robert C. Byrd (RCB) Classrooms. Seating will be on a firstcome, first-seated basis. Since it is not possible to determine the number of participants interested in specific concurrent sessions, we urge you to review the agenda and select an alternate session in the event your first choice is filled.

Cell Phones

Please have your cell phones on vibrate/mute during all sessions.

Symposium Bags

The NOIRS 2015 symposium bags are sponsored by the Liberty Mutual Research Institute for Safety.

<u>Networking Breaks</u>

The networking breaks are supported by the Liberty Mutual Research Institute for Safety.

Tuesday Evening Networking Event

The Networking Event will be held outside the Liberty Restaurant & Lounge, in the Liberty Courtyard, on **Tuesday, May 19, 2015 from 5:30 to 7:30 p.m.** In the event of rain, the event will move indoors. Hors d'oeuvres will be served. The event is sponsored by the American Society of Safety Engineers.

Wednesday Evening Poster Session/Networking Event

The Poster Session/Networking Event will be held in the Camp Dawson Multipurpose Building (MPB) on **Wednesday, May 20, 2015, from 5:30 to 7:30 p.m.** Poster authors will be available for discussion and questions from 5:30 to 6:30 p.m. Buffet dinner will be served at 6:30 p.m. The event is sponsored by the National Safety Council.

Smoking

There is no smoking permitted inside any building at the Camp Dawson Training Center. Smoking is permitted only in two established smoking areas, designated by signage (see map). Cigarette butts must be disposed of in proper receptacles.

NOIRS 2015 AT A GLANCE DAY ONE TUESDAY, MAY 19, 2015

Time	Tuesday				
7:30 – 8:30 a.m.	Registration				
8:30 – 10:00 a.m.	A	Opening Plenary Auditorium – Robert C. Byrd (RCB) Conference Center			
10:00 – 10:30 a.m.			Break		
	Concurrent Sessions A				
	A1	A2	A3	A4	A5
	006/008	010/012	003/005	007/009	017/019
10:30 a.m 12:00 p.m.	Surveillance – Young Workers	Violence in the Workplace	Fall Prevention and Protection in Construction	Analysis of Workers' Compensation Data	Motor Vehicles – Injury Prevention
12:00 – 1:30 p.m.			Lunch		
	Concurrent Sessions B				
	B1	B2	B3	B4	B5
	006/008	010/012	003/005	007/009	017/019
1:30 – 3:00 p.m.	Surveillance – General 1	Fire Fighter Safety	Systematic Reviews	Total Worker Health [™] – Session 1	Laboratory Research
3:00 – 3:30 p.m.			Break		
	Concurrent Sessions C				
	C1	C2	C3	C4	C5
	006/008	010/012	003/005	007/009	017/019
3:30 – 5:00 p.m.	Surveillance – High Risk Populations	Injury among Office and Health Care Workers	Ergonomics in Construction	Economic Factors and Consequences	Working Hours, Fatigue and Sleep – Impact on Injury
5:30 – 7:30 p.m.	<i>Networking Event</i> Liberty Courtyard (outside Liberty Restaurant & Lounge) Hors d'oeuvres served			nge)	

NOIRS 2015 AT A GLANCE DAY TWO WEDNESDAY, MAY 20, 2015

Time	Wednesday			
7:30 – 8:30 a.m.	Registration			
	Concurrent Sessions D			
	D1	D2	D3	D4
8:20 10:00 a m	006/008	010/012	003/005	007/009
6.50 - 10.00 a.m.	Underreporting of Injuries – Federal Perspective	Motor Vehicles – Agriculture/ATVs	Injury Prevention – PPE and Equipment	Total Worker Health™ – Session 2
10:00 – 10:30 a.m.		Bre	eak	
		Concurrent	t Sessions E	
	E1	E2	E3	E4
10:30 a m - 12:00 p m	006/008	010/012	003/005	007/009
10:30 a.m 12:00 p.m.	Underreporting of Injuries – State Perspectives	Preventing Falls in Construction	Perceptions, Knowledge and Awareness of Risks	Technology Transforming Safety
12:00 – 1:30 p.m.	Lunch			
	Concurrent Sessions F			
	F1	F2	F3	F4
1:30 – 3:00 p.m.	006/008	010/012	003/005	007/009
1.50 5.00 p.m.	Hazards in the Environment	Working Hours, Fatigue and Sleep - Miscellaneous	Surveillance – General 2	Safety Climate and Culture: Brief Tutorial and Review
3:00 – 3:30 p.m.		Bre	eak	
		Concurrent	t Sessions G	
	G1	G2	G3	G4
2:20 5:00 n m	006/008	010/012	003/005	007/009
3:30 – 5:00 p.m.	Industry and Occupation – Strategies and Impact	Linking Safety Culture and Performance	Technology Transfer	Injury Surveillance – Reporting Requirements
5:30 – 7:30 p.m.		Poster Session/N Multipurpo Buffet dinner ser	Vetworking Event ose Building rved at 6:30 p.m.	

NOIRS 2015 AT A GLANCE DAY THREE THURSDAY, MAY 21, 2015

Time	Thursday			
		Concurrent Sessions H		
	H1	H2	H3	H4
	006/008	010/012	003/005	007/009
8:30 – 10:00 a.m.	Safety Management and Injury Prevention	Surveillance – Motor Vehicles	Innovations in Farm Safety	Cost Effectiveness of Safety and Health Interventions
10:00 – 10:30 a.m.		Break		
10:30 a.m 12:00 p.m.	Audito	Closing rium – Robert C. Byrd	Plenary d (RCB) Conference	Center





ACKNOWLEDGEMENTS

NOIRS 2015 is being convened by the Division of Safety Research, NIOSH Dawn Castillo, Director, DSR Timothy Pizatella, Deputy Director, DSR

We gratefully acknowledge our co-sponsors for their contributions and support: American Society of Safety Engineers (ASSE) Liberty Mutual Research Institute for Safety (LMRIS) National Safety Council (NSC) Society for Advancement of Violence and Injury Research (SAVIR)

We would also like to thank the Camp Dawson Training Center for the use of their facility, and for their support in planning and holding NOIRS 2015.

Special acknowledgements are made to the following for their support and dedication to planning NOIRS 2015

Symposium Planning Committee

Timothy Pizatella [Chair], Dawn Castillo [Co-Chair], Teresa Dwornick, Cammie Chaumont Menéndez, Tonya Rowan, Christine Schuler, Joyce Spiker, Christie Wolfe and Sydney Webb

Scientific Program Committee

Christine Schuler [Chair], Cammie Chaumont Menéndez [Co-Chair], Betty Champagne [Recorder], Al Amendola, Corey Butler, Carri Casteel, Aitor Coca, Hamid Fonooni, Dan Hartley, Jim Johnson, Joan Karr, Jennifer E. Lincoln, John Myers, Ted Scharf, Jeffrey Schiffman, Christina Socias, Lisa Steiner and Oliver Wirth

Support Services

Agenda Book NIOSH, Division of Safety Research Betty Champagne

NOIRS Logo Design NIOSH, Health Effects Laboratory Division Kimberly Clough-Thomas NOIRS Website Design NIOSH, Division of Safety Research Joyce Spiker

> Camp Dawson Support Vickie DeRiggi Marketing Director

7:30 – 8:30 a.m. REGISTRATION

8:30 – 10:00 a.m.

OPENING PLENARY SESSION

Auditorium – Robert C. Byrd Conference Center

Welcome: **Dawn N. Castillo, MPH** Director, Division of Safety Research National Institute for Occupational Safety and Health

Advancing Occupational Injury Research through Integration and Partnership

John M. Howard, MD

Director National Institute for Occupational Safety and Health

David Michaels, PhD, MPH

Assistant Secretary of Labor Occupational Safety and Health Administration

Deborah A. P. Hersman, MS President & CEO

National Safety Council (NSC)

Thomas F. Cecich, CSP, CIH

Senior Vice President American Society of Safety Engineers

Presentation of NSC Award for Stakeholder Collaboration in Occupational Injury Research Deborah Hersman (NSC)

10:00 – 10:30 a.m.

BREAK

10:30 a.m. – 1	12:00 p.m. Concurrent Sessions A	
A1.0	Surveillance – Young Workers Moderator: Michael Goldcamp	006/008 RCB
10:30	A1.1 Work and Quality of Life among Adolescents in Washington State, 2010	Janessa M. Graves
10:50	A1.2 Incident (Injury) Surveillance and Associations with Socioeconomic Status Indicators among Youth/ Young Workers in New Jersey Secondary Schools	Alexsandra Apostolico
11:10	A1.3 Occupational Injury Patterns in Oregon Workers Aged 24 Years and Younger, 2000-2012	Daniel Cain
11:30	A1.4 Young Worker Fatalities Involving Federal Child Labor Violations, 2001-2012	Kimberly Rauscher
A2.0	Violence in the Workplace <i>Moderator: Dan Hartley</i>	010/012 RCB
10:30	A2.1 Types of Employee Resistance and Employee Injury in Commercial Robberies	Jennifer Jones
10:50	A2.2 Evaluation of Two City Convenience Store Ordinance Programs: Compliance to Ordinance Requirements	Cammie Chaumont Menéndez
11:10	A2.3 Engaging Small Businesses in Workplace Violence Prevention through Intermediaries	Rebecca Bruening
11:30	A2.4 Characteristics of Student-Perpetrated Injury to School District Staff	Katie Schofield Larson

10:30 a.m. – 12:00 p.m. Concurrent Sessions A (cont'd.)

A3.0	Fall Prevention and Protection in Construction <i>Moderator: Scott Earnest</i>	003/005 RCB
10:30	A3.1 Calculation of Horizontal Lifeline Tension and Deflection during Fall Arrest and Comparison to Experimental Results	Bertrand Galy
10:50	A3.2 Evaluation of a Horizontal Lifeline System Used during Residential Roofing	André Lan
11:10	A3.3 A Biomechanically Based Approach for Optimal Design of Construction Helmets	Christopher Pan
11:30	A3.4 Online Fall Protection Equipment Resource for Residential Construction	Vicki Kaskutas
A4.0	Analysis of Workers' Compensation Data <i>Moderator: Letitia Davis</i>	007/009 RCB
A4.0 10:30	 Analysis of Workers' Compensation Data Moderator: Letitia Davis A4.1 Comparison of Temporary Worker Illinois Workers' Compensation Commission Filings from 2007-2012 with Direct Hire Employees 	007/009 RCB Dana Madigan
A4.0 10:30 10:50	 Analysis of Workers' Compensation Data Moderator: Letitia Davis A4.1 Comparison of Temporary Worker Illinois Workers' Compensation Commission Filings from 2007-2012 with Direct Hire Employees A4.2 Workers' Compensation Claims for Traumatic Brain Injuries – Ohio, 2001-2010 	007/009 RCB Dana Madigan Srinivas Konda
A4.0 10:30 10:50 11:10	 Analysis of Workers' Compensation Data Moderator: Letitia Davis A4.1 Comparison of Temporary Worker Illinois Workers' Compensation Commission Filings from 2007-2012 with Direct Hire Employees A4.2 Workers' Compensation Claims for Traumatic Brain Injuries – Ohio, 2001-2010 A4.3 Surveillance of Acute Work-Related Injury Hospitalizations in California Using the Workers' Compensation Information System 	007/009 RCB Dana Madigan Srinivas Konda Christine Dobsom

10:30 a.m. – 12	2:00 p.m. Concurrent Sessions A (cont'd.)	
A5.0	Motor Vehicles—Injury Prevention <i>Moderator: Stephanie Pratt</i>	017/019 RCB
10:30	A5.1 Workplace Road Safety: Safety Management for the Occupational Driver	Sharon Newnam
10:50	A5.2 Evaluation of Telematics Feedback to Truck Drivers to Reduce Risky Driving Behaviors	Jennifer Bell
11:10	A5.3 Impact of a Motor Vehicle Crash Prevention Program in a Large Police Department	Hope Tiesman
11:30	A5.4 ATV and UTV Safety Training for Agricultural Workers: A Safety Workshop Piloted with Iowa Farmers	Charles Jennisson
12:00 – 1:30 p	.m. Lunch (on your own)	
1:30 – 3:00 p.r	n. Concurrent Sessions B	
B1.0	Surveillance – General 1 Moderator: Nancy Romano	006/008 RCB
1:30	B1.1 Underreporting of Workplace Injuries and Illnesses in Workplaces Represented by the United Steelworkers International Union: Prevalence, Causes and Solutions	Nancy Lessin
1:50	B1.2 Trends of Fatal and Nonfatal Injuries in the U.S. Construction Industry after the Recent Economic Downturn	Xiuwen Sue Dong
2:10	B1.3 Musculoskeletal Concerns do not Justify Failure to Use Nail Guns with Sequential Triggers	Mark Fullen
2:30	B1.4 Findings from the NIOSH FACE Reports in Construction	Xiuwen Sue Dong

1:30 – 3:00 p.r	n. Concurrent Sessions B (cont'd.)	
B2.0	Fire Fighter Safety <i>Moderator: Tim Merinar</i>	010/012 RCB
1:30	B2.1 Results from the Strategies to Prevent Injuries among Firefighters (SPiFi) Project and the Effectiveness of Risk Management	Gerald Poplin
1:50	B2.2 Firefighter Burnout: Antecedents and Impact on Firefighter Safety Behaviors	Todd Smith
2:10	B2.3 Respiratory Protection for Firefighters – Evaluation of CBRN Canisters for Use During Overhaul	Rustin Reed
2:30	B2.4 Implementing Risk Management to Reduce Injuries in the U.S. Fire Service	Keshia Pollack
B3.0	Systematic Reviews Moderator: Christine Schuler	003/005 RCB
1:30	B3.1 Effectiveness of OHS Workplace Interventions for Upper Extremity MSDs: An Update of the Evidence	Dwayne Van Eerd
1:50	B3.2 Evidence Synthesis for Occupational Health and Safety	Emma Irvin-Sinkins
2:10	B3.3 What is New in Return to Work: Ten Years Later?	Benjamin Amick III
2:30	B3.4 The Role of Aging in Return to Work and Stay at Work: A Systematic Review	Emma Irvin-Sinkins

1:30 – 3:00 p.n	Concurrent Sessions B (cont'd.)	
B4.0	Total Worker HealthTM - Session 1 <i>Moderator: Marvin Dainoff</i>	007/009 RCB
1:30	B4.1 Non-Wage and Quality of Life Losses Following Occupational Injury among Healthcare Workers in Canada	Hasanat Alamgir
1:50	B4.2 Workplace Social Environment and Postpartum Risk for Occupational Injury	Laura Schwab Reese
2:10	B4.3 Performance of Physically-Demanding Occupational Tasks and Physical Fitness Tests: A Systematic Review and Meta-Analyses	Veronique Hauschild
2:30	B4.4 Preliminary Results, Challenges, and Successes of Implementing a Comprehensive Ergonomics and Wellness Total Worker Health Intervention on Commercial Construction Sites	Michael Grant
B5.0	Laboratory Research Moderator: Jeffrey Schiffman	017/019 RCB
1:30	B5.1 Effect of First Receiver Protective Ensemble on Range of Motion and Postural Balance	Sharon Chiou
1:50	B5.2 Stability of a Mast Climbing Work Platform during Fall Arrest	Bryan Wimer
2:10	B5.3 The Design of a Universal Rig for Supporting Large Hammer Drills to Reduce Injury Risk	David Rempel
2:30	B5.4 Factors Affecting the Utilized Coefficient of Friction on Slippery Surfaces	Wen-Ruey Chang
3:00 – 3:30 p.n	n. Break	

3:30 – 5:00 p.n	n. Concurrent Sessions C	
C1.0	Surveillance – High-Risk Populations Moderator: Suzanne Marsh	006/008 RCB
3:30	C1.1 Occupation-Related Injuries among U.S. Army Soldiers Deployed to Afghanistan and Iraq, 2001-2012	Avni Patel
3:50	C1.2 Wildland Fire Fighter Deaths in the United States: A Comparison of Existing Surveillance Systems	Suzanne Marsh
4:10	C1.3 Non-Fatal Occupational Injuries in the Alaskan Commercial Fishing Industry during 2006 - 2010	Laura Syron
4:30	C1.4 Worksite Monitoring of Injuries Using Statistical Process Control Charts: An Example from the U.S. Army	Anna Schuh
C2.0	Injury among Office and Health Care Workers <i>Moderator: Jim Collins</i>	010/012 RCB
3:30	C2.1 Reliability and Validity of Self-Reported Productivity Measures Compared with Objectively Measured Productivity	Ann Marie Dale
3:50	C2.2 Long Term Care Employees Participating in Change: Process Evaluation and Observation Outcomes	Dwayne Van Eerd
4:10	C2.3 Development and Testing of a High-Engagement Office Ergonomics Training: Let's Try to Have Training Make a Difference	Benjamin Amick III
4:30	C2.4 Developing A Tool to Address Modifiable Factors in the Physical Work Environment of Patient Care Units	Michael Grant

3:30 – 5:00 p.n	concurrent Sessions C (cont'd.)	
C3.0	Ergonomics in Construction <i>Moderator: Bradley Evanoff</i>	003/005 RCB
3:30	C3.1 The Effects of Prefabricated Building Components on Construction Workers' Performance: A Biomechanical Analysis of Common Panelized Wall Maneuvering Tasks	Bochen Jia
3:50	C3.2 Long Term Symptomatic, Functional, and Work Outcomes of CTS among Carpenters	Bradley Evanoff
4:10	C3.3 Impact Evaluation of a Participatory Ergonomics Intervention among Construction Trades	Ann Marie Dale
4:30	C3.4 Evaluation of Facilitators and Barriers to Implementing Ergonomic Solutions in Construction	Lisa Jaegers
C4.0	Economic Factors and Consequences <i>Moderator: Anasua Bhattacharya</i>	007/009 RCB
3:30	C4.1 Are We Exporting Occupational Injuries from the Manufacturing Sector?	Seth Seabury
3:50	C4.2 Reporting and Safety Investment Effects of Self- Insuring for Workers' Compensation Benefits in the U.S.	Rena Pana-Cryan
4:10	C4.3 Developing Improved Estimates of the Total Impact of Worker Injuries and Illnesses	Rena Pana-Cryan
4:30	C4.4 Inpatient and Outpatient Costs of Hearing Loss in the U.S. Military	Hasanat Alamgir

3:30 – 5:00 p.n	concurrent Sessions C (cont'd.)		
C5.0	Working Hours, Fatigue and Sleep – Imp Injury <i>Moderator: Helen Marucci-Wellman</i>	act on	017/019 RCB
3:30	C5.1 Association of Sleep Quality and Duration wi Duty Injury among Police Officers: The BCOPS Str	th On- udy	John Violanti
3:50	C5.2 Fatigue and On-Duty Injury among Police Of The BCOPS Study	ficers:	Desta Fekedulegn
4:10	C5.3 The Impact of Shift Starting Time on Sleep D Sleep Quality, and Alertness Prior to Injury in the P Republic of China	ouration, eople's	David A. Lombardi
4:30	C5.4 Differences in Work and Lifestyle Schedules may be Associated with an Elevated Risk of Injury Multiple Job Holders Compared with Single Job Ho Findings from the American Time Use Survey	which in olders:	Helen Marucci- Wellman
5:00 p.m.	Adjourn Day One		
5:30 – 7:30 p.n	n. <i>Networking Event</i> Hors d'oeuvres served	Liberty Co Liberty Re. In event of	urtyard (outside staurant & Lounge) - `rain, event will be

moved indoors

7:30 – 8:30 a.n	n. Registration	
8:30 – 10:00 a.	m. Concurrent Sessions D	
D1.0	Underreporting of Injuries –Federal Perspective <i>Moderator: Audrey Reichard</i>	006/008 RCB
8:35	D1.1 NIOSH Research on Occupational Injury and Illness Underreporting	Suzanne Marsh
9:00	D1.2 Underreporting of Worker Injuries: An OSHA Priority	Kathleen Fagan
9:25	D1.3 Overview of the BLS SOII Undercount Research Program	Hilery Simpson
D2.0	Motor Vehicles – Agriculture/ATVs <i>Moderator: Tony McKenzie</i>	010/012 RCB
8:30	D2.1 A Population-Based Study of All-Terrain Vehicle Exposure in a Rural Iowa County	Charles Jennisson
8:50	D2.2 Occupational Deaths Due to All-Terrain Vehicle and Utility Task Vehicle-Related Trauma	Charles Jennisson
9:10	D2.3 All-Terrain Vehicle Safety Knowledge and Riding Behaviors of Farm Progress Show Attendees	Charles Jennissen
9:30	D2.4 Occupational Side-by-Side Vehicle Exposure, Safety Behaviors, and Crash Experiences of Farm Progress Show Attendees	Charles Jennissen

8:30 – 10:00 a.	Concurrent Sessions D (cont'd.)	
D3.0	Injury Prevention – PPE and Equipment <i>Moderator: Al Amendola</i>	003/005 RCB
8:30	D3.1 Safety Glasses are Effective at Protecting Eyes from Nails in Free Flight Driven by Pneumatic Nailers	Robert Cargill
8:50	D3.2 Reducing Risk of Injury from Stationary Sawing Operations	Richard Current
9:10	D3.3 Personal Flotation Device Use in the Bering Sea Crab Fleet Increased Significantly between 2008 and 2014	Devin Lucas
9:30	D3.4 Flotation Non-Wearing and Wearing in Occupational Boating Fatalities, Canada 1991-2010	Peter Barss
D4.0	Total Worker Health™ – Session 2 Moderator: Benjamin Amick III	007/009 RCB
8:30	D4.1 Age- and Exposure-Dependent Prevention of Musculoskeletal Disorders: Critical Role of Exposure Parameters	Erik Rader
8:50	D4.2 Obesity, Depression and Musculoskeletal Disorders	Anasua Bhattacharya
9:10	D4.3 Causes and Effects of Cardiovascular Diseases on Medical Claim Costs	Tannista Banerjee
9:30	D4.4 The Ontario Leading Indicators Project (OLIP): Building the Evidence Base for Choosing the Right Tools and Benchmarking OHS Performance	Benjamin Amick III
10:00 - 10:30	Break	

10:30 a.m. – 12:00 p.m. Concurrent Sessions E

E1.0	Underreporting of Injuries – State Perspectives <i>Moderator: Matt Gunter</i>	006/008 RCB
10:35	E1.1 Using Multiple Data Sources for Surveillance of Work-Related Amputations in Massachusetts: Comparison with Official Estimates and Implications for National Surveillance	Letitia Davis
10:55	E1.2 Results of the BLS Survey of Occupational Injuries and Illnesses Undercount Project: Interviews with SOII Respondents in Minnesota	Brian Zaidman
11:15	E1.3 Factors Associated with Unreported Injuries in the BLS Survey of Occupational Injuries and Illnesses	Sara Wuellner
11:30	E1.4 BLS SOII Undercount Research – Results from State Studies along with Current and Future Research	Elizabeth Rogers
E2.0	Preventing Falls in Construction <i>Moderator: Christine Branche</i>	010/012 RCB
10:30	E2.1 How to Engage Leaders in Reducing Construction Falls	Jessica Bunting
10:50	E2.2 Residential Construction Foremen's Fall Prevention and Safety Communication Training	Vicki Kaskutas
11:10	E2.3 Health and Safety in Construction: Evidence of a Union Safety Effect	Benjamin Amick III
11:30	E2.4 Slipperiness Perception and Future Risk of Slipping	Theodore Courtney

10:30 a.m. – 12:00 p.m. Concurrent Sessions E (cont'd.)

E3.0	Perceptions, Knowledge and Awareness of Risks <i>Moderator: Brianna Eiter</i>	003/005 RCB
10:30	E3.1 West Virginia Logger Hazard Awareness and Injury Risk Perception	Mark Fullen
10:50	E3.2 Exploring the State of Health and Safety Management System Performance Measurement in Mining Organizations	Emily Haas
11:10	E3.3 Knowledge of Occupational Safety among Building Construction Workers in Lagos State	Olalekan Makinde
11:30	E3.4 Factors Causing Construction Accidents	Majed Moosa
E4.0	Technology Transforming Safety <i>Moderator: Jim Green</i>	007/009 RCB
10:30	E4.1 The Technological Transformation of Driving: Lessons Learned in the Transition from Horse and Buggy to Internal Combustion Engine	Marvin Dainoff
10:50	E4.2 Truck Drivers' Pedal-Use Behavior during Lane Changes: Examination with Naturalistic Driving Data	Christopher Pan
11:10	E4.3 Partnering with Industry to Build Safe EMS Work Environments	Jim Green
11:30	E4.4 Tracking the Transfer of Recommended Technologies in High Risk Tasks of Sheet Metal Workers	Ann Marie Dale
12:00 – 1:30 p	.m. Lunch (on your own)	

1:30 – 3:00 p.n	n. Concurrent Sessions F	
F1.0	Hazards in the Environment Moderator: Jennifer M. Lincoln	006/008 RCB
1:30	F1.1 A Critical Review of OSHA Heat Enforcement Cases: Lessons Learned	Sheila Arbury
1:50	F1.2 Are Noise and Solvent Exposures Related to Workplace Accidents? A Research Review	Cheryl Estill
2:10	F1.3 The Stability of Surgical Teams and Risk of Blood-Contaminated Sharps Injuries in the Operating Room	Douglas Myers
2:30	F1.4 Factors Associated with Fatal Vessel Disasters in the Commercial Fishing Industry, Alaska, 2000-2013	Joanna Watson
F2.0	Working Hours, Fatigue and Sleep – Miscellaneous Moderator: John Violanti	010/012 RCB
1:30	F2.1 Field Study Testing the Theory that Keeping Busy Helps Sustain Alertness	Roger Jensen
1:50	F2.2 Association between Sedentary Work and BMI in a US National Longitudinal Survey	Tin-chi Lin
2:10	F2.3 Does Shift Work Play a Role in Violence against Nurses?	Steve Sun
2:30	F2.4 Development of a Research Program to Identify Improved Practical Factors to Evaluate Worker Susceptibility to Fatigue, Heat Stroke and Injury in Deep, Hot Underground Mines	Christopher Pritchard

1:30 – 3:00 p.n	Concurrent Sessions F (cont'd.)	
F3.0	Surveillance – General 2 Moderator: Elizabeth Rogers	003/005 RCB
1:30	F3.1 An In-Depth Analysis of Fall-Related Injuries among Electric Power Industry Workers, 1995 – 2013	Tiffani Fordyce
1:50	F3.2 Thirteen Years of Disabling Work Injuries in the U.S. (1998 – 2010): Findings from the Liberty Mutual Workplace Safety Index	Helen Marucci- Wellman
2:10	F3.3 Surveillance of Occupational Traumatic Injuries in 112 U.S. Hospitals: Prevention through Surveillance	Ahmed Gomaa
2:30	F3.4 Workers' Compensation Claims among Ambulance Services Workers – Ohio, 2001-2010	Chia Wei
F4.0	Safety Climate and Culture: A Brief Tutorial and Review of the Current State of the Research, with an Emphasis on the Inter-Relationships with Safety Management Systems Moderators: Ted Scharf and Jennifer Taylor	007/009 RCB
1:32	Competing Definitions of Safety Climate and Culture	Tom Cunningham, Oliver Wirth
1:39	Current Status of Research Connecting Safety Climate to Safe Work Practices	Cammie Chaumont Menéndez
1:44	Current Challenges and Key Questions in Safety Climate Research	Cammie Chaumont Menéndez
1:49	Safety Culture in the Fire Service – A Case Study	Murrey Loflin
1:56	The Linkage of Safety Climate and Culture with Safety Management Systems	Stephanie Pratt
2:03	Competing Models Linking Safety Climate to Safety Management Systems	Ted Scharf
2:10	Guides and Checklists to Improve Safe Work Practices	Scott Schneider, Elizabeth Garza

3:00 – 3:30 p.m.

3:30 – 5:00 p.m. Concurrent Sessions G		
G1.0	Industry and Occupation – Strategies and Impact <i>Moderator: Lisa Steiner</i>	006/008 RCB
3:30	G1.1 Analyzing Occupational Injuries to Develop a Mining Research Strategy	Jeffrey Welsh
3:50	G1.2 Reducing the Number of Injuries and Fatalities among Workers in the Manufacturing Sector: A Priority Goal in the National Occupational Research Agenda	Thais Morata
4:10	G1.3 The NIOSH Fire Fighter Fatality Investigation and Prevention Program's Influence on Standards Development	Murrey Loflin
4:30	G1.4 Occupational Hazards to Ambulance Providers in Turbulent Settings in Low and Middle-Income Countries	Rabia Karani
G2.0	Linking Safety Culture and Performance <i>Moderator: Jennifer Taylor</i>	010/012 RCB
3:30	G2.1 Correlation between Safety Climate and Worksite Inspection Data on Commercial Construction Sites	Michael Grant
3:50	G2.2 An SEM Approach Examining the Pathways between Safety Climate, Behavior Performance and Workplace Outcomes	David Swedler
4:10	G2.3 Improving Safety Climate through a Safety Recognition and Communication Program: A Mixed Methods Study	Emily H. Sparer
4:30	G2.4 Development and Validation of a New Short Tool for Assessing Organizational Occupational Health and Safety Performance	Benjamin Amick III

3:30 – 5:00 p.m. Concurrent Sessions G (cont'd.)		
G3.0	Technology Transfer Moderator: John Powers	003/005 RCB
3:30	G3.1 Formative Evaluation of a Mobile Application for Conducting Fishing Vessel Safety Drills	Maria Bulzacchelli
3:50	G3.2 Evaluation of a NIOSH Workplace Violence Prevention for Nurses Online Course	Maria Brann
4:10	G3.3 Ladder Safety – The Development of the First NIOSH Smartphone App	Peter Simeonov
4:30	G3.4 Protecting Fishermen from Hazards on Deck: Winch Entanglements – Research to Practice	Jennifer M. Lincoln
G4.0	Injury Surveillance – Reporting Requirements <i>Moderator: Hilery Simpson</i>	007/008 RCB
3:30	G4.1 OSHA's New Rule on Reporting Severe Injuries: What to Expect	Kenneth Rosenman
3:50	G4.2 Direct Reporting of Hospitalizations to Cal-OSHA: Implications for Federal OSHA's New Rule	John Mendeloff
4:10	G4.3 Incident (Injury) Surveillance among Youth/Young Workers in the New Jersey Secondary Schools: Initial Efficacy of a Law-Based Outline System versus Former Paper Forms	Derek Shendell
4:30	G4.4 The Case for Expanding the Scope of OSHA Compliant Inspections	John Mendeloff
5:00 p.m.	Adjourn Day Two	

5:30 – 7:30 p.m.Poster Session/Networking Event
Authors available 5:30 – 6:30 p.m.
Buffet dinner served at 6:30 p.m.Multipurpose
Building

Transportation

P01	Health and Safety Hazards of Working in Shipyards Stacy Freeman
P02	Narrative and Quantitative Analyses of Workers' Compensation-Covered Injuries in Short-Haul vs. Long Haul Trucking Industries <i>Terry Bunn</i>
P03	Magnitude of, Trends in, and Associated Factors of Road Traffic Collision in Central Ethiopia Fekede Asefa
P04	Two Motor Vehicle Collisions Associated with Laboratory Specimen Transport during the Ebola Outbreak – Bombali District, Sierra Leone, October 2014 <i>Christina Socias</i>

Agriculture/Farming

P05	Safety Perceptions and PPE Provision of Thoroughbred Farm Representatives Jessica Clouser
P06	Fatal and Non-fatal Injuries among Tree Care Workers in Washington State <i>Randy Clark</i>
P07	Migrant and Seasonal Farm Workers: A Progression of Safety and Health Jordan Blazer
P08	Immigrant Workers in Dairy – A Health and Safety Intervention Using the Community Health Worker Model in an Occupational Setting <i>Amy Liebman</i>
P09	Natural Language Processing to Identify Farm Workers in an Electronic Medical Record Scott Sandberg
P10	Potential for Addressing Agricultural Worker Safety and Health through Livestock Quality Assurance Programs James Lee

Surveillance

P11	Assessing Case-Capture of the National Electronic Injury Surveillance System – Occupational Supplement (NEISS-Work) Ruchi Bhandari
P12	Nonfatal Occupational Eye Injuries in US Emergency Departments, 2002-2011 Theresa Tonozzi
P13	Using the State-based Occupational Health Surveillance Clearinghouse for Injury Prevention and Intervention <i>Marie Haring Sweeney</i>
P14	Musculoskeletal Disorders Resulting in Job Transfer or Restriction Janice Windau
P15	Prevalence of Injury by Occupation and Industry: Role of Obesity <i>Ja Gu</i>
P16	Injury and Illness Data for Illinois Mining Industry Employees, 1990-2012 Sithembile Mabila
P17	Occupational Fatalities during an Oil and Gas Boom - United States, 2003-2013 Krystal Mason
P18	Appalachian Basin Oil and Gas Fatality Surveillance Map <i>Tiffany Rice</i>

Other High-Risk Work

P19	Personal Physical Fitness Training and Injury Risk during Military Deployment Michelle Canham Chervak
P20	Challenges to Study Hearing Loss's Impact on the Quality of Life in the Military Population <i>Hasanat Alamgir</i>
P21	Injuries among Electric Power Industry Workers, 1995 – 2013 Vitaly Volberg
P22	Fire Stop, Drop, and Roll: Workplace Hazards of Local Government Firefighters, 2009 <i>Gary Kurlick</i>
P23	The Impact of National Culture on Construction Safety Behzad Esmaeili

Vulnerable and Other Worker Populations

P24	Risk of Occupational Injuries among Migrant Workers: Research Findings and Practical Implications from a Field Experience in Italian Foundries <i>Stefano Porru</i>
P25	Bangladesh Garment Workers' Knowledge and Awareness of Health and Safety Hasanat Alamgir
P26	Physical Strength and Disability among Injured Workers who Survived Rana Plaza Building Collapse in Bangladesh Gabriela Villanueva
P27	Risk of Injury by Job Classification in School Districts <i>Katie Schofield Larson</i>
P28	Cleaning Truly Is a Pain: A Qualitative Study of Hotel Housekeeping <i>Jessica Streit</i>

Economics

Are Correctional Facility Workers Receiving Excessive Monetary Compensation? Mariana Lever
The Economic Burden of Mining Fatalities in the United States, 2000-2012 <i>Elyce Biddle</i>
A Practical Approach to EHS Leading Indicators: Cross-Industry Lessons Joy Inouye
Falls from Elevation as a Cause of Non-battle Injuries among Army Soldiers Deployed to Iraq and Afghanistan <i>Geeta Kersellius</i>
Height of Fatal Fall Injuries in the U.S. Construction Industry <i>Xiuwen Sue Dong</i>
Deciphering Fall-Related Injuries Using Narrative Incident Reports Veronique Hauschild
How is a Slip, Trip and Fall Injury Similar to a Motor Vehicle Crash? Pilot Testing a Total Worker Health [™] Exposure Metric among Aging Healthcare Workers <i>Kenneth Scott</i>

P36 Evaluation of Postural Stability during Various Methods of Exiting and Entering Scissor Lifts Sharon Chiou

Health Care Workers

- P37 High Incidence of Violence in Health Care Occupations: A Profile of Psychiatric Aides and Psychiatric Technicians *Jacqueline Longton*
- P39 Nurse Practitioners' (NPs) Comfort in Treating of Work-Related Injuries in Adolescents: A Survey of Washington and Oregon NPs Janessa M. Graves
Thursday, May 21, 2015

8:30 – 10:00 a.	m. Concurrent Sessions H	
H1.0	Safety Management and Injury Prevention <i>Moderator: Oliver Wirth</i>	006/008 RCB
8:30	H1.1 Prevention of Traumatic Occupational Injuries: Evidence for Effective Good Practices in Foundries	Stefano Porru
8:50	H1.2 Occupational Health and Safety Knowledge User Perspectives on Research Use	Dwayne Van Eerd
9:10	H1.3 Duration of Slip-Resistant Shoe Usage and the Rate of Slipping in Limited-Service Restaurant Workers: Results from a Prospective and Crossover Study	Santosh Verma
9:30	H1.4 A Socio-Cognitive Strategy to Address Farmers' Tolerance of High Risk Work: Disrupting the Effects of an Apprenticeship of Observation	Joan Mazur
H2.0	Surveillance – Motor Vehicles Moderator: Rosa Rodriguez-Acosta	010/012 RCB
8:30	H2.1 Work-Related Fatal Motor Vehicle Crashes: Matching of 2010 Data from the Census of Fatal Occupational Injuries and the Fatality Analysis Reporting System	Christen Byler
8:50	H2.2 Fatalities in Drug-Involved Truck Crashes in the United States, 2000-2013	David Swedler
9:10	H2.3 Work-Related Road Crashes of Emergency Vehicles in Québec	Patrice Duguay
9:30	H2.4 Injuries from Motor Vehicle Crashes among Electric Power Industry Workers, 1995-2013	Megan Leonhard

Thursday, May 21, 2015

8:30 – 10:00 a.	m. Concurrent Sessions H (cont'd.)	
H3.0	Innovations in Farm Safety Moderator: Larry Layne	003/005 RCB
8:30	H3.1 Challenges and Successes of a Farm Safety Consultation Program to Identify Hazards and Prevent Injuries	Iris Anne Reyes
8:50	H3.2 Youth Safe Farm: A Community Based Approach to Reducing Youth Farm Injuries	Mark Fullen
9:10	H3.3 Moving Social Work Norms via Theater for Senior Farmers	Deborah Reed
9:30	H3.4 Development of an Electronic Return-to-Work Program to Manage Injured and Ill Farm Workers	Bryan Weichelt
H4.0	Cost Effectiveness of Safety and Health Interventions <i>Moderator: Paul Keane</i>	007/009 RCB
8:30	H4.1 Injury and Occupation Coding in a Needs Assessment Mandated by the ACA	Linda Forst
8:50	H4.2 A Framework for Conducting Economic Evaluations of Occupational Health and Safety Programs in Public Healthcare	Hasanat Alamgir
9:10	H4.3 A Business Case Tool for Use in Occupational Safety and Health Decision-Making	Elyce Biddle
9:30	H4.4 \$afety Pays in Mining: A Tool to Estimate the Cost and Impact of Occupational Injuries and Illnesses to Mining Companies	John Heberger

10:00 – 10:30 a.m.	Break
--------------------	-------

Thursday, May 21, 2015

10:30 a.m. - 12:00 p.m.

CLOSING PLENARY SESSION

Auditorium – Robert C. Byrd Conference Center

ASSE/ASSE Foundation Student Travel Award Presentation Role of the Safety Professional in Workplace Injury Prevention Research

> **Research-to-Practice: Partnering throughout the Research Process**

Excellence in Research-to-Practice Panel Presentations

Scott Schneider, CIH Director, Occupational Safety and Health Laborers' Health and Safety Fund of North America

Cindy DePrater Vice President, Environmental Health and Safety Turner Construction Company

Brad Boehler

President Linamar Skyjack Group

Letitia Davis, ScD, EdM

Director, Occupational Health Surveillance Program Massachusetts Department of Health

Joan Mazur, PhD

Professor, College of Education, University of Kentucky, Southeast Center for Agricultural Health and Injury Prevention

Interactive Discussion between Audience and Panel Moderated by Dawn Castillo, MPH Director, Division of Safety Research, NIOSH

12:00 p.m. SYMPOSIUM ADJOURNS

NOIRS 2015 Opening and Closing

Plenary Speakers



Dawn N. Castillo, MPH

Dawn N. Castillo, MPH Director of the Division of Safety Research National Institute for Occupational Safety and Health

Dawn Castillo was appointed as the Director of the Division of Safety Research (DSR) at the National Institute for Occupational Safety and Health (NIOSH) in July 2011. The Division serves as the focal point for the traumatic occupational injury research and prevention programs at NIOSH.

Prior to being appointed as Division Director, Ms. Castillo served as Chief of the DSR Surveillance and Field Investigations Branch, responsible for occupational injury data collection, analysis and interpretation. Ms. Castillo is an epidemiologist by training and has authored numerous articles, book chapters, and technical documents on occupational injuries.

Ms. Castillo was the fifth recipient, in 2004, of the James. P. Keogh award, an annual NIOSH award recognizing a current or former NIOSH employee for exceptional service to the field of occupational safety and health.

Ms. Castillo received a Master of Public Health in epidemiology from the University of California, Los Angeles.



John Howard, MD

John Howard, MD Director of the National Institute for Occupational Safety and Health

For the past 13 years, Dr. John Howard has served as the Director of the National Institute for Occupational Safety and Health, part of the Centers for Disease Control and Prevention, in the U.S. Department of Health and Human Services in Washington, DC.

Prior to his appointment as director of NIOSH, Dr. Howard served as chief of the Division of Occupational Safety and Health in the California Department of Industrial Relations from 1991 through 2002.

Dr. Howard is board-certified in internal medicine and occupational medicine. He is admitted to the practice of medicine and law in the State of California and in the District of Columbia, and he is a member U.S. Supreme Court bar. He has written numerous articles on occupational health, law and policy.

Dr. Howard received his Doctor of Medicine from Loyola University of Chicago in 1974, his Master of Public Health from the Harvard School of Public Health in 1982, his Doctor of Law from the University of California at Los Angeles in 1986, and his Master of Law in Administrative Law from the George Washington University in Washington, DC in 1987.



David Michaels, PhD, MPH

David Michaels, PhD, MPH Assistant Secretary of Labor for the Occupational Safety and Health Administration

Appointed in 2009, Dr. Michaels is the longest serving Assistant Secretary in OSHA's history. He has worked to strengthen the Occupational Safety and Health Administration's (OSHA) enforcement in high hazard industries, promote common sense worker protection programs and standards, expand compliance assistance provided to small employers, improve the agency's whistleblower protection program, and increase outreach to vulnerable populations at risk for work-related injury and illness. In his role, he has also increased OSHA's focus and capabilities in the areas of data analysis and program evaluation.

Prior to his appointment at OSHA, Dr. Michaels was a professor of Environmental and Occupational Health at the George Washington University School of Public Health. From 1998 to 2001, Dr. Michaels served as Assistant Secretary of Energy for Environment, Safety and Health. In that position, he was the chief architect of the Energy Employees Occupational Illness Compensation Program, the historic initiative to compensate nuclear weapons workers who contracted occupational illnesses as a result of exposure to radiation, beryllium and other hazards.

In 2006, Dr. Michaels was awarded the American Association for the Advancement of Science's Scientific Freedom and Responsibility Award. He also won the John P. McGovern Science and Society Award in 2009, given by Sigma Xi the Scientific Research Society, for his work in scientific integrity and for gaining compensation for nuclear weapons workers.

He is a graduate of the City College of New York, and holds a Master of Public Health and PhD from Columbia University.



Deborah A. P. Hersman, MS

Deborah A. P. Hersman, MS President & CEO, National Safety Council

Deborah Hersman is president and chief executive officer of the National Safety Council. The National Safety Council saves lives by preventing injuries and deaths at work, in homes, communities, and on the roads through leadership, research, education and advocacy.

Prior to joining the National Safety Council, Ms. Hersman served as chairman of the National Transportation Safety Board. Ms. Hersman was first appointed as an NTSB board member by President Bush in 2004 and was reappointed to two additional five-year terms by President Obama in 2009 and 2013. Among her many initiatives as chairman, Ms. Hersman focused attention and actions on distracted driving, child passenger safety and helping victims and their families. Ms. Hersman was an NTSB board member on-scene for more than 20 major transportation incidents, chaired scores of NTSB hearings, forums and events and regularly testified before Congress.

Ms. Hersman was a senior advisor to the U.S. Senate Committee on Commerce, Science and Transportation from 1999-2004. She served as staff director and senior legislative aide to West Virginia Congressman Bob Wise from 1992-1999. Her efforts contributed to the passage of milestone bills such as the Motor Carrier Safety Improvement Act of 1999, Pipeline Safety Improvement Act of 2002, Transportation Equity Act of the 21st Century and Amtrak Reform and Accountability Act.

Ms. Hersman holds Bachelor of Arts degrees in political science and international studies from Virginia Tech, and a Master's of Science degree in conflict analysis and resolution from George Mason University. She is a certified child passenger safety technician and holds a commercial driver's license (with passenger, school bus and air brake endorsements) as well as a motorcycle endorsement.



Thomas F. Cecich, CSP, CIH

Thomas F. Cecich, CSP, CIH Senior Vice President for the American Society of Safety Engineers President of TFC & Associates and Chair of the Center for Safety and Health Sustainability

Elected in 2014, Mr. Cecich is Senior Vice President of the American Society of Safety Engineers (ASSE) and serves on the Society's Board of Directors. He will assume the position of Society president in June 2016.

Mr. Cecich is president of TFC & Associates, a safety, health and environmental management consulting firm. He was vice president of EHS Global Business Support at the pharmaceutical company GlaxoSmithKline. He has also held safety management positions at IBM and Allied Chemical Corporations and is recognized for his extensive experience in safety, health, and environmental management.

In addition to being elected three times to the ASSE Board of Directors, Mr. Cecich has served the Society in a variety of capacities, such as past chair on the Government Affairs committee and past president of the North Carolina Chapter. He is an ASSE Fellow, the Society's highest honor. He has also served on the Board of Certified Safety Professionals (BCSP) and is a past President of BCSP.

Mr. Cecich was instrumental in launching the Center for Safety and Health Sustainability, a global nonprofit organization representing over 100,000 occupational safety and health professionals worldwide. The Center is dedicated to advancing awareness of occupational safety and health as a vital aspect of a business's sustainability profile. He has become known in the OSH community for his efforts to advance awareness that many organizations considered "sustainable" suffer significant numbers of worker fatalities, serious injuries and high risk worker health exposures.

Mr. Cecich earned his bachelor's degree from the University of Miami and his master's degree from North Carolina State University, both in Industrial Engineering. He is also a Clinical Assistant Professor of Environmental Health Sciences at the Tulane University School of Public Health and Tropical Medicine.



Scott Schneider, CIH

Scott Schneider, CIH Director, Occupational Safety and Health Laborers' Health and Safety Fund of North America

Mr. Schneider is the Director of Occupational Safety and Health for the Laborers' Health and Safety Fund of North America (LHSFNA). LHSFNA is a non-profit associated with the Laborers' International Union of North America (LIUNA), which represents 500,000 construction workers in the United States and Canada. Mr. Schneider has been with the LHSFNA for 16 years.

For more than 30 years, Mr. Schneider has been doing occupational safety and health work for the Labor Movement. He was a Labor Representative to the Occupational Safety and Health Administration (OSHA) Advisory Committee for Construction Safety and Health (ACCSH) from 2003-2005. He also served as a member of the NIOSH Board of Scientific Counselors from 2006-2009. In 2010, he was awarded the William Steiger Memorial Award from the American Conference of Governmental Industrial Hygienists (ACGIH) for his contributions to the field.

Mr. Schneider holds a Master's Degree in Industrial Hygiene from the University of Pittsburgh and a Master's Degree in Zoology from the University of Michigan. He is a Certified Industrial Hygienist (CIH).



Cindy DePrater

Cindy DePrater Vice President, Environmental Health and Safety Turner Construction Company

Ms. DePrater has more than 37 years of construction industry experience in pre-construction, operations, safety, loss prevention, environmental, and training. As vice president, she is responsible for Turner's safety, health, and environmental program worldwide. She leads a staff of three national coordinators, more than 30 safety directors, and indirectly oversees more than 200 safety professionals across the country. Under her direction, the team ensures full compliance with Turner's internal policies and guidelines as well as all regulatory standards. Ms. DePrater is responsible for analyzing the organization's critical environmental health and safety requirements, identifying deficiencies and potential opportunities, and developing innovative solutions.

In her role at Turner, she has formed strong sustainable relationships with the Occupational Safety and Health Administration (OSHA), the National Institute for Occupational Safety and Health (NIOSH), and other government agencies. Ms. DePrater also sits on several national committees and advisory boards that influence and impact legislative action for worker health and safety.

Additionally, she is a frequent, recognized, and requested speaker on the subject of environmental safety and health at conferences nationwide, as well as a guest lecturer at several universities across the country. She has received many honors and awards.

Ms. DePrater is a graduate of Oklahoma State University and has numerous certifications and licenses, and holds the distinction of registered Associate of Loss Control Management (ALCM) from Det Norske Veritas.



Brad Boehler

Brad Boehler President Linamar Skyjack Group

Under the leadership of Mr. Boehler since 2011, Skyjack has aggressively expanded its business. Skyjack provides companies across the world with quality engineered, simple, and reliable access and telehandler equipment so that they maximize utilization and return on investment.

While Skyjack's first products were scissor lifts, Mr. Boehler has championed the company as a full-line access and telehandler supplier. This ambition is reflected in the recent and continued introduction of boom lifts and an ongoing commitment to Skyjack's telehandler range. Mr. Boehler is credited with making Skyjack the #3 manufacturer of aerial work platforms and has positioned the company for greater growth. He leads an executive team that prides itself on more than 100 years' experience in the aerial work platform and rental business.

Since joining Skyjack in 2003, Mr. Boehler has held a number of positions in the company, including director of Product Safety, vice president of Engineering and vice president of Sales and Marketing. Prior to joining Skyjack, he spent five years with Tigercat and served as a military engineer with the Canadian Armed Forces.

Mr. Boehler is a prominent leader in the powered access industry. In 2013, he was elected to the Board of Directors of the International Powered Access Federation (IPAF). From 2006, Mr. Boehler has been chair of the ANSI A92.6 subcommittee, which is responsible for the U.S. standards on self-propelled elevating work platforms. He remains involved with other global standards development organizations and is the chair of the IPAF Manufacturers' Technical Committee.

Mr. Boehler obtained his Bachelor's degree in Engineering Science from the University of Western Ontario and holds the designation of Professional Engineer. He recently completed the Executive Development Program at the Ivey School of Business campus in London as part of his preparations for assuming his current position as president of Skyjack.



Letitia Davis, ScD, EdM

Letitia Davis, ScD, EdM Director, Occupational Health Surveillance Program Massachusetts Department of Public Health

For close to 30 years, Dr. Davis has worked to develop and implement state-based surveillance systems for work-related illnesses and injuries in Massachusetts. She has overseen the formation of surveillance systems for: fatal occupational injuries, occupational asthma, acute chemical poisonings, sharps and ergonomic injuries among hospital workers, amputations, and work-related injuries to workers under age 18, which was recently expanded to include young adults. The Massachusetts Occupational Health Surveillance Program (OHSP) is committed to using data for action. Dr. Davis and the OHSP staff work with a wide range of community and agency partners to address identified occupational health and safety problems. Dr. Davis also advises the Department leadership on matters of occupational health policy.

Dr. Davis has conducted numerous surveillance research studies exploring use of a wide range of existing public health data sources to document work-related injuries and illnesses, with a special focus on identifying and addressing the needs of underserved worker populations. She has a special interest in integrating occupational health considerations into mainstream public health and exploring innovative opportunities to collaborate with other public health programs.

Dr. Davis is also a lead consultant in occupational health to the Council of State and Territorial Epidemiologists, and has played a leadership role nationally in the development of state Occupational Health Indicators and in the effort to integrate occupational health into public health practice at the state level. She is a past member of the National Institute for Occupational Safety and Health (NIOSH) Board of Scientific Counselors and currently serves on the National Advisory Committee on Construction Safety and Health. She has also served on a number of Institute of Medicine committees, including most recently a committee addressing incorporation of occupational information in electronic health records.

She received her doctorate in Occupational Health from the Harvard School of Public Health in 1983.



Joan Mazur, PhD

Joan Mazur, PhD Professor, College of Education, Department of Curriculum and Instruction University of Kentucky, Southeast Center for Agricultural Health and Injury Prevention

Dr. Mazur has worked at the Southeast Center for Agricultural Health and Injury Prevention for the past 19 years and has worked as a Principal Investigator or Co-Principal Investigator on six NIOSH-funded projects.

Currently, Dr. Mazur is a professor in Curriculum and Instruction at the University of Kentucky in the College of Education. She also serves as Principal Investigator on two National Institute for Occupational Safety and Health (NIOSH) grants: The Economics of Prevention 2 Program and the Health of Agricultural Populations Certificate Program. Additionally, she has served as the Outreach Director at the Southeast Center for Agriculture Health and Injury Prevention for the past four years.

Her research has focused on preventing injuries and fatalities among adolescent and adult farmers through strategic partnerships with educators who are trained as safety advocates to intervene with future farmers. Most recently, she has worked to integrate NIOSH cost-effective roll-over protection plans in high school agricultural mechanics classes in high-poverty Appalachian areas.

Dr. Mazur received her doctorate from Cornell University in Curriculum and Instruction. She lives with her husband on their farm in Willisburg, Kentucky.

NOIRS 2015 Abstracts

(Presenters underlined)

Although the abstracts in this publication were proofread to eliminate obvious errors in spelling, punctuation, and grammar, they were neither edited nor officially cleared by the National Institute for Occupational Safety and Health (NIOSH). Therefore, NIOSH is not responsible for the content, internal consistency, or editorial quality of the abstracts. That responsibility lies solely with the individual authors. Any use of company names and products throughout this publication does not imply endorsement by NIOSH, the Centers for Disease Control and Prevention, the Public Health Service, or the Department of Health and Human Services.

DAY ONE: TUESDAY, MAY 19, 2015

Session A1.0 Title: Surveillance – Young Workers Moderator: Michael Goldcamp

A1.1

Title: Work and Quality of Life among Adolescents in Washington State, 2010

Authors: Janessa M. Graves, Mary E. Miller, Angel Y. Li

Objectives: Among adolescents, engaging in work or working longer hours have been associated risky behavior, poorer academic performance, and inadequate sleep. We examined the association between work, work intensity, and quality of life (QOL) among adolescents in Washington State.

Methods: We analyzed 2010 Washington State Healthy Youth Survey data for 8th, 10th, and 12th grade public school students. Adolescents reported currently working for pay (not counting chores at home, yard work, or babysitting) and hours per week if working. QOL was assessed using the Youth Quality of Life Surveillance 6item Measure. Survey-weighted multivariable regression was used to test the associations between QOL and the work outcomes (working and work intensity). We tested for effect modification by grade level.

Results: Of 8,882 adolescents who completed questionnaires in 2010, 28.6% reported currently working. Effects of working on QOL were modified by grade: among 8th and 10th grade students, working was associated with significantly lower QOL scores; no association was detected for 12th grades students. Among working students, increased work intensity was associated with significantly lower QOL scores. Compared to adolescents who worked 10 or fewer hours per week, QOL scores for those who worked over 40 hours per week were 22.9% lower (95% CI: 16.7-29.0%).

Conclusion: Working during the school year was associated with lower QOL for younger adolescents, and we observed a reciprocal relationship between work intensity and QOL. For adolescents who are attending school, increased attention should be paid to the impacts of work on QOL.

A1.2

Title: Incident (Injury) Surveillance and Associations with Socioeconomic Status Indicators among Youth/ Young Workers in New Jersey Secondary Schools Authors: <u>Alexsandra Apostolico</u>, Derek Shendell

New Jersey Department of Education requires by law for accidents/incidents (injury or illness) involving career-

technical-vocational education (CTE) students, and/or staff to be reported to the Commissioner of Education within five business days. These incidents get directly reported to New Jersey Safe Schools Program (NJSS) online surveillance system (via Psychdata) for aggregate analyses.

To explore associations between socioeconomic status (SES) indicators and injuries reported to NJSS, District Factor Groups (DFGs) were used as a proxy indicator for SES of a reporting school/school district. Reporting schools were classified by DFG status as either a 'high' or 'low' scoring school, depending on the SES of the county in which they are located. Data were analyzed from NJSS injury surveillance database between 12/1998-12/2013. Chi square tests (X2) for independence were conducted to examine associations between DFG and various variables, including gender, injury treatment (hospital versus doctor), injury location on body, injury type, injury cause, severity of injury, and use of personal protective equipment (PPE). To assess potential associations between DFG scores and personal protective equipment, data were stratified by years, 2003-2008 and 2008-2013 given mandatory payment by employers for PPE determined necessary for employees in 2008 (NJ 2/2008-, U.S. 10/1/2008-).

Statistically significant associations were found between DFG scores and injury cause [X2= (7, 14.74), p=0.039] as well as DFG scores and injury treatment [X2= (1, 4.76), p=0.029]. Logistic regression was performed to better understand potential associations between treatment and DFG score. Adjusted odds ratio comparing injured students of low DFG scoring schools being treated at a hospital to injured students of high DFG scoring schools being treated at a hospital to injured at a hospital was 2.4 (95% CI = 1.3-4.3).

With small sample sizes representing low scoring schools, additional efforts should be enacted to increase reporting in these schools. Further research should examine why a higher percentage of low SES schools are treated at hospitals versus doctor clinics and explore discrepancies between injury causes for high and low DFG scoring schools. Further research should also provide direct DFG scores from CTE programs.

A1.3

Title: Occupational Injury Patterns in Oregon Workers Aged 24 Years and Younger, 2000-2012 Authors: Laurel Kincl, <u>Daniel Cain</u>, David Dreher

Objectives: Occupational injuries to young workers are a public health concern. In 2007, Oregon stakeholders organized the Oregon Young Employee Safety (O[yes]) which has been actively working to educate young workers, educators, employers, parents, and labor/trade associations through outreach, advocacy, and sharing of resources. Previous analysis of worker's compensation claim data for Oregon workers 24 years and younger from 2000-2007 described injury patterns and fostered state-wide discussions and development of O[yes]. This research examines the characteristics of workers' compensation claims in Oregon young workers, including the most recent years since O[yes] was formed. The goal of this research is to identify occupational risks faced by younger Oregon workers, and develop interventions to mitigate those risks.

Methods: Workers' compensation data from the Oregon Department of Consumer and Business Services were used to examine disabling injuries to young workers. Claims for workers of all ages were collected, so that young workers could be compared to other age groups. Disabling claims data includes such items as the nature and source of injury, occupation, industry, injury event, employer information (including demographics). hospitalization status, and claim status. Disabling claims data were analyzed from 2000-2012. Data from the SAIF Corporation, Oregon's state fund for workers' compensation, were used to study non-disabling claims among young workers from 2000-2012. Nondisabling claims can provide a richer understanding of occupational health, by examining injuries that, while typically less severe, may be much more common.

Results: Rates of injury were calculated by age group, gender and year. Injury type and occupational sectors with the highest rate were explored. The most common nature of injury for all young workers was sprain or strain, which accounted for almost half of all disabling claims (48.5%).

Conclusion: In conclusion, monitoring and improving occupational injury surveillance for young workers can focus injury prevention efforts for young workers. Targeting specific populations and sectors as well as engaging appropriate stakeholders could result in significant reductions in injuries to these vulnerable workers. Having a state coalition like O[yes] to bring significant reductions in injuries to these vulnerable workers. Having a state coalition like O[yes] to bring regulators, educators, academia, labor and youth leaders together is an effective means to this end.

A1.4

Title: Young Worker Fatalities Involving Federal Child Labor Violations, 2001-2012 Authors: <u>Kimberly Rauscher</u>, Mary Miller

Objectives: When youth are employed in violation of the child labor laws they are exposed to serious hazards and many experience injuries as a result. While several studies have documented the risk of non-fatal injury associated with child labor violations, fewer have investigated the extent to which fatalities among youth involve work that is prohibited by the child labor laws. The objective of this study was to investigate the extent to which occupational fatalities among youth under the age of 18 involve violations of the federal child labor laws and to describe the case characteristics.

Methods: We used 12 years of data (2001-2012) from the US Bureau of Labor Statistics' (BLS) Census of Fatal Occupational Injuries (CFOI). We investigated hours and job/task violations. Violations were determined by examining decedent age, relevant employment variables (i.e., family business, industry), time and date of injury, and decedent activity when injured and cross-referencing this information against the applicable federal child labor laws at the time the injury occurred.

Results: There were 406 occupational fatalities among youth under the age of 18 during the period 2001-2012. Among these, 241 involved employment subject to one or more of the federal child labor laws. In 43.73% of these cases, the minor decedent was working in violation of one or more federal child labor laws. The majority of violations were related to job/task prohibitions (43.42%). Among the cases subject only to the agricultural child labor laws (i.e. prohibited tasks), 45% involved one or more violation. Cases involving males, African Americans, and decedents under age 16, were more likely to involve a violation. Violations were more likely in cases where the decent was fatally injured during the school year and where the decedent worked in a business with less than 50 employees. Descriptive statistics were calculated.

Conclusions: Many young worker fatalities are due to employer violations of the child labor laws. The lives of young workers may be saved through increased enforcement of the child labor laws and by better educating employers as well as young workers and their parents about the child labor laws.

Session A2.0

Title: Violence in the Workplace Moderator: Dan Hartley

A2.1

Title: **Types of Employee Resistance and Employee Injury in Commercial Robberies** Authors: Jennifer Jones, Carri Casteel, Corinne Peek-Asa

Objectives: Previous studies have found that employee resistance can increase the risk of injury during robberies. However, little is known about factors which may influence employee resistance, and the association between types of resistance and employee injury during robberies. Therefore, this study sought to examine the association between employee resistance and injury, and examine whether type or location of property stolen was associated with employee resistance during commercial robberies in a large metropolitan city.

Methods: Robbery data were abstracted from police crime reports between 2008-2012. The primary outcome was employee injury. Employee resistance was categorized as active, passive, or no resistance. Additionally, we collected covariates related to the robbery such as: type of property stolen, location of cash stolen, business type, customers present, weapon use by the perpetrator, and time of day the robbery occurred. Bivariate analyses and multivariate log binomial regression models were used to identify factors associated with employee resistance and to evaluate the association between employee resistance and injury.

Results: A total of 3,775 robberies occurred in the study period, of which 1,134 (30.0 %) resulted in employee injury. Employees resisted a robber in nearly half of all robbery events. In the bivariate analyses time of day, employee resistance, customers present, weapon use and type of property stolen were all found to be statistically associated with employee injury (p-values: <.001). Type of employee resistance was found to be associated with type of property stolen. Predictors of employee resistance appear to differ depending on type of resistance exhibited. Overall, active employee resistance was significantly associated with employee injury even after adjustment for potential confounders (AdjPR: 1.49, 95% CI: 1.34, 1.65). Goods being stolen were associated with active employee resistance and employee injury, while cash only being stolen was inversely associated with employee injury (AdjPR: 0.71, 95% CI: 0.60, 0.83).

Conclusion: Employee resistance appears to be common among commercial robberies. Certain features of the robbery event appear to influence type of employee resistance. Results suggest that employee training in nonresistance, especially active-resistance, can be an important strategy in protecting employees working with the exchange of cash and goods.

A2.2

Title: Evaluation of two city convenience store ordinance programs: Compliance to ordinance requirements

Author: Cammie Chaumont Menéndez

Background: Robbery-related homicides and assaults are the leading cause of death in retail businesses. Robbery reduction approaches focus on compliance to Crime Prevention through Environmental Design (CPTED) guidelines.

Purpose: We evaluated the level of compliance to CPTED guidelines specified by convenience store safety ordinances effective in 2010 in Dallas and Houston, Texas. Methods: Convenience stores were defined as businesses less than 10,000 square feet that sell grocery items. Store managers were interviewed for store ordinance requirements from August to November 2011, in a random sample of 594 (289 in Dallas, 305 in Houston) convenience stores that were open since before the effective dates of their city's ordinance. Data were collected in 2011 and analyzed in 2012-2014.

Results: Overall, 9% of stores were in full compliance, although 79% reported being registered with the police departments as compliant. Compliance was highest for training (79%), cash limit policy (79%), security cameras (73%), alarm systems (71%) and posted trespass affidavit (69%). Compliance was consistently significantly higher in Dallas than in Houston. Compliance was lower among single owner-operator stores compared with corporate/franchise stores. Compliance to individual requirements was lowest for signage and visibility.

Conclusions: The Houston and Dallas convenience store compliance ordinances are associated with high compliance rates to some CPTED requirements but not with the less costly and more straightforward requirements. Ordinances can be an effective conduit for promoting CPTED guidelines in retail establishments, but manager understanding, buy-in and enforcement is crucial.

A2.3

Title: Engaging small businesses in workplace violence prevention through intermediaries

Authors: <u>Rebecca Bruening</u>, Karen Strazza, Maryalice Nocera, Corinne Peek-Asa, Carri Casteel

Objectives: Research has shown that small storefront businesses experience high robbery and violent crime rates leading to injury and death. Workplace violence prevention programs (WVPP) based on Crime Prevention through Environmental Design reduce this risk, but as with many occupational safety and health interventions for small businesses, low participation limits their effectiveness. Recent dissemination models of occupational safety and health (OSH) information recommend that initiator organizations collaborate with an intermediary organization to engage small businesses. This study examines the perspectives of small business operators and potential intermediary organizations on how to engage small businesses in WVPP.

Methods: Qualitative interviews were conducted with 70 small business operators selected from six US police jurisdictions where a WVPP was implemented from 2007 to 2012. Another set of qualitative interviews was conducted with 32 representatives of organizations with small business influence (e.g., chambers of commerce, trade associations, regulatory agencies, etc.). Coding and common-theme analysis were used to identify and

compare factors and recommendations for improving dissemination of a WVPP across study groups.

Results: Both study groups identified limited time, staffing, and concern about crime as barriers to WVPP participation. Both groups also recommended promoting workplace violence prevention through personal contacts but differed on other promotion methods, communication channels, messages, and the type of influential groups to target. Although many small business operators cited business membership organizations as influential, many also indicated few connections to formal business networks and greater reliance on informal networks of family and friends.

Conclusions: Successful dissemination of WVPPs to small businesses may require dissemination models inclusive of influential individuals (e.g., respected business owners in the community) as intermediaries to reach small businesses with few formal connections. Given the discrepancies in the small business operators' and organization representatives' perspectives on marketing WVPP, dissemination models may also need to give initiator organizations a more active role in helping intermediaries translate small business market research to intervention promotion.

A2.4

Title: Characteristics of student-perpetrated injury to school district staff

Authors: Katie Schofield Larson, Craig Stroinski

Background: Student-perpetrated injury to staff in the educational services sector is of particular concern, but most studies have only examined teachers' injury experience. A sizable number of factors may lend to an increased risk of student-related injuries in school districts including a changing student demographic and districts providing a greater degree of special services to students. Risk of injury to non-licensed and support staff such as educational aids, transportation employees, custodial, and food service workers needs further investigation. The goal of this research is to determine characteristics of injury resulting from students to district staff.

Methods: Workers' compensation data captured employees who suffered injuries and filed workers' compensation claims in 138 school districts over a seven vear period. Claims are categorized as medical-only or lost-time based upon severity of injury. Districts were categorized by geographic location. Employee characteristics of age, gender, and tenure were captured. Licensed employees were categorized as teacher, special education teacher, or other-licensed staff. Non-licensed employees were categorized as coaches, community education, substitute teachers, custodial, food service, educational assistant, special

education assistant, transportation, clerical, or other-nonlicensed employees. We examined text descriptions of injury claims involving students to ascertain characteristics of both the injury and the injury-causing event.

Preliminary Results: Approximately 2,300 student-related injuries were incurred by district staff during the study period. The majority of district staff were licensed, over forty years old, and female. The non-licensed educational assistants and special education assistants experienced the most injuries. Staff were struck-by students or objects thrown by students in approximately seventy-five percent of the injury claims. The head and upper extremities were the most common body part injured. Sprains and contusions were the most common type of injury. About fifteen percent of injuries were severe enough to cause lost-time from work.

Conclusions: Student-perpetrated injury and violence is a growing concern for school districts and staff. The information can be utilized to understand risk of student injury and direct injury prevention efforts.

Session A3.0

Title: Fall Prevention and Protection in Construction Moderator: Scott Earnest

A3.1

Title: Calculation of horizontal lifeline tension and deflection during fall arrest and comparison to experimental results

Authors: Bertrand Galy, Andre Lan

Objectives: Among the many occupational risks construction workers encounter every day, fall from height is the most dangerous. A horizontal lifeline (HLL) is a line that is stretched between two extremities of travel in a workplace, to provide a continuous anchor for the attachment of fall-arrest equipment. Research on HLL, both theoretical and experimental, has been made since the seventies, but there are still open questions, such as the influence of anchorage flexibility. Most analytical methods presented in past studies do not consider anchorage flexibility, leading to an overdesign of the anchorages. The objective of this paper is to propose a simple analytical design method for HLLs that includes anchorage flexibility.

Methods: Based on past studies, a new static analytical approach is proposed, considering anchorage flexibility. This method is then compared to results obtained with a SAP2000 model. Finally, the analytical results are compared to a series of 45 dynamic fall tests which have been conducted at the Ecole Polytechnique de Montreal during the 2014 summer. The fall testing uses a wooden dummy of 225lbs, CAN/CSAZ259 certified fall

protection equipment (4 ft. lanyard with class E4 energy absorber, body harness) and a 1.2m free fall height at the center of the HLL span. The line tension, lanyard tension, total fall distance of the wooden dummy, cable sag and anchorage deformation are monitored in real-time with a 1200 Hz acquisition system. The varying parameters, both for the computer model and laboratory tests, are as follows: cable diameter, initial line tension, anchorage flexibility (by varying both the height from the fixed support and section of the hollow steel sections) and HLL span.

Results: Comparison between the static SAP2000 model and analytical model shows a maximum difference of 2.3% in the line tension and deflection. The experimental results show that the proposed analytical method is a bit conservative and overestimates the line tension and deflection. The experimental results show that the proposed analytical method is a bit conservative and overestimates the line tension and deflection by about 10 to 15%.

Conclusion: In conclusion, the proposed analytical model seems to give a good estimate of the line tension and deflection considering its ease of use and the fact that it takes into account anchorage flexibility

A3.2

Title: **Evaluation of a horizontal lifeline system used during residential roofing** Authors: André Lan, Bertrand Galy

Objectives: Residential roofing is considered as one of the most risky occupations, more than six times as risky as the common trade in the construction industry. To protect workers against falls from height during roof installation, a building contractor has developed a horizontal lifeline system (HLLS) made up of 3 aluminum HSS 2"x6"x¹/4" welded together, 18' posts, assembled to end trusses of the roof, with the cable at 5 feet above the ridge. The HLLS is heavy (> 200 lb) and has never been tested with on-site braced trusses as the host structure. This paper presents the results of a study that has been carried out following a request from the Association of Master Roofers of Quebec to evaluate the HLLS and to verify the strength of on-site braced trusses as the host structure of the HLLS.

Methods: Structural analysis with CAN/CSA S 157 -Strength Design in Aluminum code shows that the 3 HSS 2"x6"x¼" can be replaced by a HSS 5"x5"x¼" to reduce its' weight by 40%. The strength of the HLLS' components has been verified with CAN/CSA Z 259 dynamic performance fall tests with a 1.2 m lanyard, an E4 energy absorber with a 1.2 m free fall of a 100 kg torso and dynamic resistance fall tests with a nylon lanyard and a 1.2 m free fall of a rigid 100 kg mass. The strength of braced trusses as host structure has been verified by CAN/CSA Z259 dynamic fall tests on a reconstructed wood frame of 24'x36' made up of 2"x6" at 16" c/c and 26' trusses at 24" c/c.

Results: Tests results show the HLLS and the braced trusses passed all dynamic fall tests and are strong enough to withstand all forces generated during the arrest of an accidental fall.

Conclusions: During roof installation, workers can be protected against falls by a HLLS that has been evaluated by CAN/CSAZ259 fall tests. It is user-friendly, efficient and reliable and allows mobility and easy access to all parts of the roof and protects workers against falls from the beginning to the end of their task.

A3.3

Title: A biomechanically based approach for optimal design of construction helmets

Authors: <u>Christopher Pan</u>, John Wu, Bryan Wimer, Richard Whisler, Nancy Romano, Darlene Weaver

Traumatic brain injuries (TBI) are among the most common severely disabling injuries in the United States. Construction is the leading industry for serious TBI. Approximately 500,000 new cases occur annually. Of those, 30%-50% are moderate to fatal head injuries. Helmets used by construction site workers are the basic. essential personal protection equipment to reduce the risks of TBI. In the current study, we proposed a biomechanically based approach to optimize the design of the construction helmet by using a finite element (FE) model. The FE models were constructed using the commercially available software ABAQUS (version 6.9). The head-brain-neck complex consists of scalp, skin tissues, skull, cervical vertebra (C1, C2, and C3), discs, brain, brain stem, cerebrospinal fluid (CFS), and spinal cord. The brain includes the cerebrum and cerebellum; and the brain stem contains the midbrain, pons, and medulla oblongata. For this simulation, we considered the spinal cord to include the surrounding pia mater. The CFS is considered to cover over the entire external surface of the brain, brain stem, and the spinal cord. The discs contain both annulus fibrosus and nucleus pulposus. Within each of these anatomical components (i.e., brain, brain stem, CFS, spinal cord, and discs), the material was considered as uniform and isotropic. The FE model of the protective helmet consists in a shell and a suspension system. The FE model was applied to a practical problem: the "struck by" issue in various industrial settings. To test the protection afforded by a helmet, a cylindrical object was dropped from different heights and impacted the top of the helmet. The simulations were performed using an implicit dynamic procedure. We calculated the head accelerations and pressures at different locations within the brain tissue in response to the impacts. The proposed biomechanical model would

provide a tool to improve the design of the construction helmet.

A3.4

Title: Online fall protection equipment resource for residential construction

Authors: <u>Vicki Kaskutas</u>, Huiping Lieser, Stelzer Barry, Bradley Evanoff

Falls continue to account for nearly all residential construction worker fatalities despite technological advancements in fall protection equipment. As a result, OSHA recently enacted more stringent residential construction fall protection standards. In order to comply, residential contractors must institute major, rapid revision of their building methods. Resources are needed to help contractors choose fall prevention devices appropriate for their contexts and use these devices in a safe manner.

Objective: To develop a comprehensive inventory of fall protection technologies for home construction that can be easily accessed from computers and mobile devices, to widely disseminate this resource, and to track outreach and effectiveness. The long term goal is to decrease construction worker falls.

Method: We identified fall protection devices appropriate for residential construction and compiled detailed information about each device into a user-friendly website developed using responsive web design; including purpose, installation procedures, photographs/videos, cost, and vendors. We matched each device to the stage(s) of construction when it may be utilized. Users can explore devices by construction stage or device type. The website was iteratively revised based on advisory panel feedback and user testing. Links to the website were posted on government-sponsored and private national organizations known to construction professionals and communications were distributed through these organizations' newsletters and social media outlets. Dissemination efforts and effectiveness were tracked.

Results: Over 150 devices from 24 manufacturers are described in detail on the website. Users reported that the website increased their awareness of fall prevention devices; some noted they will use fall protection devices more often and consider purchasing new devices after visiting the website. OSHA has embraced the website, distributing it through numerous venues. In the first month after release, 1,700 individuals visited the website, spending 4 minutes and viewing 8 pages on average.

Conclusion: This website provides a timely resource to help residential contractors identify fall prevention technologies and comply with new OSHA standards. The resource has been rapidly adopted; challenges now are to more widely disseminate this information, sustain the site over time, and keep the information current in order to decrease construction worker morbidity and mortality due to falls.

Session A4.0

Title: Analysis of Workers' Compensation Data Moderator: Letitia Davis

A4.1

Title: Comparison of temporary worker Illinois Workers' Compensation Commission filings from 2007-2012 with direct hire employees Authors: Dana Madigan, Linda Forst, Lee Friedman

Objectives: Temporary employment has been associated with increased workplace injury and the current labor market has shifted towards an increased demand for contingent laborers. While there is an increasing public health focus on identifying strategies to prevent injury, this study examines if temporary workers may be vulnerable to unfair compensation when injuries have already occurred.

Methods: This analysis examines Illinois Workers' Compensation Commission filings from 2007 through 2012 to compare litigated claim rates, total cost of the decision, days of work missed, and percent disability of employees of temporary agencies with a one-to-one random sample of direct hire claims.

Results: There were a total of 9,184 claims filed by employees of temporary agencies during this time period with an average litigated claim rate of 11.2 per 1,000 workers. Temporary workers were more likely to be male, younger at time of injury, single, have more dependents, and use attorney representation. Average weekly wage for temporary workers was approximately 51% of that of the direct hire employees ($$420\pm206$ compared to \$824±478, p<0.0001). Mean days between accident and filing was 135 days less for temporary workers (p<0.001) and mean days between accident and decision was 112 days less for temporary workers (p<0.0001). Temporary workers were more likely to have upper extremity injuries (p<0.0001) and less likely to have head and neck (p=0.0402) or lower extremity injuries (p<0.0001) compared to direct hire employees. Total award average was \$17,533±36,798 for direct hire employees and \$9,382±25,197 for temporary workers (p<0.0001). Of those employees claiming time off from work, total time off averaged 3.2 ± 6.4 weeks for direct hire employees (39.1%) compared to 2.6±4.9 weeks for temporary workers (32.5%). Total percent disability was 18.6%±15.7 for direct hire (56.6%) and 16.9%±17.2 for temporary employees (58.9%).

Conclusions: This suggests that there may be differences between temporary workers and direct hire employees in terms of total workers' compensation awards, total time off, and percent disability.

A4.2

Title: Workers' compensation claims for traumatic brain injuries - Ohio, 2001-2010

Authors: <u>Srinivas Konda</u>, Audrey Reichard, Hope Tiesman, Steve Wurzelbacher, Scott Hendricks, James Collins, Alysha Meyers, Lynne Pinkerton, Mike Lampl, Dave Robins, Ibraheem Al-Tarawneh

Objectives: This study used data from the Ohio Bureau of Workers' Compensation to describe work-related nonfatal traumatic brain injuries (TBIs) that occurred among single-location, private-employer establishments from 2001 through 2010.

Methods: Workers' compensation claims that listed TBIs as the primary or secondary diagnosis were identified using the International Classification of Diseases. Ninth Revision, Clinical Modification (ICD-9-CM). Demographic characteristics, establishment size, industry, and injury event were described. Injury events were auto-coded to the two-digit level of the Occupational Injury and Illness Classification System. Rates of TBI claims per 10,000 full-time equivalent employees (FTEs) were calculated using denominator data from the Quarterly Census of Employment and Wages for Ohio, adjusted with data from the Bureau of Labor Statistics labor, productivity, and costs series. The trend in rates over time was analyzed using Poisson regression. The distinction of medical-only or lost-time claims (>7 days away from work) was used as a surrogate measure for injury severity and lost-time claims were considered more severe than medical-only claims.

Results: From 2001-2010, 6,192 claims for TBI were reported at a rate of 3.3 per 10,000 FTEs. The majority of TBI claims occurred among men (68%); workers aged 25-54 years (67%); and workers in establishments with 1-49 employees (55%). Forty-five percent of TBI claims resulted in lost-time (n=2,789). Slips, trips and falls (n=2,758, 45%) was the leading cause of TBI, followed by contact with objects and equipment (n=2,151, 35%). From 2001 to 2010, the rate of TBI claims per 10,000 FTEs increased from 2.6 to 4.9 (p < 0.0001). The rate of lost-time TBI claims per 10,000 FTEs also increased from 1.2 to 1.9 (p < 0.01). The industries with the highest TBI rate per 10,000 FTEs were transportation and warehousing (12.1) and construction (8.7). More than 50% of TBI claims in each of these industries were losttime claims.

Conclusions: The high proportion and increasing rate of lost-time TBI claims highlight the need for occupational TBI prevention efforts, especially in high-risk industries. Such efforts to reduce TBI incidence and severity can improve employee safety, facilitate return to work, and reduce costs to employers and insurers.

A4.3

Title: Surveillance of acute work-related injury hospitalizations in California using the Workers' Compensation Information System Authors: <u>Christine Dobson</u>, Matt Frederick, Robert Harrison

Objectives: There is a recognized need for improved surveillance of work-related injuries in the US. In California, electronic reporting of First Reports of Injury (FROIs) to the state's Workers' Compensation Information System (WCIS) has been required since 2000, and medical billing data associated with claims has been required since 2006. We used this data reporting infrastructure to quantify work-related acute injury hospitalizations in California and to identify risk factors associated with these cases.

Methods: We extracted all claims submitted to WCIS through 12/31/2013 meeting our case definition for acute injury hospitalization: hospital admission date \leq 1 day of the injury date; medical bill with Facility Code of 11 (Hospital/Inpatient), 17 (Hospital/Subacute Inpatient), or 21 (Skilled Nursing/Inpatient); and medical bill with a Revenue Billed Code for room and board or treatment in an intensive or coronary care unit. We reviewed medical records of a random sample of cases to validate our case definition.

Results: A total of 17,162 cases met our definition for acute hospitalization from 2000-2013. We limited our analysis to cases occurring from 1/1/2010 through 12/31/2013 (n=6,842) to ensure consistency across years in the matching of FROI data with medical bills. During this period, the age-adjusted case rate per 100,000 workers declined from 12.4 to 8.8. Sex-adjusted rates were approximately 5 times higher among men than women, with the 55-64 year male age group experiencing the highest injury rate (range: 16.1-25.5 cases/100,000) each year. The median length of hospitalization was 2 (interquartile range: 1, 5) days, and the median dollar amount paid per medical bill was \$10,725. Fall or slip was the most frequent cause of injury; laborer, carpenter, and roofer were the most common occupations cited with these cases.

Conclusions: Acute injury hospitalizations represent a significant burden of work-related morbidity in California, accounting for approximately 5 times the number of annual occupational fatalities. Workers' compensation claims data can be used to ascertain hospitalization for acute injuries among workers and to identify key demographic and occupational characteristics. Consideration should be given to the

routine analysis of acute work-related injury hospitalization data for evaluation of OSHAmandated employer reporting, compliance inspections, and public health intervention.

A4.4

Title: Work injury compensation policies in the GCC countries

Author: Ujwal Kharel

Objectives: Work injury compensation policies in the GCC (Gulf Cooperation Council) countries present compelling case studies because rates of occupational injury and fatality in these countries are far greater than industrially advanced countries and because they rely heavily on migrant labor. It is an interesting exercise to study how well defined work injury compensation laws are in the GCC countries and how well they protect the labor force that is primarily comprised of migrant workers. This paper looks at the benefits to which injured workers and their beneficiaries are entitled in the GCC countries and compares them against benefits awarded countries with similar labor force composition.

Methods: Legislations in the six GCC countries (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates) were compared against those in Singapore, Indonesia, and Malaysia in terms of liability of medical care costs, temporary disability benefits, permanent partial disability benefits, death benefits, contributory negligence clauses, and enforcement mechanisms.

Results: Inadequacies of the work injury compensation laws in the GCC countries become more apparent when compared against those in countries like Singapore, a similarly wealthy economy with a very high proportion of foreign labor force. While entitlements concerning medical care costs and temporary disability benefits are similar across the countries, death and permanent disability benefits provided to injured workers and their beneficiaries are lacking in the GCC countries.

Conclusions: In comparison to other countries around the world, work injury compensation policies in the GCC countries seem to fall short of providing injured workers and their beneficiaries with fair and equitable compensation benefits. Labor laws and social insurance laws largely ignore workers in domestic and agriculture sectors, groups that form the most vulnerable population of migrant workers. Meanwhile, there are clauses in labor laws that allow employers to fault injured workers and thus reject liability for injuries. Migrant workers are especially vulnerable to these shortcomings because their employers are also in control of their visas. Moreover, enforcement mechanisms in place seem too weak to ensure employer's compliance. Session A5.0 Title: Motor Vehicles – Injury Prevention Moderator: Stephanie Pratt

A5.1

Title: Workplace road safety: Safety management for the occupational driver Author: Sharon Newnam

Road traffic injury is the leading cause of work-related death in Australia and internationally. Despite this, limited attention has been given to systems-based preventive strategies. A safe driving environment at work not only depends on individual compliance with safe driving practices but on all individuals anticipating threats to safety, showing concern for the safety of others, and contributing to safety improvements in the organisation. In particular, workgroup supervisors (those who monitor and regulate drivers in their performance of assigned tasks, both driving and non-driving related) play a critical role in creating a safe work environment. For example, a supervisor showing concern for a driver through increased safety-related discussions has been associated with safer driving behaviour by the employee.

Objective: This presentation will describe the role of the supervisor in the safety management of work-related drivers.

Method: I will also present an evidence-based program (i.e., Safety Management for the Occupational Driver) that aims to develop the skills of supervisors in identifying situations in which their drivers may be at risk on the road (e.g., drivers are tired, stressed, under pressure to meet deadlines) and to manage these situations effectively.

Results: I will present some preliminary findings on the effectiveness of the program in modifying safety management practices.

Conclusion: The strength of this approach in addressing the challenges associated with managing the safety of work-related drivers will be discussed.

A5.2

Title: **Evaluation of telematics feedback to truck drivers to reduce risky driving behaviors** Authors: <u>Jennifer Bell</u>, Oliver Wirth, Matthew Taylor, Guang-Xiang Chen, Rachel Kirk

Objective: The objective of this naturalistic driving study was to determine whether two types of feedback (instant feedback from an on-board video recording system (OVRS) and one-on-one coaching between supervisors and drivers) reduced risky driving behaviors in box-truck drivers. Methods: The driver population drove box trucks, delivering goods to convenience stores. This study used an on-board video recording system (OVRS) with forward- and driver-facing cameras which recorded driver behaviors, and accelerometers that detected vehicle maneuvers such as hard braking, acceleration, and speeding. When a vehicle event was triggered by a harsh maneuver, the OVRS saved a 30-second video/audio clip. 15 seconds before and after the triggering event. The videos were viewed by the OVRS vendor's trained observers and coded for approximately 60 different risky driving behaviors of varying severity. Two types of feedback to the drivers were evaluated: instant feedback from lights on the dashboard that flashed yellow or red to denote harsh vehicle maneuvers, and one-on-one coaching between supervisor and driver, consisting of viewing the recorded video events involving the driver and discussing safe driving behaviors. All trucks at seven business sites were equipped with OVRS, for a total of 158 OVRSs at the start of the study. The seven sites were assigned to an intervention group (n=5) that received instant driver feedback and supervisory coaching, or control group (n=2) that received no feedback. The data presented here cover 17 months of monitoring using OVRS in the intervention and control groups.

Results: Over the 17 months, there were approximately 237,000 useable trigger events recorded. Driving unbelted was the most common risky behavior; using hand-held electronic devices ranked 4th. Coaching varied among the sites, from a low of 52% of the drivers that should have been coached at one site to a high of 96% at another. The rate of overall risky driving behaviors decreased significantly in the intervention (lights plus coaching) group (RR=0.47, p<0.001), with no significant change seen in the control group (RR=0.93, p=0.44).

Conclusions: Preliminary results show that the OVRS intervention was associated with a decrease in risky driving behaviors that may reduce collisions, injuries and fatalities.

A5.3

Title: Impact of a motor-vehicle crash prevention program in a large police department

Authors: <u>Hope Tiesman</u>, Jeff Rojek, Geoff Alpert, Melody Gwilliam, Srinivas Konda, Jennifer Bell, Scott Hendricks

Objectives: Motor-vehicle crashes (MVCs) are the leading cause of on-duty injury death among law enforcement officers. In 2009, a large municipal police agency developed a three-pronged crash prevention program that included policy changes, new training requirements, and a marketing campaign. We evaluated the impact of this program on MVCs and motor-vehicular injuries.

Methods: Data were obtained from four agency databases: hours worked from human resource/payroll, MVCs from internal crash files, mileage data from fleet services, and injuries from workers' compensation claim data. Motor-vehicular injury rates were defined as the total number of workers' compensation claims for a MVC divided by the total productive hours and expressed per 100 full-time equivalents (FTEs). MVC rates were defined as the total number of MVCs divided by total miles driven and expressed per 100,000 miles. MVC rates and motor-vehicular injury rates were compared between the three years before program implementation (2007-2009) and three years after full implementation (2011-2013). The year of implementation was not included in the analysis (2010). Differences between the pre- and post-intervention rates were evaluated using Poisson regression.

Results: Preliminary analyses show that the agency's motor-vehicular injury rate significantly declined 41% from pre- to post-intervention (pre-intervention=3.5; post-intervention=2.1; RR = 0.59, 95% CI = 0.48 - 0.72). This was most pronounced in the patrol divisions where the motor-vehicular injury rate was cut in half (pre-intervention=4.0; post-intervention=1.9; RR=0.47, 95% CI=0.36 - 0.62). The agency's MVC rate also significantly declined 15% from 2.2 to 1.9 crashes per 100,000 miles driven (RR = 0.85, 95% CI = 0.79 - 0.91).

Conclusions: Preliminary analyses indicate that the crash prevention program was associated with a significant reduction in both motor-vehicular injury and MVC rates. Future analyses will measure changes in injury severity and characteristics of MVCs pre- and post-intervention. Additionally, the 2007-2013 MVC trends from two other large municipal law enforcement agencies will be used as comparison groups for the current study results.

A5.4

Title: **ATV and UTV safety training for agricultural workers: A safety workshop piloted with Iowa farmers**

Authors: <u>Charles Jennissen</u>, Karisa Harland, Andy Winborn, Gerene Denning

Objectives: Although some occupational all-terrain vehicle (ATV) and utility task vehicle (UTV) safety education resources are available, few operators receive any formal training. The study objective was to develop and evaluate a workshop that provides farmers education on the safe occupational use of ATVs/UTVs.

Methods: Training with evidence-based safety information for agricultural workers was developed, and is being piloted. Demographic information, safety behaviors, crash experiences, and safety knowledge (20 questions) is being collected prior to training. The reported likelihood of using the workshop information, the effects on short- and long-term knowledge, and the safety behaviors being practiced at a 6-month follow is being assessed. Descriptive and comparative analyses will be performed.

Results: A total of 65 subjects will be enrolled and their results presented. To date, 24 have participated in the training with 71% being male and a mean age of 39 years. About half enrolled were employees, and the other half owners/operators and family members. Only four had received ATV/UTV training of any kind. Most (92%) had used ATVs for occupational purposes in the prior 5 years, with nearly half reporting daily use. Of occupational ATV users, 63% reported daily or weekly use on public roadways and 77% reported having ridden with passengers. Almost all never wore a helmet. Most (71%) reported using UTVs for occupational purposes in the prior 5 years as well, with over 40% reporting daily use. Of occupational UTV users, 70% reported daily or weekly public roadway use and 60% reported never using the restraint device. Four (17%) had an occupational crash in the prior year. No difference in baseline knowledge scores were found by age, farming operation role, or riding frequency. Mean knowledge scores preworkshop were 7.4 (range 3-12) and post-workshop 14.2 (range 10-19). Mean change was 6.8 (95% CI 5.4-8.2, p<0.0001). All subjects reported they were very likely (58%) or likely (42%) to use the safety information presented.

Conclusions: Agricultural workers frequently use ATVs/UTVs for occupational purposes. Most practice unsafe behaviors. The safety training employed in this study increased short term knowledge and participants stated they would use the information provided.

Session B1.0 Title: Surveillance – General 1 Moderator: Nancy Romano

B1.1

Title: Underreporting of workplace injuries and illnesses in workplaces represented by the United Steelworkers International Union: Prevalence, causes and solutions

Authors: James Frederick, Nancy Lessin

Objectives: Discuss results of surveys regarding the underreporting of occupational injuries and illnesses conducted with members of the United Steelworkers International Union (USW) from various industries across the United States and Canada, to describe the extent and nature of injury and illness underreporting, review employer practices that discourage workers from reporting, and explore interventions to address injury and illness underreporting. Methods: Between 2008 and 2013 the USW conducted several surveys with local union officers, health and safety committee representatives and members to assess the prevalence and nature of under-reporting of job injuries and illnesses and employer practices that discourage workers from reporting job injuries and illnesses. The surveys were conducted at large USW International Union Health, Safety and Environment Conferences involving approximately 1,000 USW members each, with response rates ranging from approximately 33% to 50%.

Results: Survey results were consistent over a five year period, documenting the presence of one or more employer programs, practices or policies that discouraged workers from reporting occupational injuries and illnesses in over 90% of workplaces represented by the United Steelworkers International Union. While the amount of practices seems to be relatively constant, the nature of these practices appears to be shifting away from "prize" programs (where workers get rewards when injuries go unreported) to drug testing and disciplinary policies (where workers receive punishment or threats of punishment when injuries are reported).

Conclusion: The USW surveys are part of a growing body of evidence documenting the extent and nature of employer practices that discourage workers from reporting occupational injuries and illnesses. Some survey respondents included comments on interventions that were successful in eliminating practices that discouraged injury and illness reporting. Given the recent focus on the quality of occupational injury and illness data and government efforts to improve the tracking of workplace injuries and illnesses, including a recent OSHA proposal to prohibit employers from taking adverse action against employees for reporting injuries and illnesses; an exploration of USW's survey results will contribute to this important and on-going dialog.

B1.2

Title: Trends of fatal and nonfatal injuries in the US construction industry after the recent economic downturn

Authors: <u>Xiuwen Sue Dong</u>, Xuanwen Wang, Julie Largay

Objectives: Construction is one of the most dangerous industries in the U.S., suffering a disproportionate share of the nation's work-related fatal and nonfatal injuries. This study examines the trends of fatal and nonfatal injuries in construction over time, especially after the recent economic downturn.

Methods: Four large national datasets (the Census of Fatal Occupational Injuries, the Survey of Occupational Injuries and Illnesses, the Current Population Survey, and the Current Employment Statistics), covering 1992 to 2013, were analyzed. Stratified and time series analyses were conducted using SAS 9.3 to identify differences among subgroups in construction over time.

Results: In 2012, 849 construction workers were killed on the job and 75,200 workers had injuries involving days away from work; both numbers increased for the first time since the recent economic downturn. The fatality rate in construction increased from 9.0 per 100,000 full time workers (FTEs) in 2011 to 9.8 per 100,000 FTEs in 2012, a 10% increase in one year. The rate of injuries involving days away from work in construction was much higher than that of all private industries. Falls remained the leading cause of death, accounting for over one-third of all construction fatalities between 2011 and 2013. While the 2013 fatal injury data are still preliminary, more fatalities were found among Hispanic construction workers, especially those who were foreignborn. Increases in the number of construction fatalities were also found among older workers, self-employed workers, roofing contractors, and workers employed in residential construction. Power-line installers, roofers, and ironworkers remained the riskiest occupations for fatalities, while construction helpers and sheet metal workers had the highest rate of nonfatal injuries. (The numbers will be updated when the final data are available.)

Conclusion: The construction industry continues to face serious safety challenges after the economic downturn. Interventions should be enhanced and targeted for highrisk occupations and populations.

B1.3

Title: Musculoskeletal concerns do not justify failure to use nail guns with sequential triggers

Authors: Hester Lipscomb, <u>Mark Fullen</u>, James Nolan, Dennis Patterson

Objectives: Acute nail gun injuries can be controlled significantly by using tools with sequential triggers and training. Concern has been raised that sequential triggers, which require that the nose piece of the gun be depressed prior to pulling the trigger, could increase risk of musculoskeletal problems. We conducted active injury surveillance among union carpenter apprentices to monitor acute injuries and musculoskeletal disorders between 2010 and 2013.

Methods: Between 2010 and 2013 we collected a total of 2,552 surveys from carpenter apprentices through their training schools, representing a response rate of 95%. Some apprentices were surveyed on more than one occasion as they matriculated through the school, but never more than once in a given year. Injury rates were calculated based on estimates of hours of tool use in the last year. Multivariate modeling was conducted with Poisson regression.

Results: The number of acute nail gun injuries experienced by these carpenters ranged from none to 10 (median=0; mean=0.24). Lifetime prevalence of acute nail gun injuries was 13.7 % (350/2552). Twenty-four carpenters reported having had a musculoskeletal problem they associated with nail gun use at some point representing lifetime prevalence of less than 1%. Acute injury risk was 70% higher with contact trip rather than sequential triggers. Musculoskeletal risk was comparable (contact trip 0.09/10,000 hours (95% CI 0.02-0.26); sequential 0.08/ 10,000 hours (95% CI 0.02-0.23)).

Conclusions: Concern about excess risk of musculoskeletal problems from nail guns with sequential triggers is unwarranted. Both actuation systems carry comparable musculoskeletal risk which is far less than the risk of acute injury; there is clearly no justification for failure to prevent acute injuries through use of the safer sequential trigger.

B1.4

Title: Findings from the NIOSH FACE reports in construction

Authors: Julie Largay, <u>Xiuwen Sue Dong</u>, Xuanwen Wang

Objectives: Since 1982, the NIOSH FACE program has collected detailed narratives of thousands of work-related fatalities. However, these FACE reports have been underutilized due to the challenges of working with the text format. This study aimed to develop a numeric Construction FACE Database for statistical analysis in order to identify patterns of contributing factors to work-related fatal injuries, and provide insights for construction injury interventions.

Methods: Data were extracted from NIOSH in-house and State FACE reports in construction between 1982 and 2012, and coded into the FACE Database using a standardized set of variables. The Database covers demographics and employment of decedents, injury information, and employer and environment circumstances. The Database was analyzed (descriptive and stratified analysis) using SAS 9.3.

Results: Overall, the Database has 757 fatal cases in construction - 269 NIOSH in-house reports and 488 State reports. The initial analysis shows that almost 90% of incidents occurred on jobsites with fewer than 10 workers. Among cases where job tenure was reported (559), 20% occurred during the first month of employment. Employers with greater than 30 years in business were more than three times as likely to have a written safety plan or provide job training when compared to those in business for one year or less. Conclusion: Findings show an alarming vulnerability of new workers in construction and those employed in small construction businesses. In addition, there was a direct relationship between the length of time an employer was in business and the likelihood of having a written safety plan or providing job training. These vulnerable worker groups should be targeted for injury prevention.

The Database makes searching for information in the FACE reports more efficient, specifically data which are not available elsewhere. However, some important information was not included in the FACE reports. For example, race/ethnicity and foreign-born status were not reported for about 90% of the decedents. Moreover, information such as personal protective equipment (PPE) use was only available in some reports and with varying degrees of completeness. Collaboration between FACE programs and implementation of an investigator's template with collection items are strongly suggested.

Session B2.0 Title: Fire Fighter Safety Moderator: Tim Merinar

B2.1

Title: Results from the Strategies to Prevent Injuries among Firefighters (SPIFi) project and the effectiveness of risk management

Authors: <u>Gerald Poplin</u>, Keshia Pollack, Stephanie Griffin, Joshua Mallet, Chengcheng Hu, Virginia Day-Nash, Wayne Peate, Ed Nied, John Gulotta, Jefferey Burgess

Objectives: Injuries to fire service employees were previously shown to occur beyond the fireground (FG), with physical exercise (PE) and patient transport (PT) related activities accounting for 32.9% and 16.9% of injuries, respectively, as compared to 10.2% of injuries related to FG activities. Over a five year timespan (2004-2009), the annual injury incidence rates for a mediumsized, metropolitan fire department (FD) ranged between 13.6 and 21.5 per 100 employees. Beginning in 2009, a prospective effort between public health researchers and the FD was initiated to implement a formalized risk management (RM) program for health and safety that systematically identifies, assesses and treats the risks to which firefighters are exposed. The objective of this study is to describe the effectiveness of task-specific, risk-based control strategies for reducing injury occurrence and severity.

Methods: The study employed a quasi-experimental, controlled longitudinal intervention design over the years 2009-2013. Three participatory RM groups were established with a cross-section of the workforce for each of the PT, FG and PE activities. Defined phases of the study included hazard scoping, risk assessment, and implementation of controls, all within an iterative process. Injury rates were compared pre- and postintervention within the intervention FD, and with a regional, non-intervention control FD. Outcomes evaluated included all reported injuries for both intervention and control FDs, as well as workers' compensation claims and workers' compensation costs for the intervention FD only. In addition, all reported injury rates were evaluated for PE, PT and FG for both departments.

Results: The RM process led to the identification of 45 hazard specific-interventions, of which 9 were selected for implementation. Compared to the pre-intervention period, preliminary analyses indicate a 13% decline in the average number of injuries per year, a 30% decline in the average number of workers' compensation injury claims, and a 21% reduction in average workers' compensation claims costs.

Conclusions: While results are being finalized and reviewed in conjunction with a complementary process evaluation assessment, it appears that the risk management intervention was effective in reducing fire department injuries and costs and may be a viable approach for other FDs to adopt and adapt.

B2.2

Title: Firefighter burnout: Antecedents and impact on firefighter safety behaviors

Authors: Todd Smith, David DeJoy, Aimee Dyal

Objectives: Fighting fires and responding to emergencies is demanding work with significant pressures. We don't fully understand the impact of this work on the firefighter. There is anecdotal evidence that job-related burnout exists in the fire service, but little research has explored burnout, its causes and its consequences in the fire service. This study examines relationships between work pressure, occupational stress, work-family conflict, burnout and safety work practices including safe work practices, personal protective equipment use and safety voice.

Methods: Data were collected from firefighters working for a city fire department in the south eastern US (n = 208) in July 2014. Structural equation modeling was used to assess the specified model and hypothesized relationships. Latent factors in the model included work pressure (a=.85), occupational stress (a=.93), workfamily conflict (a=.96), burnout (a=.91), safety voice (a=.87) PPE use (a=.85) and safe work practices (a=.79).

Results: The model provided a satisfactory fit to the data (SRMSR = .076; RMSEA = .079), although the comparative fit index was slightly less than desired (.824). All items significantly loaded on their respective factors and paths were as expected. Work pressure

predicted occupational stress (B = .45, p = .001) and stress predicted work-family conflict (B = .80, p = .000) and burnout (B = .51, p = .000). Work-family conflict was also associated with burnout (B = .23, p =.000). Interestingly, burnout significantly predicted declines in safety voice (B = -.20, p = .001), PPE use (B =-.19, p = .000) and safe work practices (B = -.29, p =.001).

Conclusions: These results provide new evidence of burnout and its antecedents and safety-related consequences in the fire service. Interventions aimed at these antecedents could potentially curtail burnout and its effects. We now understand that burnout as a stressrelated process of fatigue and depletion does negatively impact safety performance. When firefighters are burnt out, they do not communicate or voice safety concerns, they do not effectively use PPE and generally do not follow SOPs or perform standard work practices in a safe manner, which could result in firefighter injuries during line-of-duty operations.

B2.3

Title: **Respiratory protection for firefighters** – **evaluation of CBRN canisters for use during overhaul** Authors: Leaton Jones, Eric Lutz, Jeffrey Burgess, Michael Duncan (<u>Rustin Reed</u> presenting)

In the United States, there are approximately 366,600 structural fires each year. After visible flames are extinguished, firefighters begin the overhaul stage of firefighting to smother remaining hot spots and initiate investigations. Typically during overhaul significant ambient concentrations of chemical contaminants remain. However, previous research suggests that the use of air purifying respirators (APR) fitted with chemical, biological, radiological, and nuclear (CBRN) canisters may reduce occupational respiratory exposures.

Objectives: This pilot study used large-scale prescribed burns of representative structural materials to perform simultaneous, side-by-side, filtering and service-life evaluations of commercially available CBRN filters.

Methods: Three types of CBRN canisters and one cartridge were challenged in repetitive post live-fire overhaul exposure tests using a sampling manifold apparatus. At a flow rate of 80L/min, nine tests were conducted in the breathing zone for three different exposure durations (0-15min, 0-30min and 0-60min).

Results: Fifty different chemicals were identified for evaluation and results indicate that 21 of the 50 chemicals tested were in the air of the overhaul environment. Respirable particles and formaldehyde were consistently present above the ACGIH recommended exposure level and threshold limit ceiling value (TLVc), respectively. Each CBRN filter effectively reduced concentrations for respirable particulates below the maximum recommended level. Formaldehyde was reduced, but not consistently filtered below the TLVc. These results were consistent across all exposure durations.

Conclusion: This study indicates that, regardless of brand, CBRN filters provide protection from the vast majority of particle and gas-phase contaminants. However, due to formaldehyde breakthrough, CBRN filters do not provide complete protection during firefighter overhaul.

B2.4

Title: Implementing risk management to reduce injuries in the US Fire Service

Authors: <u>Keshia Pollack</u>, Gerald Poplin, Stephanie Griffin, Joshua Mallet, Chengcheng Hu, Virginia Nash, Wayne Peate, Ed Nied, John Gulotta, Jefferey Burgess

Objectives: Risk management (RM), a proactive process to identify and mitigate potential injury risks, and implement control strategies, was used to reduce the risk of occupational injury at a medium-sized suburban U.S. fire department. The objective of this research is to conduct a process evaluation to document the implementation and acceptability of the RM process for future replication. A second objective was to document changes in department personnel's knowledge, attitudes, and behaviors related to the selected control strategies that were implemented as part of the RM.

Methods: Qualitative and quantitative data were collected as part of the RM. Focus groups with 25 firefighters from each of the three operation groups (patient transport (PT), fireground response (FG) and physical exercise (PE)) occurred after the initial steps of the RM process. Four key informant interviews with leadership in the fire department and 2 focus groups with eight firefighters were conducted after implementation of control strategies. Sessions were digitally recorded and transcribed, and along with notes from the scoping sessions, were subject to open coding process followed by topic coding. Approximately 450 firefighters completed each of the three cross-sectional surveys, which asked about the implementation and use of the control strategies. Descriptive analyses were conducted using Stata 13.

Results: Fire service personnel reported important changes in knowledge, attitudes and behaviors related to the control strategies, valued the participatory and bottom-up aspect of the RM process, and found the process useful for identifying risks and reducing firefighter injury risk. Firefighters were generally aware of the control strategies that were implemented. Visual reminders (e.g., signage) were noted as effective by firefighters who noticed them. Barriers to use of the control strategies (new procedures for the FG and lifting equipment for PT) included lack of knowledge of new protocols, and lack of access to/availability of equipment, as well as limited training on its use.

Conclusions: The RM process was widely accepted by fire service field personnel and leadership. Findings support the importance of effective implementation to achieve the desired impacts of control strategies for injury prevention.

Session B3.0

Title: **Systematic Reviews** Moderator: Christine Schuler

B3.1

Title: Effectiveness of OHS workplace interventions for upper extremity MSDs: An update of the evidence Authors: <u>Dwayne Van Eerd</u>, Claire Munhall, Emma Irvin-Sinkins, David Rempel, Shelley Brewer, Jack Dennerlein, Allard van der Beek, Jessica Tullar, Benjamin Amick III, Kathryn Skivington, Clint Pinion

Objectives: In Canada and the United States (US), UEMSDs and low back pain are the leading diagnoses of disabling work-related injuries accounting for 29% of all injuries and illnesses in the US (Silverstein and Evanoff, 2011). While in Canada MSDs account for between 40 to 60% of lost-time claims since the year 2000 (WSIB, 2009; WCB Nova Scotia, 2009; WorkSafeBC, 2009; WCB Manitoba, 2010).

Workplace and work process hazards contribute to the development of UEMSDs, however there is little consensus on effective ways to reduce or eliminate hazards. The Institute for Work and Health (IWH) has conducted a number of reviews to identify effective approaches for preventing and managing UEMSDs. The objective of this project is to update the review of workplace-based UEMSD prevention with a view to updating the key messages.

Methods: The team of researchers and stakeholders followed a systematic review process developed by the IWH: research question formulation; literature search; relevance review; quality appraisal; data extraction; and evidence synthesis. A best evidence synthesis approach was adapted from Slavin (1986), based on three aspects of the evidence: Quality, Quantity, and Consistency. Synthesis of the evidence on a particular UEMSD intervention-health outcome relationship is ranked on a scale from strong to insufficient evidence.

Results: The following electronic databases were searched from January 2008 until December 2012: MEDLINE, EMBASE, and Cumulative Index to Nursing and Allied Health Literature (CINAHL), Canadian Centre for Occupational Health and Safety's CCINFO web, Cochrane Library and Ergonomic Abstracts. The search yielded 9909 non-duplicate references. We found 26 high and medium quality studies that were relevant to answer our research question. Stakeholders were consulted to help frame the resulting recommendations.

Conclusions: We combined the 26 studies from 2008 to 2013 with 35 from the original review to synthesize the evidence. Our synthesis reveals strong evidence for resistance training and moderate evidence for stretching programs, mouse use feedback and forearm supports in preventing MSD symptoms or disorders. Stakeholder involvement ensured practical messages about these interventions.

B3.2

Title: Evidence synthesis for occupational health and safety

Authors: <u>Emma Irvin-Sinkins</u>, Dwayne Van Eerd, Kim Cullen, Claire Munhall

Introduction: Occupational injuries and work-related musculoskeletal disorders are a substantial burden for workers, workplaces, compensation, and insurance systems. There continues to be a rapid growth in literature on workplace-based interventions to reduce hazards and protect workers. It is impossible for an individual stakeholder to keep current on this literature. Synthesizing the literature is important for evidence informed Occupational Health and Safety (OH&S) approaches. This presentation will summarize a number of different evidence synthesis approaches and the challenges and benefits of each. In addition, the key role played by stakeholders in each of these approaches will be described.

Methods: There are different approaches to evidence synthesis including systematic reviews (SR), rapid reviews, scoping reviews, meta-analysis etc. Each approach has different purposes and audiences. Systematic reviews are syntheses of the literature to answer a specific question about effectiveness, prognostic factors, or etiology. Rapid reviews tend to answer similar questions but are more focused and have limited resources and time. Scoping reviews seek to provide information about the available literature on a particular topic. Meta-analyses are a statistical approach to combine data from multiple studies, they are often part of a systematic review.

Results: The IWH has developed a prevention review program and in the course of so doing has conducted a number of different types of evidence syntheses. A series of syntheses will be presented each highlighting different evidence synthesis approaches including: a mixedmethod systematic review on RTW interventions; a review examining aging and work will illustrate a scoping review methodology; and a systematic review on multi-disciplinary treatment for low back pain will demonstrate a meta-analysis.

Conclusions: Different evidence synthesis approaches have been beneficial to summarize and disseminate evidence for OH&S stakeholders. This presentation will discuss key findings from three types of syntheses. In addition we will indicate the challenges/benefits of conducting syntheses of the OH&S literature.

B3.3

Title: What is new in return to work: Ten years later? Authors: Emma Irvin-Sinkins, <u>Benjamin Amick III</u>, Alex Collie, Kim Cullen, Ulrik Gensby, Sheilah Hogg-Johnson, Vicki Kristman, Marie Laberge, Quenby Mahood, Sharon Newman, Rasa Ruseckaite, Ron Saunders, Dianne Sheppard, Swati Shourie, Dwayne Van Eerd

Objectives: What are effective workplace and system based RTW interventions for workers with MSK and pain-related conditions in improving returning workers to work and health and quality of life outcomes?

Methods: The team of researchers and stakeholders followed a systematic review process developed by the IWH: research question formulation; literature search; relevance review; quality appraisal; data extraction; and evidence synthesis. Review steps were completed with two independent reviewers coming to consensus for each reference. Synthesis of the evidence is ranked on a scale from strong evidence, through moderate, limited, and insufficient evidence.

Results: The following electronic databases were searched from January 1990 until April 2012: Medline, EMBASE, PsycINFO, CINAHL, ABI Inform, Sociological Abstracts, and ASSIA. This comprehensive search yielded 6896 non-duplicate references. From these references we found 57 articles that were relevant to answer our research question. Methodological quality scores for the relevant studies are higher than those from the previous review and previous reviews. There is a strong body of evidence for a variety of interventions across the workplace, system and mental illness domains within our research question.

Conclusions: We will present a synthesis of the evidence on the effectiveness of programs to reduce work disability and return injured workers to employment.

B3.4

Title: The role of aging in return to work and stay at work: A systematic review

Authors: <u>Emma Irvin-Sinkins</u>, Ivan Steenstra, Dorcas Beaton, Kim Cullen, Judy Geary, Monique Gignac, Doug Gross, Patrick Loisel, Sara MacDonald, Quenby Mahood, Glen Pransky, Martine Puts, Heather Scott-Marshall, Emile Tompa, Dwayne Van Eerd, Ross Wilkie, Amin Yazdani

Objectives: Workforce health is capturing increased attention as a critical driver of the economy. An important demographic trend that will affect worker health and work disability is aging of the workforce. While the number of aging workers wanting or needing to return to work or stay at work after injury or chronic disease is increasing, knowledge on their specific needs and circumstances has not been summarized in a systematic way. This review had the following objectives: what is the effectiveness of interventions aimed at return to work and/or stay at work in aging workers? What factors are associated with return to work and/or stay at work in aging workers?

Methods: The team of researchers and stakeholders followed a systematic review process developed by the IWH: research question formulation; literature search; relevance review; quality appraisal; data extraction; and evidence synthesis. Review steps were completed with two independent reviewers coming to consensus for each reference. Our evidence synthesis methods will be adapted from the Cochrane Collaboration for RCTs, and on other IWH reviews of non-randomized studies, which are adapted from Slavin's method known as best evidence synthesis. Synthesis of the evidence is ranked on a scale from strong evidence, through moderate, and limited, down to insufficient evidence. The SR program at IWH relies heavily on stakeholder involvement and have published our process. We involve our stakeholders multiple times during the review process.

Results: The following electronic databases were searched from inception to the present: the Cochrane Central Register of Controlled Trials (CENTRAL), MEDLINE, EMBASE, Web of Science, SocINDEX, Sociofile/Sociological Abstract), PsycINFO, American Business Index (ABI) Inform, EconLit, and Health and Safety Science Abstracts. This comprehensive search yielded 6176 non-duplicate references. From these references we found 14 articles that were relevant to our first objective and 103 studies that answer our second objective.

Conclusions: We will present the results for this review on the state of the evidence on aging and return to work and stay at work. Session B4.0 Title: Total Worker HealthTM – Session 1 Moderator: Martin Dainoff

B4.1

Title: Non-wage and quality of life losses following occupational injury among healthcare workers in Canada

Authors: Jaime Guzman, A. Ibrahimova, Emile Tompa, Mieke Koehoorn, <u>Hasanat Alamgir</u>

Objectives: Economic evaluations of occupational health and safety (OHS) programmes are increasingly reported and used to inform programme choices and funding decisions. Most published economic analyses of occupational health and safety interventions consider economic losses for the employer or the insurer, but ignore the non-wage losses that remain uncompensated and other consequences for workers experiencing occupational injuries. This research examines non-wage and quality of life losses following occupational injury among healthcare workers in Canada and factors associated with their magnitude.

Methods: Inception cohort of workers was formed who were filing an occupational injury claim in a Canadian Province. Worker self-reports were used to calculate: a) non-wage economic losses in 2010 Canadian dollars; and b) number of quality-adjusted life days lost based on the EuroQOL index.

Results: Most workers (84%, n=123) had musculoskeletal injuries (MSI). Mean non-wage economic losses within the 12 weeks after MSI were \$3,131 (95% CI: \$3,035; \$3,226). These included \$338 in out-of-pocket expenditures, 66 hours lost from leisure and volunteering, and 39.5 hours spent by others assisting the injured worker. Non-wage losses corresponded to about 59% of lost wages, resulting in total mean economic losses of \$8,417 (95% CI: \$7,213; \$9,620). Losses varied with type of injury, region of the province and occupation. Non-MSI were associated with smaller losses. Results from the EQ-5D showed that during the first week after injury: 41.5% of participants reported mobility problems; 59.8% problems with personal self-care; 85.7% problems with their usual activities; 87.2% pain or discomfort; and, 50.4% feeling anxious or depressed. As expected, EQ-5D index scores increased over time as workers recovered from their injury.

Conclusions: The information reported in this study can be used to integrate workers' perspectives into comprehensive economic evaluations of occupational health and safety programmes to prevent occupational injury. Future economic evaluations should take into account these substantial additional losses borne by the workers and their families, which corresponded to 59% of wage losses in this study.

B4.2

Title: Workplace social environment and postpartum risk for occupational injury

Authors: <u>Laura Schwab Reese</u>, Marizen Ramirez, Corinne Peek-Asa

Objectives: New mothers may be at an increased risk for occupational injury due to the increased mental and physical demands associated with delivery and parenting infants. The purpose of this study was to investigate the relationships between supportive employment environment (co-worker, supervisor, and organization) during the postpartum period and mental and physical risk factors of occupational injury (overall physical health, anxiety, depression, and stress).

Methods: One hundred thirty mothers recruited from The University of Iowa mother-baby unit during the first 48 hours after live birth completed questionnaires after recruitment and three and six months postpartum. This analysis included the 98 participants who completed all three questionnaires. At each time point, mothers answered questions on mental health (depression, anxiety, and stress), physical health (overall perception of health and work-related injuries), and employment characteristics. During the six-month questionnaire, mothers answered questions about interactions with coworkers, supervisors, and the employing organization. Logistic regression was used to identify the association between the work environment and health risk factors.

Results: Most mothers (64%, n=61) worked during the postpartum period, including two who did not work during pregnancy. Most mothers perceived a supportive employment environment. On a scale of 1 to 4, where higher numbers indicated higher levels of support, women reported a median score of 3 on each of the support subscales. Two women experienced a workrelated injury during the study period but many more experienced mental and physical health risk factors for occupational injury. Co-worker support was an important predictor of maternal health during the postpartum period. Higher levels of co-worker support were associated with decreased odds of experiencing anxiety symptoms (OR: 0.16; 95%CI: 0.04-0.73), high levels of stress (OR: 0.26; 95%CI: 0.07-1.01), and overall poor physical health (OR:0.29; 95%CI: 0.09-0.96). Higher levels of supervisor support were associated with reduced odds of experiencing anxiety symptoms (OR:0.16; 95% CI: 0.04-0.75). Perceived organizational support was not significantly associated with any health outcomes.

Conclusions: Women who experience mental and physical health issues are at significantly increased risk for occupational injury, and intervention to enhance coworker and supervisor support may be one novel way to reduce occupational injuries.

B4.3

Title: **Performance of physically-demanding** occupational tasks and physical fitness tests: A systematic review and meta-analyses Authors: <u>Veronique Hauschild</u>, David DeGroot, Shane Hall, Karen Deaver, Keith Hauret, Tyson Grier, Bruce Jones

Purpose: To re-evaluate the Army physical fitness test (a 2-mile run, sit-ups, and push-ups test) as an occupational standard, a systematic review was used as a form of a job analysis for associating performance of military-relevant physical tasks to physical fitness tests.

Methods: Search terms (e.g., "occupational," "physical fitness," "job analysis," "job standard") were applied to several literature databases with criteria to identify studies of healthy adult populations providing correlation coefficients between task performance and fitness tests. From 17,000 articles, 27 studies were selected. Data were organized into twelve categories of physically-demanding tasks and four types of physical fitness groups. Tasks included those performed by military and civilian occupations (e.g., firefighters, police, and athletes). Fitness tests were sorted into cardiorespiratory endurance, muscle strength, muscle endurance, and flexibility. Muscular strength and endurance tests were subcategorized into upper, lower, and trunk/core body regions. Fitness tests included run tests, sit-ups, push-ups, and other equipment/nonequipment tests (e.g., jump tests, squats, sprints, pull-ups, grip tests, arm lifts, curls, and extension machine tests). A series of meta-analyses provided pooled correlation coefficients for tasks and fitness test groups.

Results: Cardiorespiratory endurance tests were most strongly correlated to the greatest number of tasks (highest r = 0.80, average r for the top 5 tasks = 0.68). Muscular strength and endurance both had strong correlations with several tasks (average for top 5 tasks = r>0.50). Lower body strength and endurance tests (average top 5 task r = 0.63 and r = 0.58) are of similar strength to correlations for top correlations with upper body endurance (average top 5 task r = 0.57). Core endurance, and sit-ups specifically, are weakly correlated with most tasks (average r for top 5 tasks r = 0.38).

Conclusions: While muscle strength and endurance are critical physical components to military job capabilities, cardiorespiratory appears more important. Of the individual tests evaluated, sit-ups are not well correlated to the tasks. The 2 mile run and push up tests have greater validity. Since run times and push-ups have historically been useful measures injury surveillance, consideration for retaining these tests is warranted.

B4.4

Title: **Preliminary results, challenges, and successes of implementing a comprehensive ergonomics and wellness Total Worker Health intervention on commercial construction sites** Authors: <u>Michael Grant</u>, Kristen Ironside, Jack Dennerlein

Objectives: Despite prevalence of Musculoskeletal Disorders (MSD) and high-risk health behaviors, integrated health protection and health promotion does not exist for commercial construction workers due to the highly dynamic and variable nature of the construction industry. The worksite environment provides policy, resources, and the social factors that are fundamental to success of work-related health and safety interventions. Our main objective was to develop an integrated worksite-based health and safety intervention with integrated messaging about planning for work and life. This study explored the working hypothesis that: Workers employed on intervention worksites will report greater reductions in MSD complaints and greater improvements in ergonomics practices and health behaviors, compared with workers on control sites.

Methods: We conducted a feasibility study with four construction industry contractors in the Boston Area. Each contractor volunteered two job sites of similar size and phase of construction which were randomly assigned to intervention or control. The first part of the intervention is a comprehensive ergonomics program. The program consists of ergonomics trainings followed by weekly inspections and feedback with the goal of reinforcing the use of ergonomic pre-task planning across the trades throughout the worksite. At the conclusion of the ergonomics program there is a health week where diet, physical activity, and smoking cessation resources are made available to workers at break times.

Results: The qualitative findings from initial focus groups with participating workers and interviews with safety managers show consistencies regarding study specifics and general health and safety trends. Many workers share concerns about the quality of food served at food trucks, poorly managed stress, alcohol abuse and air quality. Workers found that the intervention reinforced good ergonomic habits that are often forgotten. Safety managers stressed the importance of management buy-in on the impact of our program.

Conclusions: The intervention developed from this research will provide a step toward improving health outcomes for workers in this high-priority industry on a worksite-specific basis. It is important to understand the challenges and successes of intervention delivery in order to inform and improve future worksite-based interventions that aim to improve Total Worker Health.

Session B5.0 Title: Laboratory Research Moderator: Jeffrey Schiffman

B5.1

Title: Effect of first receiver protective ensemble on range of motion and postural balance

Authors: <u>Sharon Chiou</u>, Joyce Zwiener, Mathew Hause, John Powers, Darlene Weaver, Robert Chetlin, Mahmood Ronaghi, Ridenour Marilyn

Objectives: Healthcare workers are at risk for occupational exposures to chemical, biological, or radiological materials when treating contaminated patients, particularly after mass casualty incidents. When handling victims, healthcare workers normally wear the personal protective equipment (PPE) recommended in an OSHA Best Practices document for hospital-based first receivers. Traditionally, the design of PPE focuses on the physical and mechanical properties of materials, with very few considerations of usability. The bulky PPE ensemble can restrict mobility. limit effective emergency response, and increase risks for overexertion and sliptrip-fall injuries. The objective of this study was to quantify the barriers to the use of first receiver ensembles by evaluating ergonomic and biomechanical stresses imposed on the wearers.

Methods: This study evaluates the effect of first receiver ensembles on range of motion (ROM) and postural stability. Healthcare workers (N=24) who had at least 12 months of experience wearing surgical masks or N-95 respirators were recruited. The test ensemble included a 3M Breathe Easy Powered Air-Purifying Respirator system, a double layer of gloves, boots, and a Tychem® suit. Measurements of ROM at the shoulders, elbows, trunks, hips, and knees were taken for each subject while wearing PPE or regular clothing (T-shirt and shorts) using a universal goniometer. Postural stability, measured using a Tekscan HR MatTM, was assessed under the experimental conditions of subjects' eyes either open or closed, while standing on either a firm surface or a four-inch foam mat.

Results: The use of PPE had a significant effect on all movements. ROM capability appeared to decrease consistently across all joints. The most restricted areas included shoulders and hips in the frontal plane with more than 30% decrease in shoulder and hip abduction. The use of PPE produced higher sway area and sway length, suggesting increased muscular activity is required to maintain balance.

Conclusions: This study demonstrated that ROM and postural stability was affected by the use of PPE. Future study is needed to examine dynamic stability during decontamination operations. Findings from this study will be used to recommend safer work practices and PPE design to improve the usability of first receiver PPE.

B5.2

Title: Stability of a mast climbing work platform during fall arrest

Authors: <u>Bryan Wimer</u>, Mat Hause, Christopher Pan, Tim Lutz

Mast climbing work platforms (MCWPs)-mast climbersare a type of elevating construction equipment with a powered drive unit that propels a work platform up and down a vertical mast structure. MCWPs are being used more frequently in the United States and are a potentially safe and configurable alternative to traditional tube-andcoupler or system scaffolding. An estimated 22,000 MCWPs are in use in the United States [O'Shea, February 2014], with roughly 70% of those being used daily. Freestanding variations of MCWPs offer mobility and can readily be moved around job sites. These nonanchored MCWPs can be assembled to a working height of up to 45 feet, but under OSHA regulation (1926.451 (g) (1) (vii)), it is only necessary to wear a fall-arrest protection system when an open edge is present. This presents a safety concern for fall exposure. A National Occupational Research Agenda feasibility study investigated the stability of a freestanding, 45-foot mast climber during a fall-arrest condition. A Fraco ACT8 mast climber was erected in its largest freestanding configuration (45 feet tall with 30-foot-long platforms on each side of the mast). A fall-arrest condition was created by dropping an Advanced Dynamic Anthropometric Manikin under three test conditions representing common exposures. Arresting force at the anchor point and platform displacement in the vertical direction were measured. The maximum arrest force under the test conditions was well within the ANSI Z359.1-2007 standard. The maximum initial vertical platform displacement occurred on the unloaded platform condition and was recorded to be 4 inches over an approximate 0.3-second time frame. During each of these tests, the overall stability of the MCWP remained intact. It was noted that if the outriggers were not properly placed according to the manufacturer's recommendation, then the unit could become unstable. Additionally, due to platform movement during the fall-arrest condition, a worker could be exposed to fall hazards if not properly secured.

B5.3

Title: **The design of a universal rig for supporting large hammer drills to reduce injury risk** Authors: <u>David Rempel</u>, Alan Barr

Objectives: Drilling holes into concrete with heavy hammer and rock drills is one of the most physically demanding tasks performed in commercial construction and poses risks for musculoskeletal disorders, noise
induced hearing loss, hand arm vibration syndrome and silicosis. The aim of this study was to use a participatory process to develop a rig to support pneumatic rock drills or large electric hammer drills in order to reduce the risks for musculoskeletal disorders, regional fatigue, and silicosis while maintaining productivity and usability.

Methods: Prototype rigs for supporting large hammer drills were developed with feedback on usability from commercial contractors and construction workers. Laborers and electricians (N=29) performed their usual dowel and rod concrete drilling for structural upgrades on six job sites with the usual method and the new rig and completed questionnaires on usability and fatigue. For a subset, the workers were videotaped and drilling productivity was measured.

Results: Across four body regions (e.g., neck, shoulders, hands and arms, lower back), subjective fatigue was significantly less when using the universal rig compared to the usual manual method. Usability ratings for the rig were significantly better than the usual method on stability, control, drilling, accuracy, and vibration. Drilling time was reduced by approximately 50% with the rig.

Conclusions: A participatory feedback process involving construction workers led to the development of a rig for supporting heavy hammer and rock drills with good usability. The final design significantly reduced regional body fatigue and improved productivity. Commercial construction contractors, laborers and electricians who use large hammer drills for drilling many holes should consider using such a rig to prevent musculoskeletal disorders, fatigue, and silica dust exposure.

B5.4

Title: Factors affecting the utilized coefficient of friction on slippery surfaces

Authors: <u>Wen-Ruey Chang</u>, Chien-Chi Chang, Mary Lesch, Simon Matz

Introduction: The utilized coefficient of friction (UCOF) reflects the friction used when walking on surfaces that could be contaminated and the participants' adjustments to avoid slips. UCOF is one of the predictors of the potential for slip incidents and is obtained from the maximum of the vector sum of the transverse and longitudinal components of the ground reaction force divided by the normal force at the same instant. Typically, UCOF has been demonstrated in the literature to be affected by some kinematics parameters. Human is a complex system and more variables could be involved in predicting UCOF.

Methods: In this experiment, 29 participants were exposed to five floor types under the glycerol condition (45% by weight ratio with water). One walkway, 6.08 m long and 0.81 m wide, was constructed for each floor type and the glycerol was applied to the whole walkway. The participants walked back and forth on the walkway for five times. The kinematics and UCOF of the last trial were used in the analysis. Perceived slipperiness rating (PSR) for each walkway was collected from each participant right after the completion of five trials. The kinematic parameters obtained were step length, walking speed and, at heel strike, heel angle with the floor, heel angular velocity, horizontal heel velocity, vertical heel velocity and ankle angle at the last trial. The relationship between UCOF, and PSR, gait kinematics and available coefficient of friction (ACOF) was explored with a backward step-wise regression analysis.

Results: The adjusted R² values for the initial and final regression equations were 0.754 and 0.757, respectively. The results showed that PSR, ACOF, step length, heel angle and ankle angle were the major predictors of the UCOF. Heel angle had a highest standardized regression coefficient of 0.422 (p < 0.05). The standardized regression coefficients for the rest of the variables that reached the statistical significance were 0.391 (p < 0.001) for ankle angle, 0.343 (p < 0.01) for step length, -0.294 (p < 0.01) for PSR and 0.172 (p < 0.05) for ACOF.

Conclusion: The results demonstrated the complex system involved in human locomotion.

Session C1.0

Title: Surveillance – High-Risk Populations Moderator: Suzanne Marsh

C1.1

Title: Occupation-related injuries among US Army soldiers deployed to Afghanistan and Iraq, 2001-2012 Authors: <u>Avni Patel</u>, Bonnie Taylor, Keith Hauret, Bruce Jones

Introduction: The majority of non-battle injuries (NBIs) among deployed soldiers are due to occupational related tasks. Given that NBIs are a significant cause of morbidity and mortality, occupational safety and health is a great concern for the military. These potentially preventable injuries can have a direct effect on deployed troop strength, consume limited medical resources, and prevent soldiers from doing their jobs. Leading causes of NBIs in the military are also common in non-military occupational settings. Nationally, falls and motor vehicle accidents are leading causes of fatal and non-fatal occupational injuries in the civilian workforce.

Objectives: To determine the incidence, causes, types, and anatomical locations of non-fatal NBIs requiring medical air evacuation of soldiers while deployed to Afghanistan (2001-2012) and Iraq (2003-2011).

Methods: Injury surveillance air evacuation records were used to identify non-fatal NBIs that required medical air evacuation from Afghanistan or Iraq between October 2001 and December 2012. Cause of injury was determined by experienced coders based on narratives in patient movement records. Medical diagnosis codes in the air evacuation records provided the injury type and anatomical location. Descriptive statistics were used to report incidence, causes, injury types, and anatomical location.

Results: There were 66,556 soldiers air evacuated from Afghanistan and Iraq between 2001 and 2012. NBIs accounted for 33% of air evacuations, compared to 17% for battle injuries. Overall, the three leading causes of injury were sports/physical training (PT) (24%), falls/jumps (18%), and motor vehicle-related accidents (11%). The leading injury types were fractures (19%; the majority of which were caused by falls/jumps), dislocations (11%), and sprains/strains (8%). The top four anatomic injury sites were the back (17%), knee (15%), wrist/hand (14%), and ankle/foot (12%).

Conclusion: Ongoing surveillance shows non-fatal occupational injuries negatively impact soldier performance and unit readiness during military deployments. Leading causes of injury among soldiers were similar to occupational injury causes in the civilian workforce. Fractures dislocations, and sprains/strains, as well as back injuries, can require lengthy periods of time for treatment, rehabilitation, and return to full duty. Continued focus is needed to develop prevention strategies for these occupational injuries to lessen their impact during deployments.

C1.2

Title: Wildland fire fighter deaths in the United States: A comparison of existing surveillance systems Authors: Corey Butler, <u>Suzanne Marsh</u>

Background: Wildland firefighting is a high-risk occupation requiring considerable physical and psychological demands. Multiple agencies publish annual fatality data and/or summary statistics for wildland fire fighters (WFFs); however, the number and types of deaths reported varies. These differences create challenges to accurately characterize these fatal events. There are at least five different surveillance systems that capture deaths, including traumatic WFF occupational injuries, each with varying case definitions and case inclusion/exclusion criteria. Four of these are population systems and one is a case-based system.

Methods: We examined the data within each of the five surveillance systems to better understand the types of WFF data collected, to assess each system's utility in characterizing wildland fire fighters fatalities, and to determine each system's potential to inform prevention strategies. To describe similarities and differences in how data were recorded and characterized, we also matched the wildland fire deaths for three of the population based systems* and compared individual fatalities across systems.

Results: Between 2001 and 2012, 247 unique deaths were captured among the systems; 73% of these were captured in all three systems. The most common causes of death in all systems were traumatic injuries associated with aviation, vehicles and medical events (i.e., heart attacks), and entrapments/burn overs. Our data show that, although the three systems often report similar annual summary statistics, the actual events captured in each system vary by roughly 20% each year, depending on the types of events that the system is designed to track.

Conclusions: The overarching and central goal of each system was to collect accurate and timely information to improve WFF safety and health. Each system is unique and has varying inclusion and exclusion criteria for capturing and tracking different subsets of WFF tasks/duties. Use of a common case definition and better descriptions/interpretations of the data and the results would help to more accurately characterize WFF traumatic injuries, lessen the likelihood for misinterpretation of WFF fatality data, and assist with defining the true occupational injury burden within this high-risk population.

C1.3

Title: Non-fatal occupational injuries in the Alaskan commercial fishing industry during 2006 - 2010 Authors: <u>Laura Syron</u>, Devin Lucas, Viktor Bovbjerg, Laurel Kincl

Objectives: While commercial fishing has the highest occupational fatality rate in the United States, information on far more frequent non-fatal injuries is limited, despite the potential for these injuries to cause lower productivity, lost wages, lost quality of life, and/or disability. This descriptive epidemiological study describes non-fatal injuries in the Alaskan commercial fishing industry during 2006 - 2010.

Methods: Data were extracted from United States Coast Guard investigation reports. Hazardous work processes were identified. Workers' age and position on board were used to identify groups with frequent injuries. Non-fatal injury rates by fishery and gear type were quantified.

Results: One hundred thirty six injury cases were included in this study. By the vessel's gear type, 67 injury cases (49%) occurred on trawlers, 19 (14%) on vessels using pots, and 15 (11%) on longliners. Analysis of work process by gear type showed: for trawlers, injuries occurred most frequently during the main work process of handling frozen fish (31%); for pot gear vessels during handling gear on deck (42%); and for longliners during traffic on board (47%). Young workers (15 - 24 years) represented 21% of injury victims. By position, the most frequently injured workers were processors (46%) and deckhands (40%). By fishery and gear type, the highest injury rates were: Bering Sea crab catcher/processor with pots (123 per 10,000 FTEs), Bering Sea/Aleutian Islands Pacific cod and other ground fish catcher with trawlers (100 per 10,000 FTEs), Bering Sea crab catcher with pots (96 per 10,000 FTEs), and Bering Sea/Aleutian Islands Pollock catcher with trawlers (73 per 10,000 FTEs).

Conclusions: Analyzing reported injuries, though limited, provides important information. Non-fatal injury prevention strategies on vessels using pot and trawler gear should target removing hazards when handling gear on deck and handling frozen fish, respectively. Our findings inform two recently initiated studies: the Pacific Northwest Agricultural Safety and Health Center (PNASH)-funded "Non-fatal injuries among commercial fishing workers in Alaska, Washington, and Oregon" and the NIOSH-funded "Injury Prevention in the West Coast Dungeness Crab Fleet." These studies will build the evidence base for practical and scalable injury prevention efforts.

C1.4

Title: Worksite monitoring of injuries using statistical process control charts: An example from the US Army

Authors: Anna Schuh, Michelle Chervak

Injuries are a leading health problem for the U.S. Army, with over 1.3 million injury-related medical encounters affecting over 300,000 Soldiers annually. A problem this large and complex requires a strategy to provide information to those who can affect change at a local level.

Objectives: As part of the Army Medicine 2020 Campaign (AMEDD2020), a process to assist Army installations with development of injury prevention strategies will be developed. An essential aspect of the process includes monitoring injury frequencies, rates, and trends among personnel at each installation using statistical process control Shewhart u-charts. Control charts are used for public health monitoring, predominantly in healthcare and hospital applications such as the surveillance of hospital wait times and the frequency of surgical failures. The frequency of active duty Army injuries follows a similar Poisson distribution, such that control charts may be used.

Methods: Control charts for Army injuries were created using data provided by the Armed Forces Health Surveillance Center. The charts signal statistically significant increases in injury rates, which can be used by leadership to identify effects of new training requirements, weather-related factors, shifts in Soldier demographics, or enhanced reporting standards. Significant decreases are also signaled, which may be due to injury prevention education efforts or other interventions.

Results: As an example of their applicability, control charts have revealed that installations responsible for training soldiers (the Training and Doctrine Command, TRADOC) experience higher injury rates than the Army average, but from 2007-2013 the combined TRADOC rates were steadily decreasing. In 2013, the rate was below the lower statistical process control limit, and a linear regression analysis confirmed the decreasing trend. Army-wide injury rates remained relatively stable during this same period, so this information will be used to highlight the success of injury prevention strategies being employed within TRADOC. When increases in injury rates are observed, control charts can be similarly used to guide investigations into causes and potential interventions.

Conclusions: This work demonstrates the benefits of using control charts to detect shifts in injury rates for Active Duty Soldiers at the installation or command levels.

Session C2.0

Title: **Injury among Office and Health Care Workers** Moderator: Jim Collins

C2.1

Title: Reliability and validity of self-reported productivity measures compared with objectively measured productivity

Authors: Bethany Gardner, <u>Ann Marie Dale</u>, Skye Buckner-Petty, Linda Van Dillen, Benjamin Amick III, Bradley Evanoff

Objectives: Lost health-related work productivity is an important health outcome. Several self-reported surveys have been developed to assess productivity loss, but there is little validation with workplace productivity metrics. This study sought to examine agreement among existing health-related productivity loss questionnaires, to measure responsiveness of these measures to changes in health status, and to validate self-reported productivity with workplace productivity metrics.

Methods: We analyzed data from an ongoing longitudinal study of work productivity and health among medical billing office workers. Collection of follow-up data is ongoing, and will be presented along with cross-sectional analyses described below. Baseline and follow-up surveys included the Work Ability Index (WAI), Work Limitations Questionnaire (WLQ), Health and Work Performance Questionnaire (HPQ), and Work

Productivity and Activity Impairment Questionnaire (WPAI). Workplace productivity metrics were calculated as the percent of individual workers' monthly productivity goals attained. Health status data include back pain, upper extremity symptoms, and the Patient Health Questionnaire-15 (PHO-15). We assessed concurrent validity between the four self-reported productivity loss measures, between self-reported productivity loss and health status, and between selfreported productivity loss and workplace productivity metrics using Spearman rank correlations and intraclass correlation coefficients (ICC). We used the Wilcoxon rank-sum test to compare differences in median scores on self-reported measures and workplace productivity metrics between workers meeting different symptomatic case definitions.

Results: We obtained cross-sectional surveys from 93 workers: 49 also had workplace productivity metrics. We observed strong to moderate correlations among the four self-reported productivity measures (r=0.59-0.78). Correlations between self-reported productivity and health were moderate (r=0.28-0.60); correlations between self-reported productivity and workplace productivity metrics were weak (0.16-0.35). ICCs among self-reported productivity measures ranged from 0.23 to 0.59, but were lower comparing self-report with workplace productivity metrics (ICC=0.08-0.20). Self-reported productivity was significantly lower among cases with upper extremity symptoms, back pain, and moderate overall symptoms compared to non-cases; however, no differences were observed between cases and non-cases on workplace productivity metrics.

Conclusions: Each questionnaire likely measures different aspects of work productivity and performance. Longitudinal analyses will examine responsiveness to determine whether changes in self-reported health and productivity correspond to changes in workplace productivity metrics.

C2.2

Title: Long term care employees participating in change: Process evaluation and observation outcomes Authors: <u>Dwayne Van Eerd</u>, Era Mae Ferron, Benjamin Amick III, Teresa D'Elia, Claire Munhall, Henrietta Van Hulle

Objectives: Musculoskeletal disorders (MSDs) and slips, trips and falls (STFs) are a major source of work disability and substantial proportion of injuries in health care. Participatory ergonomics (PE) programs are popular approaches to reduce workplace injuries but evidence on effectiveness is inconsistent. A comprehensive PE program, Employees Participating in Change (EPIC), was recently developed to reduce the incidence of MSDs and STFs in long term care (LTC). EPIC seeks to build management systems and accountability structures to support program success and sustainability. Our objective is to describe observational measures and findings and a process evaluation in a field study of EPIC.

Methods: The field study was conducted in six LTC facilities, (3 intervention, 3 control). Two of the participating intervention sites focused on reducing MSDs (n=96 and n=26) and the other on STFs (n=269). Department selections were matched at control sites for both MSD sites (n=207, n =22) and the STF site (n=245). We have adapted and developed data collection instruments to capture key outcomes for STFs and MSDs. A process evaluation (Linnan and Strickler, 2002), was adapted for participatory programs in LTC employing a qualitative approach. Structured interviews were conducted with program participants and frontline staff (n=5 to 7 at intervention sites) at three time points (early, mid and later in program implementation).

Results: We have observational data on MSD hazard reduction for 18 intervention workers and 21 control workers. For STFs, 11 intervention workers and 7 control workers were observed. Results reveal initial average RULA scores of 6.5 (range 4 - 7) which improve after implementation. EPIC participants have identified injury prevention efforts as a "win-win" for both management and frontline staff, high levels of staff "buy-in", and increased regular communication among staff about identifying and managing hazards at work. Program sustainability is also evident, as sites are incorporating MSD and STF identification and management in orientation for new workers.

Conclusions: We observed changes related to reducing hazards, however more work is needed to adapt methods to better capture these changes. Participants provided details about the EPIC program that would be difficult to glean using other methods.

C2.3

Title: **Development and testing of a high-engagement** office ergonomics training: Let's try to have training make a difference

Authors: <u>Benjamin Amick III</u>, Michelle Robertson, Dwayne Van Eerd, Trevor King, Ivan Steenstra, Selahadin Ibrahim

Background: A recent IWH-NIOSH systematic review suggested that training alone may not have an impact on occupational health outcomes. We report on the development and testing of a new high-engagement office ergonomics training program. The primary research questions were: can an office ergonomics eLearning be designed to produce equivalent results to an in-person training, and can a high-engagement training added to trainings improve outcomes? Methods: The quasi-experimental filed trial had a sample of 435 office workers from various sectors. Data were collected at baseline, and at 3, 6 and 9 months post training. Key outcomes included: knowledge, selfefficacy (SE), postural risk (PR), appropriate office ergonomic adjustments (AOEA) and musculoskeletal symptoms. The study had five groups: a control group (received a link to an office-ergonomics information page), a 90 minute in-person training group, a 90-minute eLearning training group, and an eLearning group and an in-person group that received supplementary high engagement training sessions (three group sessions over three months with workers and one session with supervisors) between 3 and 6 months. All analyses were done using multivariable regressions using a difference in difference analysis. Comparisons at three months posttraining only involved 3 groups since the high engagement training did not start until month 3.

Results: Knowledge scores did not differ between the eLearning and in-person training immediately posttraining. At three months postural risk and AOEA scores had significantly improved in both eLearning and inperson training groups compared to the control group, but the two training groups did not differ. We found worker self-efficacy to manage their office workspace improved significantly over time within the two basic training groups compared to the control group. At 9 months post training the high engagement groups had significant improvements in postural risk and AOEA compared to the basic training groups. Additionally, we found significant improvements in self-efficacy in the high-engagement groups compared to basic training groups and control group.

Conclusions: In-person and eLearning office ergonomics training programs can be designed to be comparable and high-engagement training leads to longer-term selfefficacy gains, postural improvements, hazard identification and control.

C2.4

Title: **Developing a tool to address modifiable factors in the physical work environment of patient care units** Authors: <u>Michael Grant</u>, Jack Dennerlein

Objectives: Healthcare workers are at elevated risk for MSDs due to a range of job factors related to their physical work environment, including awkward postures; housekeeping; and safe patient handling and mobilization. Improving and protecting the health and well-being of healthcare workers requires addressing ergonomic factors in the physical work environment related to risk of MSDs. Very few tools exist to assess the physical work environment with respect to ergonomics factors. It is important not only to identify these ergonomic factors but also to prioritize resource allocation and intervention efforts. Previous work with our group has shown that checklists are not very useful for comprehensive evaluation and change. *Our main objective* was to develop a tool to help guide the management level of an integrated TWH intervention. We wanted to test the effectiveness of the tool as well as the feasibility of performing a walkthrough of the physical work environment on patient care units.

Methods: We conducted ergonomics inspection walkthroughs using a customized checklist-type tool as part of a proof of concept trial, testing an integrated intervention in an acute hospital setting among direct patient care units. The tool provided the observer with a framework to identify modifiable aspects of the physical work environment that contribute to MSDs and acute injury. Modifiable aspects were determined from previous work and OSHAs Safety and Health Program Assessment Worksheet. The walkthrough and survey were implemented on the four intervention units and involved a research team member as well as a combination of the Nurse Director, Clinical Nursing Specialist, Resource Nurse, and assorted nurses and patient care assistants.

Results: We were able to use the results from the walkthrough to work directly with Occupational Health to identify recommendations for each observation picked up by the tool. An actionable report was delivered to each of the intervention units.

Conclusions: Such a tool can help to identify areas ways to improve existing patient care environments to reduce the likelihood of injury. The report could be used to begin the process of addressing some of the modifiable factors in the physical work environment and to launch discussions with the Nurse Directors.

Session C3.0

Title: **Ergonomics in Construction** Moderator: Bradley Evanoff

C3.1

Title: The effects of prefabricated building components on construction workers' performance: A biomechanical analysis of common panelized wall maneuvering tasks Author: <u>Bochen Jia</u>

With the development of industrialized construction methods, residential construction industry began to use more and more prefabricated components (such as, panelized walls, doors or roof trusses) that are site assembled by construction workers. Lack of ergonomic consideration of workers' work capacity during the design of prefabricated components could greatly increase the risks of occupational injuries among construction workers. Therefore, this work was completed to investigate the effects of a range of simulated panelized wall maneuvering tasks on construction workers through estimating the workers' physical demands associated with such tasks. The physical demands (i.e., trunk muscle activities, and triaxial moments at L5/S1 joint) were determined using a three-dimensional, electromyography-based biomechanical model. Twenty-four participants were recruited to complete several lab-based simulations of wall maneuvering tasks, which include lifting, erecting and moving. In order to represent the real working situation, both panelized wall parameters (i.e., size and mass) and panelized wall maneuvering tasks were identified through a prior task analysis and on-site measurements. The results of this work identified a wide range of physical demands placed on workers with several extreme cases. For example, lifting tasks tested in this work resulted in the largest spinal loads in the sagittal plane, which is beyond the action limit of 3400 Newton. Panelized walls are representative of the current trend toward increasing use of industrialized methods in residential construction. Understanding the physical demands associated with construction tasks can facilitate proactive control of residential construction using prefabricated components in order to reduce musculoskeletal exposures and occupational injury risks.

C3.2

Title: Long term symptomatic, functional, and work outcomes of CTS among carpenters

Authors: <u>Bradley Evanoff</u>, Jaime Strickland, Ann Marie Dale

Objective: Describe the natural history of Carpal Tunnel Syndrome (CTS) including outcomes of symptoms, functional status, work disability, and economic impact.

Methods: We used health insurance claims data from a carpenters' union health and welfare fund to identify active workers with a claim for CTS and control workers without a CTS claim; controls were matched on age and insurance eligibility. We collected administrative data on work hours from union payroll records, and conducted structured telephone interviews with cases and controls to evaluate the impact of CTS on symptoms, hand function, work ability, and hours worked. Cases were identified through claims from 2003 - 2010.

Results: We interviewed 240 workers with CTS claims and 249 matched controls. Interviews were conducted from 2 to 9 years following the index CTS claim (mean 5 yrs.). Compared to matched controls, workers with a past medical claim for CTS were more likely to report recurrent hand symptoms in the past year (OR 2.3, 95% CI 1.6- 3.4), decreased production or quality of work performed (OR 1.5*, 95% CI 1.2- 1.8), decreased ability to perform physical demands of work (OR 1.3*, 95% CI 1.0-1.5), and decreased functional status of the upper extremity as measured by the Levine Functional Status Scale (OR 1.2*, 95% CI 1.1- 1.3]) and by the Quick DASH Work and Hobby modules. (*=OR expressed as one point decrease in measurement scales) Workers with CTS retired an average of 2.3 years earlier than those without, though this difference was not statistically significant. Initial analyses of work hours shows that workers with CTS claims worked more than 10% fewer hours in the year following the claim compared to controls.

Conclusions: Claims for CTS outside of the workers' compensation system were associated with long term outcomes of hand symptoms, decreased functional status, and decreased work hours. When these data are combined with other data describing cost-shifting of work-related chronic MSD from workers' compensation system to traditional health insurance, the findings suggest that available national data underreport the morbidity and disability consequences of work-related chronic MSD such as CTS.

C3.3

Title: **Impact evaluation of a participatory ergonomics intervention among Construction Trades** Authors: <u>Ann Marie Dale</u>, Lisa Jaegers, Laura Welch, Bradley Evanoff

Objectives: Construction workers continue to suffer from high rates of musculoskeletal disorders. Previous studies utilizing participatory ergonomics (PE) interventions have shown mixed results. Programs targeting single high-risk work tasks are often successful, although the solutions are often not readily transferred to a wide-range of tasks in construction. Efficacy of PE interventions designed to educate work groups in problem-solving methods for the rapidly changing work tasks is unknown. We used a structured logic model to evaluate the shortterm, intermediate, and long-term impacts of a PE intervention.

Methods: We recruited 95 workers from seven contractors in three construction trades, and trained work groups in ergonomic problem identification and implementation of task-specific solutions. We evaluated program efficacy using mixed methods (quantitative and qualitative) including data from surveys and researcher observations.

Results: Eighty-six workers completed the program. At baseline most workers could identify high-risk tasks and reported the willingness to test solutions. Following training, workers showed statistically meaningful improvements in knowledge (short-term outcome). Workers were able to develop ergonomic solutions to reduce exposures relevant to MSD risk although only 58% reported taking action to change work tasks. Most contractors provided equipment to reduce risks in manual material tasks prior to the start of the project but few provided equipment to address specific problematic work tasks identified during the project. No changes were seen in long-term outcomes of MSD symptom prevalence or self-reported physical exposures.

Conclusion: Although workers successfully identified high risk work behaviors and proposed potential changes in work practices or equipment, relatively few changes occurred. Most changes occurred in processes or equipment under worker control; few reported or observed changes were made by contractors due to the program. Overall, there were limited changes made in response to participation in the program. An exploration of the barriers and facilitators may help improve implementation. Successful reduction of MSDs in high risk construction trades will require multilevel approaches with high contractor support.

C3.4

Title: **Evaluation of facilitators and barriers to implementing ergonomic solutions in construction** Authors: <u>Lisa Jaegers</u>, Ann Marie Dale, Laura Welch, Bradley Evanoff

Objectives: Construction workers experience high rates of musculoskeletal disorders (MSDs) and diffusion of ergonomic solutions to reduce their risks for MSDs is a challenge. We evaluated the facilitators and barriers to implementing existing ergonomic solutions in a subset of construction trades to describe both opportunities and difficulties for diffusing innovations.

Methods: During a 4-year participatory ergonomics study among construction trades we collected data on the implementation of ergonomic solutions through worker focus groups, contractor and industry representative interviews, worker surveys (n=86), and researcher field notes. We defined an ergonomic solution as an existing or new device or technology that can be used to reduce MSD risk factors in construction related tasks; we limited our coding to solutions that were proposed or implemented in our study. We adapted an existing framework (Weinstein et al. 2007) to code intervention attributes including relative advantage, usability, compatibility, complexity, trialability, and observability. Our team of 3 researchers coded the attributes and level of adoption for each observed solution using a rating scale (e.g. full adoption, intermittent, rarely, not used).

Results: Our preliminary results identified 19 ergonomic solutions, which we categorized as equipment, positioners, hand tools, power tools, manual material handling devices, personal protective equipment, and design for safety technology. Eight solutions received positive ratings for all 6 attributes; of these solutions only 3 were implemented frequently, 2 of which were in the workers' control. Most solutions were implemented intermittently (n=9); all had 4 or more positive attributes. Two solutions that were implemented only rarely (n=4), and one solution not implemented (n=3) had all six positive attributes. Identified barriers for solutions that were not frequently implemented despite positive attributes included: required use of an extra tool, tool did not always fit the task, equipment was only used for large jobs, or using the solution required extra planning or coordination with other workers.

Conclusion: Implementation of ergonomic solutions in construction is challenging due to multiple barriers even for solutions with positive attributes. Many barriers lie outside the control of individual workers; improved prevention of MSD will require greater engagement by contractors.

Session C4.0

Title: Economic Factors and Consequences Moderator: Anasua Bhattacharya

C4.1

Title: Are we exporting occupational injuries from the manufacturing sector?

Authors: Seth Seabury, Ujwal Kharel

Objectives: Fatal and nonfatal occupational injuries and illnesses in the U.S. have declined significantly over the last few decades. This has also coincided with an increase in U.S. manufacturing imports, causing many to argue that we are outsourcing our most dangerous jobs. However, there uncertainty and debate about the extent to which the outsourcing of riskier jobs has contributed to the reduction in U.S. occupational injury risk. This paper estimates the number of occupational injuries in foreign countries attributable to U.S. consumption and assesses how rising imports of manufacturing goods affect the occupational injury risk of the U.S.'s largest trading partners.

Methods: This is a retrospective study using data from International Trade Administration (ITA) and ILOSTAT data from International Labor Organization (ILO) in combination with World Development Indicators data from the World Bank. We study the fatal and nonfatal occupational injuries for the U.S. and the top 30 exporters of manufacturing goods to the U.S. from 1989-2013. Using negative binomial regression models, we estimate the number of fatal and nonfatal injuries as functions of U.S. manufacturing imports, labor force size, national income and other development indicators. Finally, we measure the number of occupational injuries that are potentially related to U.S. consumption demand.

Results: Regression results show that the occupational injury rate varies significantly across countries according

to their size, income, unemployment and health standards. While results are preliminary, attributing injuries from other countries to the U.S. according to manufacturing imports significantly increases the number of occupational injuries and fatalities associated with domestic consumption.

Conclusions: While the number of occupational injuries and fatalities has fallen in the U.S., a significant portion of that is due to the decline of the U.S. manufacturing sector.

C4.2

Title: **Reporting and safety investment effects of selfinsuring for workers' compensation benefits in the US** Authors: Abay Asfaw, <u>Rene Pana-Cryan</u>

Objectives: We previously published a study on selfinsuring for workers' compensation benefits. We showed that, compared to buying insurance, self-insuring was more likely to be positively associated with fewer nonfatal occupational injuries. However, we could not attribute this finding to either reporting or true safety investment effects because, while self-insuring increases the incentive of firms to invest in safety, it also increases their incentive to engage in excessive claims management practices. Therefore, we would expect more discrepancies between reported and actual injures in self-insured than in insured firms. This would represent a 'reporting effect.' On the other hand, self-insured firms have additional economic incentives to invest in safety and health and this is the major driver for the observed low level of injuries in self-insured firms. This would represent a 'safety investment' effect. In the current study, we examined the impact of self-insurance on safety investments using a hard to underreport indicator, fatal occupational injuries.

Methods: We used panel data from the Bureau of Labor Statistics and National Academy of Social Insurance. We used data from all states for the period between 1998 and 2005 and a fixed effects vector decomposition technique. We hypothesized that if self-insurance affected only claims-reporting, the association between self-insurance and fatalities would not be statistically significant.

Results: We found that states with high shares of selfinsured firms were associated with fewer fatal occupational injuries. After controlling for firm size, labor force composition, industrial mix, and other statelevel fixed effects, a ten percentage point increase in the share of self-insured firms was associated with a decrease of the occupational fatality rate by 4.5 percent. When we measured self-insurance as a dichotomous variable (as above and below the median value), we derived similar results. States with above the average share of selfinsured firms experienced nearly 4 percent less occupational fatalities compared to states with below the average share of self-insured firms.

Conclusions: The negative association between selfinsuring and occupational fatality rates implied that selfinsuring was likely to increases the incentive of firms to invest in safety, rather than engage in excessive claims management practices.

C4.3

Title: **Developing improved estimates of the total impact of worker injuries and illnesses** Author: <u>Rene Pana-Cryan</u>

Objective: To articulate the value of investing in research and prevention to improve worker safety and health, we need to understand the total impact or broad consequences of worker injuries and illnesses on society overall. This will help to better prioritize needs at the societal level and provide context for partial estimates from different perspectives such as the employer's.

Methods: We can derive impact estimates by three broad approaches. Estimating medical costs and productivity losses is the most common approach. Another approach focuses on risk-money trade-offs. A third approach focuses on health-related quality of life (HRQL). While regulators rely on the risk-money trade-off approach, decision makers in public health rely more on the other approaches.

Synthesizing impact estimates has been a challenge. For example, Leigh (2011) provided assessments based on medical costs and productivity losses but there is no sustainable related initiative. We are conducting a pilot study that uses a composite index of several impact metrics. Our inspiration was a USDA report on foodborne pathogens, particular foods, and the incidence and consequences of foodborne illnesses. The authors assessed which pathogens in which foods cause the greatest impact by summarizing the impact of diverse conditions into comparable metrics. They developed a set of impact estimates for 14 leading pathogens, representing 95 percent of annual illnesses and hospitalizations, and 98 percent of the deaths due to 31 foodborne pathogens, across 12 food categories. For each pathogen-food combination, the authors ranked health impacts by medical costs, productivity losses and loss of Quality-adjusted Life Years (QALY). Combining the rankings by each metric into an average index provided a prioritized list of pathogen-food combinations. The top ranked pathogen was Salmonella spp., the top food was poultry, and the top pathogen-food combination was *Campylobacter* - poultry.

Results: Following this example, we synthesize information to rank exposures to several hazards, conditions suffered as a result of these exposures and assessed by different health impact metrics and industry sectors, and combinations of exposures, conditions, impact metrics, and industry sectors. We include conditions attributed to exposures to occupational and non-occupational hazards.

Conclusions: This pilot effort will help to improve our understanding of the total impact.

C4.4

Title: Inpatient and outpatient costs of hearing loss in the US Military

Authors: <u>Hasanat Alamgir</u>, David Tucker, Jose Betancourt, Natasha Gorrell, Tanisha Hammill, Andrew Senchak, Mark Packer

Objectives: The goal of this research is to comprehensively determine the economic impact of hearing injury among active duty US service members (SM) from the perspective of the Department of Defense (DOD).

Methods: The population studied is active duty military SM during the January 1 2007 to Dec 31, 2012 timeframe. SMs with a hearing injury are identified based on clinical encounters with a diagnosis related to hearing loss. A list of ICD-9 diagnosis and CPT procedure codes believed to be associated with detecting hearing loss was established, and clinical data for these military SM was requested from the Medical Data Repository (MDR): Standard Inpatient Data Record (SIDR) and Comprehensive Ambulatory Provider Encounter Record (CAPER).

Results: We are exploring the quality and validity of these datasets and examining how to identify cases and convert them to dollar values. For 2007 to 2012, we obtained 11,122,965 encounter records from CAPER, representing 2,791,566 distinct patients and 27,185 encounters from SIDR, representing 21,239 persons. For outpatient direct care data, using Relative Value Units (RVUs) for clinical encounters, estimates of cost can be calculated using conversion factors appropriate for the year and location of the encounter. For inpatient direct care, estimates in dollars are provided in the clinical encounter record. Occupational audiograms from the DoD hearing conservation program will be used to further refine analytical results. To determine costs of clinical diagnosis of hearing loss, an initial effort will use RVU values of CPT codes in encounter records having diagnoses based on the case definition.

Conclusions: We have requested additional data, including paid provider data, and have identified sources or received cost information for other cost areas, including hearing aids and batteries, occupational audiograms, fixed/structural costs, etc. to develop a comprehensive estimate of all costs of hearing loss to the DoD. Our estimates should prove to be a valuable decision-making tool for DoD policymakers. These cost estimates could identify high-burden groups, enable proactive measures for concerted education and training, identify best practices, and develop return-to-duty programs following hearing loss, all of which may contribute to retention of skilled, experienced, and mission-ready military personnel.

Session C5.0

Title: Working Hours, Fatigue and Sleep – Impact on Injury

Moderator: Helen Marucci-Wellman

C5.1

Title: Association of sleep quality and duration with on-duty injury among police officers: The BCOPS Study

Authors: John Violanti, Desta Fekedulegn, Tara Hartley, Luenda Charles, Michael Andrew, Cecil Burchfiel

Objectives: To assess associations of sleep quality and duration with occurrence of on-duty injury among police officers.

Methods: Participants were officers enrolled in the Buffalo Cardio-Metabolic Occupational Police Stress (BCOPS) Study (2004-2009). Sleep quality and actual hours of sleep were determined using the Pittsburgh Sleep Quality Index (PSQI) questionnaire which assessed usual sleep habits during the past month. The PSQI consists of seven subscales each with a four-point Likerttype scale (0-3). The subscales were summed to obtain a global score ranging from 0 to 21, with higher total scores indicating poorer sleep quality. Poor sleep quality was defined as global PSQI score > 5. Computerized payroll records documenting officer's work history were available from 1994 to date of examination. The work history data contained day-by-day account of start time of work, type of activity, work hours, and type of leave (vacation, sickness, or injury). Occurrence of injury in the one-year prior to date of exam was analyzed. No additional information was available concerning the type of injury or its severity. Poisson regression was used to estimate prevalence and prevalence ratios (PR) of onduty injury associated with sleep quality and duration.

Results: The prevalence of poor sleep quality was 55% (95% confidence interval (CI): 50.2, 60.3) among the 371 officers with complete data (268 men and 103 women). On average the officers slept 6.1 hours per day (SD=1.2). The overall prevalence of injury during the past year was 19.4% (15.8 – 23.9). After accounting for potential covariates including age, rank, workload, physical activity, and alcohol consumption, injury prevalence increased by 25% for one-standard deviation (SD=3.4) increase in sleep quality score [PR=1.25 (1.02 - 1.51), p-

value = 0.03]. On the other hand, the association of sleep duration with injury was not statistically significant [adjusted PR for 1-SD (1.2) increase in sleep hours was 1.05 (0.85 - 1.29), p-value=0.64].

Conclusions: Results indicate that poor sleep quality is associated with elevated injury prevalence among police officers. Future longitudinal studies could assess whether poor sleep quality predicts occurrence of injury and elucidate the underlying mechanisms.

C5.2

Title: Fatigue and on-duty injury among police officers: The BCOPS Study

Authors: <u>Desta Fekedulegn</u>, Cecil Burchfiel, Claudia Ma, Michael Andrew, John Violanti

Objective: To assess association of fatigue or feeling of tiredness with occurrence of on-duty injury among police officers.

Methods: Participants were officers (205 men and 75 women) enrolled in the Buffalo Cardio-Metabolic Occupational Police Stress (BCOPS) Study (2004-2009). A 10-item questionnaire with a five point Likert-type scale (not at all, little, somewhat, much, very much so) was administered to assess how tired or energetic the officers generally felt irrespective of sleep hours or workload. The questionnaire consisted of five positive items (e.g. feeling of having plenty of energy) and five negative items (e.g. feeling being drained). Total scores for all 10 items were computed by summing the scores for the individual items. Computerized payroll records documenting each officer's work history contained a dayby-day account of injury leave. Occurrence of injury in the one-year prior to date of exam was analyzed. Poisson regression was used to estimate prevalence and prevalence ratios (PR) of injury associated with total fatigue score.

Results: The overall prevalence of on-duty injury during the past year was 23.9%. Injury prevalence showed a significant increasing trend across increasing tertiles of total fatigue score: 19.6, 21.7, and 30.8% for the lowest, middle and highest tertiles respectively (trend pvalue=0.037). After controlling for age, gender, race/ethnicity, level of education, workload, physical activity, and alcohol consumption, a one-standard deviation increase in total fatigue score was associated with a 20% increase in prevalence of injury (PR=1.20, 0.98 - 1.47) but this was marginally significant (p=0.075). Officers in the highest tertile of fatigue score had injury prevalence that was 67% larger compared to those in the lowest tertile (PR=1.67, 0.99 - 2.83) and this result approached statistical significance (p=0.055).

Conclusions: Results indicate that higher fatigue score is associated with elevated injury prevalence among police officers; however after multivariate adjustment results showed borderline statistical significance. With additional prospective evidence it is possible that work place interventions designed to enhance level of energy may reduce feelings of tiredness and hence may prevent injury.

C5.3

Title: The impact of shift starting time on sleep duration, sleep quality, and alertness prior to injury in the People's Republic of China

Authors: <u>David A. Lombardi</u>, Kezhi Jin, Céline Vetter, Theodore K. Courtney, Simon Folkard, Anna Arlinghaus, Youxin Liang, Melissa J. Perry

Objectives: Early shift start time and night shifts are associated with reduced sleep duration and poor sleep quality that often lead to adverse safety and health outcomes. This study investigates the impact of shift starting time on sleep patterns, and alertness / sleepiness at the time of injury, in a large epidemiological field study of hospitalized adults with severe work-related hand injury in the People's Republic of China (PRC).

Methods: Over a two-year period, study subjects were recruited from patients admitted for treatment of a workrelated traumatic injury to the fingers, hand or wrist among two hand-surgery and nine general hospitals in three industrially-developed cities in the PRC: Ningbo, Liuzhou and Wuxi. 730 employed adults were screened in the hospital for a face-to-face interview and 96.4% completed the study. ANCOVA was used to compare sleep duration, sleep quality, and alertness/sleepiness across 3h increments of shift start time adjusting for age, gender, work hours, shift duration, day of injury. Effect modification by gender was evaluated.

Results: Within 4 days of injury - 703 adults were interviewed; 527 (75.0%) were male, with a mean (\pm SEM) age of 31.8 \pm 0.4 years who worked long weekly (55.7 \pm 0.6h) and daily hours (8.6 \pm 0.07h). Average sleep duration prior to injury was 8.5h (\pm 0.07), and showed significant variations (p-value <0.05) across shift starting time increments. Mean prior sleep duration was shortest for individuals starting shifts from "21:00-23:59" (5.6 \pm 0.8h) followed by "00:00-02:59" (6.1 \pm 0.6h).

Discussion: A statistically significant interaction (p<0.05) was observed between gender and shift starting time, for males shortest sleep duration was 5.6h ("21:00-23:59") and females shortest was 4.3h ("24:00-02:59" and "1500-17:59"). Sleep quality (generally quite well) and alertness/sleepiness based on the KSS (generally alert) did not vary significantly across shift starting time. Results suggest that sleep duration is shortest among injured PRC adults starting shifts late night and early morning. However, with more than 8.5h of sleep on average on work days, Chinese slept much longer than

typical US day workers (Sleep in America Poll, 2012, 6:44 on workdays, 7:35 on free days), and this may help to explain higher than expected alertness / sleepiness scores at the time of injury.

C5.4

Title: Differences in work and lifestyle schedules which may be associated with an elevated risk of injury in multiple job holders compared with single job holders. Findings from the American Time Use Survey

Authors: <u>Helen Marucci-Wellman</u>, Tin-Chi Lin, Joanna Willetts, Melanye Brennan, Santosh Verma

Objectives: In 2012, 8.5% of the employed workforce in the U.S. worked in more than one job during a one-week period. In a prior study, using data from the U.S. National Health Interview Survey, authors found that workers with more than one job in a one-week period (MJH) had a higher risk of injury both on and off the job compared with single job holders (SJH). The rate remained elevated even after controlling for hours worked. There are several potential reasons why work in multiple jobs is associated with an increased risk of injury, including the possibility of fatigue due to extra hours worked, less time sleeping, and working odd shifts in order to fit multiple jobs into a work week.

Methods: In this study using information from the American Time Use Survey 2003-2011, we explored differences in time use patterns between MJH and SJH. We classified workers into 6 workgroups depending on whether they were a SJH or MJH and whether they worked their primary, other, multiple or neither job on the diary day. We use multivariate regression models to determine if the difference in the duration spent in an activity between MJH and SJH is significantly different, controlling for other work or demographic factors and also examine differences in time of day spent in each activity.

Results: We found MJH working multiple jobs on the diary day worked, on average, more than 2 additional hours a day (2.25 hours weekday, 2.75 hours weekend, p<.05), odd hours of the day (5pm to 7am), with more work travel time (10 minutes weekday, 9 minutes weekend, p<.05) and less sleep (-45 minutes, weekday, - 62 minutes, weekend, p<.05) and time for other household and leisure activities than SJH (p<.05). This workgroup also had the highest participation in work and travel during *non-regular hours*, (5pm to 7am).

Conclusions: There were large differences in time use patterns for MJH compared with SJH. MJH may be at heightened risk of fatigue and injury due to long work hours concurrent with long daily commutes, working multiple shifts and less sleep and leisure time for recovery.

DAY TWO: WEDNESDAY, MAY 20, 2015

Session D1.0

Title: Underreporting of Injuries – Federal Perspective Moderator: Audrey Reichard

D1.1

Title: NIOSH research on occupational injury and illness underreporting

Authors: <u>Suzanne Marsh</u>, Audrey Reichard, Ruchi Bhandari

Objective: NIOSH initiated two follow back studies of emergency department (ED) patients in 2010: (i) to identify incentives and disincentives for reporting workrelated injuries (Barriers study), and (ii) to assess the prevalence of underreporting work-related injuries and illnesses to ED staff, employers, and/or other authorities (Congressional study). This presentation provides an update on these projects.

Methodology: Both studies used the occupational supplement to the National Electronic Injury Surveillance System (NEISS-Work), which is a surveillance system for estimating work-related injuries and illnesses treated in EDs. NEISS-Work is populated with data collected through a national stratified probability sample of U.S. hospitals. Potential respondents for the two studies were sampled from NEISS-Work and screened for eligibility during initial telephone interview questions. Eligibility criteria for the Barriers study included workers with acute injuries and excluded self-employed workers, workers on farms, and volunteers. Barriers data were analyzed as a case series. Eligibility criteria for the Congressional study included self-employed workers and workers with illnesses. Congressional data were re-weighted to represent national estimates of ED treated work-related injuries and illnesses.

Results: From the Barriers study telephone interviews, 401 respondents met the eligibility criteria. Of these, 99% indicated that they reported their injury to their employer. From the Congressional study telephone interviews, 2,598 respondents met the eligibility criteria. Most (95%) were not self-employed, 96% of which indicated that they reported their injury or illness to their employer. Workers who reported that they were self-employed were generally not covered by workers' compensation.

Conclusion: This approach offered advantages including the ability to collect information directly from workers, capture less severe injuries not reported elsewhere, and capture all worker types. Challenges included low response rates due to little incentive to participate and the fact that the surveys were difficult to administer over the phone. An additional challenge will be faced in presenting results from these studies because the findings are not corroborating with previous underreporting research. Nonetheless, our approach does provide useful insights that could be applied to similar studies in the future.

D1.2

Title: Underreporting of worker injuries: An OSHA priority

Authors: Kathleen Fagan, Michael Hodgson

A 2009 Government Accounting Office (GAO) report, along with several published studies, have documented that many worker injuries go unrecorded on the OSHA 300 logs and consequently are underreported in Bureau of Labor Statistics (BLS) reports. OSHA conducted a twoyear Recordkeeping National Emphasis Program (NEP) to investigate the extent and causes of employer underrecording of occupational injuries and illnesses. 405 Federal inspections and 171 State inspections were conducted under the NEP. The inspections included record reviews, interviews of workers and management, and walk-throughs. OSHA found recordkeeping violations in 50% of the facilities inspected. OSHA also found that disciplinary and absentee programs had a substantial negative affect on employee injury reporting. Employee interviews conducted during the NEP indicated that a substantial number of workplace injuries and illnesses are never reported to employers, in part due to workers' fear of retaliation. OSHA has made it clear that reporting an injury or illness is a protected right under the Whistle blower Act and has taken the position to discourage incentive and absentee programs that discourage injury reporting. To improve tracking of workplace injuries and illnesses, OSHA has proposed an amendment to the OSHA recordkeeping regulations to add requirements for the electronic submission by employers of injury and illness information. Findings of the recordkeeping NEP and an update of the proposed rule will be presented. In addition, systematic work arising from off-shore oil and gas, poultry, and meatpacking enforcement cases will define a typology of under-reporting. These case studies will illustrate how company policies regarding medical management influence underreporting.

D1.3

Title: Overview of the BLS SOII Undercount Research Program Author: Hilery Simpson

The Survey of Occupational Injuries and Illnesses (SOII), conducted annually by the Bureau of Labor Statistics (BLS), provides national and state estimates of nonfatal injuries and illness that occur to workers in private industry and state and local government establishments. The completeness of the SOII has come under criticism in recent years as outside research pointed to an undercount of SOII eligible occupational injuries and illness when matched against workers compensation records.

In 2009, Congress identified funding for the BLS, NIOSH and OSHA to establish an ongoing research program devoted to investigating underreporting issues related to workplace injuries and illnesses. In addition to research conducted within the agency, BLS has partnered with outside researchers, including state workforce agencies and private contractors, to establish this program. In the initial round, BLS partnered with three states and one contractor to match SOII cases to workers' compensation records, conduct a pilot test using multiple data sources to identify all amputations and carpel tunnel syndrome cases (regardless of SOII eligibility), and interview a small number of employers about their injury and illness recordkeeping practices. In the second round, BLS partnered with four states and expanded the interviews on employer recordkeeping practices in order to get quantitative results for all employers in these four states. In the third round, BLS is working with a contractor to conduct a national follow-back survey on various injury and illness recordkeeping practices using a sample of 2013 SOII respondents, and to study the feasibility of contacting workers directly to collect occupational injury and illness data.

Results from SOII to Workers' Compensation matching studies in the first round indicate that SOII misses some eligible cases, but the magnitude of the undercount varied considerably depending on the methodology employed. Employer responses to the interviews conducted by BLS state partners in the second round point toward a widespread misunderstanding of OSHA injury and illness recordkeeping rules. BLS anticipates initial results from the follow-back study with a sample of 2013 respondents and employee data collection research in late 2015 or early 2016.

Session D2.0

Title: Motor Vehicles – Agriculture/ATVs Moderator: Tony McKenzie

D2.1

Title: A population-based study of all-terrain vehicle exposure in a rural Iowa county

Authors: <u>Charles Jennissen</u>, Justin Chau, Karisa Harland, Gerene Denning

Objectives: All-terrain vehicle (ATV) crashes are common in agricultural communities, but few studies have reported on who is being exposed and may be at greatest injury risk. This study was performed to determine the epidemiology of ATV exposure and crashes in a rural county. Methods: Data was analyzed from the Keokuk County Rural Health study which is a prospective populationbased, longitudinal study gathering environmental, family, lifestyle and health information from residents in Keokuk County, Iowa. Descriptive and comparative analyses of variables were performed on 2006 Round 3 survey data which included ATV-related questions.

Results: Of 1,123 respondents, 38% reported having ridden an ATV in the previous year. Respondents who were male, younger, currently working on a farm, had higher income, or owned/rented more acres had a greater likelihood of recent ATV exposure. Adults with children in the home were more likely to have ridden an ATV in the past year than those with none (53% vs. 28%, p<0.0001). ATV exposure also varied by place of residence, with 57% of those living on a farm being exposed vs. 20% of those living in town (p<0.0001). Respondents who currently work on a farm had one of the highest exposure rates (75%). Those 12-19 years of age, with taxable household income <\$60,000, and adults who had never been married were each significantly more likely to have experienced an "ATV wreck" in the previous year. Of adults, 92% never wore a helmet when riding an ATV with "don't own a helmet" the most common reason (43%). Other frequent responses were "don't ride very often/only go short distances" (17%) and "inconvenient/too lazy" (16%). Ten percent reported having been injured on an ATV in the past with more than one-half requiring medical attention. Previous safety training was reported by only 14% of adults having had ATV exposure in the past year.

Conclusions: Study respondents had a high exposure to ATVs, particularly young people and those who lived or worked on farms. Safety training efforts should be focused on demographic groups identified with higher exposure and greater likelihood of ATV crash, including agricultural workers and their families.

D2.2

Title: Occupational deaths due to all-terrain vehicle and utility task vehicle-related trauma

Authors: <u>Charles Jennissen</u>, Karisa Harland, Marizen Ramirez, Gerene Denning

Objectives: All-terrain vehicles (ATVs) and utility task vehicles (UTVs) are increasingly valuable assets in many work settings. Few studies have reported on traumatic occupational deaths related to these vehicles. The study objective was to describe occupational fatalities from ATV/UTV-related trauma, and determine mechanisms of injury and contributing risk factors.

Methods: The Iowa Fatality Assessment and Control Evaluation (FACE) Program collects information on all occupational fatalities in Iowa. ATV/UTV work-related fatality cases in the FACE database were compiled from 1996-2012 and reviewed. Descriptive analyses were performed.

Results: There were 35 Iowa occupational deaths that involved an ATV (25) or UTV (9); more than half occurred in the last five years of the study. All cases involved agricultural activities. The most common mechanism was a rollover. Excluding cases where the terrain was unknown, all rollover fatalities were due in part to uneven or sloped terrain. This was often exacerbated by a shift in the center of gravity, either due to a change in operator positioning or in the movement of materials being hauled. One-third of ATV-related occupational fatalities occurred during spraying activities, with shifting of fluid in a tank being carried or towed likely contributing to the rollover. Asphyxiation due to the vehicle pinning the victim against the ground or an immobile object was the cause of death in 61% of all cases. Six cases involved a crash with another motor vehicle. None of the victims were documented as being helmeted or under the influence of alcohol or drugs. None of the UTV victims were belted. More than 1/3 of all fatalities were >60 years of age.

Conclusions: ATVs and UTVs account for an increasing number of Iowa work-related fatalities. The high number of traumatic asphyxiation cases is likely due in part to the dramatic increase in size of ATVs sold in recent years. Occupational ATV/UTV-related deaths are much less likely to have alcohol or drug use as a contributing factor compared to recreational fatalities, and appear to have a different age distribution. Certain groups, such as elderly farmers, may be at increased risk and should be targeted for ATV/UTV safety education.

D2.3

Title: **All-terrain vehicle safety knowledge and riding behaviors of farm progress show attendees** Authors: Karisa Harland, Gerene Denning, Kristel Wetjen, Pam Hoogerwerf, <u>Charles Jennissen</u>

Objectives: The epidemiology of agricultural-related allterrain vehicle (ATV) use is largely unknown. The study objective was to describe the epidemiology of ATV use, riding behaviors, crash history and safety knowledge among visitors to the nation's largest outdoor farm show.

Methods: Farm Progress Show attendees in 2012 and 2013 were surveyed on ATV use (excluded side-by-sides) and their history of safety behaviors at the Iowa ATV Safety Task Force tent. Descriptive and comparative analyses were performed.

Results: 1,036 visitors completed the survey. Nearly twothirds of those surveyed were male; one-fifth were under 16 years of age. Just over one-half of participants lived on a farm, with nearly another 20% living in the country but not on a farm. Overall, more than 90% had ridden an

ATV. Males were significantly more likely to be riders (p<0.0001), as were those that lived on farms (p<0.01). One in 10 riders was over the age of 65 with the majority of riders being 31-65 years of age. Among riders, 61% rode at least once a week with 39% riding almost daily. Regarding unsafe behaviors, over 80% had ridden with a passenger, and 65% had ridden on a public road. Nearly one-half never or almost never wore a helmet, and only 24% stated they always or almost always wore one. Nearly 40% had been in a crash, defined as having hit something, rolled over, or fell/thrown from the vehicle. Males were more likely to have been in a crash (p<0.0001). Those having been in a crash were more likely to have reported riding with passengers and on the road (both p<0.0001). Safety knowledge did not necessarily correspond with safer behaviors. For example, 80% of those who knew you should only have one rider on an ATV still had ridden with passengers.

Conclusion: ATV use is prevalent in rural populations but few riders report safe riding behaviors. Study and input from rural community members and agricultural producers is needed to understand how to increase safety behaviors among this population. ATV safety education and training programs should be developed to target agricultural workers.

D2.4

Title: Occupational side-by-side vehicle exposure, safety behaviors, and crash experiences of farm progress show attendees

Authors: <u>Charles Jennissen</u>, Karisa Harland, Kristel Wetjen, Pam Hoogerwerf, Gerene Denning

Objectives: Side-by-sides, often called utility-task vehicles, have become increasingly popular for performing work-related tasks. No studies have examined the safety issues and experiences of agricultural workers and their families while driving side-by-sides. The study objective was to better understand the epidemiology, safety behaviors, and crash experiences of side-by-side riders.

Methods: Visitors to the 2014 Farm Progress Shows, the nation's largest outdoor farm show, were surveyed on their side-by-side use at the Iowa ATV Safety Task Force tent. Descriptive and comparative analyses were performed.

Results: Two hundred twenty seven surveys were completed. Respondents were 66% male. Average age was 39 years (range 8-80 years), and 77% were involved in agricultural work. About one-third currently owned a side-by-side in their family. Of respondents, 72% had driven or ridden a side-by-side in the past year. Of these, over three-quarters had used one for occupational purposes. Participants whose family owned a side-by-side were significantly more likely to have driven or ridden

one in the past year (92% vs. 60%, p<0.0001). Respondents reported more frequent occupational than recreational use, with 59% of side-by-side users reporting occupational use at least once a week. Occupational sideby-side uses included transportation (94%), checking fields (68%), hauling loads (54%) and spraying (44%). Nearly all occupational users had driven on roadways, with 32% and 49% reporting driving at least once a week on paved and unpaved roads, respectively. Over 50% stated they never wear a helmet and 26% said they never use the safety belt/harness when using a sideby-side for work. During their lifetime, an occupational crash was reported by 15% of occupational side-by-side users. Of these, 37% occurred in the past year (6% of occupational users). Occupational crashes more frequently involved rollovers, and had a higher percentage of victims that sought medical attention than those in recreational crashes.

Conclusions: Farmers frequently own and use side-bysides for occupational purposes. Transportation is a frequent occupational use, and driving on roadways is exceedingly common. Many side-by-side users are not wearing the restraint device which is critical in order to stay within the rollover protective structure if in a crash.

Session D3.0

Title: **Injury Prevention – PPE and Equipment** Moderator: Al Amendola

D3.1

Title: **Safety glasses are effective at protecting eyes from nails in free flight driven by pneumatic nailers** Authors: <u>Robert Cargill</u>, Samantha Cargill

Objectives: Evaluate the effectiveness of a group of commercially available, non-prescription safety glasses against direct impacts from pneumatically-driven nails in free flight.

Methods: Five types of nails (framing and large finishing) were ejected directly from 4 types of commercially available pneumatic nailers. The nails were directed towards 6 models of safety glasses worn by a medium EN168:2001 head form. The free flight distance was either 3 feet or 1 foot. The safety glasses were obtained from "big box stores" and were manufactured to either the 2003 or 2010 version of the ANSI Z87.1 standard. Nail speed and mass were recorded. The impacts were recorded on high speed video. The types of impacts, dislodgement of the safety glasses, and whether or not the safety glasses were penetrated were recorded. The studies were performed in triplicate.

Results: Nails in free flight driven directly from pneumatic nailers do not travel as an 'arrow' and predominantly tumble through the air. Impacts to the safety glasses were categorized based on the location and orientation of the nail at impact. At the 1 foot distance, the nails struck point-first in the majority of cases and these tests were the best indicator of penetration resistance. None of the safety glasses lenses fractured or were penetrated by any of the nails fired. In some instances, the lens was disconnected from the glasses frames during an impact. In some cases, the rebound of the safety glasses caused them to be projected off of the head form after the nail impact. In no case did impact occur between a nail and the eye or surrounding periorbital area of the head form.

Conclusions: The momentum and energy of pneumatically driven nails in free-flight are within the energy and momentum of the high mass impactor specified in the ANSI Z87.1 standard. Safety glasses satisfying the requirements of the 2003 and 2010 editions of the ANSI Z87.1 standard are effective at stopping pneumatically-driven nails in free flight, even at close range. At the early stage of the transition to the 2010 standard, there are no discernible changes in the effectiveness of the safety glasses in this context.

D3.2

Title: Reducing risk of injury from stationary sawing operations

Authors: James Harris, <u>Richard Current</u>, Bruce Main, Alfred Amendola

The National Institute for Occupational Safety and Health (NIOSH) and occupational safety and health colleagues have established a goal to reduce work-related injuries due to contact with equipment or machinery. One of the leading machinery sources for days away from work injuries is the category of metal, woodworking, and special material machinery. Within this category of machines, contact with stationary sawing machinery resulted in 2,560 injuries with days away from work in 2010. Many of these injuries are amputations which past research has shown to be the most costly workers' compensation indemnity claim, averaging \$12,230 per claim. The machine subgroup of table saws is the leading source of days away from work injuries within stationary sawing machinery.

Current best practices, as embodied in consensus standards, call for application of risk assessment to reduce risk and improve machine safety. Our team utilized risk assessment principles to identify high risk areas for stationary sawing machinery and specifically for table saw operations. Following guidelines of ANSI B11.0, our team started by identifying tasks and associated hazards for table saw operation. Key to this process was the input of safety and health consultants from the Ohio Bureau of Workers' Compensation (OBWC). Hazards were also identified through manual review of narrative information from 716 saw-related claims in the OBWC database from 2001-2009. As a final method for inclusion of hazards in our evaluation, our team visited 21 sites throughout Ohio that utilize stationary sawing machinery.

After application of a risk scoring system from the ANSI B11.0 standard, our team identified several areas of high risk: noise level, cutting/severing, entanglement, unexpected start, and kick-back. Risk reduction measures were recommended in summary reports issued to each site visited for the specific applications.

D3.3

Title: Personal flotation device use in the Bering Sea crab fleet increased significantly between 2008 and 2014

Authors: <u>Devin Lucas</u>, Jennifer Lincoln, Theodore Teske, Christy Forrester

Objectives: Fatal falls overboard are a persistent problem in the commercial fishing industry. During 2000-2013, 198 workers drowned after falling overboard from fishing vessels in the US (30% of all fatalities in the industry). NIOSH has repeatedly identified falling overboard as a critical hazard in the industry, and an area where use of personal flotation devices (PFDs) could significantly reduce the number of fatalities. During 2008, NIOSH surveyed PFD use among 100 workers on-board crab fishing vessels in the Alaska Bering Sea. Since that time, NIOSH and other organizations have engaged workers in the Bering Sea crab fleet in various ways to promote PFD use. The purpose of the current study was to measure changes in PFD use, attitudes about PFDs, and perceptions about falls overboard.

Methods: A questionnaire was administered to a sample of 100 workers on crab vessels in Dutch Harbor, Alaska during 2014. The questions were identical to those on the 2008 survey, as was the method for selecting the sample. Differences in PFD use and attitudes about PFDs were measured and tested for statistical significance using independent samples t-tests and chi-squared tests of independence.

Results: Worker age, sex, residence, experience and job position were not significantly different between the 2008 and 2014 samples. Vessel size and crew size were also the same between the samples. Self-reported PFD use was dramatically higher in the 2014 sample than in the 2008 sample; specifically, in 2008, 22% of workers reported always wearing a PFD on deck, which increased to 52% in 2014 (X^2 =22.5; p<0.001). Attitudes about PFDs were largely unchanged between 2008 and 2014, except for attitudes about PFD comfort, which improved from 34% reporting that PFDs are comfortable in 2008 to 55% in 2014 (X^2 =8.7; p<0.05).

Conclusions: PFD use on-board crab fishing vessels appears to have improved substantially during the six years from 2008 to 2014. Attitudes about PFD comfort have also improved. NIOSH has had a strong focus on improving PFD use among fishing industry workers during that time period; similar intervention efforts should be applied to improve PFD use among workers in other fishing fleets.

D3.4

Title: Flotation non-wearing and wearing in occupational boating fatalities, Canada 1991-2010 Authors: <u>Peter Barss</u>, Karlyn Olsen, Jane Hamilton, Shelley Dalke

Objectives: Ascertain trends and factors associated with non-wearing of flotation among occupational boating fatalities in Canada, and compare with recreational users.

Methods: Annual Red Cross collection of 1991-2010 Canadian coroner data by structured questionnaire. Analysis included activity, purpose, personal, equipment, environment factors, and trends.

Results: There were 10,511 water-related deaths, 9,961 from immersion including drowning and cold, 513 trauma, and 37 other injuries. Excluding land and air transport, 37% of immersions involved boating, 12% (n=366) of 3324 boating deaths involved occupation and 85% recreational or daily life. Occupational boating immersions included 297 drownings, 53 drownings with hypothermia, 5 deaths due to hypothermia complicated by drowning, and 11 hypothermia deaths. At least 55% involved very cold water less than 10°C. 62% were commercial fishing and 14% marine shipping; 9% of fishers and 12% of shipping victims were properly wearing a flotation device. Overall, 11% were properly wearing, 2% improperly wearing, and at least 35% not wearing flotation, possibly more since flotation was unknown for 38%. For 9% flotation was absent in the boat, and for 55% unknown. Range of boats in violation of current regulations, with no flotation, ranged from 9 to 64%, with many unknowns. Incidents included 31% capsizes, 27% falls overboard, and 25% swamping; only 5% dying falling overboard wore flotation, 9% in capsizes, 17% in swamping. There was no trend in nonwearing during surveillance. Most deaths occurred in Nova Scotia, British Columbia, and Newfoundland/ Labrador. Numbers of deaths declined from 246 during 1991-2000 to 120 during 2001-2010. For recreational deaths, a flotation device was worn properly by 12%; in \geq 50% flotation was absent, representing violation of current regulations requiring flotation in boats, even if wearing is not required.

Conclusions: While occupational deaths have declined, for various reasons, non-wearing of flotation among victims remains high. Legislation on wearing varies and is left to discretion of the operator. Review of various boating interventions has found the greatest effectiveness to be legislation mandating wearing, coupled with effective enforcement. Hypothermia protective garments may also be required in cold water conditions, frequent in the Canadian context, especially for occupational boating.

D4.0

Title: Total Worker Health[™] − Session 2 Moderator: Benjamin Amick III

D4.1

Title: Age- and exposure-dependent prevention of musculoskeletal disorders: critical role of exposure parameters

Authors: <u>Erik Rader</u>, James Ensey, Robert Chetlin, Marshall Naimo, Brent Baker

Musculoskeletal disorders account for 30% of time away from work and are associated with costs exceeding \$50 billion annually in the US. Susceptibility to these disorders increases with age - an important concern given that 20% of US workers are over the age of 55. In this regard, consideration of the exposure to muscle contractions with aging is crucial to preventing musculoskeletal disorders. However, the age of onset for increased susceptibility to these disorders and which contraction parameters to modify for prevention are not well established. To initially address these issues at a fundamental level, we assessed muscle performance and mass of Fischer Brown Norway hybrid rats after one month of exposure to muscle contractions (80 contractions per session, 3 sessions per week). For young rats (3 months old), muscle mass and force output increased by $20 \pm 2\%$ and $17 \pm 7\%$, respectively. In contrast, muscles of adult rats (6 months old) increased mass by $16 \pm 2\%$ with no concomitant increase in force output, indicating that muscle adaptation diminishes long before the onset of old age. Muscles of old rats (27 to 30 months old) exhibited contraction-induced weakness in response to the exposure protocol. We next determined whether reducing the frequency of exposure (i.e., from 3 to 2 sessions per week) or reducing the contraction number in each exposure (i.e., from 80 to 40 contractions) are effective means for preventing the muscle maladaptation previously observed in old rats. Both exposure modifications were successful at preventing contraction-induced weakness from occurring. These results provide a framework for further investigation into the age range of increased susceptibility to contraction-induced musculoskeletal disorders and the exposure parameters to modify for the prevention of such disorders.

D4.2

Title: Obesity, depression and musculoskeletal disorders

Authors: <u>Anasua Bhattacharya</u>, Tannista Banerjee, Sudha Pandalai

Objective: This study investigates the relationship between obesity, depression and medical claims related to MSD among the working population. The study also examines if employees with depression and higher BMIs have higher medical costs.

Data and Methodology: This study utilizes MarketScan group health medical claims and Health Risk Assessment (HRA) databases for the years 2009 and 2010. The medical claims databases provide claims and cost data on MSD for inpatient admission and outpatient services, and HRA provides data on health risk factors. All the records in these databases are classified by unique identification codes for each employee.

Data from group health medical claims and HRA databases are linked together using the employee identification codes and classified by industry, region, worker demographics, BMIs and indicators of depression. Probit models are then used to examine the association between obesity, depression, stress management and MSD, controlling for other factors. We apply different robustness checks to verify the validity of our estimation strategy.

Results: The preliminary results suggest that there exists a positive association between MSD and higher BMIs, MSD and depression and stress management reduces the probability of filing for MSD claims.

Conclusion: This study illustrates that individuals with depression have a higher probability of filing for a MSD claim and have higher average medical costs related to MSDs for all genders, age groups and regions. It also suggests that stress management reduces MSD costs.

D4.3

Title: Causes and effects of cardiovascular diseases on medical claim costs

Authors: Anasua Bhattacharya, <u>Tannista Banerjee</u>, Sudha P. Pandalai

Objectives: This study investigates the association between obesity, depression and the risk of having cardiovascular diseases (CVD) in the next ten years among the working population. The study also examines if employees with higher risk of having CVD in the next ten years have higher group health medical costs in the current year.

Data and Methodology: This study utilizes MarketScan group health medical claims and Health Risk Assessment

(HRA) databases for the years 2009 and 2010. The medical claims databases provide claims and costs data for inpatient admission and outpatient services, and HRA provides data on health risk factors. All the records in these databases are classified by unique identification codes for each employee.

Data from group health medical claims and HRA databases are linked together using the employee identification codes and classified by industry, region, worker demographics, BMIs and indicators of depression. The risk of having CVD was calculated using the Risk Assessment Tool for Estimating the 10-year Risk of Having a Heart Attack from the US National Heart, Lung, and Blood Institute. This long-standing calculator estimates CVD risk based on the age, gender, HDL, cholesterol, systolic blood pressure and smoking status.

Ordinary least squares regression models are then used to examine the association between obesity, depression, stress management and risk of having CVD, controlling for other factors. We analyze these effects in different industries. We apply different robustness checks to verify the validity of our estimation strategy.

Results: The preliminary results suggest that there exists a positive correlation between CVD risk factor and total costs and average costs of medical claims. In addition, the results also suggest a positive association between CVD risk factors and higher BMIs, and CVD risk factors and depression.

Conclusions: This study illustrates that individuals with higher risk of having CVD in the next ten years are more likely to file for a medical claim and have higher average and total medical costs for all genders, age groups and regions.

D4.4

Title: **The Ontario Leading Indicators Project** (**OLIP**): **building the evidence base for choosing the right tools and benchmarking OHS performance** Authors: <u>Benjamin Amick III</u>, Sheilah Hogg-Johnson, Colette Severin, Selahadin Ibrahim, Lynda Robson, Michael Swift

Background: There remains tremendous debate about the best leading indicators to use in occupational health and safety to manage occupational health and safety performance. OLIP was an effort to try and describe the reliability and validity of several tools: the organizational policies and practices (OPP) questionnaire (health and safety leadership, safety practices, ergonomics policies and practices, disability management policies and practices and employee engagement), the IWH-OPM measure of safety culture, the NIOSH measure of safety climate and a measure of occupational health and safety management system policies and practices.

Methods: Data were collected from over 1900 firms in Ontario in the education, municipal, health care, manufacturing, services, agriculture, construction, transportation, electrical and utilities and pulp and paper sectors using a stratified (geography and firm size) random sample. A single key informant was asked for each firm. Social desirability, assessed using the Crowne-Marlow measure, was not found to influence reporting. The IWH Leading Indicators group developed a series of psychometric criteria to support decisionmaking on the selection of leading indicators. Key indicators were sound internal consistency and test-retest reliability. Structural validity assessed using confirmatory factor analyses and concurrent validity with historical workers compensation data for the participating firms.

Results: All scales had reasonable Cronbach's alpha's (> 0.70). Only the NIOSH safety climate measure had a poor two-week test-retest ICC of 0.37 (acceptable level was 0.70). All measures met reasonable criteria for structural validity using confirmatory factor analysis fit indices. Three measures from the OPP questionnaire demonstrated reasonable concurrent validity using historical workers compensation claims data; Safety Practices (β = -0.1454, p= 0.0357), Ergonomic Policies and Practices (β = -0.1058, p=0.0070), and People-Oriented Culture (β = -0.1058, p=0.0030).

Conclusions: All tools showed some value but based on the concurrent validity results we would suggest using the OPP questionnaire. Because the IWH-OPM has shown predictive validity in another project we would also recommend its use. Currently, the OLIP has been made available for public use in Ontario as a gaps analysis tool for all businesses but especially small and medium sized businesses who want an easy-to-use tool with valid benchmarks.

Session E1.0

Title: Underreporting Injuries –State Perspectives Moderator: Matt Gunter

E1.1

Title: Using multiple data sources for surveillance of work-related amputations in Massachusetts, comparison with official estimates and implications for national surveillance

Authors: <u>Letitia Davis</u>, Kathleen Grattan, Sangwoo Tak, Lucy Bullock, Yaritza Roberts, Leslie Boden, Al Ozonoff

Objectives: The burden of work-related injuries is often estimated from a single data source; yet, no one source captures all cases and all characteristics of these cases. Massachusetts was one of three states funded by the Bureau of Labor Statistics to pilot multi-data source surveillance of work-related amputations, compare multisource findings with state estimates from the Survey of Occupational Injuries and Illnesses (SOII), and assess generalizability of this approach to national surveillance.

Methods: Three data sources were used to identify workrelated amputations: workers' compensation indemnity claim records, the Massachusetts SOII sample, and three state-wide hospital data sets, collectively referred to as Case Mix (CM) data. Potential amputations were identified through injury classification codes (ANSI, OIICS, ICD-9) and narrative searches. For potential cases identified through CM data, medical records were abstracted to assess work-relatedness and obtain worker/employer identifiers needed for case linkage. Iterative deterministic and probabilistic linkages were used to identify unique cases. Proportions of cases captured by data source were computed and distributions of cases by demographic, injury and employment characteristics were compared across data sources using weighted SOII estimates for these comparisons. Further comparison of multisource findings with SOII estimates was restricted to SOII eligible cases.

Results: Seven hundred eighty seven work-related amputations were enumerated, 3.7 times higher than the SOII estimate of 210; 52% were identified through hospital records only. This difference was only partially explained by cases outside the scope of SOII (e.g., selfemployed). Restricting enumerated cases to those clearly eligible for SOII, the estimated SOII undercount was 48% (CI 36-61%). Some eligible cases were reported in SOII as other injuries accounting for about half the undercount. Proportionately more SOII estimated cases than enumerated cases were employed in manufacturing and proportionately fewer in smaller establishments.

Conclusion: Multi-source surveillance enhanced our understanding of the magnitude and distribution of workrelated amputations in Massachusetts and provided useful, otherwise unavailable information to inform prevention efforts. Findings also added to the evidence and understanding of the SOII undercount. While not currently feasible to implement nationally, multisource surveillance is useful in the states. Better understanding of potential biases in the SOII is needed.

E1.2

Title: Results of the BLS Survey of Occupational Injuries and Illnesses Undercount Project: Interviews with SOII respondents in Minnesota Authors: Brian Zaidman, William Boyer

Respondent knowledge and their application of OSHA recordkeeping standards in the maintenance and reporting of injury and illness records are central to the quality of the BLS SOII state and national estimates. Randomly selected SOII respondents participated in telephone interviews about OSHA recordkeeping, and SOII reporting experience, knowledge, and actions. Significant differences were found between establishments in different size groups: respondents for larger employers indicated that they have more experience and training in recordkeeping and their knowledge and actions were more likely to be consistent with the recordkeeping guidelines. Trained OSHA record keepers with many vears of experience were found to be more common at the larger establishments. These establishments were also more likely to be frequent SOII participants. These SOII respondents may add year-to-year stability to the SOII estimates, while the small establishments that participate less frequently in the SOII were more likely to make recordkeeping errors leading to over-reporting or underreporting the true number of OSHA recordable cases. Also of concern was the quality of data from frequent SOII participants at mid-sized establishments who did not have trained record keepers or whose record keepers had misconceptions about what belonged on the OSHA log. Finally, national requirements for OSHA recordable injuries differ from what constitute compensable state workers' compensation claims. To the extent that establishments keep OSHA logs and submit SOII responses based on state workers' compensation statutes and compensability decisions made by workers' compensation insurers, judges and administrators, the data from different states may not be comparable or combinable, and the quality of the estimates compromised.

E1.3

Title: Factors associated with unreported injuries in the BLS Survey of Occupational Injuries and Illnesses Authors: <u>Sara Wuellner</u>, Darrin Adams, David Bonauto

Objectives: The Bureau of Labor Statistics (BLS) Survey of Occupational Injuries and Illness (SOII) is the US's largest occupational injury and illness surveillance system. Each year, the BLS publishes national and statelevel estimates of nonfatal work-related injuries based on records submitted by a sample of employers. Although several studies have found that sampled employers underreport cases in SOII, less is known about whether underreporting varies by employer characteristics.

Methods: We linked SOII injury cases to workers' compensation (WC) claims among SOII-sampled Washington establishments to compare case capture across the two data sources. Based on the record linkage, we estimated the magnitude of unreported SOII-eligible WC claims among Washington employers and explored characteristics potentially associated with unreported WC claims including: establishment size; industry; event or exposure leading to injury; and injury type.

Results: Approximately one in three SOII-eligible WC claims were not included in the SOII injury case data submitted by Washington establishments. Claims among

Construction establishments were less likely to be reported in SOII compared with claims among manufacturing establishments. Underreporting was also found to vary by injury characteristics: claims classified as sprains, strains, tears were less likely to be reported in SOII compared with fractures, but more likely to be reported compared with non-traumatic diseases, conditions, disorders. Claims for injuries resulting from falls or contact with objects were more likely to be reported than claims for injuries resulting from bodily reaction and exertion.

Conclusion: Underreporting in BLS SOII data compared with WC claims vary by establishment and injury characteristics, challenging the notion that SOII data can be used to compare injury rates across industries or injury types. Other data sources may be more appropriate for gauging injury risk across establishment or injury characteristics.

E1.4

Title: BLS SOII Undercount Research - Results from state studies along with current and future research plans

Author: Elizabeth Rogers

The Bureau of Labor Statistics (BLS) partnered with six state workforce agencies during the first and second rounds of BLS sponsored SOII undercount research. Entering into agreements with states was crucial to the success of each research project.

Results from the first two rounds of research point to some basic conclusions:

• Applying a multiple source model to SOII is resource intensive and not feasible at a national level. States, however, may want to use the multisource model for targeted surveillance goals.

• SOII to Workers' Compensation matching studies in the first round indicate that SOII misses some eligible cases, but the magnitude of the undercount ranges from 20 - 70 percent depending on the methodology employed. More recent work by WA seems to put the undercount at the lower end of that range.

• Employer responses to the interviews point toward a widespread misunderstanding of OSHA injury and illness recordkeeping rules and some confusion on what they were required to provide to the BLS when included in the survey.

BLS is evaluating the results of the research to determine new areas of research and additional insights into the underlying causes of the undercount, with special focus on determining changes to the survey that may address or mitigate it.

Session E2.0 Title: Preventing Falls in Construction Moderator: Christine Branche

E2.1

Title: How to engage leaders in reducing construction falls

Authors: <u>Jessica Bunting</u>, Christine Branche, Chris Trahan

Objectives: Falls kill - they are the top cause of construction fatalities and account for 1/3 of on-the-job injuries and deaths in the industry. Each year in the U.S. more than 200 construction workers are killed, and over 10,000 are seriously injured by falls. For this reason, OSHA, NIOSH, and CPWR came together to start the national construction fall prevention campaign with a goal of preventing fatal falls from roofs, ladders, and scaffolds by encouraging residential construction contractors to (1)PLAN ahead to get the job done safely; (2)PROVIDE the right equipment; and (3)TRAIN everyone to use the equipment safely. During the third year of the campaign, we held a national safety standdown - a voluntary event conceived by OSHA for employers to talk directly to employees about hazards, protective methods, and the company's safety policies, goals, and expectations. We present here the results of one part of an evaluation of the success of this Standdown.

Methods: OSHA provided certificates of participation in the stand-down through a website that collected limited information about the participant's demographics and activities conducted. CPWR then analyzed the data, generating patterns of participation by size, location, and type of construction.

Results: The data showed that the stand-down was a resounding success and provided recommendations for doing additional similar efforts. Through the extensive efforts of all campaign partners, 770,193 individuals were reached just through the stand-downs reported in this database. We will present information gathered on the numbers of stand-down events and individual participants reached, specific activities reported, efforts by state and region, and comments and recommendations made.

Conclusions: The data presented here is limited due to the fact that providing one's information was voluntary. Many more companies and individuals participated in the stand-down than are included here. However, as one piece of the overall evaluation, this analysis demonstrates just how many contractors, workers, and safety professionals were reached through the effort, making it a prime example of what can be accomplished through partnership. Based on these results, it is recommended that OSHA, NIOSH, and CPWR conduct additional stand-down efforts going forward.

E2.2

Title: **Residential construction foremen's fall prevention and safety communication training** Authors: <u>Vicki Kaskutas</u>, John Mormann, Lynda Mueller

Drendel, Skye Buckner-Petty, Ann Marie Dale, Bradley Evanoff

Falls from heights annually account for most residential construction worker fatalities. Residential construction crews are small, exposures are high, and fall protection equipment use is rare. Crew foremen, who direct safety and production, have considerable knowledge, yet rarely correct workers' unsafe behaviors.

Objective: To increase residential construction worker safety by training crew foremen in fall prevention methods and safety communication.

Methods: This 8-hour intervention used demonstration and discussion to train 84 participating foremen in fall prevention techniques for each construction phase and methods to effectively communicate with crew to improve safety behaviors. Surveys of foremen and their crewmembers and worksite audits were performed twice pre-training and at 6, 12, and 24 weeks post-training.

Results: Foremen and their crewmembers reported more frequent and increasingly interactive toolbox talks. Statistically significant improvements in safety climate were noted at 6-12 weeks and at 6-months post-training. Both foremen and crewmembers reported increased safety behaviors when working at heights; activities emphasized in training demonstrated larger improvements and the effects remained at 6-month follow-up. We observed increased use of fall prevention methods during worksite audits, but were underpowered to identify statistically significant changes in these observed behaviors. Based on associations between safety behaviors and reported falls seen in a previous study of construction workers, the magnitude of the change in fall safety behaviors reported by crewmembers post-intervention would be associated with a 16.7% decrease in the annual odds of sustaining a fall from height.

Conclusion: This intervention resulted in sustained improvements in fall prevention behaviors and safety communication in residential construction, an industry sector with high fall rates. After training foremen in both fall prevention and safety communication, their crewmembers reported improvements in fall prevention behaviors, safety communication, and safety climate. Agreement between foremen's self-reports and their crewmembers' reports increased the strength of our findings. This research adds to the growing literature demonstrating that needs-driven training can improve construction worker safety and worksite safety communication. Although this intervention did not target safety culture, changes reported by participants suggests that training in safety and safety communication may improve safety culture, an emerging priority for construction safety and health.

E2.3

Title: Health and safety in construction: Evidence of a union safety effect

Authors: <u>Benjamin Amick III</u>, Sheilah Hogg-Johnson, Ron Saunders, Desiree Latour

Objectives: While there is colloquial discussion about the presence of a union safety effect, there is little evidence in Canada of such an effect and no evidence in the construction sector. This project sought to understand whether there was a significant difference in injury and illness claim rates among industrial, commercial, and institutional (ICI) construction firms that were union-certified (meaning they only hired union trades members) compared to non-union firms. The project represents a collaboration between IWH and the Ontario Construction Secretariat (OCS). The primary research question is: do union certified ICI construction firms have lower workers' compensation claims rates compared to non-union firms?

Methods: To answer this question data from trade associations and union lists on union-certified firms were linked to Ontario Workplace Safety and Insurance Board (WSIB) claims data over the period 2006-2012. Data from the Ontario Labour Relations Board was used to assess changes in certification status. The final sample included 38,626 non-union (811,146 FTEs) and 5,797 union (718,828 FTEs) firms after excluding firms with less than 1 FTE over the entire period. In multivariable negative binomial regression models we adjusted for WSIB classification unit, firm location and workplace size and complexity.

Results: The adjusted effect for all claims was 1.13 (1.09-1.17) indicating overall higher injury claim rates for the unionized firms. The effect for no-lost time claims was 1.35 (1.30-1.41) and for lost-time claims 0.77 (0.73-0.81) indicating lower LT injury claim rates for unionized firms. Amongst lost-time claims the adjusted effects for musculoskeletal claims was 0.83 (0.77-0.89) and critical injuries 0.71 (0.63-0.81).

Conclusions: Further research, scheduled to begin in November of this year, will survey Ontario construction firms and compare their organizational policies and practices to try to explain the observed difference.

E2.4 Title: **Slipperiness perception and future risk of slipping**

Authors: <u>Theodore Courtney</u>, Santosh Verma, Wen-Ruey Chang, Yueng-Hsiang Huang, David Lombardi, Melanye Brennan, Melissa Perry

Objectives: Slipping, tripping and falling (STF) are responsible for a substantial injury burden in the global workplace. Prior research has suggested a modest correlation between objective measures such as coefficient of friction and subjective measures of slipperiness such as worker perception in the workplace. However, the degree of association between subjective measures and the actual risk of slipping in the workplace is unknown. This study examined the association between workers' perceptions of slipperiness and their subsequent risk of slipping on the job.

Methods: Four hundred seventy five workers from 36 limited-service restaurants participated in a 12-week prospective-cohort study. At baseline, demographic information was collected, participants rated floor slipperiness in eight functional areas of the restaurant, and work environment factors including co-efficient of friction were measured. Restaurant and area-level mean perceptions of slipperiness were calculated from baseline data. Participants next reported their slipping experience at work each week for the following 12 weeks. The associations between perception of slipperiness and the rate of slipping were assessed using generalized estimating equations (GEE).

Results: Adjusting for age, gender, BMI, education, primary language, mean COF, use of slip-resistant shoes, and restaurant chain, each 1 point increase in mean restaurant-level perception of slipperiness (on a 4 point Likert scale) was associated with a 2.7 times increase in the subsequent rate of slipping (95% CI 1.2- 5.9). Results were similar for area-level perception within the restaurant (RR 2.9, 95% CI 2.4- 3.5).

Conclusions: Perceptions of slipperiness and the subsequent rate of slipping were strongly associated. These findings suggest that health and safety professionals, risk managers and employers could utilize aggregated worker perceptions of slipperiness (which could be more practical and scalable to implement) to identify slipping hazards and, potentially, to assess intervention effectiveness.

Session E3.0

Title: **Perceptions, Knowledge and Awareness of Risks** Moderator: Brianna Eiter

E3.1

Title: West Virginia logger hazard awareness and injury risk perception Authors: Mark Fullen, Kimberly Rauscher, Wayne

Lundstrom, Douglas Myers

Objectives: Loggers in West Virginia are more than twice as likely to be fatally injured on the job as loggers across the nation. Since 1999 West Virginia loggers and owners have been participating in a state-wide Logger Safety program that includes a certification program and requires safety training but the majority of the educational information produced by the program is provided only to the owners. This pilot research included the development a survey tool that was deployed to collect pilot data on hazard awareness and injury risk perception data of West Virginia loggers and owners to provide insight on how the workers and owners within this industry perceive risk.

Methods: Objectives included 1) to develop a survey instrument designed to assess the level of hazard awareness among loggers, including workers and owner/operators; 2) to explore the level of hazard awareness and injury risk perception among loggers and logger owner operators in West Virginia; 3) to explore differences in hazard awareness and injury risk perception; and 4) to use the survey results to identify the gaps in hazard awareness and injury risk perception in order to inform the development of future targeted interventions to reduce injury in the industry.

Results: Survey data shows that 57.73% of the owners and workers agree or strongly agree that the cause of logging accidents to be the fault of the injured worker and 82.9% of workers and 86.2% of owners agreed or strongly agreed that most on the job injuries are caused by worker carelessness. Of these same workers, 87.8% agreed or strongly agreed that they are confident in knowing the hazards of logging and how to protect themselves but (53.7%) agreed or strongly agreed that to get the job done sometimes a logger must take risks that endanger their safety. Finally, 61% of the owners agreed or strongly agreed that workers sometimes do not report injuries because they fear being blamed.

Conclusions: These preliminary results show evidence of a work culture that has not been educated or informed and has little to no experience in implementing an effective safety and health management system.

E3.2

Title: Exploring the state of health and safety management system performance measurement in mining organizations

Authors: Patrick Yorio, Emily Haas

In recent years, complex debates and arguments have been soundly articulated regarding the theoretical foundation of health and safety management system (HSMS) performance measurement and numerous categorizing frameworks for performance indicators have been proposed. The culmination of these efforts has seemingly begun to enhance a collective understanding of the theoretical nature of health and safety management performance measurement in organizations. Despite this enhanced understanding, however, there is still evidence of continuing debates and little consensus. The goal of the current research effort was to empirically explore the current state of HSMS performance measurement in mining organizations; the purpose being to determine if a strictly inductive approach could add value and insight into the ongoing approaches to HSMS performance measurement. Nine active health and safety executives, managers, and professionals were provided with 135 practices corresponding to 20 elements aligned within the HSMS cycle. Participants were asked to supply information as to how they (1) assess the performance of each practice in their organization, or (2) would assess each practice if it were an identified strategic imperative. Content analysis results suggest that all of the indicators provided could be categorized into interventions, objective organizational and worker performance, and subjective perceptions. A discussion of how these categories relate to previous theoretical discussions of indicator frameworks is provided along with suggestions for future research.

E3.3

Title: **Knowledge of occupational safety among building construction workers in Lagos State** Authors: <u>Olalekan Makinde</u>, Abdul Hakkem Abiola

Objectives: The building construction workers are a peculiar group of workers. A high level of exposure to hazards that have been associated with their profession. These hazards have been reported in both developed and developing countries, but data in developing countries are still very sparse. This study aimed at determining the level of knowledge of occupational safety among this group of workers.

Methods: This was a cross sectional study with a total of 285 respondents, recruited in a multi-staged sampling. Interviewer administered questionnaires were used to elicit information like socio-demographic characteristics and knowledge of occupational hazard and safety measures. The data were analyzed using Epi-Info 3.5.1 statistical software.

Results: Most of the respondents (86.3%) were male. The mean age of respondents (36.29 \pm 10.68years).Majority of the respondents (52.6%) had a poor knowledge of occupational hazards and safety measures. The mean knowledge score was 43.2 \pm 12.4. The knowledge source highest among the respondents was personal experience (82%).

Conclusions: This study shows that the knowledge level among the building construction worker is poor.

E3.4

Title: Factors causing construction accidents Author: <u>Majed Moosa</u>

Research indicates that construction site accidents are a global concern, and rates are increasing. In rapidly developing countries like Saudi Arabia, safety issues are largely ignored and little is known about the causes.

Objective: To shed light on factors causing Saudi Arabian construction accidents.

Methods: A detailed survey of accident features, safety practices, and perception of factors casing accidents was sent to thirty-five construction companies, with a response rate of 68%.

Results: The largest contributing factor in construction site accidents was found to be attitudes toward safety practices. This finding is similar to published findings on construction accident causes.

Conclusion: Survey results confirmed the findings from the literature in that management attitudes and human factors were ranked as the most important safety issues. Changes in attitudes towards safety management practices are the key to changing the practices themselves. Only by changing attitudes, can the construction industry change its accident record.

Session E4.0

Title: Technology Transforming Safety Moderator: Jim Green

E4.1

Title: The technological transformation of driving: Lessons learned in the transition from horse and buggy to internal combustion engine Author: <u>Marvin Dainoff</u>

Significant safety issues are raised by rapid technological changes in the world of surface transportation. These technologies comprise a two-dimensional space characterized by levels of Automation and Connectivity. Automation levels can be described using the NHTSA classification which ranges from no automation (human

driver in control) to full automation (human driver not required). Connectivity (embedded within the vehicle infrastructure) can be unidirectional (radio, GPS), bidirectional (Bluetooth-linked mobile device, telematic devices), Vehicle-to-Vehicle (vehicle spacing information), and Vehicle-to-Infrastructure (traffic flow information). Within this space are many alternative versions of these technologies, some of which have the potential for increasing safety (Advanced Driver Assistance Systems, telematics coaching) or decreasing safety (distracting infotainment systems). A sociotechnical analysis (Geels, 2005) of the transition from horse and buggy to internal combustion engine reveals a similar period of rapid technological change. In this analysis, the automobile did not simply replace the horse-drawn carriage but a number of intermediate steps intervened and alternative trajectories might have been possible. These alternatives reflected interactions among different kinds of technology (steam, electric, internal combustion), supporting governmental policies (safety regulations, infrastructure, licensure), and public opinion, all of which relate directly to the current situation. Geels, G.A. (2005). Technology Analysis and Strategic Management. 17(4), 445-476.

E4.2

Title: **Truck drivers' pedal-use behavior during lane changes: Examination with naturalistic driving data** Authors: <u>Christopher Pan</u>, Shan Bao, Stephanie Pratt, Ted Hitchcock, Paul Keane, David LeBlanc, Huei Peng

This study is designed to evaluate heavy-truck drivers' pedal-use behavior during lane changes, which are a major source of two-vehicle crashes that involve one large truck and one light vehicle, and are very likely to produce both fatal and non-fatal injuries. Previous studies have reported that driver-related errors are the leading factors contributing to truck-related lane change crashes. There are limited studies that have been conducted to evaluate drivers' pedal use during lane changes. The data used in this study were collected through the naturalisticdriving study of the Integrated Vehicle-Based Safety System (IVBSS) program. Ten tractors were used as instrumented research vehicles, while they additionally performed normal operational activities. These vehicles were built to specification for Con-way Freight. Each truck was equipped with instrumentation to capture information regarding the driving environment, driver activity, system behavior, and vehicle kinematics. Driving data from eighteen professional heavy-truck drivers, who operated the instrumented trucks over a 10month period, were collected, as the drivers were conducting Con-way's normal business activities. A total of 198,132 lane change events were identified from the IVBSS database. Among them, there were 111,850 leftlane changes and 86,282 right-lane changes. About 33% of all the lane changes occurred during night time, and 67% occurred during the daytime. 35% of the left-lane

changes and 45% of the right-lane changes occurred during highway driving; the remainder occurred on nonhighway roads (i.e., main surface and local roads). Analysis of variance results showed that road type, lane change direction and time of day all have significant impact (p<0.05 in each case) on drivers' maximum acceleration rate during lane changes. A significant lower maximum acceleration rate was observed when drivers were driving on highways when compared to driving on non-highways. This difference was more obvious during day time driving. Drivers had a higher value of maximum acceleration rate when making right lane changes than making left lane changes. The results of this study suggest that lane change maneuver is a multifactorial process, with implications for motor vehicle crash contributors. The study team is currently reviewing the findings, and will make recommendations for safer truck driving.

E4.3

Title: **Partnering with industry to build safe EMS work environments** Author: Jim Green

This presentation will summarize the results from the NIOSH developed collaborative research program to improve ambulance crash safety. NIOSH worked hand-in-hand with the ambulance industry to create a family of component specific test standards or test methods aimed at improving the safety of workers and occupants while riding in the patient compartment of an ambulance. The component specific test standards cover; (1) ambulance crash response in frontal impact; (2) ambulance crash response in side impact; (3) ambulance crash response in rear impact; (4) seating and occupant restraints; (5) gurney and patient restraint; (6) equipment mounting, (7) patient compartment structural integrity, (8) gurney-to-floor structural integrity, (9) cabinet and drawer content retention, and (10) seated occupant excursion at impact.

Each test standard or test method is based on quantitative, science based research. Each meets or exceeds existing international standards. All have been validated using full scale test articles redesign and provided by the ambulance industry and its suppliers as a part of the collaborative research process. Each of these component specific test standards or methods has or will be published by the Society of Automotive Engineers (SAE). To date, the first six (6) have been published, while the remaining four (4) are in the SAE review process.

NIOSH is now utilizing these research results and published SAE documents to directly influence changes to four bumper-to-bumper standards now used, or intended for use, in the design of an ambulance. The targeted standard setting bodies and documents are: the General Services Administration's Federal Specification for the Star-of-Life Ambulance; the Ambulance Manufacturer's Division of the National Truck Equipment Association's Ambulance Standards, the National Fire Protection Association's 1917 Automotive Ambulance Standard and the Commission on Accreditation of Ambulance Services Ground Vehicle Standard for Ambulances (GVS 2015). The research team has secured the agreement and cooperation of each of these entities to work toward this common goal and has, as of 2014, provided input to, or directly published standards language with, each.

E4.4

Title: **Tracking the transfer of recommended technologies in high risk tasks of sheet metal workers** Authors: <u>Ann Marie Dale</u>, Kim Miller, Ching-Ting Hwang, Bethany Gardner, Laura Welch, Bradley Evanoff

Objectives: Sheet metal workers are at high risk for developing musculoskeletal disorders, with one of the highest rates of overexertion injuries among all construction trades. The National Institute for Occupational Safety and Health held a stakeholder meeting to gather information about perceived risk of work tasks, availability of ergonomic controls, and perceived barriers to controlling hazards in sheet metal activities. Stakeholders created prioritized lists of problematic work tasks and recommended interventions for each task and published results in 2005. The objective of this study was to determine whether previously recommended voluntary control measures for high risk activities were being utilized during a sample of commercial heating, ventilating, and air conditioning installation projects.

Methods: Stakeholder groups identified six sheet metal work activities and associated tasks and assigned a risk level (high, moderate, low) and body region potentially affected, and suggested solutions to address the risk in each task. This framework was used to evaluate a series of case studies. Sixteen commercial sheet metal worksite assessments collected between 2007 and 2009 were reviewed. The reviewer determined whether the work methods used to perform each activity incorporated stakeholder-suggested solutions or novel solutions not previously described. The review included video analysis using the Multimedia-Video Task Analysis (MVTA) software, which assists with automating time studies of observable activities, to evaluate postures and time spent carrying loads.

Results: Videos were available for four primary sheet metal activities with high/moderate risk tasks including pack (move material), support system (install hangers), prep (assemble duct), and install ductwork/ equipment. Some stakeholder-suggested solutions were observed in each activity; workers commonly employed mechanical handling equipment to pack heavy objects. Many workers used power tools in place of manual tools. Limited alternative risk-reduction methods were observed for overhead and extended reach tasks. Novel solutions observed included preassembling duct and supports prior to installation and worker-designed manual assist devices. There were high levels of outstanding risk for the low back during prep and shoulder during installation tasks.

Conclusion: Adoption of recommended solutions is limited. There are few interventions available for some sheet metal tasks. Future solutions should explore system designs that eliminate overhead work.

Session F1.0 Title: Hazards in the Environment Moderator: Jennifer M. Lincoln

F1.1

Title: A critical review of OSHA heat enforcement cases: Lessons learned

Authors: Sheila Arbury, Michael Hodgson

Objectives: To review all OSHA heat enforcement cases 2012-2013 to review actions, understand difference between hazard alert letters (HALs) and General Duty Clause citations (GDC), and to identify needed changes in inspection strategies.

Methods: 1) review science underlying heat illness prevention programs to identify elements and criteria; 2) develop and pilot data coding approach; 3) identify all heat inspections from 2012 and 2013 from OSHA IT systems; 4) collect and analyze data.

Results: OSHA conducted 84 heat enforcement cases in 2012 and 2013. Of those, 23 inspections (27.4%) were triggered by deaths and 20 (23.1%) resulted in GDCs. Employer heat prevention programs lacked multiple critical elements: only 40.5% of the 84 employers had a heat illness prevention program; only 3% used an appropriate work/rest cycle based on current heat index and intensity of work; 77% provided water and 65.5% provided shade or appropriate heat-shielded rest areas; only 15.5% used the daily heat index to identify heat illness risk; and only one employer had an acclimatization program. The structure and components of employer heat prevention program elements were not statistically significantly different between cases with and without deaths or between actions resulting in GDC and HALs. The one important significant difference was that the average temperature was higher in GDC than in HAL cases. Subsequent more detailed review of the death cases (n=10) that resulted in HALs rather than GDC suggests that exposure and workload documentation were less precise than in those that resulted in GDCs.

Conclusion: Results suggest that rethinking documentation of workload and heat load may allow OSHA to better enforce heat illness prevention programs.

F1.2

Title: Are noise and solvent exposures related to workplace accidents? A research review Author: <u>Cheryl Estill</u>

More than 5,000 fatalities and eight million injuries occurred in the workplace in 2007 at a cost of \$6 and \$186 billion, respectively. The relationship between noise exposure and acute injury is not well understood. Ototoxic chemicals are known to cause central nervous system affects among workers. However, the relationship between exposure to noise and solvents and acute injuries is unknown. A thorough review of the literature resulted in 37 articles that examined the relationship between noise exposure, hearing loss, or solvent exposures with various health outcomes: hearing loss, workplace injuries, absence from work due to sickness, fatalities, hospital admissions due to workplace accidents, traffic accidents, hypertension, balance, slip, trips, or falls, cognitive measures, or disability retirement. Important covariates in these studies were age of employee, type of industry or occupation, or length of employment. Most studies that evaluated noise exposure concluded that higher exposure to noise results in more of the chosen health effect but the relationship is not well understood. Studies that evaluated hearing loss found that hearing loss was related to occupational injury, disability retirement, or traffic accidents. Studies that assessed both noise exposure and hearing loss as risk factors for occupational injuries reported that hearing loss was related to occupational injuries as much or more than noise exposure. Research results showed that solvent exposure is likely to be related to accidents or other health consequences such as loss of balancing abilities. The review showed that many physical and chemical hazards are related or likely to be related to accidents in the workplace. Many studies reported that noise exposures and hearing loss, respectively, are likely to be related to occupational accidents.

F1.3

Title: The stability of surgical teams and risk of bloodcontaminated sharps injuries in the operating room Authors: <u>Douglas Myers</u>, Hester Lipscomb, John Dement, Carol Epling, Debra Hunt, Lynn Smith-Lovin, William Richardson

Background and Objectives: We explored whether the stability of membership on surgical teams affects the risk of blood contaminated sharps injuries during surgical procedures.

Methods: A dynamic cohort of surgical teams working in a single large academic medical institution was

compiled. Approximately 333,000 procedures were amassed and 2,113 events were recorded over the tenyear study period. An index of "past collaboration" developed by social network analysts was used to quantify the extent to which the surgical teams had worked together in the six months prior to each surgical procedure. The measure, a property of the team performing the procedure, is standardized ranging from 0 to 1. Poisson regression was used to model the outcomes while controlling for a variety of characteristics and accounting for the duration of the surgical procedures.

Results: Controlling for a variety of procedure properties, results suggest a modest protective effect of past collaboration for percutaneous injuries (RR = 0.92, 95%CI [0.88, 0.98] for a one standard deviation increase in the past collaboration index). As expected, results varied by device type. The association was slightly stronger for events involving instruments other than suture needles; the association with suture needles was protective but non-significant.

Conclusions: Greater team stability may improve safety among surgical team members for certain types of sharpsrelated injuries and under certain circumstances. More research is needed to verify these findings in other settings. The measure of past collaboration used here may be used to examine other situations in which teamwork may affect safety. Results may have significance pertaining to other outcomes, such as patient safety, as well.

F1.4

Title: Factors associated with fatal vessel disasters in the commercial fishing industry, Alaska, 2000–2013 Authors: Joanna Watson, Devin Lucas, Jennifer Lincoln

Objective: The largest fishing ports in the United States are found in Alaska. Although the fatality rate has been declining, the commercial fishing occupational fatality rate in 2013 was 75 deaths/100,000 full time equivalent workers, 23 times the rate for all US workers. During 2000–2013, 51% of the 623 fishing worker deaths resulted from vessel disasters. NIOSH has worked on a number of successful projects to increase the odds of survival after a vessel disaster. The objective of this study is to better understand risk factors for fatal vessel disasters so that interventions can be developed to prevent the events from occurring.

Methods: Vessel disasters in Alaska were identified from the NIOSH Commercial Fishing Incident Database. Vessel disasters are events (sinking, capsizing, burning, grounding or structural damage), which force the crew to abandon the vessel. Fatal vessel disasters were those resulting in ≥ 1 death. Using logistic regression, fatal and non-fatal vessel disasters were compared to identify factors that were associated with fatal outcomes. Hypothesized factors included: distance from shore (<=3 miles or >3 miles), season (summer or winter), weather related (yes or no), vessel length (feet), vessel age (years) and hull material (fiberglass, aluminium, steel or wood).

Results: During 2000–2013, 261 vessel disasters (26 fatal, 235 non-fatal) occurred resulting in 63 deaths. The majority of deaths (72%, n=55) resulted from drowning. The most common disaster type was sinking, accounting for 20/26 fatal disasters (77%) and 147/235 non-fatal disasters (63%). Vessel disasters were more likely to be fatal if they were weather related (OR: 3.42; 95% CI: 1.43–8.14) or occurred >3 miles from shore (OR: 6.01; 95% CI: 2.49–14.5). Time of year, vessel length, vessel age, and hull material were not significantly associated with a fatal outcome.

Conclusion: Vessel disasters are a major contributor to fatalities in the commercial fishing industry. Priorities for further investigation and prevention efforts for vessel disasters should focus on issues related to vessels operating in heavy weather, and those vessels operating >3 miles from shore. These results will support the US Coast Guard in developing and implementing evidence-based safety programs.

Session F2.0

Title: Working Hours, Fatigue and Sleep – Miscellaneous Moderator: John Violanti

F2.1

Title: Field study testing the theory that keeping busy helps sustain alertness Author: <u>Roger Jensen</u>

Control room operators in a nuclear power plant participated in this on-site study to test the theory that keeping busy helps sustain alertness. Since circadian rhythms strongly affect alertness, this study was designed to account for different times of the 24-hour day. The participating reactor operators worked rotating 8-hour shifts in the control room. Every 20 minutes they completed a form with two psycho-physical rating scales. The first, a nine-point rating scale, asked for alertness level compared to when they started the shift. That level was set at five. The second, a 13-point rating scale, asked for their workload during the preceding period. This scale was developed by the Air Force Flight Test Center. These observations were obtained throughout three day shifts, three evening shifts, and three night shifts, for a total of 560 pairs of ratings.

Alertness ratings of 2 and 3 on the 9-point alertness scale indicated a substantial reduction in alertness. All 19 of these low ratings occurred during the hour 0300 and 0640; and 17 were preceded by an activity level rated in the low range (0 to 3). Subsequent analyses accounted for circadian effects on alertness by grouping data into six sets containing the first and second half of each shift. To test the theory that keeping busy helps sustain alertness, the regression relationships for alertness ratings predicted by workload were computed. The strongest relationship was during the second half of the night shift (0300 to 0700). During that time, a significant positive relationship indicated that higher alertness tended to occur following 20 minutes of higher workload (p = .001). A significant positive relationship was also found for the second half of the evening shift (p = .003). Relationships in other half shifts were not significant at the 0.05 level.

This field study supports two conclusions. First, the participating control room operators maintained their alertness during all hours except the early morning hours. Second, the theory that keeping busy helps sustain alertness was supported for the early morning hours and the second half of the evening shift; for other times, these results were inconclusive.

F2.2

Title: Association between sedentary work and BMI in a US national longitudinal survey

Authors: <u>Tin-chi Lin</u>, Theodore Courtney, David Lombardi, Santosh Verma

Objectives: Technological advancements have made life and work more sedentary, and long hours of sitting are known to have many health concerns. Several studies have reported an association between prolonged sitting time at work and weight gain, but the results are inconsistent. This study examined the relationship between sitting time at work and body mass index (BMI) prospectively using data from a nationally representative cohort of U.S. men and women from 2002 to 2010. Initial analyses were performed in 2013, with additional analyses in 2014.

Methods: The sample size at the base year (2002) was 5,305 and the age range 38-45. The outcome, body mass index (BMI), was based on self-reported measures of height and weight. Estimates of workplace sitting time were linked from an external database (Occupational Information Network), and the occupation-wide rating for sitting time was linked to survey participants by occupation. Fixed-effects models controlling for time-invariant effects of all time-invariant characteristics were employed to examine the association, controlling for age, education, work hours, and frequencies of leisure-time exercise.

Results: Longer sitting time was significantly associated with higher BMI for the overall sample (point estimate = 0.055, p < 0.05) and men (point estimate = 0.089, p <

0.01). For women, the association was not statistically significant.

Conclusions: The findings provide further support for initiatives to reduce workplace sitting time as a means of reducing the risk of obesity and related health conditions.

F2.3

Title: Does shift work play a role in violence against nurses?

Authors: <u>Steve Sun</u>, Susan Gerberich, Andrew Ryan, Lisa Peterson

Objectives: Nurses are known to be at risk of violence; yet, to date, relevant research has primarily addressed general environmental exposures. The purpose of this nested case-control study was to determine if type and length of shift work are associated with work-related physical assault against nurses.

Methods: Phase-1 involved randomly identifying 6300 nurses, from the 1998 licensing database, who practiced in Minnesota; these nurses were surveyed to determine their employment and occupational violence experiences. In the Phase-2 case-control study, cases reported at least one work-related physical assault in the previous 12 months while controls were randomly selected from assault-free months. Cases were questioned about exposures experienced during the month prior to their assault month; if multiple events were reported, cases were surveyed about the month before the earliest event. Controls were questioned about exposures for random months, selected as described above. Shift work was classified into refined categories of shift type (day, evening, night, day and evening, day and night, others) and shift length (≤ 8 hours, 10 hours, ≥ 12 hours) to examine the association between those categories and physical assault. Directed acyclic graphs identified confounders for multivariate analyses, including facility in which they worked the most time, primary population with which they worked, primary professional activity, license type, age and gender. These variables adjust for potential confounding and avoid bias from variables that are located in the causal pathway between shift work and physical assault.

Results: Among 946 controls and 310 cases, the majority worked 8 hours or less (88%, 87%, respectively). More controls than cases worked day shifts (70%, 44%, respectively); conversely, fewer controls than cases worked night shifts (8%, 24%, respectively). Multivariate analyses (Odds Ratios [OR] and 95% Confidence Intervals [CI]) revealed increased risks for those working specific shifts. Those shifts were: evening (1.55; 1.05–2.27); night (3.54; 2.31-5.44); and rotating day and evening (2.88; 1.22-6.80). Length of shift did not appear important.

Conclusion: These results indicated that shift may play a significant role in the outcome of work-related assault against nurses. They serve as a basis to guide further investigation of mechanisms to mitigate risks associated with shift work.

F2.4

Title: Development of a research program to identify improved practical factors to evaluate worker susceptibility to fatigue, heat stroke and injury in deep, hot underground mines Author: <u>Christopher Pritchard</u>

Underground miners have encountered hot working conditions from ancient times, but have begun to more effectively deal with heat-related health and safety issues starting with mining in the Comstock Lode of Nevada in the 1860's. Early remedies attempted were confined to limited ventilation and sending mountain ice down to miners in ore cars. As mines close to the earth's surface are exhausted, deeper, hotter and more challenging ore deposits will be developed, potentially increasing the incidence of fatigue, heat exhaustion and associated accidents.

Researchers have examined the effects of heat on miners, primarily in the deep mines of South Africa, Australia, United States and Canada to understand and evaluate how miners respond to working in hot conditions. Early tests concentrated on measuring body core temperatures and acclimatizing workers for the purposes of maximizing worker productivity. They also identified other significant areas affecting worker's ability to tolerate heat such as hydration, low body weight, advanced age, and being grossly overweight. The critical values established to evaluate human body heat transfer were air temperature, water vapor pressure, air velocity, mean radiant temperature and wet bulb temperature.

Ultimately an index called Thermal Work Limit (TWL) was developed by Brake and Graham (2002) which takes into account environmental conditions, a greatly improved evaluation method which combines wet bulb and dry bulb temperatures, the type of clothing worn, air velocity and radiant heat load. Unfortunately, the primary, less effective method used today still utilizes only air temperature and humidity.

The proposed research aims to evaluate whether the addition of hydration status, core body temperature, recent shift history, sleep quality information provided by the miner, or other significant information, either alone or in combination - could improve the use of the TWL method in predicting the incidence of heat stress and related accidents in hot underground mines. Brake DJ, Graham PB [2002] Limiting Metabolic Rate (Thermal Work Limit) as an Index of Thermal Stress, Applied Industrial Hygiene, Volume 17(3): 176-186.

Session F3.0 Title: Surveillance – General 2 Moderator: Elizabeth Rogers

F3.1

Title: An in-depth analysis of fall-related injuries among electric power industry workers, 1995 - 2013 Authors: <u>Tiffani Fordyce</u>, Vitaly Volberg, Gabor Mezei, Ximena Vergara, Lovely Krishen

Objectives: This presentation describes an in-depth analysis of injuries occurring from falls among workers in the electric power industry.

Methods: We calculated injury rates related to falls using the Electric Power Research Institute's (EPRI) Occupational Health and Safety Database (OHSD), which contains personnel, injury, and claim information from 18 participating electric power companies from 1995-2013.

Results: The OHSD includes data on 9.799 injuries resulting from falls, representing 16% of injuries and 19% of full-time equivalents (FTEs) lost in the OHSD. Falls accounted for 6% of the fatalities in the OHSD. Combined medical costs for falls are around \$32M (17% of all medical costs). Falls account for 21% of reported medical costs per company, on average. Meter readers, line workers, and welders had the highest injury rates for falls (239, 161, and 114 per 10,000 employee-years, respectively), but injuries to line workers were the most costly, accounting for more than 30% of the medical costs from falls and 5% of all FTEs lost in the OHSD. Meter readers experienced the same percentage of falls regardless of sex (14% for females, 16% for males). However, for males the most common occupational group to experience fall injuries were line workers (25%) whereas for females, administrative and technical professional support workers accounted for 43% of fall injuries. Sprains and strains are the most common type of injury resulting from falls (55%), followed by contusions and bruising (15%), and fractures/dislocations (11%). Sprains are the most costly injuries in terms of actual costs (49% of medical costs for falls). Fractures and dislocations make up a larger proportion of the medical costs than contusions and bruising relative to the frequency of type of injury (30% and 6% of medical costs, respectively). Sprains and fractures resulting from falls account for 10% and 5% of all FTEs lost in the OHSD, respectively.

Conclusions: For electric power industry workers, particularly line workers and meter readers, falls remain a costly hazard, from medical costs and lost work time. These observations can help to identify injury prevention and cost reduction opportunities and result in improved worker health and productivity.

F3.2

Title: Thirteen years of disabling work injuries in the US (1998-2010): Findings from the Liberty Mutual Workplace Safety Index

Authors: <u>Helen Marucci-Wellman</u>, Theodore Courtney, Helen Corns, Tom Leamon, Simon Matz, Ian Noy

Objectives: Although occupational injuries are among the leading causes of death and disability around the world, the burden due to occupational injuries has historically been under-recognized, obscuring the need to address a major public health problem. The longstanding goal of the Liberty Mutual Workplace Safety Index (LMWSI) has been to annually produce a reliable metric of the leading causes of the most disabling workplace injuries in the U.S. by direct insured cost.

Methods: LMWSI annual estimates are developed in two discrete stages. First, Liberty Mutual workers compensation (WC) mean costs are multiplied by Bureau of Labor Statistics frequencies for each 2-digit BLS Occupational Injury and Illness Classification System event category for workplace injuries resulting in greater than 5 lost workdays. The fractional component cost of each event group is determined to identify and rank the top 10 disabling event categories. The total national burden by event group is determined by multiplying the cause specific proportions by the total annual benefits paid out estimated and published annually by the National Academy of Social Insurance.

Results: Approximately 600 billion dollars in direct WC costs were spent on the most disabling compensable non-fatal injuries and illnesses in the American workplace from 1998 to 2010; Over the 13-year period, the direct WC costs spent on the most disabling compensable non-fatal injuries and illnesses grew nominally by 38% from \$37.1 billion in 1998 rising to \$51.1 billion in 2010. The *overexertion* (13.6 B dollars, 2010) and *fall on the same level* (8.6 B dollars in 2010) categories were consistently ranked 1st and 2nd since the beginning of the index.

Conclusion: Close to 1 billion U.S. dollars a week are being spent on direct, insured costs for the most disabling work-related injuries. There has been a lack of substantial, real reduction in burden over the past 13 years. The burden of overexertion injuries still far outweighs any other cause despite much research and focus on safer materials handling practices, the burden of falls on the same level has grown at a steady rate since 2002, while the burden of repetitive motion experienced a significant reduction.

F3.3

Title: Surveillance of occupational traumatic injuries in 112 US hospitals: Prevention through surveillance Authors: <u>Ahmed Gomaa</u>, Susan Nowlin, Raymond Sarmiento

Objectives: Describe how NIOSH Occupational Health Safety Network (OHSN) surveillance in collaboration with participating hospitals provides an evidence base for identifying and promoting practical prevention strategies for healthcare personnel (HCP) in hospital settings.

Methods: OHSN tracks musculoskeletal disorders due to patient handling (PHM); slips, trips, and falls (STF); and workplace violence among HCP (WPV) in 112 hospitals in 20 states from January 2012 to October 2014. OHSN describes occupational injury patterns distinguishing different types of HCP and related the patterns to circumstances and activities causing the injuries.

Results: A total of 13,000 injuries were reported to OHSN. More than 76% of injuries were OSHA recordable. Nurses (39%), nursing assistants (17%), and radiology technicians (4%) accounted for 60% of injuries. Most of the injuries happened in the inpatient setting (51%) followed by non-patient care areas (17%), outpatient setting (14%), and radiology (4%).

The annual rates of STF, PHM, and WPV were 40, 39, and 22 per 10,000 workers, respectively. The top three departments where PHM injuries occurred were adult ward, intensive care unit (ICU), and emergency room. The major activities attributed to PHM injuries were positioning a patient in bed/stretcher, transferring/ lifting a patient from bed/chair, and transferring a deceased patient. PHM injuries occurred most often when workers were using no lifting equipment 51%, when workers using lifting equipment12%, and 37% unspecified.

Highest STF injuries occurred in adult ward, maintenance, and public areas such as parking lot. The leading causes of STF were contaminant, step/stairs/handrails, and hazard object.

WPV was reported most often in adult ward, inpatient psychiatric department, and ICU. All WPV were perpetrated by patients with 64% being physical assault against workers, 35 % unspecified, 1% verbal assault, and less than 1% against property. Contributing factors to violence were; patient mental health, cognitive dysfunction, and anger related to situation.

Conclusion: OHSN near real time data enables hospitals to track injuries 24/7, benchmark, empower prevention, and monitor impact of intervention. OHSN data guided collaboration with hospitals to implement interventions at hospital key areas which can substantially reduce the risk to HCP from common, serious, and preventable injuries.

F3.4

Title: Workers' compensation claims among ambulance services workers -- Ohio, 2001-2010 Authors: <u>Chia Wei</u>, Steve Wurzelbacher, Alysha Meyers, Steve Bertke, Mike Lampl, Dave Robins

Objectives: A concurrent study identified Ambulance Services as having one of the highest claim rates by industry subsector among all of Ohio Bureau of Workers' Compensation (OHBWC) insured, single-location, private employers from 2001-2010 across all NIOSH industry sectors. This study further examined workers' compensation (WC) claims for Ambulance Service workers.

Methods: OHBWC insured workers' compensation policies and claims for the Ambulance Services industry subsector was identified among single-location, private employers with a North American Industry Classification System (NAICS) code of 62191. Rates of WC claims per 100 adjusted full-time equivalent employees (FTEs) estimated from labor, productivity, and costs surveys were calculated. Two claim types (medical-only and losttime) were used to determine the severity of injury. In Ohio, lost-time claims are those with more than seven days away from work. Causes of injury were manually and auto-coded into three mutually exclusive categories: ergonomic-related musculoskeletal disorders (MSD), slips/trips/falls (STF), or any other event/exposure (OTH). In addition, one of 57 injury categories (e.g. contusion, fracture, or sprains, etc.) were assigned to each claim based on the ICD-9-CM diagnosis code for the most severe diagnosis. Occupational Injury and Illness Classification System (OIICS) codes were also utilized to further determine the exposure of the injury claims.

Results: A total of 4,853 WC claims were identified among Ambulance Service workers from 2001-2010. The majority of claims were medical-only claims (81.9%) found among those workers aged 25-44 years (63.7%) working at employers with 50-249 employees (57.9%). The risk class for 78.5% of all claims was, "7370: Employee and Drivers," based on the National Council on Compensation Insurance (NCCI) manual class industry code. The overall claim rate was 11.36 per 100 FTE among Ambulance Service workers. MSDs were the leading cause of injury among ambulance workers (49.0%) with a claim rate 5.6 per 100 FTE, followed by OTH (3.7 per 100 FTE), and STF (2.1 per 100 FTE).

Conclusions: Results of this study serve as a basis for further studies and can inform the development of targeted intervention strategies to reduce injury claims by focusing on the leading causes relevant to ambulance workers.

Session F4.0

Title: Safety Climate and Culture: A Brief Tutorial and Review of the Current State of Research, with an Emphasis on the Inter-Relationships with Safety Management Systems

Moderators: Ted Scharf and Jennifer Taylor

Authors: NIOSH Safety Climate/Culture Working Group, Scott Schneider, Jennifer A. Taylor

Presenters: <u>Ted Scharf</u>, <u>Thomas Cunningham</u>, <u>Oliver</u> <u>Wirth</u>, <u>Cammie Chaumont Menéndez</u>, <u>Murrey Loflin</u>, <u>Stephanie Pratt</u>, <u>Scott Schneider</u>, <u>Elizabeth Garza</u>

The terms "safety climate" and "safety culture" have received – and continue to receive – increasing attention in the literature addressing safe work processes and safety management. Assessments of safety climate have been shown to be reliable and valid *leading indicators* of safety at work (both positive and negative, e.g., Zohar, 2010).

One real-world problem is that failures in "safety culture" (most often) and "safety climate" (sometimes) are blamed for major catastrophes in firefighting, oil drilling and exploration, transportation, nuclear power, and even in bio-safety at CDC (e.g., Frieden, 2014; Guldenmund, 2000, and 2010; NIOSH, 2013). This short tutorial will review the inter-related concepts of safety culture and safety climate in relation to safety management systems, socio-technical systems, and the overall organization of work in hazardous work environments. We will provide a very brief introduction to safety climate and culture definitions, research status, and challenges. We will also connect safety climate and culture to safety management. Perhaps most important, we will focus on examples of safety culture in the fire service and in construction with suggestions for tools to improve both safety culture and safety management. Following this working group's charge, we will summarize:

1) competing definitions of safety climate and culture, including the similarities linking these two terms: although there are conceptual and empirical differences between "culture" and "climate," one of the principal differences is that term "climate" is used primarily by researchers, while "culture is used by workers, supervisors, top-level managers, and by safety professionals, i.e. just about everyone else;

2) current status of research connecting safety climate to safe work practices: safety climate has been clearly established as a leading indicator of safety and safe work practices in hazardous work environments;

3) current challenges and key questions in safety climate research: while generic measures of safety climate have been validated, the issue of industry specific measures and the proper context for safety climate measurement are just two of the many challenges facing researchers;

4) safety culture within the fire service, a case study example from DSR: theoretical discussions of safety culture do not always translate easily or directly onto the fireground. This presentation will provide examples from firefighter fatality investigations to keep the more theoretical discussions of safety climate and culture grounded in the real world, and to provide an example of a successful model of safety management: the Incident Command System;

5) a brief introduction to safety management systems: professionals distinguish between process and worker safety management; this presentation will suggest that from the perspective of the worker in the hazardous environment with respect to safety climate, such distinctions are unimportant. All elements of safety and safe work practices must function well, and together must contribute to the work group's perception of safety climate;

6) competing models linking safety climate to safety management (and socio-technical) systems – placing safety climate into its proper context: a coherent and consistent model will connect safety climate to work group and organizational-level productivity and safety management systems;

7) current guides and checklists to help improve safe work practices and safety climate in hazardous industries: results from the CWPR-NIOSH workshop on safety culture and climate in construction, along with contributions from four focused workgroups regarding:
1) worker participation, 2) integration of safety, 3) supervisor training, and 4) incident investigation.

Session G1.0 Title: Industry and Occupation –Strategies and Impact

Moderator: Lisa Steiner

G1.1

Title: Analyzing occupational injuries to develop a mining research strategy Authors: <u>Jeffrey Welsh</u>, Linda McWilliams

Objective: The mining process involves large, powerful equipment to extract and transport the mined ore. Often the work is in confined spaces, and in close proximity to mobile equipment. The work environment is continually changing as the ore is removed, and the roof needs supported underground to prevent it from collapsing. Work areas may have trip hazards and slippery surfaces. In addition, many tasks involve manual labor. Although the numbers of injuries and fatalities in mining have declined over the years, they are still at unacceptable levels. For the period 2003 - 2012 there were 536 fatal injuries in mining, and 70,756 nonfatal, lost-time injuries. The objective is to reduce injuries in mining through a focused research program.

Methods: The National Institute for Occupational Safety and Health (NIOSH) uses the Mine Safety and Health Administration (MSHA) *Employment and Accident, Illness and Injury Database* to help determine where to invest research dollars to make the greatest impact on reducing occupational injuries and illnesses in mining. Data fields in the MSHA database for each incident resulting in an injury include: Accident Classification, Mine Worker Activity, Nature of Injury, Source of Injury, Total Mining Experience, Experience in this Job, Degree of Injury, Mine Size, and Age, among others. Narratives provide additional information about each incident. Numbers and rates of injuries are determined.

Results: As an example, for nonfatal lost-time injuries in underground mining (2008-2012), handling material (30.4%), slip or fall of person (19%), fall of ground (14.8%), machinery (11.4%), and powered haulage (11.2%) are the major accident classifications, or the circumstances which contributed most directly to the incident. For nonfatal lost-time injuries in surface mining (2008-2012), handling material (34.4%), slip or fall of person (29.3%), and hand tools (10%) are the major accident classifications. This data is analyzed in more detail to help determine how workers are being injured. From this information, along with stakeholder input, strategic goals and research priorities are established.

Conclusion: This presentation will provide an analysis of injuries in mining, and provide an overview of how the NIOSH mining research program is targeting the most urgent occupational safety needs.

G1.2

Title: Reducing the number of injuries and fatalities among workers in the Manufacturing Sector: A priority goal in the National Occupational Research Agenda

Authors: Thais Morata, Gregory Lotz, Alberto Garcia

In 2012, over 14 million U.S. workers were employed in manufacturing. That year, 327 manufacturing sector workers died from work-related injuries (http://www.bls.gov/iif/oshwc/cfoi/cftb0268.pdf). The leading causes of death were contact with objects and equipment, transportation incidents, and falls. The U.S. Bureau of Labor Statistics (BLS) reported 502,800 recordable injury or illness cases in manufacturing industries in 2012 with more than half of these requiring days away from work, job transfer or restriction (http://www.bls.gov/news.release/archives/osh 11072013.pdf). The leading causes of days-away-

from-work cases (<u>http://www.bls.gov/iif/oshwc/osh/</u> <u>case/ostb3596.pdf</u>) were contact with objects or equipment (46,640); overexertion and repetitive motion (46,040); and falls (22,040). There were fourteen industries that reported more than 75,000 nonfatal occupational injuries and illnesses to BLS in 2012; three of these were in the manufacturing sector: transportation equipment manufacturing (75,300), fabricated metal product manufacturing (79,000), and food manufacturing (77,800) (<u>http://www.bls.gov/news.release/archives/</u> <u>osh_11072013.pdf</u>).

During 2005 and 2006, the National Institute for Occupational Safety and Health (NIOSH) and partners held 13 Town Hall Meetings seeking public input on the future of occupational safety and health research. Over 1000 stakeholders (workers, employers, organized labor, professional associations, and academics) attended the meetings and provided input regarding research needs. Following this consultation, the NIOSH Program Portfolio was re-organized into 8 National Occupational Research Agenda (NORA) Sector Programs representing industrial sectors, and 24 cross-sector programs organized around adverse health outcomes, statutory programs and global efforts (http://www.cdc.gov/niosh/ programs/). One of these cross-sectors focusses on the prevention of traumatic injury, and it intersects with some of the goals identified as high priority for the industry sectors, such as manufacturing. These programs have guided the funding of high quality research, and several projects have benefitted from the national partnerships developed through Cross-Sectors and Sector Councils. Beyond research, the Councils aim to contribute to the transfer and translation of research findings, technologies, and information into highly effective strategies, practices and products that assist in the prevention of injuries and illnesses of workers. This presentation will conclude with descriptions of some of the contributions specific to reducing the number of fatalities and injuries among workers in the Manufacturing Sector.

G1.3

Title: The NIOSH Fire Fighter Fatality Investigation and Prevention Program's influence on standards development

Authors: Murrey Loflin, Matt Bowyer, Steve Miles

Introduction: The fire service utilizes National Fire Protection Association (NFPA) standards for training and qualifications, safety and health, apparatus design, use of personal protective equipment (PPE) and respiratory protection, communications, and incident management in their daily operations. In the event of a fire fighter fatality, investigation outcomes can identify the need to make changes to the affected fire service standards. This presentation will illustrate the impact of NIOSH fire fighter fatality investigations on the development of new NFPA standards and the revisions to current NFPA standards.

Methods: The NIOSH Fire Fighter Fatality Investigation and Prevention Program (FFFIPP) investigates fire fighter line of duty deaths (LODD) to identify contributory factors and formulate prevention strategies. During the investigation of a LODD, NIOSH investigators document and evaluate all activities and circumstances associated with the fatality. NIOSH investigators are participating members of NFPA technical committees that set standards for: Electronic Safety Equipment, Respiratory Protection Equipment, and Fire Service Occupational Safety and Health. Thus, investigation findings are provided directly to a particular NFPA technical committee through NIOSH staff participation. This enables a technical committee to generate language for a new standard or develop revisions for a current standard. NIOSH FFFIPP provides data and information addressing emerging or previously unrecognized risks associated with firefighting operations.

Results: Over the past 10 years, NIOSH has used research data plus evaluation and testing to influence the improved design and operation of portable radios, personal alert safety systems (PASS), and self-contained breathing apparatus. Additionally, based upon recommendations from investigation reports, NIOSH investigators have proposed revisions to standards related to fire fighter occupational safety and health, training, incident management, and command safety. The information provided through NIOSH participation in standards development has resulted in the adoption of enhanced NFPA standards for fire fighter safety and health.

Conclusions: The NIOSH Fire Fighter Fatality Investigation and Prevention Program maintains a working relationship with the NFPA standards development process. The results from FFFIPP investigations continue to be used to develop standards addressing risks for fire fighters. With the final adoption of these standards, fire fighter safety and health continues to improve.

G1.4

Title: Occupational hazards to ambulance providers in turbulent settings in low and middle-income countries

Authors: <u>Rabia Karani</u>, Aruna Chandran, Kiran Ejaz, Helen Zhao, Rohini Siva, Junaid Razzak, Adnan Hyder

Objectives: Ambulance providers in low and middleincome countries face many of the same physical and psychological stresses as providers in developed countries. However, these providers also face additional hazards that come from operating in turbulent settings. This study reviews the hazards faced by providers working in turbulent settings in low and middle-income countries, and also highlights specific dangers faced by providers in Karachi, Pakistan.

Methods: The first portion of this study was a systematic literature review of studies that reported hazards to ambulance providers operating in turbulent settings in low and middle-income countries. The initial search yielded 16643 studies, of which 60 studies described relevant data. The second portion of this study involved conducting in-depth interviews with 30 ambulance providers in Karachi, Pakistan. These providers were selected by convenience sampling and represented providers from one of two non-profit ambulance services, or from the emergency department at Aga Khan Hospital.

Results: Our review of the literature divulged five main categories of hazards. Threats to ambulance providers from attacks on ambulances or providers were a key cause of death and injury. Exposures to biological hazards, radiation, and accidents were also a significant contributor to morbidity for these providers. Psychiatric consequences such as PTSD and chronically high levels of stress were seen in many providers. Misuse of ambulances, often to provide non-medical transport, or by rerouting of ambulances from hospitals led to significant loss of time for providers. Finally, work related conditions such as involvement of lavpeople in an accident, low pay, poor roads, and an unbalanced lifestyle further contributed to the struggles faced by ambulance providers. These dangers were all present for ambulance providers in Karachi as well. However, a hazard unique to ambulance providers in Karachi was their duty to transport mentally ill people to asylums, without any medical assistance or support.

Conclusions: The results of our study are important for demonstrating the hazards to providers who are often the first line of care for patients. Our findings demonstrate a need for protection of ambulance providers in low and middle-income countries, both by pre-hospital care systems and local and international governments.

Session G2.0

Title: Linking Safety Culture and Performance Moderator: Jennifer Taylor

G2.1

Title: Correlation between safety climate and worksite inspection data on commercial construction sites Authors: <u>Michael Grant</u>, Emily Sparer, Jack Dennerlein

Objectives: The composition of the construction workforce on a given worksite is constantly changing depending on the phase of construction as well as the needs of individual subcontractors. Typically, these worksites rely on individual workers to provide and maintain safe working conditions while they are on site. Safety climate has been linked to safety performance and a positive safety climate has been shown to reduce workers' unsafe behaviors on construction sites. Safety climate may be reflected by worksite inspections of safety performance but it is unknown whether they are correlated. Our main objective is to understand how safety performance scores, correlate with worker selfreported safety climate measurements.

Methods: We used data from seven construction sites in the Boston area that were recruited for a separate safety communication-reward study. Monthly safety climate data was captured from workers via surveys. Approximately once per week, a trained safety inspector from the general contracting company or the site owner conducted a comprehensive site safety inspection. During the inspection, the inspector classified each observation and denoted them as "safe" or "unsafe", characterized based on a severity-likelihood risk matrix. We can calculate a weighted monthly safety score (a ratio of the number of safes to the total number of observations) using inspection data for each site that accounts for the severity of the unsafe observation and the category of the safe observation.

Results: Crude analyses show that safety climate shows a significant correlation with safety performance score (correlation coefficient of 0.4723, p=0.011). Among all sites, the mean safety performance score was 94.45, ranging from 67.78 to 99.9. The mean safety climate score was 72.78, with a range of 68.06 to 79.34. We plan to further investigate the influence of site specific and temporal factors on this relationship.

Conclusions: The results indicate that higher safety climate scores are associated with higher safety performance scores. This relationship could help address the burden on organizations implementing workplace interventions, reducing the need for extensive surveying and using inspections that occur regularly on construction sites. This research demonstrates a basic application of inspections for evaluating workplace interventions related to safety climate and injury prevention.

G2.2

Title: An SEM approach examining the pathways between safety climate, behavior performance and workplace outcomes

Authors: <u>David Swedler</u>, Santosh Verma, Yeung-Hsiang Huang, David Lombardi, Wen-Ruey Chang, Melayne Brennan, Theodore Courtney

Objectives: Safety climate has previously been associated with increasing safe workplace behaviors and decreasing occupational injuries. This study seeks to understand the structural relationship between employees' perceptions of safety climate, performing a safety behavior (i.e., wearing slip-resistant shoes), and risk of slipping in the setting of limited-service restaurants.

Methods: At baseline, we surveyed 349 employees at 30 restaurants for their perceptions of their safety training and management commitment to safety as well as demographic data. Safety performance was identified as wearing slip-resistant shoes, as measured by direct observation by the study team. We then prospectively collected participants' hours worked and number of slips weekly for the next 12 weeks. Using a confirmatory factor analysis, we modelled safety climate as a higher-order factor composed of previously identified training and management commitment factors.

Results: In a structural equation model, safety climate indirectly affected prospective risk of slipping through safety performance, but no direct relationship between safety climate and slips was evident.

Conclusions: Results suggest that safety climate can reduce workplace slips through performance of a safety behavior and suggests a potential causal mechanism through which safety climate can reduce workplace injuries.

G2.3

Title: Improving safety climate through a safety recognition and communication program: A mixed methods study

Authors: <u>Emily H Sparer</u>, Paul J Catalano, Robert F Herrick, Jack T Dennerlein

Objectives: To evaluate the effectiveness of a safety communication and recognition program (B-SAFE) on safety climate and communication on commercial construction sites in Boston.

Methods: A matched pair cluster randomized controlled trial was conducted on 8 worksites (4 received the B-SAFE intervention, 4 served as control sites) for approximately five months per site. Pre- and post-exposure worker surveys were collected at all sites and assessed safety climate and communication (n=615, pre-exposure response rate=74%, post-exposure response rate=88%). Focus groups (n=6-8 workers/site) were conducted following data collection. Transcripts were coded and analyzed for thematic content using Atlas.ti (V6). Multi-level mixed effect regression models evaluated the effect of B-SAFE on safety climate and communication.

Results: The qualitative data indicated that at intervention sites, workers noted increased levels of safety awareness, communication, and teamwork, when compared to control sites. The mean safety climate score at intervention sites increased by 1.3 points between preand post-B-SAFE exposure, compared to control sites that decreased by 0.2 points (scale ranged from 0-90). When adjusting for time variables including the project month the worker started on-site and total length of time on-site, as well as worker characteristics (worker trade, title, and race/ethnicity), the intervention effect size was 2.22 (p-value=0.015). Safety communication scores improved similarly at both intervention and control sites and the effect size was non-significant in the adjusted mixed effects model.

Conclusions: B-SAFE led to many positive changes, including an increase in safety climate, awareness, teambuilding, and communication. All sites had relatively strong systems of safety prior to program implementation, which was reflected in the small effect size. The observed effect size was comparable to previous studies on safety climate changes and relation to injury severity. B-SAFE was a low-cost intervention that demonstrated that a program that engaged all workers through strong communication infrastructures improved worksite health and safety.

G2.4

Title: Development and validation of a new short tool for assessing organizational occupational health and safety performance

Authors: <u>Benjamin Amick III</u>, Lynda Robson, Basak Yanar, Michael Swift, Selahadin Ibrahim

Background: Many jurisdictions and organizations are looking for short, easy-to-use tools for assessing leading indicators of occupational health and safety performance. We report the results of a project to validate a short 8-item tool developed by safety professionals in Ontario in collaboration with the Institute for Work and Health. The tool was intended to assess an organization's safety culture.

Methods: The structural validity of the measure was examined using confirmatory factor analysis fit indices. The construct validity was examined through development of case studies at 5 companies and comparing the item and scale scores with actual observational and interview data on occupational health and safety performance. The five companies were selected based on their OPM score with three being high and two being medium low. Predictive validity of the measure was examined by linking 2009 OPM score data for 529 firms to Workplace Safety and Insurance Board workers compensation claims data to see if it predicted future claims.

Results: The eight-item tool has a strong structural validity with the single dimension 8-item factor structure the best-fit model across a range of fit indices. The construct validity is reasonable. Organizations that score high on the scale also have the best occupational health and safety practices compared to those that do not score

high. Finally, the tool predicts future claims rates in a multivariable negative binomial model after adjusting for sector, firm size, firm location and 6 years of historical claims information about the firm. Models suggest that the lost-time claims can be reduced by 25% by moving a firm from the lowest to the highest scale score.

Conclusion: This research presents new data on the validity of a short easy-to-use tool. It appears to have reasonable validity. Currently, it is being used in 6 Canadian provinces and at least 2 other countries to provide basic data for managing leading indicators.

Session G3.0 Title: Technology Transfer Moderator: John Powers

G3.1

Title: Formative evaluation of a mobile application for conducting fishing vessel safety drills

Authors: Leigh McCue, <u>Maria Bulzacchelli</u>, Jerry Dzugan

Background: Working in harsh, remote environments on a pitching and rolling deck, with heavy equipment makes commercial fishing one of the most dangerous jobs in the United States. When incidents occur, having a crew properly trained in how to respond can save lives. The tremendous value of safety training has been discussed at length and has been recognized by regulatory agencies. The United States Coast Guard requires each fishing vessel operating outside the boundary line to carry an appropriately trained drill conductor and to conduct monthly safety drills. Each crew member must be trained in abandoning the vessel, firefighting, recovering a man overboard, handling flooding, donning survival gear and launching survival craft, making distress calls, activating the general alarm, and reporting inoperative alarms.

Objectives: The purpose of this project is to conduct a formative evaluation of FVdrills, a mobile application (app) for conducting fishing vessel safety drills, and to incorporate feedback into a revised version of the app. FVdrills is modeled upon previously published commercial fishing safety guidelines, and is designed to facilitate conducting drills, logging drill completion, and communicating safety-related needs.

Methods: The FVdrills app is being tested in a convenience sample of commercial fishermen in the Northeastern United States. After a hands-on demonstration of the FVdrills app, feedback is collected via self-administered questionnaire. In addition to demographic data and user characteristics (e.g., fishery type), participants provide their assessment of the perceived benefit and user-friendliness of the app on a 5point Likert-type scale. General feedback, including any other potential commercial or non-commercial maritime uses for the app, is collected via open-ended questions.

Results: The revised FVdrills app will be presented. Key features of the app and its enhanced functionality will be described. Participant characteristics and feedback will be summarized.

Conclusion: The revised FVdrills app will incorporate feedback from commercial fishermen and will be ready for evaluation in the field. If a mobile app that facilitates conducting safety drills results in drills being conducted more regularly, then FVdrills can potentially improve the likelihood of survival when incidents occur on commercial fishing vessels.

G3.2

Title: Evaluation of NIOSH Workplace Violence Prevention for Nurses online course Authors: <u>Maria Brann</u>, Dan Hartley

Objectives: The primary objective was to evaluate the effectiveness of the NIOSH Workplace Violence Prevention for Nurses online course in raising awareness and increasing knowledge about workplace violence among a study population of nursing students. The secondary objective was to identify suggestions for improving the course.

Methods: A mixed-methods approach was used. The quantitative part of the study had a 79% (n=48) participation rate and employed a pre/post/post-test survey design to assess awareness and knowledge. Focus group discussions were then used to further evaluate participant Health. The tool was intended to assess an organization's safety culture.

The structural validity of the measure was examined using confirmatory factor analysis fit indices. The construct validity was examined through development of case studies at 5 companies and comparing the item and scale scores with actual observational and interview data on occupational health and safety performance. The five companies were selected based on their OPM score with three being high and two being medium low. Predictive validity of the measure was examined by linking 2009 OPM score data for 529 firms to Workplace Safety and Insurance Board workers compensation claims data to see if it predicted future claims.

Results: The eight-item tool has a strong structural validity with the single dimension 8-item factor structure the best-fit model across a range of fit indices. The construct validity is reasonable. Organizations that score high on the scale also have the best occupational health and safety practices compared to those that do not score high. Finally, the tool predicts future claims rates in a multivariable negative binomial model after adjusting for

sector, firm size, firm location and 6 years of historical claims information about the firm. Models suggest that the lost-time claims can be reduced by 25% by moving a firm from the lowest to the highest scale score.

Conclusion: This research presents new data on the validity of a short easy-to-use tool. It appears to have reasonable validity. Currently, it is being used in 6 Canadian provinces and at least 2 other countries to provide basic data for managing leading indicators.

G3.3

Title: Ladder Safety - development of the first NIOSH smartphone app

Authors: Peter Simeonov, Hongwei Hsiao, John Powers

The NIOSH Ladder Safety app was developed as part of a large National Occupational Research Agenda project on extension ladder safety. The app features an innovative multimodal indicator, which uses visual, sound, and vibration signals to assist the user in positioning an extension ladder at an optimal angle. The app also provides graphic-oriented, interactive reference materials, safety guidelines and checklists for extension ladder selection, inspection, safe use, and accessories.

The patented multimodal indicator concept used in the app was first tested in the NIOSH laboratories with 40 participants. The tests included a comprehensive comparative evaluation of five ladder positioning methods and devices, using four extension ladder conditions. The multimodal indicator prototype was shown to be both effective and efficient - it improved the accuracy of ladder set-up angle and required less time to set up as compared to other methods. The graphicoriented ladder safety guide in the app was largely based on the existing US ladder safety standards and regulations, and was developed with input from the ANSI A14 committee on Ladder Safety, the American Ladder Institute, and other stakeholders. The final development and release of the app was accomplished in collaboration with a NIOSH contractor.

The Ladder Safety app was released in June 2013, and is available in English and Spanish as a free download for Apple and Android devices. Postings through webpages, email, social media, and partnering agencies were used for broad dissemination of the app. Since its release, the Ladder Safety app has been downloaded more than 28,900 times, and has received excellent reviews and high ratings from ladder users and safety professionals. Focus group interviews with ladder users and safety professionals were used to get feedback for app further enhancement. Current development efforts are directed to improve the app content and functionality and add a section on step ladders safety. The NIOSH Ladder Safety app was received with great enthusiasm by safety professionals and ladder users, and has proved to be a great vehicle for delivering safety related interactive tools and information directly into the hands of various occupational audiences.

G3.4

Title: **Protecting fishermen from hazards on deck: Winch entanglements - research to practice** Authors: <u>Jennifer Lincoln</u>, Chelsea Woodward, Devin Lucas, Grant King, Theodore Teske

Objective: The objective of this study is to use epidemiological research to guide the design and implementation of effective solutions to protect deckhands from entanglement hazards.

Background: In 2012, a 15-year-old deckhand on a shrimp trawler in the Gulf of Mexico lost his life after getting entangled in a winch. NIOSH reviewed data from the Commercial Fishing Incident Database as well as US Coast Guard investigative reports to understand the risk factors associated with winch entanglements in this fishing fleet. During 2000-2011, 35 injuries (8 fatal) involving winches were reported in the shrimp fleet. Injuries involving the main winch drums had a higher risk for fatal outcomes compared to injuries involving the winch cathead (RR=7.5; 1.1-53.7). Fatal outcomes were also associated with being alone on the vessel (RR=5.8; 2.1-15.9).

Methods: NIOSH conducted a site visit to better understand the current design and use of deck winches on shrimp trawlers. Each trawler has main winch drums and smaller try-net winch drums. Each type of winch drum also has a rotating cathead. Several hazardous areas and activities were identified. Based on the characteristics of the injuries, site visit observations and input from vessel owners, NIOSH determined that the use of effective winch drum guarding would reduce the risk for entanglement. The initial focus is on the main winch drums since they are highly associated with fatalities. Surveys identified the most common types of main winches.

Results: Three prototype designs for standardized stationary guarding have been installed on vessels and are being tested at sea. The data collected during sea trials will be used to improve the prototypes. The plans for each guarding system, including materials and estimated build costs, will be widely disseminated and provided to industry and workers free of charge. The next phase of this project will focus on incentives for installation.

Conclusions: This approach has proven effective in providing tools to prevent other types of winch injuries. By using injury epidemiology to identify hazards along with practical industry input, effective safety
interventions to control hazards can be designed and implemented.

Session G4.0

Title: Injury Surveillance – Reporting Requirements Moderator: Hilery Simpson

G4.1

Title: **OSHA's new rule on reporting severe injuries:** What to expect

Authors: <u>Kenneth Rosenman</u>, Mary Jo Reilly, Thomas Largo

Objectives: To review the experience in Michigan on identifying and investigating injuries covered by OSHA'S new reporting requirement for employers.

Methods: Since 2006, State Health Department regulations required all 136 hospitals/emergency departments in Michigan to report injuries. Since 2006, Michigan has conducted multi-source tracking of all work-related amputations and since 1/1/2014 all hospitalized work-related injuries where workers' compensation was the payer. Reports received included personal identifiers of the patient and the company where the injury occurred. The patient was contacted if the name and location of the company in the medical record was not adequate for making a referral to Michigan OSHA for an enforcement investigation.

Results: There were 3,901 non self-employed workrelated amputations identified in Michigan from 2006-2012 (Bureau of Labor Statistics (BLS)) estimated 1,770 amputations during this same seven year period). The top three industries were manufacturing (45%), construction (12%) and food services (8%). Citations were issued for 160 of 172 (93%) of the inspections (range 7-44). Eighty eight percent of the citations were for hazards directly related to the amputation and 61% of the hazards had not been corrected prior to the inspection.

There were 309 non self-employed, non-motor vehicle collision work-related acute injuries with hospitalizations in the first six months of 2014. The top industry categories were Construction (23%), Manufacturing (16%), Administrative, Support and Waste Management and Remediation (9%) and Retail Trade (9%). The major cause was a fall (194, 55%). There were no injuries for the loss of an eye. To date, 23 inspections have been referred to Michigan OSHA and one inspection has been performed, leading to five citations.

Conclusion: The new OSHA reporting rule will provide company specific reports and identify a larger number of injuries than estimated in the BLS employer survey. A strategy to deal with the large number of reports will need to be developed. Selective follow-up OSHA enforcement inspections were very useful identifying ongoing safety problems. The outcome of such inspections may change if employers know that an injury is likely to lead to an OSHA inspection. Ways to use the information to develop educational campaigns will be suggested.

G4.2

Title: Direct reporting of hospitalizations to Cal-OSHA: Implications for federal OSHA's new rule Authors: John Mendeloff, Seth Seabury

Objectives: Recently, federal OSHA proposed a rule requiring employers to report most hospitalizations to the agency with 8 hours. This expands a reporting requirement that had been limited to fatalities and events where 3 or more workers were hospitalized. California has required this broader scope of reporting for many years. Cal-OSHA is also required by statute to investigate all of these accidents except those due to violence or highway motor vehicle crashes. Therefore, its experience may be useful in predicting problems that federal OSHA will face, especially with respect to underreporting.

Methods: Although we looked at other sources on the total number of hospitalizations in California, our chief test was to compare (using the OSHA Integrated Management Information System, IMIS) the number of fatality cases investigated in a county to the number of hospitalization cases investigated. Although this does not provide a direct estimate of the magnitude of possible underreporting, it does provide some sense of the magnitude. We carried out this analysis for deaths in the construction sector both because the number of cases is large there and to provide more comparable cases across counties.

Results: Extrapolation from NEISS suggests that about twice as many in-scope hospitalization cases should have been reported to Cal-OSHA and investigated as actually were (4,000 vs. 2,000). The county accident investigation figures ranged from ten hospitalization cases for each fatal case in San Francisco to three fatal cases for each hospitalization case in Kings County, a 30fold difference. The pattern was for fewer hospitalization cases relative to fatalities in Southern California and in rural areas. Because the San Francisco figure is closer to what most experts believe is the truth, the implication is that a great deal of underreporting of hospitalizations occurs, at least in construction.

Conclusions: Although some of the differences in the ratios we find undoubtedly have other causes, differences of 20- to 30-fold seem to support the conclusion that wide variations in the reporting of hospitalization cases exist, even in a state that has required that practice for many years. Federal OSHA should probably expect similar problems.

G4.3

Title: Incident (injury) surveillance among youth/young workers in New Jersey secondary schools: Initial efficacy of a law-based online system versus former paper forms Authors: Thomas Cordon, <u>Derek Shendell</u>

Introduction: New Jersey Department of Education (NJDOE) requires by law for accidents/incidents (injury or illness) involving career-technical-vocational education (CTE) students, and/or staff to be reported to the Commissioner of Education within five business days. These incidents get directly reported to New Jersey Safe Schools Program (NJSS) online surveillance system (via Psychdata) for aggregate analyses.

Methods: Twenty three data fields were used to compare completion percentage between old (2010-2012) and new (2013-2014) reporting forms. These were: 1) District Name, 2) School Name, 3) Sex, 4) Type of Person Injured, 5) School Property, 6) Where incident took place, 7) Where was injured Person Sent To, 8) Grade, 9) Age, 10) Actual hours in school on day of injury, 11) Hours at work on day of injury, 12) Which Career Cluster, 13) Type of Co-op / Structured Learning Experience, 14) Did incident involve a student with an Individual Education Program, 15) Body Injury Location Marked, 16) Nature of Injury Marked, 17) Severity of Injury, 18) Was personal protective equipment worn at time of the incident?, 19) What type of protective equipment was used, 20) Date of Accident, 21) Hour of Accident, 22) Description of incident, and 23) Corrective Action Described.

Results: For the years 2010-2012, there was an average of 15% missing data, providing an 85% completion percentage for submitted reports (n=112). Between the years 2013-2014, there was approximately 6.9% of missing (incomplete) data fields (n=158), indicating a 93.1% completion percentage. Comparing 2010-2012 and 2013-2014, reporting completion increased 8.1%. The highest three increased percentages were: 1) Data field "Actual hours in school on day of injury"--completion percentage increased by 35%; 2) Data field "Career Cluster"--completion percentage increased by 27.2%; and, 3) Data field "Did incident involve a student with an Individual Education Program"--completion increased by 27.2%. The lowest decrease was for the data field "Hour of accident," where completion percentage decreased by 4.4%.

Conclusions/Recommendations: The NJSS/NJDOE state law-based online incident (injury/illness) reporting surveillance system for youth/young workers in approved CTE programs is an improvement over the paper-based system and will continue to lead to improved reporting completeness, accuracy and precision.

G4.4 Title: The case for expanding the scope of OSHA complaint inspections

Authors: John Mendeloff, Wayne Gray, Misha Dworsky

Objectives: This paper explains why it would be desirable to selectively expand the scope of OSHA complaint inspections-from a "limited" scope that focuses on the subject of the complaint to a "comprehensive" scope that explores all major hazards at a workplace. Currently, 95% of federal OSHA complaint inspections are "limited" in scope.

Methods: We examine the difference in the number of serious violations cited in limited complaint inspections versus the number cited in comprehensive programmed inspections for manufacturing establishments, controlling for industry, establishment size, and the year of the inspection. We also compare the difference in the number of inspection hours for each inspection type, controlling for the same factors. We then estimate the number of additional serious violations cited per extra inspection hour from expanding the scope of complaint inspections in different categories of establishments.

We also compare the injury rates at workplaces that receive complaint inspections with the rates at workplaces getting programmed inspections.

Results: The analysis of extra serious violations cited per added inspection hour from expanding the scope of complaint inspections indicates that the figure is higher than the average number for programmed inspections, especially for safety inspections at establishments with 50-99 employees.

We also find that the lost workday injury rates at establishments getting complaint inspections are higher, on average, than the rates at establishments getting programmed inspections, despite the fact that the latter are targeted.

Other analyses that we cite indicate that first-time inspections at an establishment tend to cite many more serious violations than subsequent inspections do and that complaint inspections cite more serious violations at establishments whose higher injury rates are much higher than the average rate for the industry.

Conclusion: It seems likely that OSHA could cite more serious violations if it selectively expanded the scope of complaint inspections, especially in the category of establishments noted above. Other guidelines are to expand the scope of complaint inspections at workplaces that have not been inspected before, or not for a long time, and at those that have injury rates well above the average rate for their industry.

DAY 3 - THURSDAY, MAY 21, 2015

Session H1.0

Title: **Safety Management and Injury Prevention** Moderator: Oliver Wirth

H1.1

Title: **Prevention of traumatic occupational injuries: Evidence for effective good practices in foundries** Authors: <u>Stefano Porru</u>, Stefano Calza, Cecilia Arici

Background: The problem of occupational injuries (OI) is still very relevant, with significant impacts on workers, companies and society. However, intervention studies with effectiveness evaluation of OI prevention programs are seldom performed.

Objectives: To present the results of a pragmatic field study with effectiveness evaluation of a multifaceted intervention to prevent traumatic OI, with an interrupted time series (ITS) design.

Methods: The study was carried out during 2008-2010 in 33 Italian foundries (23 ferrous=A; 10 non-ferrous=B; 3306 male blue collars/year). The research followed a preliminary analysis showing high OI rates. Each foundry was invited to establish a multidisciplinary prevention team for risk assessment, monitoring and discussion of OI, with involvement of employers, occupational physicians, health and safety personnel, workers' representatives, supervisors. Overall targets of intervention were: workers, equipment, organization, workplace and job tasks. The outcomes were reduction in standardized OI rates (incidence=OI/workersx10², frequency=OI/working hoursx10⁵, severity=workdays lost-WDL/working hoursx10³) and in specific OI types and body sites.

Results: 4368 traumatic (e.g. burns, wounds, dislocations, strains, sprains, fractures, eye injuries) OI and 80157 WDL were formally registered in 2003-2010. The most frequent modes of injury were 'struck by', 'contact with', 'trapped and crashed' with main material agents 'materials, objects, products, machine components, debris, dust'. ITS analysis displayed sustained decreasing trends for all OI rates (incidence: -14% p<0.01 in A, -8% p=0.342 in B; frequency: -9% p=0.048 in A, -5% p=0.628 in B; severity: -13% p=0.102 in A, -12% p=0.194 in B); negative slope changes for incidence rates were significantly (p<0.001, p=0.002) greater than those of reference categories. Before-after analysis showed significant reduction in specific OI types (e.g. 'burns, scalds': -29% p=0.031 in A, -50% p=0.052 in B) and body sites (e.g. eye injuries: -34% p<0.01 in A, -59% p<0.01 in B). Sector-specific benchmarks for OI rates were also developed to promote the implementation of good practices.

Conclusions: The study indicates that a multifaceted pragmatic intervention leads to a reduction in the burden of traumatic OI in small-, medium- and large-sized enterprises in the foundry sector, with overall good external validity.

H1.2

Title: Occupational health and safety knowledge user perspectives on research use

Authors: <u>Dwayne Van Eerd</u>, Siobhan Cardoso, Ron Saunders, Trevor King, Sara Macdonald, Emma Irvin-Sinkins

Objectives: Knowledge transfer and exchange (KTE) is concerned with generating, disseminating and implementing the best available evidence. Integrated KTE approaches with knowledge user engagement are considered to have greater impact on research use. Research use or utilization is the use of research or evidence to guide practice. While this seems straightforward, the use of research in decision making requires skill, time and resources. The objective of the project was to examine the experiences and perspectives of Occupational Health and Safety (OHS) knowledge users regarding research use.

Methods: An online survey was sent to 690 OHS knowledge users in Ontario exploring aspects of research use. A subset of the survey respondents were invited to participate in either an interview (n=6) or focus groups (n=7) to explore aspects of research use in more detail. The survey, interviews, and focus groups covered aspects of acquiring research findings, assessing research findings, adapting the findings for use, and applying (using) research findings in decision-making.

Results: There were 236 responses to the survey (34% response rate) over three months. Preliminary results indicate that OHS knowledge users consider research use important however, organizational support for it varied based on leadership and resource availability. Many respondents report limited time to acquire and use research. A majority of respondents indicated they acquired and used research evidence in their work. Furthermore, respondents appreciated having research consolidated and easily accessible for it to be most useful in their job roles. Individual interviews and focus groups revealed credibility as a recurring theme related to acquiring and assessing research. Tailoring messages and audience context were themes related to adapting and applying research. Time and resources were consistently noted as barriers to research use.

Conclusions: OHS knowledge users in Ontario indicate that research use is important in their decision-making process. The majority of participants reported using research in their jobs. We will present complete survey results and the detailed analysis of focus groups and interviews describing the knowledge user perspectives on research use. We will explore the barriers and enablers of research use and how this may impact on KTE strategies.

H1.3

Title: **Duration of slip-resistant shoe usage and the rate of slipping in limited-service restaurant workers: Results from a prospective and crossover study** Authors: <u>Santosh Verma</u>, Zhe Zhao, Theodore Courtney, Wen-Ruey Chang, David Lombardi, Emily Huang, Melanye Brennan, Melissa Perry

Slip-resistant shoes (SRS) may have a positive effect on reducing the risk of slips and falls. Few studies, however, have examined how duration of shoe usage affects their slip-resistance properties. This study examined the association between the duration of SRS usage and the self-reported rate of slipping in limitedservice restaurant workers.

Four hundred and seventy five workers from 36 limitedservice restaurants were recruited to participate in a 12week prospective study of workplace slipping. At baseline, information on slip-resistant status of the shoes and duration of the shoe usage was collected. Participants reported their slip experience weekly for up to 12 weeks. Eighty three out of 475 participants reported changing to new shoes at least once during the 12 week follow-up.

The results show that use of SRS for 6 months or less was associated with a 58% reduction in the reported rate of slipping (RR = 0.42, 95% CI 0.28 to 0.64). Use of slipresistant shoes for more than 6 months was marginally associated (p = 0.06) with a reduction in the reported rate of slipping. Change of shoes among those wearing SRS was associated with 55% reduction in the rate of slipping (95% CI 11% to 77%).

The results suggest that duration of shoe usage has a significant effect on the slip-resistance property of the slip-resistant shoes. Employers' shoe policy should not only encourage workers to wear slip-resistant shoes but also include guidance on change to new shoes at the appropriate time or regular interval.

H1.4

Title: A socio-cognitive strategy to address farmers' tolerance of high risk work: Disrupting the effects of an apprenticeship of observation Authors: Joan Mazur, Susan Westneat

Objectives: Examine a persistent finding in a multi-year dataset. Why do we see generations of farmers who tolerate the high risk work of agriculture and resist safe farm practices?

Methods: This study presents an analysis inspired by empirical data from NIOSH funded studies conducted from 1993-2012 on the differing effects of farm safety interventions between participants who live and work on farms and those who don't, when both were learning to be farm safety advocates.

Results: Both groups show statistically significant gains in knowledge and on behavioral change proxy measures using GLM procedures. However, non-farm participants' gains consistently outstripped their live/work farm counterparts. Drawing on socio-cultural perspectives we propose a useful construct to understand the resistance of farmers to adopt safety measures and best practices—the role of long-time farmers' participation in *an apprenticeship of observation* and to address what has been obscured during this powerful socialization process.

Conclusions: Our findings have implications for farm safety intervention programs. An understanding of *apprenticeships of observation* can expose the sources of deeply anchored beliefs and how they operate insidiously to promote familiar, albeit unsafe farming practices. The challenge for intervention-prevention programs becomes how to disrupt what has been learned during these *apprenticeships of observation* and to address what has been obscured during this powerful socialization process.

How might this disruption occur? First, farm safety advocates and prevention researchers need to attend to demographics and explicitly explore the prior experiences and background of safety program participants. Second, farm youth, in particular need opportunities to explore, explicitly, their own apprenticeships of observations, preferably through the use of new social media and or digital forms of expression, for example through family interviews and digital documentaries (www.eoponline.org). Third, careful study of the organization of work and farm experiences and practices need to provide the foundations for intervention programs. Finally, it is crucial that farm safety programs understand that because apprenticeships of observation are generational and ongoing over time. Finally, it is crucial that farm safety programs understand apprenticeships of observation are generational and ongoing over time, and interventions prevention programs need to be 'in it' for the long haul.

Session H2.0

Title: **Surveillance – Motor Vehicles** Moderator: Rosa Rodriguez-Acosta

H2.1

Title: Work-related fatal motor vehicle crashes: Matching of 2010 data from the Census of Fatal Occupational Injuries and the Fatality Analysis Reporting System

Authors: <u>Christen Byler</u>, Laura Kesy, Scott Richardson, Stephanie Pratt, Rosa Rodriguez-Acosta

Background: Motor vehicle crashes (MVCs) remain the leading cause of work-related fatalities in the United States, with crashes on public roadways accounting for 25% of all work-related deaths in 2012. Characterization of fatal work-related MVCs is currently limited by data sources that lack either data on potential risk factors or work-relatedness confirmation and employment characteristics. In the United States, the Bureau of Labor Statistics (BLS) Census of Fatal Occupational Injuries (CFOI) provides accurate counts of fatal work injuries based on confirmation of work relationship from multiple sources, while the National Highway Traffic Safety Administration (NHTSA) Fatality Analysis Reporting System (FARS) provides detailed data on fatal motor vehicle crashes based on police reports.

Methods: Researchers from BLS, NHTSA, and the National Institute for Occupational Safety and Health (NIOSH) collaborated to analyze a merged data file created by BLS using CFOI and FARS data. A matching algorithm was created to link 2010 data from CFOI and FARS using date of death and other case characteristics, allowing for flexibility in variables to address coding discrepancies.

Results: Using the matching algorithm, 953 of the 1,044 CFOI "highway" cases (91%) for 2010 were successfully linked to FARS. Further analysis revealed systematic differences between cases identified as work-related by both systems and by CFOI alone. Among cases identified as work-related by CFOI alone, the fatally-injured worker was considerably more likely to have been employed outside the transportation and warehousing industry or transportation-related occupations, and to have been the occupant of a vehicle other than a heavy truck.

Conclusion: This study is the first step in a collaboration between BLS, NHTSA, and NIOSH to improve the completeness and quality of data on fatal work-related motor vehicle crashes. It has demonstrated the feasibility and value of matching data on fatal work-related crashes from CFOI and FARS. The results will lead to improvements in CFOI and FARS case capture, while also providing researchers with a better description of fatal work-related MVCs than would be available from the two data sources separately.

H2.2

Title: Fatalities in drug-involved truck crashes in the United States, 2000-2013

Authors: <u>David Swedler</u>, Molly Simmons, Santosh Verma, David Lombardi

Background: Like drunk driving, driving under the influence of drugs can increase the risk for motor vehicle crashes (MVCs). U.S. Code 49, section 31306 requires that commercial motor carriers "conduct preemployment, reasonable suspicion, random, and postaccident testing of operators of commercial motor vehicles for the use of a controlled substance." Additionally, prior to receiving a CDL, the Federal Motor Carrier Safety Administration (FMCSA) requires that truck drivers must be tested for drugs as part of a physical exam; however, drivers are not actively monitored for drug use between physical exams. This study will examine the frequency with which MVC fatalities in the U.S. involve a truck driver under the influence of legal or illegal drugs. With the release of the 2013 FARS data in December 2014, we will also provide an analysis of the impact on these rates of a 2012 change in the FMCSA drug testing regulation.

Methods: Using the Fatality Analysis Reporting System (FARS) database, we identified all MVCs from 2000-2012 that involved at least one fatality and a commercial truck involved in the crash who tested positive for any drug use. We analyzed fatalities to truck drivers as well as all vehicle occupants killed in these crashes. To calculate crash rates, historical data on vehicle miles traveled (VMT) were obtained from Department of Transportation databases. D conducted at the state*year, national*year, and national*month levels. Finally, national monthly mortality rates were analyzed for trend across the entire study period.

Results: Over the 13-year study period, 3,986 fatally truck drivers were fatally-injured in MVCs, and 13,258 total vehicle occupants (including truck drivers) were killed in crashes involving truck drivers. The national crash fatality rates were 0.105 per billion VMT for truck drivers and 0.349 per billion VMT for all vehicle occupants. Annual rates increased from 2003-2008 then decreased from 2008-2012. There was great variation between states and within some states across the study period.

Conclusions: We were able to describe fatality counts and rates for drug-involved truck crash fatalities for the entire U.S. and each state over 13 years.

H2.3

Title: Work-related road crashes of emergency vehicles in Québec

Authors: <u>Patrice Duguay</u>, François Bellavance, Sonia Pignatelli

Objectives: The study seeks to describe the main characteristics of emergency motor vehicle crashes (MVCs) in the province of Québec (Canada). The finality is to get useful information for prevention.

Methods: A single database of 2000-2008 work-related MVCs was created by linking an occupational injuries database from the Québec workers compensation board (CSST) with data about road crashes reported by police and extracted from the Société de l'assurance automobile du Québec (SAAQ) database. Nearly 8,600 work-related MVCs were studied using univariate and multivariate methods, including multiple correspondence and cluster analyses.

Results: We identified seven types of work-related MVCs (segments). One concerns mainly accidents of emergency vehicles. This segment includes nearly 10% of all compensated work-related MVCs. Injured workers, among others, are police officers (42%) and ambulance attendants or nurses (11%). Compared to all workrelated MVCs, crashes in this segment are more likely to occur at road intersections (50% against 17%), in urban areas where the speed limit is 60 km/h or less (85% against 36%), between 8 pm and midnight (22% against 7%) or between midnight and 4 am (17% against 5%), Saturday (19% against 6%) or Sunday (14% against 4%). It also differs from other segments by a high proportion of collisions due to non-respect of a stop or a traffic light (32% against 10%). The average age of victims is the lowest (33 years) of the seven segments due to a preponderance of 25-34 years (46%) and 16-24 years (17%). Women are slightly more represented (32%) than for all work-related MVCs. It is also the group where there is the highest proportion of worker victim of MVCs as passenger (39%). The proportion of injured workers not wearing seat belts is also quite high (20%).

Conclusions: Although MVCs of emergency vehicles are not the largest segment in number of victims, they seem to have several specific characteristics that could be used to identify topics for prevention; like crossroad accidents and weekend, evening and night accidents.

H2.4

Title: Injuries from motor vehicle crashes among electric power industry workers, 1995-2013 Authors: Tiffani Fordyce, Vitaly Volberg, Gabor Mezei, Ximena Vergara, Lovely Krishen (<u>Megan Leonhard</u> presenting)

Objectives: Electric utility service vehicles and the workers who operate them comprise a distinct subgroup that is significantly different from other vehicles and workers involved in work-related vehicle crashes. To identify injury prevention opportunities, this presentation describes injuries resulting from motor-vehicle crashes among workers in the electric power industry.

Methods: We calculated motor vehicle related injury rates using the Electric Power Research Institute's (EPRI) Occupational Health and Safety Database (OHSD), which contains information on recordable injuries, medical claims, and data from personnel files from 18 participating electric power companies from 1995-2013.

Results: Motor-vehicle crashes account for 3.4% of all injuries in the OHSD and 27.0% of fatal injuries. The overall rate of injuries sustained during motor-vehicle crashes is 10.78 per 10,000 employee-years. Between 1995 and 2009, there was a significant downward trend in the rate of injuries resulting from motor-vehicle crashes. Since then, the rate has fluctuated, but the differences are not statistically significant. 62.9% of motor-vehicle crash related injuries resulted in less than one lost workday and 24.6% of the injuries were severe enough to result in more than five lost workdays. The majority of injuries sustained in motor-vehicle crashes were sprains and strains (57.4%). The rate of motor-vehicle injuries was significantly higher among males than females (10.41 and 5.79 injuries per 10,000 employee-years, respectively). More than half of motor-vehicle accidents involved employees from four occupational groups: meter readers, line workers, technical/professional support, and mechanics. Meter readers, line workers and mechanics also have some of the highest injury rates for motorvehicle-related injuries (73.1, 22.2, and 18.1 per 10,000 employee-years respectively). In general, the rate of motor-vehicle-related injuries decreased with increasing age.

Conclusions: While the rate of motor-vehicle crashes among electric utility workers has not increased in recent years, injuries from vehicle crashes still account for a relatively high percentage of fatalities relative to the percentage of injuries. While we identified demographic and occupational groups that can be targeted for intervention efforts, more research is needed to determine if increased distractions or other work factors or conditions are related to crashes so that appropriate prevention measures can be designed and implemented. Session H3.0 Title: Innovations in Farm Safety Moderator: Larry Layne

H3.1

Title: Challenges and successes of a farm safety consultation program to identify hazards and prevent injuries

Authors: <u>Iris Anne Reyes</u>, Yurany Ninco Sanchez, Carol Magurany, Matthew Keifer

Objectives: Despite a decline in fatal work injuries in agriculture in recent years, farming remains one of the most dangerous industries in the United States. Agriculture's industry sector continues to record the highest fatal injury rate of any sector at 22.2 fatal injuries per 100,000 FTE workers. In 2011, OSHA established a local emphasis program in Wisconsin and began inspecting dairy farm operations to protect workers from common hazards known as the "Dairy Dozen". To help farmers prepare for OSHA visits, this group launched a state-wide safety consultation program to identify and address hazards through surveys, inspections and worker training.

Methods: The program targeted the largest dairy producers that were more likely to be inspected by OSHA. Surveys conducted with producers and farm workers included farm demographics, safety knowledge and work practices. Trained safety professionals conducted farm inspections and provided recommendations to address identified hazards created by machinery, dairy operations, environmental exposures and work practices and behaviors. Bilingual trainers conducted farm worker health and safety training and evaluation in English and Spanish. Training topics covered the Dairy Dozen hazards and workers' rights.

Results: Over 30 farm inspections were conducted and over 450 workers were trained. The development and implementation of the program had both challenges and successes. There were difficulties in marketing, funding the program and employing qualified personnel. However, farm owners and workers felt that the services were helpful. They were receptive and were willing to promote a safe environment in the workplace.

Conclusion: The agricultural safety consultation program provides consultation to farm owners to identify hazards and training to workers to prevent injuries. While it has shown positive impact in the farming community, its sustainability remains in question due to operation costs and limited human resources.

H3.2

Title: Youth Safe Farm: A community based approach to reducing youth farm injuries

Authors: <u>Mark Fullen</u>, Jean Woloshuk, Wayne Lundstrom, Brandon Takacs

Objectives: The Youth Safe Farm program was a community-based effort to educate and empower underserved Appalachian farm families to reduce farm injuries to youth. WVU recruited 72 farm families in 9 underserved WV counties. This project utilized an innovative research driven program of community and family based health promotion.

Methods: WVU developed Youth Safe Farm curriculum based on NAGCAT (North American Guidelines for Children's Agricultural Tasks) materials and adapted to a family/community based educational format in addition to safety and health information. The recruited families (youth and adult) met at regularly scheduled community meetings, to learn and be empowered to employ graphic risk mapping to identify hazards to youth and propose controls and practices that will abate these hazards. Subsequent meetings were to report on hazard identification and control, to exchange successes and problems, and to provide motivation to continue to monitor and improve safety conditions. Learning outcomes and hazard reduction was measured through collecting risk mapping journals completed by the families that included all hazards identified, how they were corrected, and the use of a probability/seriousness score that allowed the families to rank the hazards prior to and after the correction was made.

Results: A total of 819 hazards were identified with 476 of those hazards being corrected. On average 11.4 hazards were identified per family and 6.6 hazards were corrected. The families spent a combined 870 hours of effort correcting hazards and \$45,089. The families also reported how the hazards were abated (engineering, personal protective equipment, work practice or NAGCAT). The majority (48.9%) of hazards were corrected using engineering controls followed by work practice changes (33.4%). All the participating families that completed the program received the "Youth Safe Farm Family" designation.

Conclusions: The program resulted in real change on family farms, including eliminating and correcting many serious hazards. Hazard data collection validated the training and dinner meeting model as being effective in hazards. H3.3

Title: Moving social work norms via theater for senior farmers

Authors: Deborah Reed, Deborah Claunch, Pam Teaster

Objectives: Older farmers carry workloads similar to their younger counterparts, working as much as 10-12 hours per day. Senior farmers/farm workers accounted for over half of all farming deaths between 1992 and 2004 (3,671 of 7,064 deaths) (Myers, et al., 2009). Usual educational interventions with farmers have been met with limited success in reducing injury. New approaches are needed. This study reports on a promising practice to reduce injury and fatalities.

Methods: In a recently completed two year study with senior farmers and their families that focused on how to best approach the continued injury challenge, investigators discovered that the farm population desired interventions that supported continued work and appreciated their culture. An innovative strategy, didactic reader's theater, was piloted in response to those findings. The approach incorporated adult learning strategies based on Ajzen's (1991) Theory of Planned Behavior. This presentation reports on the success of the first pilot of the intervention.

The intervention was marketed as a dinner theater, using local farmers as actors, and was presented at a site well known to the farm families. Three short socio-novels, based on stories shared with the investigator in previous studies, were presented by local farmers who served as actors. Following each drama participants completed a quick reaction form, and had a short discussion about the drama content. One week later a phone survey was completed that tapped further reaction to the content and behavior changes made.

Results: Farm couples were recruited. Mean age = 64 years, range 43-81; average farm work years =55. N=33. The quick reaction form, completed after each drama, was nearly 100% "strongly favorable" on all ratings. The follow-up survey sustained this enthusiasm, noting the realism and applicability of the content. 42% of the participants had already made safety changes based on their participation; 67% reported "thinking about/intending" to make changes. Participants liked the non-threatening environment that supported continued family conversation about health and safety.

Conclusion: This format is effective, easily adapted to local issues, can be delivered using existing infrastructure, and is acceptable to the farm community. It is currently being tested on a larger scale.

H3.4

Title: **Development of an electronic return-to-work program to manage injured and ill farm workers** Authors: Iris Anne Reyes, <u>Bryan Weichelt</u>, Will Ray, Andrea Mahnke, Laurel Verhagen, Matthew Keifer

Objectives: Large animal farms in the Midwest are growing in size, increasing in work task specialization and hiring more immigrant labor. Workers not only face inherent risks in the agricultural workplace but are also introduced to significant dangers in these operations. Injuries in pork and dairy farms are common and are increasingly managed by primary care physicians. Yet, clinicians are often unfamiliar with the physical demands of farming and have little training and few resources to manage the return-to-work of injured workers. This project is developing a computer application designed for clinicians to guide early return to work planning for injured workers in the dairy and pork industries.

Methods: The application has several components: database of functional job profiles, a clinician interface and customized return-to-work sheets for farm owners and their injured workers. The functional job profile database consists of hazards and physical demands for common tasks on the farm collected by physical and occupational therapists. The clinician interface allows the provider to electronically enter restrictions. It has algorithms to automatically produce alternative job assemblies within the injured worker's limitations. Lastly, simpler return-to-work sheets are customized for farm owners and workers to replace the traditional form.

Results: Focus groups, interviews and usability tests with end users are conducted throughout the development of the software. Clinicians who were interviewed were aware of the usability issues of the complex return-towork form currently used in practice but believed that the complexity was necessary. They expressed the desire to learn more about tasks on the farm through photos and videos, but felt that they had little time to do so. Farm owners and workers preferred a simpler return-to-work form with lay person terms and would like additional hand-outs regarding the injury or illness. All groups felt that the creation of a Spanish version of the form would be helpful for Spanish-speaking workers.

Conclusion: This project addresses an unmet need in agricultural health and safety, that of connecting the clinician to the farm to reduce disability and sustain an adequate, safe workforce for the growing agriculture industry. Session H4.0 Title: Cost Effectiveness of Safety and Health Interventions Moderator: Paul Keane

H4.1

Title: **Injury and occupation coding in a needs assessment mandated by the ACA** Author: <u>Linda Forst</u>

Objectives: A university health system conducted a community based assessment of primary care needs and gathered baseline data to evaluate effectiveness of health care and public health programs in its service area. Collection of Industry and Occupation variables were obtained as a way to highlight the value of these indicators.

Methods: Industry and Occupation variables were hand coded using SOC codes and NAICS crosswalks. Codes were matched with O*Net hazard categories and BLS data to predict the numbers and types of injuries that might be experienced by patients in this service area, as well as workers' compensation projections.

Results: There were 58.5% of 617 respondents are working; 20% in health care, 10% in educational services and 9% in Accommodation and Food Services. Specific hazards and injury/illness surveillance data provided information on potential healthcare needs and reimbursement.

Conclusions: Industry and occupation data collection enhance community based needs assessments and projections for healthcare systems. This demonstration project has initiated dialogue about inclusion of I&O and other occupational indicators in the electronic medical record of one university health system.

H4.2

Title: A framework for conducting economic evaluations of occupational health and safety programs in public healthcare

Authors: Jaime Guzman, Emile Tompa, Mieke Koehoorn, Sara Macdonald, Henriette de Boer, <u>Hasanat</u> <u>Alamgir</u>

Objectives: Evidence-based resource allocation in the public healthcare sector requires reliable economic evaluations to support decisions that are different than those needed in the for-profit industrial sector. Economic evaluation of occupational health and safety (OHS) initiatives in the peer reviewed literature has been largely focused on the analysis of insurance costs, taking the perspective of the company, and relying on workers' compensation expenses as the key and often the only measure of outcomes. This paper describes a process whereby a framework for conducting economic evaluations of OHS programs in healthcare was developed with sector stakeholders. The aim of our project was: 1) define key costs and consequences to be considered in economic evaluations of OHS programs, and 2) integrate these into a comprehensive framework.

Methods: The primary methodology was participatory action research supported by mixed qualitative and quantitative methods. It included a multi-stakeholder working group, key informant interviews, a Delphi panel, and nominal group methods.

Results: According to this study three resources had top priority: OHS staff time; training the workers; and program planning, promotion and evaluation. Similarly, five outcomes had top priority: number of injuries; safety climate; job satisfaction; quality of care; and days lost. The framework derived during this project consists of a monograph and four electronic templates built around seven key principles that stakeholders can use to assist them in conducting economic evaluations of OHS programs.

Conclusion: The participatory action research process described in this paper has resulted in a methods framework for use in economic evaluations of OHS programs in the healthcare sector. The main principles and methods may be applicable to other jurisdictions with universal healthcare systems and to other non-profit service sectors funded from general taxes, such as education and municipal services. We believe that utilisation of this framework will increase the quality of economic evaluations of OHS programs in healthcare, and facilitate program comparisons for evidenceinformed resource allocation decisions.

H4.3

Title: A business case tool for use in occupational safety and health decision-making Authors: <u>Elyce Biddle</u>, Georgi Popov

Objective: The objective of this study was to create a new comprehensive yet easy-to-use tool for businesses of all sizes that identifies and measures the business value of implementing occupational safety and health initiatives in the workplace.

Methods: The tool is based on standard, traditional business methodologies and terminologies, and the principles of ASSE Z590 Standard, *Prevention through Design (PtD): Guidelines for Addressing Occupational Risks in Design and Redesign Processes,* and the related ASSE *Prevention through Design: an ASSE Technical Report, TR-Z790.001-2009.* Furthermore, it builds on previous strategies, such as the Centers for Disease Control and Prevention *Business Case Resource Guide* and the American Industrial Hygiene Association *Value* of the Profession Strategy, to establish a five-step process.

Results: The tool process begins by creating an inventory of business objectives, identifying hazards, and conducting a risk assessment and culminates with determining the financial and non-financial value of an occupational safety and health program, activity, or intervention. The tool design also includes the capability of the tool to be incorporated into safety and health management systems, and which allows the user to readily incorporate the hierarchy of controls into the Business Case results for the intervention being examined. Most importantly, field testing has shown that this tool is user-friendly and does not require prior knowledge of financial or economic analysis.

Conclusions: This tool represents the next generation of decision-making tools for the safety and health professional. The methods were expanded to include the impact on non-financial measures as well as the more traditional financial measures. The new Business Case tool can demonstrate that mitigating potential safety and health hazards with effective and efficient solutions can create an economic advantage for the firm. It can also be used to demonstrate that OSH professionals are important partners with business executives in managing enterprise risks-which includes the risk of adverse safety and health incidents. Finally, it includes measures to demonstrate the contribution of occupational safety and health to corporate social responsibility, sustainability, and product stewardship.

H4.4

Title: *\$afety Pays in Mining*: A tool to estimate the cost and impact of occupational injuries and illnesses to mining companies

Authors: John Heberger, Elyce Biddle

Objective: The objective for developing *\$afety Pays in Mining* is to demonstrate how avoiding occupational injuries and illnesses can impact the profitability of a mining company. With a mine's input, this tool estimates the total cost of occupational injuries and illnesses to the mine and their effect on profitability. *\$afety Pays in Mining* also gives examples of how a mine could spend savings from occupational injuries and illnesses that did not occur.

Methods: This web application builds on OSHA's *\$afety Pays* as it uses direct costs to calculate indirect costs of occupational injury/illness, but uses profit margins and annual sales based on specific mining commodities. Input data for this user-friendly web application can be specific individual company information or default values from the US Census Bureau, Bureau of Labor Statistics and the National Council on Compensation Insurance. Additionally, *\$afety*

Pays in Mining shows how a mine could spend potential savings by calculating how many additional employees could be hired, as well as specific mining personal protective equipment that could have been purchased.

Results: Results vary according to the injury/illness and commodity. For example, \$afety Pays in Mining shows that one electric shock injury has an estimated direct cost of \$103,000 and an estimated indirect cost of \$114,000, therefore total cost is estimated at \$217,000. For a coal mine with a profit margin of 10% and estimated annual sales of \$31,250,000, \$afety Pays in Mining calculates that the total cost of an electric shock is 0.7% of annual sales; it would take \$2,174,000 in additional sales just to offset the injury cost. Without the electric shock injury, the company could have earned \$22,000. If the injury did not occur, three more additional employees could be hired (for one year), the company could have provided a hearing loss prevention program to 579 employees, provided 1,449 employees with safety boots, or purchased 4,348 hard hats.

Conclusion: *\$afety Pays in Mining* assists mining companies to understand the financial consequences of occupational injuries/illnesses and helps build the business cases for interventions that will prevent those injuries.

NOIRS 2015 Poster Abstracts

(Presenters underlined)

Although the abstracts in this publication were proofread to eliminate obvious errors in spelling, punctuation, and grammar, they were neither edited nor officially cleared by the National Institute for Occupational Safety and Health (NIOSH). Therefore, NIOSH is not responsible for the content, internal consistency, or editorial quality of the abstracts. That responsibility lies solely with the individual authors. Any use of company names and products throughout this publication does not imply endorsement by NIOSH, the Centers for Disease Control and Prevention, the Public Health Service, or the Department of Health and Human Services.

Abstracts Wednesday, May 20, 2015 POSTER SESSION/NETWORKING EVENT Multipurpose Building

LIST OF FEATURED POSTERS

Transportation

P01

Title: Health and safety hazards of working in shipyards Author: Stacy Freeman

The purpose of this research is to evaluate exposures of hazards to shipyard workers, globally, and to determine the effectiveness in the reduction of hazardous exposures. Various scholarly articles were viewed to obtain information regarding the hazards that workers could possibly encounter on a daily basis, when executing the various tasks that pose a risk to hazard exposures. These tasks of the shipbuilding and repair industry include manufacturing, maintenance, and repair which can pose various harmful safety and health hazards, chemically and physically. Some of these hazards include exposures to air contaminants such as metallic dust and micro-fibers (asbestos), confined spaces, noise, and falls. Studies have shown that the injury and illness rates of a shipyard workers is slightly greater than the average of other occupations, with a majority of the cases being associated with jobs that dealt with ship building. Over time, these conditions have improved to the point where the risk of exposure has lowered from high to moderate due to advances in technology, personal protective equipment, and better standards and regulations. Although there are fewer cases of injuries and illness in comparison to the past, it has been determined that there are more actions that can be done to reduce exposures in shipyards, but further research and improvements in current technologies will be needed to complete these actions.

P02

Title: Narrative and quantitative analyses of workers' compensation-covered injuries in shorthaul vs. long-haul trucking industries

Authors: Mark Chandler, Terry Bunn, Svetla Slavova

Background: The truck transportation industry has an elevated nonfatal occupational injury rate of 4.5 per 100 workers compared to 3.4 per 100 workers for all industries combined in 2012, and the rate of injuries resulting in days away from work, job transfer, or job restriction was 3/100, nearly twice the rate for all

industries combined (Bureau of Labor Statistics). The aims of the study were to (1) identify and characterize differences in injury types between workers in shorthaul and long-haul trucking; (2) analyze and code narrative text to identify and characterize the activities that resulted in injuries within each trucking industry group; and (3) target areas for improved safety interventions.

Methods: Quantitative and narrative analyses of 2012 Kentucky short-haul and long-haul truck transportation workers' compensation first reports of injury and narrative text data were performed. Chi-square tests assessed differences in demographics, injuries, award disposition, and award characteristics between shorthaul and long-haul trucking industries. Narrative descriptions for the top injury scenarios in short-haul and long-haul trucking were analyzed to illustrate primary work-related activities that resulted in injuries.

Results: Leading injury activity scenarios in both short-haul and long-haul trucking involved (1) moving freight; (2) tarping the trailer; and (3) handling the trailer door. A higher proportion of long-haul drivers suffered injuries due to tarping, trailer door handling, and slipping while entering or exiting the cab compared to short-haul truck drivers. In contrast, a higher proportion of short-haul drivers suffered injuries due to the vehicle leaving the roadway and being rear-ended by other vehicles.

Conclusions: Both trucking groups could benefit from increased access to freight moving equipment and engineering control measures such as access to ladders, scaffolding and harness systems for tarping at shipping locations. Long-haul truckers specifically may benefit from the use of portable tarping systems to prevent injuries. Other recommended injury control measures for both long-haul and short-haul truck drivers include the use of slip-resistant footwear and the use of three points of contact to prevent falls while entering or exiting the cab.

P03

Title: Magnitude of, trends in, and associated factors of road traffic collision in Central Ethiopia Authors: <u>Fekede Asefa</u>, Demeke Assefa, Gezahegn Tesfaye

Background: Road traffic collision (RTC) is one of many public health problems. Globally, about 1.2 million people die due to RTCs every year. Of these, 85% reside in low and middle income countries. Despite low road network density and vehicle ownership, Ethiopia has a relatively high collision record. Collisions in the Addis Ababa and Oromia Regions account for 58% of all fatal collisions in Ethiopia. The aim of this study was to assess the magnitude of, trends in and factors associated with RTCs in central Ethiopia.

Methods: A retrospective study was conducted using relevant police reports obtained from eight police stations found between Akaki and Adama (central Ethiopia). The study included reports from July 2007 to June 2012. Both quantitative and qualitative techniques were employed, and bivariate and multivariate analyses were performed to identify the factors associated with the RTCs.

Results: From July 2007 to June 2012, 2,335 collisions were registered, though the outcomes of 24 of these crashes were not recorded. Among these collisions, 389 (16.7%) resulted in death, 316 (13.5%) brought about severe injuries, 290 (12.4%) caused slight injuries, and 1,316 (56.4%) caused property damage. These collisions affected about 1,745 individuals. While 515 (29.5%) people died, 549 (31.5%) were severely injured, and the remaining 681 (39%) were slightly injured. Driving at midnight [AOR 1.67, 95% CI; 2.9-9.6], failing to give priority for other vehicles and pedestrians [AOR 5.03, 95% CI; 2.3-9.3], and vehicular technical problems [AOR 19, 95% CI; 6.4-56] were determinants of RTC fatality.

Conclusions: RTCs steadily increased in the study area over this period of time. This calls for urgent interventions. Ensuring that drivers obey traffic rules and enforcing the speed limit appear to be the most critical parts of interventions.

P04

Title: Two motor vehicle collisions associated with laboratory specimen transport during the Ebola outbreak---Bombali District, Sierra Leone, October 2014

Authors: <u>Christina Socias</u>, Kristy Joseph, Tom Sesay, Sorie Bundu Conteh, James McAuley, John Redd

Sierra Leone is currently experiencing the largest Ebola virus disease (EVD) outbreak in history, with nearly 8,000 laboratory confirmed cases since May 2014. More than 900 confirmed cases have been documented in the northern district of Bombali, mostly in the capital city of Makeni. Sierra Leone's remoteness and hazardous driving conditions present increased risk of motor vehicle collisions (MVCs) when EVD specimens are transported long distances to the few laboratories with testing capacity. During October 2014, two MVCs exemplified the hazards to workers and bystanders of specimen transport daily from Makeni to the CDC laboratory in Bo, 83 miles away.

On Monday, October 20, 2014, a light pick-up truck (Vehicle X) carrying Driver A and Laboratory Technician A departed from Makeni in the early afternoon to transport 37 blood and buccal swab specimens to Bo. At 1600 hours, along unpaved, narrow, and eroded roads, Vehicle X struck a hut, where a pedestrian subsequently died. Both passengers feared violence from family members and acquaintances of the pedestrian. Laboratory Technician A retrieved the cooler with undamaged specimens and fled to a nearby clinic for assistance. Clinic staff rejected the samples, for fear of contracting EVD, which were stored overnight in the damaged, locked vehicle.

On October 23, 2014, a sport utility vehicle designated as an ambulance (Vehicle Y) departed Makeni carrying Driver B, Laboratory Technician A, and 27 new specimens. At 1100 hours, Vehicle Y experienced a roll-over following a high-speed lateral collision on a paved highway with a slow-moving overloaded truck; there were no injuries. Laboratory Technician A retrieved the undamaged specimens and informed CDC staff to send a replacement vehicle.

Agriculture/Farming

P05

Title: Safety perceptions and PPE provision of thoroughbred farm representatives

Authors: Jessica Clouser, Jennifer Swanberg, Henry Bundy

Objectives: Agriculture, particularly animal agriculture, is one of the leading industries for occupational illness or injury. Although some of the inherent risks associated with working in agriculture may be well understood by farm operators, safety behaviors do not always follow. Few studies have looked at the relationship of managements' risk perception and subsequent provision of personal protective equipment (PPE) in large animal operations. This qualitative study aimed to describe: 1) the risk perceptions of thoroughbred farm management representatives, 2) the personal protective equipment (PPE) provided by farms, and 3) the factors that influence farms' provision of personal protective equipment.

Methods: Thirty-five representatives from 26 farms participated in a 1-4 hour, face-to-face, semistructured interview covering topics such as farm characteristics, workforce demographics, work organization factors (e.g., job tasks, scheduling practices), perceived risks associated with horse work, and perspectives and provision of PPE. Constant comparative analysis was utilized in order to ground emergent themes in the original text of the transcripts and themes were culled and democratically agreed upon by team members in weekly meetings.

Preliminary Results: Representatives of thoroughbred farms identified the horse as the most hazardous exposure and horse-related tasks as the most dangerous tasks on thoroughbred farms. Despite this perception, PPE designed to protect against the horse (e.g., helmets, vests, steel-toe boots) was not as commonly provided to workers as PPE designed for non-horse related tasks (e.g., gloves and safety glasses). Factors influencing farms' provision of PPE included: 1) differences in farm size/context, 2) the belief that workers were most important agents in their safety, 3) management's lack of confidence in horserelated PPE's efficacy, and 4) the perception that risk could never be eliminated.

Conclusions: Provision of PPE was limited by management's poor perceptions of its efficacy relative to other factors. Future research is needed to understand workers' perception of risks associated with thoroughbred farm work and strategies to minimize exposure to these risks.

P06

Title: Fatal and non-fatal injuries among tree care workers in Washington State

Authors: Christina Rappin, Todd Schoonover, <u>Randy</u> <u>Clark</u>

Objectives: According to the Census of Fatal Occupational Injuries, an average of 80 tree care workers were fatally injured each year in the U.S. between 1992 and 2007. The objectives of this study were to identify high risk tasks and describe the nature and burden of fatal and non-fatal injuries among tree care workers in Washington State.

Methods: Worker fatalities occurring during tree care operations were identified using Washington State Fatality Assessment and Control Evaluation (FACE) surveillance data. Case data was used to determine the most frequent types of fatal injury events, and decedent's industry and occupation.

Injured worker claims from the Washington Workers' Compensation system were characterized using industry, injury event, injury type, paid time loss days, and claim costs for workers in the "tree trimmers and pruners" occupation.

Narrative text from injury claims and fatal case records was examined to determine the activities being done at the time of the incident.

Results: Between 1998 and 2014, there were 28 fatalities among tree care workers. The most frequent fatal injury events included falls (50%), struck by falling object (20%), and electrocution (18%). Landscaping services industry workers accounted for 89% of fatalities. Most fatalities occurred during tree removal (50%) or tree trimming/pruning (36%).

Between 2009 and 2013, there were 633 injury claims among tree trimmers and pruners. The majority of injuries were to workers in either the agriculture (primarily in apple and other fruit farming) or landscaping services industries. The most common injury events were falls (38.5%), contact with objects and equipment (28.1%), and bodily reaction and exertion (26.2%). Injury event varied by industry: agriculture workers were most frequently injured by falls (53%); landscaping workers by contact with objects and equipment (39%). Median days of paid time loss was highest for falls (38). Median claim cost was highest for injuries caused by contact with objects and equipment (\$14,642).

Conclusion: Tree care workers face risks for occupational injuries and fatalities that vary by industry, indicating a need for industry-specific prevention measures. Narrative text of injuries is valuable to identify high risk activities, and will lead to better targeting of prevention efforts.

P07

Title: **Migrant and seasonal farm workers: A progression of safety and health** Authors: Jordan Blazer, Hamid Fonooni, Mike Behm

As the world's population continues to grow, so does the rising demand for food and consequently crops. With a multi-billion industry in Agriculture, it would be assumed that the hard laborers that make this industry possible, would be well taken care of as far as safety and health. Unfortunately, this is not the case, specifically when it comes to Migrant and Seasonal Farm Workers (MSFW). According to the U.S. Department of Labor's National Agricultural Workers Survey, out of the approximate 2.5 million employees in this industry, 1.4 million of these farm laborers are MSFW. With an overwhelming percentage of this labor going to foreign-born workers, safety training that would typically cover a wide range of hazards often is neglected when it comes to the awareness of employers and workers in this industry. This high risk population faces numerous obstacles such as cultural barriers, safety culture, lack of education, poor access to health care and other hurdles that other industries do not encounter as often, leaving agricultural labor with higher injury and fatality rates. Although great strides have been made, we still face the challenge of successfully passing on this knowledge and information to employers and workers but with the advancement of Occupational Injury Research through integration and partnership, a difference can be made. Key factors are identified in this research and recommendations are made to help improve the safety and health as well as quality of life for migrant and seasonal farm workers.

P08

Title: Immigrant workers in dairy - A health and safety intervention using the community health worker model in an occupational setting Authors: <u>Amy Liebman</u>, Patricia Juárez-Carrillo, Iris Reyes, Yurany Ninco Sanchez, Matthew Keifer

Objectives: 1. Develop and test a culturally appropriate, evidence-based occupational health and safety intervention for immigrant dairy workers. 2. Compare farms using community health workers (CHW) to promote worker health and safety with farms not using CHW. 3. Evaluate the intervention to determine reduction in hazards; changes in knowledge, attitude and behaviors among immigrant dairy workers; and acceptability of model among workers, employers and popular educators.

Methods: A comprehensive needs assessment was conducted and included literature reviews, worker focus groups, and key informant interviews with dairy operators, insurers, clinicians, trainers and farm observations. The project designed and tested a fivemodule training curriculum to educate workers in reducing worksite hazards and improving health and safety knowledge and practices. It is delivered on the farm using culturally appropriate education techniques to ensure understanding by workers with low levels of literacy and limited formal education. Picture-based resources are provided to underscore important safety messages reviewed during the training. Picture-based assessments and verbally administered questions are used to evaluate worker knowledge. A 'train-thetrainer' approach and *promotores de salud* (community health workers or CHW) are employed to help deliver training to new workers, reinforce health and safety messages and serve as a liaison between the workers and the employer. Farms are recruited via an extensive marketing effort that includes mailings, phone calls and word of mouth recruitment. All participating farms received a safety audit, worker training and resources. Half of the farms are randomly selected to implement a CHW program.

Results: The needs assessment underscored lack of culturally appropriate resources for worker health and safety, desire among workers and farmers for health and safety training, and hazards and injuries common in dairy. To date, 503 workers on 40 farms have been trained and 11 farms have initiated a community health program. Initial results show an increase in worker knowledge and interest and acceptability of the CHW program.

Conclusion: Culturally appropriate health and safety training is needed for immigrant workers in dairy. Sustaining such programs may prove to be a worthwhile investment to reduce hazards and ultimately injuries in dairy.

P09

Title: Natural language processing to identify farm workers in an electronic medical record Authors: <u>Scott Sandberg</u>, Steve Waring, Jacqueline Bohne, David McClure, Matt Keifer

Objectives: The objective is the development and testing of natural language processing (NLP) algorithms to identify agricultural workers within our EMR and characterize their injury experience.

Methods: The Marshfield Clinic's electronic medical records (EMR) date back to 1960's and can easily be queried and mined for health outcomes. Initial incidence and prevalence of our dairy population vs our non-dairy population in our EMR, paradoxically

showed fewer farmers are suffering injuries than an age matched non-dairy control population.

We imagined two possible explanations for this perplexing outcome. It is possible that our producer population has migrated to management and no longer has direct contact with the hazards associated with dairy farming. It is also possible, and highly likely, that our non-farmer control population within our EMR is "contaminated" with hired workers who do more physical work on the farm, and are more frequently exposed to dairy farming hazards. Unfortunately, like in many EMR systems, occupation is not a coded, searchable field, in the Marshfield Clinic EMR. We describe the development and use of natural language processing algorithms to identify agricultural workers within our EMR and characterize their injury experience. We will also be able to determine the degree to which contamination of the control group underestimated injury experience in the dairy producer population.

Results: Preliminary manual chart abstraction of a subsample of presumable non-farm controls revealed that 30.4% of that group had farm exposure described in their EMR. The NLP will be designed to identify these individuals through a much less labor intensive method.

Conclusion: Initial incidence and prevalence of our dairy population vs our non-dairy population in our EMR, paradoxically showed fewer farmers are suffering injuries than an age matched non-dairy control population. The population of dairy owners and operators is an easily attainable data set. However, a much harder population to capture is the dairy farm worker. We describe the development and use of natural language processing algorithms to identify agricultural workers within our EMR and characterize their injury experience.

P10

Title: **Potential for addressing agricultural worker safety and health through livestock quality assurance programs**

Authors: <u>James Lee</u>, Bruce Alexander, Timothy Goldsmith

Objectives: The purpose of this study was to evaluate livestock quality assurance programs for existing agricultural worker safety and health education, and to identify potential areas for worker safety expansion.

Methods: We evaluated three major quality assurance programs and associated training materials for existing safety education and training. Livestock handling areas with high injury risk were identified through literature review. Results: There are well known occupational hazards associated with animal agriculture. Quality Assurance Programs are widely accepted guidelines used in cattle and swine production to maintain standards of meat quality and animal welfare. Despite the well documented occupational hazards associated with cattle handling, worker safety has not been a major focus of any of the cattle quality assurance programs. Swine quality assurance programs do incorporate worker safety topics, but these programs could expand their coverage of infectious disease and chronic injuries.

Conclusion: Quality assurance programs could be a valuable platform to address worker safety and health issues in animal agriculture.

Surveillance

P11

Title: Assessing case-capture of the National Electronic Injury Surveillance System -Occupational Supplement (NEISS-Work) Authors: <u>Ruchi Bhandari</u>, Suzanne Marsh, Audrey Reichard, Theresa Tonozzi

Objectives: The National Institute for Occupational Safety and Health (NIOSH) conducted hospital audits in 2011 to assess the case-capture and completeness of data from the occupational supplement to the National Electronic Injury Surveillance System (NEISS-Work).

Methods: NEISS-Work estimates non-fatal workrelated injuries and illnesses treated in U.S. emergency departments (EDs) from data collected through a national stratified probability sample of 67 hospitals. A coder at each sampled hospital reviews every ED medical record and abstracts work-related cases. For this assessment, 20 of the 67 hospitals were subsampled. A minimum of 1,000 ED records within a specified date range from each hospital were independently reviewed and work-related cases were abstracted by NIOSH staff (the auditors) approximately 1-2 months after abstraction by hospital coders. If time permitted, auditors and hospital coders adjudicated cases while onsite. Otherwise, adjudication was conducted by auditor consensus. Analyses use adjusted hospital weights to produce national estimates. In addition to the adjudicated information, qualitative information was collected through structured interviews with hospital coders and semi-structured notes recorded during each audit.

Results: Of the 21,626 injury and illness cases reviewed by the auditors, 970 cases were initially classified as work-related by either the coder or auditor. Of these, 849 cases were determined to be true work-related cases by the NIOSH auditors during the adjudication process. The hospital coders had identified 265 of these cases as non-work related. Sensitivity was 69%, indicating over two-thirds of the work-related cases were correctly classified by hospital coders. Specificity was 99%, indicating coders misclassified 1% of the non-work related cases as work-related. Additional results will be presented based on the analysis of qualitative data gathered during audit visits.

Conclusion: This assessment suggests a moderate number of work-related cases were missed in NEISS-Work data leading to a potential underestimate of EDtreated occupational injuries and illnesses. The knowledge gained through this study can be used to better understand the availability and quality of data abstracted from medical records. It can also help improve case-capture in NEISS-Work and other occupational injury and illness surveillance systems using medical records data.

P12

Title: Nonfatal occupational eye injuries in US emergency departments, 2002-2011

Authors: <u>Theresa Tonozzi</u>, E. Michael Goldcamp, Susan Derk

Objectives: Workers in the United States (U.S.) are at risk for job-related eye injuries. Flying debris, chemicals, infectious agents, moving machinery, and exposure to light are a few hazards that may lead to serious injuries of the eye. This study provides descriptive and trend information to better understand nonfatal occupational eye injuries and to inform preventive recommendations.

Methods: Data from the National Electronic Injury Surveillance System-occupational supplement (NEISS-Work) from 2002 through 2011 were analyzed. NEISS-Work is a clustered sample of emergency department (ED) visits from a stratified simple random sample of 67 U.S. hospitals. Nonfatal work-related injuries are abstracted from medical records at each hospital. To conduct descriptive and trend analyses, a subset of eye injuries in NEISS-Work was used. The Current Population Survey yearly employment estimates provided the denominator for rate calculations.

Results: From 2002-2011, an estimated 2,003,000 (95% confidence interval $[CI]=\pm 482,000$) nonfatal eye injuries treated in EDs were reported. For workers 16 years of age and older, there were 149 (95% CI= \pm 40) eye injuries per 100,000 full-time equivalent workers. These accounted for 6% of all ED-treated occupational injuries reported between 2002 and 2011. There was a significant average decrease of approximately 10,000 eye injuries per year over the 10

year period. A total of 83% of the eye injuries occurred in males (n=1,663,000; 95% CI= \pm 424,000). Workers 20-29 years of age sustained 33% (n=657,000; 95% CI= \pm 201,000) of the injuries. Two thirds (67%) of the injuries were related to contact with objects or equipment (n=1,348,000; 95% CI= \pm 396,000), with the primary sources being scrap, waste, and debris (n=796,000; 95% CI= \pm 252,000) and chemical exposure (n=277,000; 95% CI= \pm 64,000).

Conclusion: NEISS-Work data show that eye injuries persist in the U.S. workforce. Engineering controls, such as machine guarding, can eliminate work site hazards. When hazards exist, correct use and maintenance of certified eye/face safety equipment (goggles, safety glasses, and face shields) can prevent injuries. Ongoing occupational injury surveillance efforts could further delineate why eye injuries still occur in the U.S. workplace.

P13

Title: Using the State-based Occupational Health Surveillance Clearinghouse for injury prevention and intervention

Authors: Marie Haring Sweeney, Sue Nowlin

Background: Several years ago, NIOSH state occupational health partners were searching for a venue to share and enhance distribution of their communication products. These materials were usually not published in the peer reviewed literature, had limited distribution and were not easily accessible to the public or other state occupational health or labor departments.

Methods: In 2011, NIOSH launched the *State-based Occupational Health Surveillance Clearinghouse website*, <u>http://wwwn.cdc.gov/niosh-survapps/</u> <u>statedocs</u>. This site provides a one-stop-shop for posting, exchange and further dissemination of materials produced by state health and labor departments. All materials are submitted by the state to NIOSH using RSS Feed technology. Although access is through the NIOSH internet, the information resides on the server of the authoring state. Users are able to search for materials by state, industrial sector, cross sector or disease, hazard and language.

Results: Annual reports, fact sheets, safety brochures, newsletters, videos and other formats are available to the public health community and the general public through the *State-based Occupational Health Surveillance Clearinghouse*. Topics cover a wide range of subjects from descriptions of fatal incidents in Fatality Assessment and Control Evaluation (FACE) reports to training materials for confined space exposures or for reducing falls from ladders. More than 3750 documents from 26 states in 8 languages appear on the site at least 2004 documents are specific to traumatic injury. States have been able to adapt topic-specific products, thus avoiding the need to create the information *de novo*.

Conclusions: Before the launch of the State-based Occupational Health Surveillance Clearinghouse website, state generated materials may have had only limited circulation. The use of RSS feed technology permits the states to showcase successes as well as share information and data that, in the past would have had limited coverage and accessibility.

P14

Title: Musculoskeletal disorders resulting in job transfer or restriction Author: Janice Windau

Objectives: This presentation will profile musculoskeletal disorders (MSDs), paying particular attention to the specific activity or incident involved.

Methods: The Bureau of Labor Statistics (BLS) has published information on case circumstances and worker characteristics for workplace injuries and illnesses resulting in days away from work since 1992. In 2011, BLS implemented a pilot study to test collection of similar data for cases resulting in job transfer or restriction (DJTR). The pilot study for 2011-2013 covered six industries--most of which had increasing levels of these cases relative to cases with days away from work.

Results: As with days away from work cases, musculoskeletal disorders comprised a sizable proportion of cases resulting in job transfer or restriction. In 2012, MSDs accounted for between one-third and one-half of the DJTR cases in the six industries studied.

Conclusions: Being able to analyze data for MSDs resulting in days of job transfer or restricted activity affords one a more complete picture of these conditions and their toll on workers.

P15

Prevalence of injury by occupation and industry: Role of obesity

Authors: Ja Gu, Luenda Charles, Desta Fekedulegn, Claudia Ma, Michael Andrew, Cecil Burchfiel

Objectives: In 2012, approximately 3.6 million nonfatal occupational injuries occurred in the United States. Our objectives were to estimate the prevalence of injury among US workers by occupation and industry and to investigate the association between obesity and injury across occupational and industry groups. Methods: Self-reported injuries within the previous three months collected annually for US workers in the National Health Interview Survey during 2004-2013. Obesity status was defined using body mass index (BMI). BMI was categorized as normal weight (BMI: 18.5-24.9 kg/m²), overweight (BMI: 25.0-29.9), and obese (BMI: 30+). Prevalence ratios (PR) and 95% confidence intervals (CI) from fitted logistic regression models were used to access relationships between obesity and injury after controlling for covariates.

Results: The overall weighted prevalence of injury during the previous three months was 76.6 per 10,000 workers. Among the occupational groups, age-adjusted prevalence was greatest for Construction and Extraction (169.7/10,000), followed by Production (162.7), Installation/ Maintenance/ Repair (134.9), and Protective Services (133.9). Among the industry categories, workers in the Construction sector (149.2) had the highest prevalence of injury, followed by the Agriculture/ Forestry/ Fishing/ Mining/ Utilities sector (145.2) and Manufacturing sector (112.4). Compared to workers in the Professional group, workers in Construction and Extraction were four and a half times more likely to report an injury (PR: 4.44, CI: 1.77-3.83). In addition, workers in the Construction and Agriculture/ Forestry/ Fishing/ Mining/ Utilities sectors were more than two and a half times as likely to have an injury compared to workers in the Services sector. The prevalence of injury in most occupational and industry groups gradually increased as BMI levels increased. Elevated BMI levels were associated with a higher prevalence of all occupational injuries combined. Overweight and obese workers were 23% to 43% more likely to experience injuries than normal weight workers.

Conclusion: The prevalence of injury varied by occupation and industry. Overall, obesity was positively associated with prevalence of injury. Prospective studies are warranted. Education and weight reduction programs in certain occupations and industries may be effectively targeted towards overweight and obese groups to prevent or reduce work-site injuries.

P16

Title: Injury and illness data for Illinois mining industry employees, 1990-2012

Authors: <u>Sithembile Mabila</u>, Gabriela Gracia, Kirsten Almberg, Robert Cohen, Lee Friedman

Objectives: Identify and evaluate injury types associated with higher injury rates and compensation among Illinois miners. We analyzed workers' compensation claim data from the Illinois Workers' Compensation Commission to (1) describe the cause and nature of occupational injuries suffered by miners between 1990-2012 in Illinois stratified by the mine type, (2) compare claim rates with injury rates reported to MSHA, (3) identify key drivers of cost, missed work and permanent disability among miners and describe how they differ from non-miners.

Methods: Cases were selected from the Illinois Workers' Compensation database from 1990-2012 to determine injury rates and compensation among miners and non-miners. Separate logistics models were analyzed using TWC, TTD, and PPD as primary outcomes.

Results: The major drivers of TWC in both groups were TTD, PPD, average weekly wage and age at the time of filing, while systemic injuries was an additional driver of final monetary compensation among miners. Miners were compensated \$618 less (TWC; CI 95%: -971, -266; p<0.001), had 2.1 more weeks away from work (TTD; CI 95%: 1.58, 2.63; p<0.001), and had higher systemic injuries than nonminers. Among the mining group, the most commonly affected body parts by injury/illness was as follows: upper extremities (n=4146, 27.9%), lower extremities (n=2936, 19.8%), and systemic (n=2619, 17.6%). Among non-mining industry employees, commonly affected body parts by injury/illness were as follows: upper extremities (n=5387, 36.3%), lower extremities (n=3005, 20.2%), and back and spine (n=3262; 22.0%). The most common causes of injury among mining industry employees were struck against/caught in or between objects (16.7% vs 9.3%), overexertion injuries (e.g. sprains, strains; 12.9% vs. 15.7%), contact by inhalation (11.6% vs. 0.2%), and falls/slips (11.2% vs 17.1%). Almost all the injuries caused through contact by inhalation were filed by workers over the age of 45 years (96%).

Conclusions: We were able to clearly show that systemic injuries played a large role in final monetary compensation and higher weeks of TTD among mining industry employees. Based on the adjusted models, median monetary compensation and PPD were lower for mining industry employees compared to non-mining employees, but miners received about 2 weeks more than non-miners.

P17

Title: Occupational fatalities during an oil and gas boom – United States, 2003-2013

Authors: <u>Krystal Mason</u>, Kyla Retzer, Ryan Hill, Jennifer Lincoln

Objectives: During 2003-2013, the U.S. oil and gas extraction industry more than doubled the size of its workforce and increased the number of drilling rigs by 71%. Although the number of fatal injuries in the oil and gas extraction industry increased 32% during the same time period, it has been unclear if the increase was the result of the growing workforce (i.e., more workers exposed), or the result of an increase in fatality risk. NIOSH analyzed data from the Bureau of Labor Statistics (BLS) Census of Fatal Occupational Injuries (CFOI) to describe fatal events during this time and measure trends in the risk of fatal injuries.

Methods: BLS CFOI data were used to determine the number of fatal injuries to workers in the U.S. oil and gas extraction industry during 2003-2013. Annual occupational fatality rates were calculated using worker estimates from BLS QCEW. Annual and overall fatality rates were calculated by event type according to OIICS and by company type according to NAICS. Negative binomial regression was used to model fatality rates and calculate the percent rate of change.

Results: During 2003-2013, 1,189 oil and gas extraction workers died on the job, resulting in an average of 108 deaths per year and an annual occupational fatality rate of 25.0 deaths per 100,000 workers. Most decedents (1, 179, [99%]) were male and were non-Hispanic whites (844, [71.0%]). The largest number of fatalities occurred to workers employed by well-servicing companies (615, [51.7%]) and involved transportation events (479, [40.3%]). The industry's occupational fatality rate decreased significantly (IRR0.957, p-value<0.01) with an average annual decrease of 4% per year.

Conclusions: The occupational fatality rate in the oil and gas extraction industry showed a statistically significant decrease even as the industry grew and number of fatal injuries increased. However, the fatality rate remains elevated compared to the rate for all U.S. workers. Oil and gas employers should continue to implement safety measures that focus on the most frequent fatal events. Occupational safety and health professionals should use the findings of this study to create targeted interventions for specific types of companies and events to further reduce worker fatalities.

P18

Title: Appalachian Basin oil and gas fatality surveillance map

Authors: Tiffany Rice, Brandon Takacs

Background: With an increase of workers in the oil and gas industry and an increasing number of wells and production, comes the potential for an increase of workplace injuries and fatalities. The number of fatal injuries in oil and gas extraction industries fell from 138 in 2012 to 112 in 2013. However, the industry's fatality rate continues to be seven times greater than the rate for all U.S. industries. As the industry, specifically in the Appalachian Basin continues to grow West Virginia University – Safety and Health Extension WVUSHE determined a need for fatality data collection and reporting within the Appalachian Basin to include the Marcellus and Utica Shale plays.

Methods: WVUSHE developed the oil and gas fatality map by gathering incident information from OSHA, Bureau of Labor Statistics, Industry Publications, and newspaper articles in the Appalachian Basin region. Each fatality is then placed on an ARCGIS created map using a pinpoint feature. Pinpoint data displays: death date, employer, city, state, incident descriptions, NAICS/SIC code and source. Regionally specific fatality data and information and lessons learned are then made available.

Results: The most common types of incidents include; 41% struck by, 25% fire and explosion, and 14% onsite transportation related. West Virginia has a considerably higher fatality rate compared to other states when using the data from the fatality map and rig count historical data.

Conclusion: The map provides a resource for operators, contractors, insurance providers, educational institutions, etc. for reviewing past fatalities. This information can then be used to track trends within the Appalachian Basin, focus future training efforts and provide case studies/lessons learned. This map does not include all transportation related fatalities at this time.

Other High-Risk Work

P19

Title: Personal physical fitness training and injury risk during military deployment

Authors: <u>Michelle Canham Chervak</u>, Tyson Grier, Jason Butler, Timothy Bushman, Morgan Anderson, Ryan Steelman, Mellina Stephen, Bruce Jones

Physical training during personal time can be necessary to maintain a healthy weight and meet physical fitness requirements in physically demanding occupations such as the military.

Objective: Investigate the relationship between personal physical training and injury risk during deployment.

Methods: Demographics, personal physical training activities, physical fitness, and injuries during deployment were collected by survey from a U.S. Army infantry brigade immediately following an 18month deployment. Body mass index (BMI) was defined using CDC definitions, with a BMI of 18.524.9 considered normal, 25-29.9 as overweight, and 30+ as obese. Univariate regression models were used to determine the association of personal characteristics, physical fitness, and personal physical training activities with injury risk during deployment. Variables with p≤0.10 were entered into a multivariable logistic regression model.

Results: A total of 2,091 Soldiers completed the survey. The majority were male (93.7%), enlisted (93.5%), and in combat arms (49.3%) or combat service support (31.5%) occupations. Mean age was 27.5 years (standard deviation [SD] ± 5.7) and average BMI was $26.0(\pm 3.2)$. Given the small number of women, subsequent analyses focused on men. Multivariate results indicated that age and BMI were significant predictors of injury during deployment, with higher risks among Soldiers age 27-30 (OR1.41, 95% CI 1.03, 1.92) and 31 or older (OR1.73, 95% CI 1.28, 2.35) compared to Soldiers age 23 or younger. Overweight Soldiers had a 35% higher risk (OR1.35, 95%CI 1.06, 1.71) and obese Soldiers had a 76% higher risk of injury during deployment (OR1.76, 95%CI 1.22, 2.52) compared to those of normal weight. Soldiers who reported sprint training had a 21% lower risk of injury (OR0.79, 95%CI 0.64, 0.98) compared to those who did not perform sprint training as part of their personal physical training program. These Soldiers were also more likely to report performing other forms of personal physical training and, on average, had higher physical fitness levels.

Conclusions: Modifiable risk factors for injury during deployment include BMI and sprint training. Soldiers who incorporate cross-training-type activities like sprint and interval training may reduce injury risk by lowering exposure to repetitive training activities such as running.

P20

Title: Challenges to study hearing loss's impact on the quality of life in the military population Authors: <u>Hasanat Alamgir</u>, Jose Betancourt, David Tucker, Sharon Cooper, Sun-Young Kim, Nicole Wong, Caryn Turner, Natasha Gorrell, Tanisha Hammill, Andrew Senchak, Mark Packer

Objectives: The objectives of this research were to 1) summarize the evidence available on hearing loss's impact on quality of life (QoL) among U.S. Active Duty Service members, 2) describe the QoL instruments that have been used to quantify the hearing loss's impact on QoL, 3) examine the national population level secondary databases to report on their utility about studying impact of hearing loss on QoL among Active Duty Service members, and 4) provide recommendations for future studies that quantify the impact of hearing loss in this population.

Methods: The following QoL instruments have been used: Standard Form 36 Health Survey (SF-36), Health Utilities Index Mark 3, Hearing Handicap Inventory for the Elderly (HHIE), Quantified Denver Scale of Communication Function (QDS), Short Portable Mental Status Questionnaire (SPMSQ), Geriatric Depression Scale (GDS), Self-Evaluation of Life Function (SELF). Mini-Mental State Examination (MMSE), Psychological General Well-being Index, the International Outcome Inventory-Cochlear implant, and the Nord-Trondelag Health Study (HUNT). Among the secondary databases evaluated in this study, including the National Health and Nutrition Examination Survey (NHANES), National Health Interview Survey - Occupational Health Supplement (NHIS-OHS), Behavioral Risk Factor Surveillance System (BRFSS), National Health Interview Survey (NHIS), and the Health and Retirement Study (HRS), there is a lack of information that covers the intersection of hearing impairment, military population, and quality of life measures.

Results: In audiologic research, U.S. military personnel offer a unique research population, as they are exposed to noise levels and blast environments that are highly unusual in civilian work-settings, and serve as a model population for studying the impact on QoL associated with these conditions. The SF-36 was the most frequently cited survey instrument for assessing health-related quality of life (HRQL) and appears to have reliable outcomes when investigating the association between hearing impairment or military status and HRQL.

Conclusions: Our team recommends conducting a study on Active Duty Service members with hearing loss using the SF-36 as the measurement instrument to determine QoL.

P21

Title: Injuries among electric power industry workers, 1995 - 2013.

Authors: <u>Vitaly Volberg</u>, Tiffani Fordyce, Gabor Mezei, Ximena Vergara, Lovely Krishen

Objectives: To characterize trends and patterns of injury rates by demographic and occupational characteristics and by injury type among electric power industry workers in a large, representative, and detailed database.

Methods: We calculated injury rates by age, sex, occupational group, and injury type among workers in the Electric Power Research Institute's (EPRI) Occupational Health and Safety Database (OHSD), which contains information on recordable injuries, medical claims, and personnel data from 18 participating electric power companies from 1995-2013.

Results: The OHSD includes a total of 63,193 injuries over 1,977,436 employee-years of follow-up, for an overall injury rate of 3.2 injuries per 100 employeeyears. Annual injury rates steadily decreased from 1995 to 2000, increased sharply in 2001, and subsequently steadily decreased to their lowest rate of 1.3 injuries per 100 employee-years in 2013. Males had a higher overall injury rate compared to females (2.7 vs. 1.6), which is partially explained by maledominated occupations with high injury rates, such as welders, line workers, and mechanics (13.6, 10.4, and 6.9 injuries per 100 employee-years, respectively). For all workers, injuries were highest for those aged 30 and younger (3.7 injuries per 100 employee-years) and decreased with age. Welders and machinists did not follow this trend and had higher injury rates among the oldest age groups compared to those 30 and younger. Sprains and strains accounted for the majority of all injuries (40.9%), followed by cuts, lacerations, and punctures (16.0%), and contusions and bruises (9.2%). Sprains and strains accounted for 43.7% of medical costs, followed by fractures and dislocations (12.3%) and carpal tunnel and repetitive stress injuries (10.9%). Injuries from burns and electrocution had the highest cost per incident of all injury types. The most common injuries were to the back and trunk (17.7%) and to the neck and shoulders (14.1%).

Conclusions: Although injury rates have decreased over time, certain high-risk groups remain. These trends indicate that a deeper level of analysis is needed to pull out the more susceptible workforce categories, but these initial findings provide a promising snapshot of on-the-job injury trends for safety and occupational health practitioners to focus their efforts.

P22

Title: **Stop, drop, and roll: Workplace hazards of local government firefighters, 2009** Author: <u>Gary Kurlick</u>

Objectives: To observe how often firefighters are injured at work, when they are hurt, where they are injured, and how their injuries compare with those of workers in other professions.

Methods: This article uses data from the Bureau of Labor Statistics (BLS) Survey of Occupational Injuries and Illnesses (SOII) and Census of Fatal Occupational Injuries (CFOI). The BLS developed the Occupational Injury and Illness Classification System (OIICS) to present a reliable set of procedures for recording the characteristics of workplace injuries, illnesses, and fatalities. The SOII publishes four case characteristics to describe each incident that leads to an injury or illness resulting in at least 1 day away from work; in addition to these four characteristics, the CFOI publishes an additional characteristic (secondary source) to describe a fatal workplace injury. The circumstances of each case are classified on the basis of the BLS OIICS manual and the characteristics described in the following paragraphs.

Results: Despite extensive training and wearing personal protective equipment, firefighters regularly encounter workplace hazards that result in injury or death. The most common nonfatal injuries to firefighters when performing their duties resulted from bodily reaction and overexertion. Old and young, regardless of age and experience, firefighters in the local government with nonfatal injuries and illnesses had an incidence rate two times higher (511.822) compared with all workers (184.8) in 2009. Men accounted for the majority of fatal and nonfatal injury cases because of the high proportion employed in this occupation. The types of events that led to fatal occupational injuries among firefighters (such as transportation accidents) differed from those that led to nonfatal occupational injuries and illnesses (overexertion).

Conclusions: When compared with all workers, firefighters are injured in similar ways but at a much higher rate, with work-related injuries caused by "stress, exertion, and other medical-related issues" accounting for the largest number of deaths and with risks of fatal injuries 25.7 percent higher and nonfatal injuries and illnesses over two times greater.

P23

Title: **The impact of national culture on construction safety** Author: <u>Behzad</u> Esmaeili

More than nine million Americans with diverse cultural backgrounds work in the construction industry, which has a disproportionately high injury rate. One of the main causes of construction accidents is the unsafe behaviors of construction workers. In addition, the complexity of project behavior is increased when two or more national cultures are present on a project. Considering the fact that the number of Hispanic workers in the construction industry is increasing, examining the impact of national culture on individual's decision-making and work behaviors related to safety is rewarding. The research objectives of this study were to: (1) develop theories to explain the impact of national culture on workers' decision making and unsafe behavior; (2) test the validity of the theories developed in the previous phase by conducting field tests and engaging test subjects to participate in a virtual-reality simulation program; (3) construct an agent-based simulation

model of workers' behavior and simulate construction activities based on theories and observations. This study challenges the traditional safety management paradigm by testing the impact of national culture on safety risk perception, safety risk tolerance, decision making, and unsafe behavior in a multicultural workforce. The proposed study's findings will transform the current training and educational practices in the construction industry, enhance training effectiveness for underrepresented groups, and provide a scientific basis for simulating workers behavior using agent based models.

Vulnerable and other Worker Populations

P24

Title: Risk of occupational injuries among migrant workers: Research findings and practical implications from a field experience in Italian foundries

Authors: Stefano Porru, Stefano Calza, Cecilia Arici

Background: Migrant workers (MWs) usually perform dirty, dangerous and demanding ("three-D") jobs in poor working conditions, which are possible determinants of occupational safety inequalities (OSI) that, in turn, lead to increased risk of traumatic occupational injuries (TOI). Literature generally lacks of field studies analyzing OSI in risky sectors.

Objectives: To present data from an intervention field study carried out during 2008-2011 in the context of a wider project for occupational health and safety in the Italian foundry industry.

Methods: Data are reported from 35 foundries, 24 ferrous and 11 non-ferrous. A multifaceted intervention was carried out, with the main outcome of reduction in standardized TOI rates (incidence=TOI/workersx10², frequency=TOI/working hoursx10⁵, severity=workdays lost-WDL/working hoursx10³). An interrupted time series (ITS) analysis was performed, using generalized linear mixed-effects models.

Results: A mean of 567 MWs/year were employed in the period 2003-2011, with an upward trend in the last few years (i.e. +60% from 2003 to 2011). MWs were blue collars, 98% males, mainly coming from North-West Africa (55%) and East Europe (25%), mean age 38.5 (range 19.6-62.9), mean duration of employment 7.3 years (range 0.2-28.8), accounting on average for 30% of both workforce (range 7-88%) and working hours (range 6-84%), mostly performing "three-D" tasks. In 2003-2011, 1115 TOI (e.g. burns, wounds, dislocations, strains, sprains, fractures, eye injuries), representing 33% of total injuries and 6322 WDL (25% of total) were registered in MWs. Before the intervention (2007), MWs displayed significantly higher TOI incidence rate (1.78, p=0.005) as compared to Italian workers (IWs). ITS analysis showed increasing trend of all TOI rates (incidence: +28%, p=0.045; frequency: +76%, p=0.026; severity: +47%, p=0.034) among MWs in the intervention/post period, opposite to the slope direction registered for IWs. Possible explanations regarding these findings attain to differences in job tasks, type of employment, health surveillance, education, compliance with safety procedures as compared to IWs.

Conclusions: The study provides evidence of OSI among MWs in the foundry sector and highlights the need for dedicated interventions, with proactive role of occupational physicians and safety responsible, for the ultimate goal of healthy and safe integration of migrant workforce.

P25

Bangladesh garment workers' knowledge and awareness of health and safety

Authors: <u>Hasanat Alamgir</u>, Ines Kämpfer, Dingxiaozi Ding

Objectives: Established in the aftermath of recent factory tragedies, the Alliance for Bangladesh Worker Safety (Alliance) was founded by a group of North American apparel companies, retailers, and brands that collectively source from over 600 factories. The Alliance conducted a study to assess garment workers' knowledge and awareness of health and safety issues, their experience with injuries and fires, and their involvement in training and worker committee activities.

Methods: The study used both quantitative and qualitative data collection techniques: a 50 question multiple-choice survey and off-site Focus Group Discussions (FGDs). The survey questionnaire was designed to accommodate time limitations and a low level of literacy among the worker population and administered through I-Pad. The survey used a stratified random sample of 28 factories from an overall list of 625.

Results: A total of 3207 workers participated, including representative samples from each factory. An additional 101 workers participated in the FGDs. The majority of respondents are female (58%), with middle school or lower education levels (77%). Two thirds of surveyed workers did not know the basic elements need to start a fire, only 2% were able to correctly identify common hazards, and nearly 40% did not know what to do in case of an emergency. When given a list of responsibilities, nearly half of the surveyed workers did not think it was their obligation to know the emergency procedure (48%) or report injuries (49%). Approximately one third did not believe they share responsibility for reporting unsafe conditions (33%), nor feel obligated to wear protective equipment or clothing to ensure their safety (36%).The study results also expose the absence of functioning worker participation structures and find that H&S committees are insufficiently driving worker participation. Results also show that existing training activities have had limited impact.

Conclusions: Overall, survey results indicate that there is a significant gap in workers' knowledge about fire safety. Training content is not adapted to account for workers' low literacy levels, particularly among female workers. The results provide a baseline from which to measure the effectiveness of training and assessment activities in improving worker safety.

P26

Title: Physical strength and disability among injured workers who survived Rana Plaza building collapse in Bangladesh

Authors: <u>Gabriela Villanueva</u>, Taylor Fitch, Mohammad Quadir, Hasanat Alamgir

Objective: In April 24, 2013, a tragedy struck Rana Plaza-a high rise building in Bangladesh where garments were being made for major international companies leaving more than 1100 dead and thousands seriously injured. In this study, our objective is to report on the surviving workers' physical strength, disability level, and their return to work status one year after the disaster.

Methods: This cross sectional study took place at the Centre for Rehabilitation of the Paralysed (CRP) which provided care for 517 victims from this disaster. In addition to administering a survey asking questions on demographics and economic conditions, we assessed upper extremity strength by dynamometer hand grip (HG) and lower extremity strength using 5 time sit-to-stand test (STS). Disability level was measured using the WHODAS assessment tool and self-efficacy was measured by General Self-Efficacy questionnaire. All data were first collected manually and then entered into MS Excel and STATA for analyses.

Results: We recruited 181 subjects. Their mean age was 27.8 years, 60.8% of them were women, and 34.3% had only completed primary school education. A total of 179 participants completed the HG test with mean scores for men being 61.1 lbs and for women being 36.4 lbs. Only 127 participants were able to complete STS tests with mean scores for men being 18.7 seconds and for women 20.7 seconds. Disability mean score was higher among women compared to men (51.2 vs 47.7). Self-efficacy scores were 25.5 for men and 24.4 for women. A majority of the respondents (66.3%) reported to be unable to work due to health conditions.

Conclusions: The study subjects fell below norm levels of HG and 5-time STS tests. Women were found to be particularly weaker and reported higher level of disability. There is an immense need to develop and deliver post-injury recovery, rehabilitation and return to work programs for the work-injured marginalized population in the resource poor countries many of who make their living manufacturing products for the western markets.

P27

Title: Risk of injury by job classification in school districts

Authors: Katie Schofield Larson, Craig Stroinski

Background: The educational services industry sector employs a large percentage of United States workers. Risk of injury to teachers has been documented; risk to non-licensed and support staff such as educational aids, transportation employees, custodial, and food service workers needs further investigation. In addition to personal effect of injury to employees, injuries have serious consequences on district budgets, distract time and energy from the district's educational mission, and negatively impact the taxpayers and children of the communities in which they are located. The goal of this study is to determine risk and severity of injury among all job classifications in school districts.

Methods: Minnesota Department of Education (MN DOE) data was paired with workers' compensation data for 138 school districts over five years to ascertain the underlying population at-risk in the districts as well as those employees who suffered injuries and filed workers' compensation claims. Workers' compensation claims are categorized as medical-only or lost-time based upon severity of injury. Districts were categorized by geographic location. Employee characteristics of age, gender, and tenure were captured. Licensed employees were categorized as teacher, special education teacher, or other-licensed staff. Non-licensed employees were categorized as custodial, food service, educational assistant, special education assistant, transportation, clerical, or other-non-licensed employees. We will examine rate of injury and severity and risk for job classifications. A Poisson regression model will account for time-dependent factors and estimate rate ratios (RR) and 95% confidence intervals (CI) as a function of injury rate. Generalized estimating equations will account for correlated observations.

Preliminary Results: Approximately 7,500 injuries were incurred by district staff during the study period resulting in an injury rate of 3.7 per 100 employees. The majority of district staff were licensed, over forty, and female. Teachers and custodians suffered the most injuries.

Conclusions: The information can be utilized to understand risk of employment in school districts and direct injury prevention efforts, as well as assist in workers' compensation management. It will allow opportunity for further study and collaboration with the MN DOE and the insurance carrier, and for continued utilization of workers' compensation data for injury research.

P28

Title: Cleaning truly is a pain: A qualitative study of hotel housekeeping

Authors: <u>Jessica Streit</u>, Kellie Pierson, Pamela Vossenas, Susanna Nemes, Philip Moberg, Lida Orta-Anes, Susan Afanuh

Background/Objectives: The 500,000 hotel housekeepers currently employed in the United States represent 25% of all hospitality workers. Hotel housekeepers are primarily women (90%) and Hispanic or Latina (44.3%; BLS CPS, 2013). Their work involves repetitive, strenuous tasks: raising oversized mattresses to tuck bed sheets, stuffing and fluffing pillows, scrubbing bathroom walls and floors, lifting piles of heavy/wet linens and towels, and vacuuming. Self-report rates of back and shoulder injuries; tendonitis; bursitis; carpal tunnel syndrome; and chronic neck, low back, hand, and wrist pain are as high as 75% for this low-wage job, and OSHA logs provide evidence that housekeepers have the highest injury rates of all hotel workers (Buchanan et al., 2010; Lee and Krause, 2002; Scherzer et al., 2005). Since 2010, NIOSH and the North American Labor Union UNITE HERE have partnered to explore hotel housekeeping and develop research tools and industry recommendations, and guidance for this job.

Methods: A series of focus groups (N_group=18) were convened in 2013 to discuss job tasks, supplies, and tools; training availability; workplace policies, climate, and culture; a housekeepers (N_ind=85). All participants were women, and 82% (n=70) were Hispanic or Latina. Job tenure ranged from 3-40 years.

Results/Conclusion: Full focus group transcript analysis using Atlas.ti qualitative research software is currently in process. Preliminary results extracted during the synthesis of the open content coding completed by two independent raters confirm previous reports of housekeepers' shoulder, back, hand, wrist, and knee pain/injuries. While housekeepers identified vacuuming, bed making, and maneuvering heavy and/or poorly-maintained carts as their most hazardous job tasks, they expressed the most concern over excessive time pressures and unrealistically high workloads. These worries are exacerbated by a shortage of needed supplies (e.g., effective cleaning solutions, undamaged linens) and assistive tools and policies (e.g., long-handled scrubbers and dusters, quota adjustments for room complex rooms and checkouts).

The generation of thorough, hierarchical code networks will be completed by the end of 2014. The resulting network maps will yield a comprehensive picture of the relationship between job tasks, assistive tool and training availability, and housekeepers' adverse health outcomes.

Economics

P29

Title: Are correctional facility workers receiving excessive monetary compensation? Authors: Mariana Lever, Linda Forst, Lee Friedman

Objectives: Thousands of correctional facility workers are exposed to workplace hazards. In 2011, workers' compensation laws in Illinois were changed because of a purported excess in claims and pay outs to correctional officers in one particular facility. The objectives of this study are 1) describe occupational injuries among correctional officers vs a matched, non-correctional officer control group; and 2) determine whether the workers' compensation costs for correctional facility workers in the state of Illinois from 1982 to 2012 were higher than the costs for the matched group in the same time period.

Methods: The Illinois Workers Compensation Commission maintains a database of claims from all Illinois employees for occupational injuries and illnesses. We extracted all injuries and illnesses among correctional facility workers as well as a matched group and described them using SAS version 9.4. The total workers monetary compensation and wages were adjusted for inflation (2012). Regression analysis was used to compare injuries, total monetary workers compensation (TWC), permanent partial disability (PPD) percent, and number of weeks away from work for temporary total disability (TTD) between the two groups.

Results: From 1982 to 2012 there were 9079 claims filled by Illinois correctional facility workers. Among these claims, the most commonly affected body parts by injury/illness were: Upper Extremities (n=2551; 28% of total), Lower Extremities (n=2119; 23%), and Multiple Body Parts/Unspecified (n=1829; 20%). The

major drivers for TWC were average weekly wage, PPD, and TTD. Correctional facility workers were compensated \$297 less (TWC; CI 95%: -483, -111; p<.0017), and had 1.7 less weeks away from work (TTD; CI 95%: -2.1, -1.3).

Conclusions: Employees of correctional facilities earn low wages and are exposed to a variety of hazards that result in occupational injury and illness. Comparisons of matched samples of different occupational groups can discern similarities and differences in injury experience and economic costs. Surveillance data is an important resource that can provide evidence to drive workers' compensation policy changes and to focus preventive measures. Wider study would enhance the ability to prevent illnesses and injuries among this poorly studied, and vulnerable workforce.

P30

Title: The economic burden of mining fatalities in the United States, 2000-2012

Authors: <u>Elyce Biddle</u>, John Heberger, Jamie Lancaster

Objective: To more completely understand the burden imposed by deaths in the workplace, a *Mining Fatality Cost Calculator* was developed for the Office of Mine Safety and Health Research website. This online calculator provides a complementary perspective to traditional surveillance data that can provide insight into both the financial and economic dimension of loss. The data generated can also assist in directing limited research and prevention resources.

Methods: This model uses the Cost-of-Illness approach to measure the societal costs of occupational fatalities. There are two main components: a one-time direct cost and an annual series of indirect costs beginning with the decedent's age at death and ending at age 67. The direct cost is the medical cost associated with a fatality. The indirect cost has two components: the compensation value (wage and benefits adjusted for growth) and the household production value. For each year in which the indirect cost is calculated, these two values are summed and then adjusted for the time value of money using a real discount rate. All costs are adjusted for inflation using the GDP deflator. Data used in the model are from the MSHA accident/injury/illness records and Bureau of Labor Statistics.

Results: From 2000-2012 there were 762 mining fatalities with an average cost of \$1,280,000 per fatality, totaling \$975,560,000. Coal led all commodities with 404 deaths and a cost of \$532,640,000. Stone followed with 158 deaths costing \$183,000,000 to the U.S. economy. Two hundred and twenty deaths were classified as powered haulage incidents costing \$268,520,000. Fall of rib/roof/rock was the second highest accident classification with 150 deaths costing \$210,450,000. Looking at a breakdown by state, West Virginia led all states with 145 fatalities with an estimated cost of \$198,510,000 to GDP. Kentucky followed with 111 occupational fatalities costing \$148,640,000.

Conclusion: The *Mining Fatality Cost Calculator* builds on previous research and incorporates new information and counts from MSHA fatality data. Researchers and concerned groups within occupational health professions, NIOSH, policy makers, academics, labor unions, and mine companies can use this research to support their efforts for a safe workplace.

P31

Title: A practical approach to EHS leading indicators: Cross-industry lessons Author: Joy Inouye

Objectives: This session will provide an overview of the concepts behind a practical approach to EHS leading indicators, as well as specific metrics and case studies all organizations can put to use.

Methods: This presentation will explain the mixedmethod research – including expert workgroups, surveys, case studies, and quantitative and qualitative analysis – that led to the development of a practical guide and thought map of EHS leading indicators. The Campbell Institute gathered knowledge from EHS executives and experts representing Institute Member organizations regarding practical leading indicator information – from general categories of data collected to specific metrics that have made a profound impact on their EHS performance.

Results: While one size does not fit all when it comes to leading indicators, research conducted by the Campbell Institute at the National Safety Council has shown that robust leading metrics do share common critical characteristics. What's more, these indicators can be classified into a taxonomy that helps all organizations better conceptualize their implementation, use, and iteration. We will present this taxonomy, as well as the enabling factors that drive the effective use of leading indicators and the barriers to their implementation. We will also present the lessons learned around buy-in, correlation, return on investment, and other key elements of leading metric implementation and use.

Conclusion: The "Holy Grail" or "Silver Bullet" approach to problem-solving is appealing for a reason – who wouldn't want to be able to use the same solution for every issue that arises? Yet in the field of environmental, health, safety, and sustainability (EHS) leading indicators, this approach has been proven time and again to be impractical or even damaging to performance. Combining a user-friendly, easily communicated framework with real-world evidence, we provide answers to long-standing questions that will enable organizations to develop – and sustain – the leading indicator initiative needed to achieve EHS excellence.

P32

Title: Falls from elevation as a cause of non-battle injuries among Army soldiers deployed to Iraq and Afghanistan

Authors: <u>Geeta Kersellius</u>, Bonnie Taylor, Keith Hauret, Bruce Jones

Introduction: Falls are a major source of occupational morbidity and mortality in the U.S. National Workers Compensation data from 2001-2002, showed that the second highest workers compensation costs (averaging \$18,838 per claim) were attributed to falls, surpassed only by motor vehicle crashes. Falls are also a major priority for the military, accounting for 18% of the non-battle injuries (NBIs) that required air evacuation from Iraq and Afghanistan (2003-2008).

Purpose/Objectives: The objective of this investigation was to utilize air evacuation data to describe NBI falls (excludes jumps and near-falls) from one level to another (elevation) sustained by U.S. Army soldiers deployed in support of Operations in Iraq and Afghanistan.

Methods: Army soldiers who were medically evacuated for a fall from elevation while deployed to Iraq or Afghanistan (October 2001-December 2013) were identified from air evacuation records. Patient history and diagnoses were used to determine the cause of injury, fall type and injury type. Descriptive statistics were used to report the incidence of falls, fall types, and injury types.

Results: Overall 22,576 soldiers were air evacuated for an NBI. Falls were the second leading cause of NBIs (n=3,028). Forty-seven percent (n=1,435) of falls were from an elevated height and more than one third of these falls (n=589) were from stationary vehicles. The three leading vehicle types were trucks (34%), Humvees (12%), and mine-resistant ambush-protected vehicles (11%). Twenty-seven percent (n=231) of nonvehicle-related falls were from statis/ladders. The top three specified factors contributing to the remaining non-vehicle-related falls (n=615) were holes/ditches/cliffs (10%), slippery conditions (3%), and unstable surfaces (3%). Overall the leading injury types were fractures (45%), pain/inflammation (12%), and dislocations (11%). Conclusions: Falls from a height constitute a serious threat to the Army even during combat operations. This investigation found that almost half of the fall-related injuries air evacuated from Iraq and Afghanistan were falls from an elevation, of which nearly over a third were falls from stationary vehicles. Many of these injury circumstances may be modifiable and therefore should be a priority among injury prevention programs.

P33

Height of fatal fall injuries in the US construction industry

Authors: Xuanwen Wang, <u>Xiuwen Sue Dong</u>, Julie Largay

Objectives: Falls are the leading cause of fatal injuries in construction. Despite the significance, detailed data (e.g., the distance fallen) were not available in the past. The Bureau of Labor Statistics substantially revised the Occupational Injury and Illness Classification System which has been used to code injury and illness data since 2011. This study examines fatal fall injuries by height to identify more evidence and insights for developing fall prevention strategies in construction.

Methods: Data from two large national datasets between 2011 and 2012 were analyzed, including the Census of Fatal Occupational Injuries and the Current Employment Statistics. Stratified analyses were conducted to identify differences among subgroups in construction.

Results: In 2011 and 2012, 563 construction workers died from falls, accounting for more than one-third (34.5%) of construction fatalities. The number of fatal falls increased 9% between 2011 and 2012, from 269 to 294. Overall, 22% of the fatal falls were from over 30 feet and 38% were from 15 feet or less (including 8% from less than six feet). Older workers were more likely to die from lower height falls than younger workers. Nearly 60% of the decedents over 64 years of age fell from 15 feet or less, compared to 21% of the decedents under 35 years of age. A larger proportion of falls from 15 feet or less was found among the decedents who were employed by smaller establishments (10 or fewer employees) than those employed by larger establishments. Compared to the non-residential construction subsector, residential construction had a higher rate of fatal falls and a larger proportion of falls from 15 feet or less. The risky occupations for lower height falls were drywall installers and electricians while power-line installers, welders, and brick masons were more likely to fall from over 30 feet.

Conclusions: The patterns of fatal falls from height differ among age groups, occupations, construction

subsectors, establishment sizes, and employment status. Developing needs-based fall prevention programs with specific focus and strategies is an efficient way to address the unique risks of different worker groups.

P34

Title: **Deciphering fall-related injuries using narrative incident reports** Authors: Veronique Hauschild, Anna Schuh

Purpose: Unintentional falls are repeatedly identified as a top cause of injuries in the U.S. and the Army. This project was conducted to elicit detailed information about fall-related injuries within the Army to identify means to reduce such injuries.

Methods: Data was collected from three reporting systems containing narrative descriptions of Active Duty Army incidents. Data was limited to calendar year 2011 and categorized into deployment and nondeployment groups. Data were screened to combine duplicated incidents and two investigators independently reviewed data to ensure incidents were "fall" related. Incidents that described an item "falling on a person" or a "slip of a knife" were not included. Incidents that involved moving vehicles were not included, but incidents involving stationery vehicles were included. Investigators coded variables for scenarios, activities, injury type/ body region, and hazard factors. Descriptive statistics of nondeployment data were calculated for the first phase of this assessment.

Results: Of 988 fall incidents, four resulted in fatalities while the majority (79%) resulted in lost duty time. Over 70% involved scenarios conducted on duty and/or under some military auspices. Sports scenarios caused the most injuries (22%). Parachuting scenarios were next most prominent (20%). Because fall injuries are only a portion of overall injuries attributed to parachuting and sports, falls from these activities (n=415) were separated from the other activities. The top five activities causing remaining incidents (n=573)were: walking (30%), climbing (25%), physical training/running (14%), combat training (12%), and occupational tasks (9%). Body regions most injured included foot/ankle, hand/wrist, and knee. Most common injury types were sprain/strains and fractures. Of the contributing factors, the greatest percentages were ice/snow (19%) and steps/stairs (15%).

Conclusions: A "fall" is the mechanism that results in an injury. To prevent the injury cause, the specific activities/factor(s) leading to the fall must be defined. Top activities resulting in Army fall injuries include parachuting and sports. Previous studies of parachuting and sports-injuries indicate some interventions (e.g. ankle braces) may reduce injuries. While interventions for other activities/ factors are less clear, an investigation of polices and techniques to increase awareness and/or reduce ice hazards on Army properties should be considered.

P35

Title: How is a slip, trip and fall injury similar to a motor vehicle crash? Pilot testing a Total Work HealthTM exposure metric among aging healthcare workers

Author: Kenneth Scott

Overview: Slip, trip and fall (STF) injury risk increases with age and physical activity decreases with age. Like driving, walking represents an interaction between individual and environmental risk factors for injury. Commercially-available technology may make it feasible to analyze STF injuries using an analogous metric of at-risk experience (e.g. the number of injuries per steps traveled). The mean number of steps taken per hour is also a measure of occupational physical activity. Steps per hour may serve as an integrated Total Worker HealthTM exposure metric that informs STF injury risk as well as risk for various other chronic health outcomes.

Objectives:

--To pilot test a novel exposure assessment technology, assessing the acceptability to participants and potential sources of measurement error --To compare the variability in occupational physical activity patterns within subjects to the variability between subjects over a 6-week period --To assess the impact of workers' access to their occupational physical activity data on their occupational physical activity levels

Methods: A group of healthcare workers 55 years of age and older were enrolled in a pilot study focusing on walking at work. Longitudinal pilot data was collected over a period of 16 weeks to assess occupational walking patterns using commerciallyavailable Fitbit FlexTM physical activity monitors. Follow-up time was divided into two phases: a 6-week period in which participants were "blinded" to their data and a 10-week period in which participants could access their data through an online dashboard developed by Fitbit. We analyzed the data using mixed effects regression modeling to determine whether there are noticeable differences in walking patterns between the blinded data collection period and the un-blinded period. Secondarily, we explored potential sources of error in the data and identified strategies to improve data fidelity in future research studies using this exposure assessment technology.

Results: The acceptability of the device was high. Several sources of measurement error were identified. Physical activity levels declined over the period of the study.

Conclusions: Providing data to employees about their occupational physical activity levels may not be sufficient to influence walking patterns at work.

P36

Title: **Evaluation of postural stability during various methods of exiting and entering scissor lifts** Authors: <u>Sharon Chiou</u>, Christopher Pan, Bryan Wimer

Objectives: The use of scissor lifts has increased tremendously in industries to facilitate the completion of tasks performed at elevation. Previous NIOSH studies documented the increasing trend for fatalities associated with falls from scissor lifts. According to draft American National Standards Institute (ANSI) *A10.29*, workers may enter or exit scissor lifts at heights greater than 6 feet when the lift work platform is adjacent to an elevated surface with a vertical gap smaller than 8 inches and a horizontal gap smaller than 14 inches. To date, there has been no scientific evidence on the manner in which the horizontal and vertical gaps were determined and how the distances between the lift platform and the adjacent surface may affect workers' postural stability.

Methods: Twenty-two construction workers who had at least one year of experience working with aerial lifts participated in the study. A series of postural stability tests were performed to evaluate workers' balance characteristics immediately after participants exited, or entered, a scissor lift (Model SJIIIE 3219, Skyjack, Inc.) at a 10-foot height, using two force plates. The horizontal distance from the landing surface was set at 0, 7, or 14 inches from the scissor lift. The vertical distance was 4, 8, and 12 inches lower or higher than the scissor lift platform. Also, the landing surface was either flat or sloped at 26 degrees.

Results: The repeated measure ANOVA revealed that greater postural instability was found when subjects were exiting to or entering from a sloped surface (p<0.05). Greater postural instability was found to be associated with sloped landing surfaces in terms of sway speed, medial-lateral sway, anterior-posterior sway, and sway length. Entering the lift placed greater postural demands on the subjects compared to exiting (p<0.05).

Conclusions: This study demonstrated that postural stability was significantly affected by various entering and exiting methods. Findings from this study will be

used to recommend safer work practices to prevent fall injuries from elevation for the use of scissor lifts.

P37

Title: **High incidence of violence in health care** occupations: A profile of psychiatric aides and psychiatric technicians Author: Jacqueline Longton

Objectives: The first objective of this research is to analyze the similarities and differences of psychiatric aides and technicians. The second objective is to looking at areas such as the source, the event, the part of body affected, and the nature of the injury or illness to compare their experiences. Lastly, the research compares these occupations to the national rates as well as other selected occupations.

Methods: A brief overview of their work environments is given followed by a historical synopsis of how psychiatric patients are committed to hospitals throughout the country. Data from the 2011 Survey of Occupational Injuries and Illnesses is used to show the occupational injury and illness profile of psychiatric aides and technicians. Proportions were constructed for the part of body affected and the nature of injury and illness in order to compare their experiences.

Results: Psychiatric aides and technicians are experiencing high rates of nonfatal occupational injury and illness due to violence in the workplace by patients. Psychiatric aides have a higher number of nonfatal occupational injuries and illnesses as compared with technicians. Their proportions of injuries and illnesses in terms of part of body affected and the nature of the injury or illness from a violent event show similarities and differences in their experience. These occupations have higher rates of nonfatal occupational injuries and illnesses when compared to selected occupations.

Conclusions: Psychiatric aides and technicians, while similar in environment and job duties, experienced occupational injuries and illnesses at rates different from one another and different as compared with other occupations. The event and the source of the majority of their injuries and illnesses are the same: violence and patients. The comparison of the part of body affected and the nature of the injuries and illnesses showed a variety of similarities and differences across the different categories selected for analysis.

There are many unknowns surrounding these two occupations. Further analysis into their work environments, data on employee-to-patient ratios, information regarding training, and relevant data on the types of patients they are working with should be gathered to help prevent such high rates.

P39

Title: Nurse practitioners' (NPs) comfort in treating of work-related injuries in adolescents: A survey of Washington and Oregon NPs

Authors: Janessa M. Graves, Tracy A. Klein

Objectives: In Washington and Oregon, nurse practitioners (NPs) are licensed independent providers. Previous research suggests that NPs play an important role in treating injured workers, especially in rural areas. We surveyed NPs in Washington and Oregon in order to examine and describe their experience and comfort level in treating adolescents with work-related injuries.

Methods: A self-administered, web-based survey was sent to all licensed family medicine, pediatrics, and mental health NPs in Washington and Oregon (N=4,612). Respondents were asked to indicate whether they had ever treated an adolescent for an injury that occurred while they were working in a job and to rate their comfort level in treating occupational or work-related injuries in adolescents.

Results: Of NPs eligible to receive the survey, 945 completed the survey at least partially (20.5% response rate). Among respondents, 908 (N=908) completed questions pertaining to work-related injuries, of whom 21.4% reported having ever treated an adolescent for a work-related injury. Few NPs indicated a high level of comfort ("very comfortable") in treating occupational or work-related injuries in adolescents (5.3%), whereas nearly 45% reported being uncomfortable or very uncomfortable (24.5% and 18.6%, respectively). Using multivariable regression and accounting for survey weighting, we evaluate factors associated with NP's comfort level in treating adolescents with occupational or work-related injuries, including practice setting, training, experience, and demographics.

Conclusions: Many NPs in Washington and Oregon report at least some level of discomfort in treating adolescents with work-related injuries. Given their expanded scope of practice in these states, it is crucial that NPs receive appropriate training and education to prepare them to treat injured young workers, including how to file workers' compensation claims. This study lays the groundwork for developing educational and outreach efforts to better prepare NPs to treat workrelated injuries among adolescents.

Disclaimer: Survey data collection for this study is ongoing and will extend through 12/31/14. Results reported here reflect data collected up until 11/28/14. More extensive analyses, including survey weighting and multivariable regression will be conducted after data collection is complete.

NOIRS 2015 ABSTRACT REVIEWERS

NOIRS 2015 Abstract Reviewers

Alfred Amendola, PhD, PE, CPE NIOSH

Jennifer Bell, PhD NIOSH

Ruchi Bhandari, PhD NIOSH

Elyce Biddle, PhD West Virginia University

Kathleen Carlson, PhD, MS Portland VA Medical Center

Carri Casteel, PhD, MPH University of Iowa

Guang Chen, MD NIOSH

Sharon Chiou, PhD NIOSH

James Collins, PhD, MSME NIOSH

Hamid Fonooni, PhD East Carolina University

Michael Goldcamp, PhD NIOSH

Kitty Hendricks, MA NIOSH

Edward (Ted) Hitchcock, PhD NIOSH

Yueng-Hsiang (Emily) Huang, PhD Liberty Mutual Research Institute for Safety

Ken Kolosh, MS National Safety Council

Larry Layne, MS NIOSH

Mary Lesch, Ph.D Liberty Mutual Research Institute for Safety Jennifer E. Lincoln, BSF, MSSM NIOSH

Jennifer M. Lincoln, PhD, CSP NIOSH

Murrey Loflin, MS NIOSH

David Lombardi, PhD Liberty Mutual Research Institute for Safety

Todd Loushine, PhD, CIH, CSP University of Wisconsin – White Water

Suzanne Marsh, MPA NIOSH

Cammie Chaumont Menéndez, PhD, MPH, MS NIOSH

Paul Moore, BSME NIOSH

John R. Myers, MS NIOSH

Jack Oguto, PhD Millersville University

Richard Olawoyin, PhD Oakland University

Corinne Peek-Asa, PhD, MPH University of Iowa

Kara Perritt, MS NIOSH

Keshia Pollack, PhD, MPH Johns Hopkins University

Audrey Reichard, MPH NIOSH

Scott Richardson Bureau of Labor Statistics

CAPT Marilyn Ridenour, BSN, MBA, MPH, CPH NIOSH Rosa Rodríguez-Acosta, PhD NIOSH

Diane Rohlman, PhD University of Iowa

Nancy Romano, MS, CSHM NIOSH

Mahmood Ronaghi, MSME, MSAE NIOSH

Frederick (Ted) Scharf, PhD NIOSH

Ashley Schoenfisch, PhD, MSPH Duke University Medical Center

Christine Schuler, PhD NIOSH

William (Karl) Sieber, PhD NIOSH

Peter Simeonov, PhD NIOSH

Sergey Sinelnikov, MPH National Safety Council

Christina Socias, DrPH NIOSH

Hope Tiesman, PhD NIOSH

Theresa Tonozzi, MPH NIOSH

Jeff Welsh NIOSH

Janice Windau, MS Bureau of Labor Statistics

Amanda Young, PhD Liberty Mutual Research Institute for Safety

NOIRS 2015 List of Pre-Registered Participants

Our apologies for any errors in name, affiliation, address, phone, etc.
Harrison Ajeh, MD

Occupational Medicine West Virginia University 1 Medical Center Drive Morgantown, WV USA 26506 PH: 304-293-0741 Email: <u>hiajeh@hsc.wvu.edu</u>

Hasanat Alamgir, PhD

Professor UT School of Public Health Occupational amd Environmental Health 13546 Chappel View San Antonio, TX USA 78249 PH: 210-251-9021 Email: <u>abul.h.alamgir@uth.tmc.edu</u>

Edem Amedzro

Safety and Health Speed Real Estate and Land Investment PO Box SC 186 Tema, Greater Accra, Ghana PH: +233-24-4153064 Email: edemkodjobobby@gmail.com

Al Amendola, PhD, PE, CPE

Supervisory Safety Engineer Division of Safety Research NIOSH 1095 Willowdale Road, MS G800 Morgantown, WV USA 26505 PH: 304-296-3376 Email: <u>aaa1@cdc.gov</u>

Benjamin Amick III, PhD

Scientific Director Institute for Work and Health 481 University Avenue, Suite 800 Toronto, Ontario Canada M5G 2E9 PH: 416-927-2027 ext. 2115 Email: <u>ben.amick@gmail.com</u>

Alternate listing:

Florida International University Health Policy and Management 11200 SW 8 Street AHC5-453 Miami, FL USA 33199 PH: 305-348-7803 Email: <u>bamickii@fiu.edu</u>

Doug Ammons, BS

Computer Engineer Division of Safety Research NIOSH 1095 Willowdale Road, G800 Morgantown, WV USA 26505 PH: 304-285-6223 Email: DAmmons@cdc.gov

Karla Amos

Employee Health Kindred Healthcare 2250 East Flamingo Road Las Vegas, NV USA 89119 PH: 702-894-4300 Email: <u>karla.amos@kindred.com</u>

Alexsandra Apostolico, MPH

New Jersey Safe Schools Program Rutgers School of Public Health 335 George Street, Suite 2200 New Brunswick, NJ USA 08901 PH: 732-235-4988 Email: <u>alexsandra.apostolico@gmail.com</u>

Sheila Arbury

Office of Occupational Nursing US Department of Labor Occupational Safety and Health Administration 200 Constitution Avenue NW Room 3457 Washington, DC USA 20210 PH: 202-693-2547 Email: arbury.sheila@dol.gov

Fekede Asefa, MPH

Dept of Public Health College of Health and Medical Science Haramaya University P O Box 235 Harar, Ethiopia 235 PH: +25-191-3072716 Email: <u>sinboona@gmail.com</u>

Olamide Awolola

Clinical Pharmacy and Pharmacy Administration University of Ibadan Ibadan, Oyo Nigeria 234 PH: +08071019938 Email: <u>awomide@gmail.com</u>

Tannista Banerjee, PhD

Economics Auburn University 0324 Haley Center Auburn, AL USA 36849 PH: 334-844-2922 Email: tzb0018@auburn.edu

Thomas Barnett, BSc, CRSP

Assistant Deputy Minister's Office Ontario Ministry of Natural Resources 300 Water Street, 2nd Floor, N Peterborough, Ontario Canada K9J 8M5 PH: 705-755-2040 Email: tom.w.barnett@ontario.ca

Peter Barss, MD, ScD

Division of Occupational and Environmental Health School of Population amd Public Health University of British Columbia Canadian Red Cross PO Box 605, 5191 69th Avenue NE Canoe, British Columbia Canada V0E 1K0 PH: 250-833-4730 Email: peter.barss@gmail.com

Jennifer Bell, PhD

Researcher Epidemiologist Division of Safety Research NIOSH 1095 Willowdale Road, MS 1811 Morgantown, WV USA 26505 PH: 304-285-5802 Email: JBell@cdc.gov

Ruchi Bhandari, PhD

Associate Service Fellow Division of Safety Research NIOSH 1095 Willowdale Road, MS 1900 Morgantown, WV USA 26505 PH: 304-285-5909 Email: <u>ygn8@cdc.gov</u>

Anasua Bhattacharya, PhD

Economist Fellow Education and Information Division NIOSH 1150 Tusculum Avenue, MS C15 Cincinnati, OH USA 45226 PH: 513-533-8331 Email: <u>ABhattacharya1@cdc.gov</u>

Elyce Biddle, PhD

Assistant Professor Health Policy, Management and Leadership West Virginia University PO Box 9190, Room 3825, HSC 1 Medical Center Drive Morgantown, WV USA 26506 PH: 304-581-1858 Email: EBiddle@hsc.wvu.edu

Jordan Blazer

Technology Systems East Carolina University Science and Technology Building Suite 201 Greenville, NC USA 27858 PH: 828-275-9667 Email: <u>blazerj14@students.ecu.edu</u>

Thomas Bobick, PhD

Safety Engineer (Research) Division of Safety Research NIOSH 1095 Willowdale Road, MS G800 Morgantown, WV USA 26505 PH: 304-285-5986 Email: <u>TBobick@cdc.gov</u>

Brad Boehler

President Skyjack Inc. 201 Woodlawn Road West Guelph, Ontario Canada N1H 1B8 PH: 519-837-0888 Email: <u>brad.boehler@skyjack.com</u>

Matt Bowyer

General Engineer Division of Safety Research NIOSH 1095 Willowdale Road, MS 1808 Morgantown, WV USA 26505 PH: 304-285-5991 Email: mqb2@cdc.gov

William Boyer

Research and Statistics Minnesota Department of Labor and Industry 443 Lafayette Road St. Paul, MN USA 55155 PH: 651-284-5228 Email: william.boyer@state.mn.us

Christine Branche, PhD

Principal Associate Director Director, Office of Construction Office of the Director NIOSH 395 E Street SW, Suite 9200 Washington, DC USA 20201 PH: 202-245-0625 Email: <u>CBranche@cdc.gov</u>

Maria Brann, PhD

Associate Professor Communication Studies Indiana University-Purdue University Indianapolis 425 University Boulevard, CA 317 Indianapolis, IN USA 46202 PH: 317-274-8562 Email: mabrann@iupui.edu

Rebecca Bruening, MPH

Occupational and Environmental Health The University of Iowa 2190 Westlawn Iowa City, IA USA 52242 PH: 319-384-4226 Email: rebecca-bruening@uiowa.edu

Maria Bulzacchelli, PhD

Assistant Professor Department of Health Promotion and Policy University of Massachusetts-Amherst 715 North Pleasant Street Amherst, MA USA 01003 PH: 413-545-7428 Email: bulzacchelli@schoolph.umass.edu

Terry Bunn, PhD

Associate Professor Kentucky Injury Prevention and Research Center University of Kentucky 333 Waller Avenue, Suite 242 Lexington, KY USA 40504 PH: 859-257-4955 Email: <u>tlbunn2@uky.edu</u>

Jessica Bunting

Research to Practice The Center for Construction Research and Training 8484 Georgia Avenue, Suite 1000 Silver Spring, MD USA 20910 PH: 301-495-8515 Email: jbunting@cpwr.com

Corey Butler

Prevention Specialist Western States Division NIOSH PO Box 25226 Denver Federal Center, Building 25 Denver, CO USA 80225 PH: 303-236-5953 Email: guz5@cdc.gov

Christen Byler

OSHS/CFOI Bureau of Labor Statistics 2 Massachusetts Avenue NE Washington, DC USA 20212 PH: 202-691-6252 Email: <u>byler.christen@bls.gov</u>

Daniel Cain

Industrial Hygienist Environmental Public Health Oregon Health Authority 800 NE Oregon Street, Suite 640 Portland, OR USA 97232 PH: 971-673-0197 Email: <u>daniel.t.cain@state.or.us</u>

Doug Cantis

Physical Scientist Technician Division of Safety Research NIOSH 1095 Willowdale Road, MS G800 Morgantown, WV USA 26505 PH: 304-285-6013 Email: <u>DCantis@cdc.gov</u>

Linda Cantley

Research Associate Occupational and Environmental Medicine Yale University School of Medicine 135 College Street New Haven, CT USA 06510 PH: 203-785-7202 Email: <u>linda.cantley@yale.edu</u>

Robert Cargill, PhD

Cargill Bioengineering LLC 1207 Royal Lane West Deptford, NJ USA 08086 PH: 215-525-4242 Email: rcargill@cargillbioengineering.com

Carri Casteel, PhD

Associate Professor Occupational and Environmental Health University of Iowa 145 North Riverside Drive S314 CPHB Iowa City, IA USA 55242 Email: <u>carri-casteel@uiowa.edu</u>

Dawn Castillo, MPH

Director Division of Safety Research NIOSH 1095 Willowdale Road, MS 1900 Morgantown, WV USA 26505 PH: 304-285-5894 Email: <u>DCastillo@cdc.gov</u>

Thomas Cecich, CSP, CIH

Senior Vice President American Society of Safety Engineers 113 Kenneth Ridge Court Apex, NC USA 27523 PH: 919-601-5224 Email: tom@tfc-assoc.com

Betty Champagne

Secretry to the Deputy Director Division of Safety Research NIOSH 1095 Willowdale Road, MS 1900 Morgantown, WV USA 26505 PH: 304-285-5894 Email: <u>fsk7@cdc.gov</u>

Wen-Ruey Chang, PhD

Center for Physical Ergonomics Liberty Mutual Research Institute for Safety 71 Frankland Road Hopkinton, MA USA 01748 PH: 508-497-0219 Email: wen.chang@libertymutual.com

Cammie Chaumont Menéndez, PhD, MPH

Epidemiologist Division of Safety Research NIOSH 1095 Willowdale Road, MS 1811 Morgantown, WV USA 26505 PH: 304-285-6233 Email: <u>CMenendez@cdc.gov</u>

Guang Chen, PhD

Epidemiologist Division of Safety Research NIOSH 1095 Willowdale Road, MS 1811 Morgantown, WV USA 26505 PH: 304-285-5995 Email: <u>gdc0@cdc.gov</u>

Michelle Chervak, PhD, MPH

Injury Prevention Program U.S. Army Public Health Command 5158 Blackhawk Road ATTN: MCHB-IP-DI ABD, MD USA 21010-5403 PH: 410-929-9059 Email: michelle.c.chervak.civ@mail.mil

Robert Chetlin, PhD

Technician Tech II Division of Safety Research NIOSH 1095 Willowdale Road, MS G800 Morgantown, WV USA 26505 PH: 304-285-6349 Email: <u>RChetlin@cdc.gov</u>

Sharon Chiou, PhD

Health Scientist Division of Safety Research NIOSH 1095 Willowdale Road, MS G800 Morgantown, WV USA 26505 PH: 304-285-6029 Email: <u>SChiou@cdc.gov</u>

Randy Clark

SHARP Program Washington State Department of Labor and Industries PO Box 44330 Olympia, WA USA 98504-4330 PH: 360-902-5661 Email: claa235@lni.wa.gov

Debbie Claunch

College of Nursing University of Kentucky Room 509G, CON Building Lexington, KY USA 40536-0232 PH: 859-323-3480 Email: <u>dtclau2@uky.edu</u>

Jessica Clouser, MPH

College of Public Health Department of Health Behavior University of Kentucky 151 Washington Avenue 346 Bowman Hall Lexington, KY USA 40506-0059 PH: 859-323-0587 Email: jess.clouser@uky.edu

Jim Collins, PhD, MSME

Chief, Analysis and Field Evaluations Branch Division of Safety Research NIOSH 1095 Willowdale Road, MS 1800 Morgantown, WV USA 26505 PH: 304 285-5998 Email: JCollins1@cdc.gov

Theodore Courtney, MS, CSP

Center for Injury Epidemiology Liberty Mutual Research Institute for Safety 71 Frankland Road Hopkinton, MA USA 01748 PH: 508-497-0200 Email: theodore.courtney@libertymutual.com

Cassandra Crifasi, PhD, MPH

Health Policy and Management Johns Hopkins Bloomberg School of Public Health 624 North Broadway, Room 588 Baltimore, MD USA 21205 PH: 443-287-8040 Email: <u>ckerchel@jhu.edu</u>

Thomas Cunningham, PhD

Education and Information Division NIOSH 1150 Tusculum Avenue, MS C-10 Cincinnati, OH USA 45226 PH: 513-533-8325 Email: TCunningham@cdc.gov

Richard Current, BSA, PE

General Engineer (Research) Division of Safety Research NIOSH 1095 Willowdale Road, MS G800 Morgantown, WV USA 26505 PH: 304-285-6084 Email: RCurrent@cdc.gov

Marvin Dainoff, PhD, CPE

Center for Behavioral Sciences Liberty Mutual Research Institute for Safety 71 Frankland Road Hopkinton, MA USA 01748 PH: 508-497-0245 Email: marvin.dainoff@libertymutual.com

Ann Marie Dale, PhD, OTR/L

Research Assistant Professor Washington University School of Medicine 660 South Euclid Avenue Campus Box 8005 St. Louis, MO USA 63110 PH: 314-454-8470 Email: <u>adale@dom.wustl.edu</u>

Gregory Dang, DrPh, CPH

Division of Public Health NC Department of Health and Human Services 5505 Six Forks Road Building 1, Mail Service Center 1912 Raleigh, NC USA 27699-1912 PH: 919-707-5904 Email: gregory.dang@dhhs.nc.gov

Steven Davidson, CSP, CPCU

Loss Control Continental Western Group 11201 Douglas Avenue PO Box 1594 Des Moines, IA USA 50306-1594 PH: 515-473-3374 Email: <u>sdavidson@cwgins.com</u>

Letitia Davis, ScD, EdM Director

Occupational Health Surveillance Program Massachusetts Department of Public Health 250 Washington Street Boston, MA USA 02108 PH: 617-624-5626 Email: <u>letitia.davis@state.ma.us</u>

Andrew Denny

West Virginia University 971 Valley View Avenue Apartment 305 Morgantown, WV USA 26505 PH: 304-629-0360 Email: <u>adenny89@gmail.com</u>

Cindy DePrater

Vice President Environmental Health and Safety Turner Construction Coompany 10100 North Central Expressway Suite 600 Dallas, TX USA 75231 PH: 214-244-9803 Email: <u>cdeprater@tcco.com</u>

Christine Dobson, ScD

Occupational Health Branch California Department of Public Health 850 Marina Bay Parkway Building P, 3rd Floor Richmond, CA USA 94804 PH: 510-620-3649 Email: christine.dobson@cdph.ca.gov

Xiuwen Sue Dong, DrPH

Director, Data Center CPWR - The Center for Construction Research and Training 8484 Georgia Avenue, Suite 1000 Silver Spring, MD USA 20910 PH: 301-578-8500 Email: <u>sdong@cpwr.com</u>

Patrice Duguay

Statistical Research and Surveillance Scientific Division IRSST 505 Boulevard de Maisonneuve Ouest, 15e étage Montréal, Québec Canada H3A 3C2 PH: 514-288-1551 Email: <u>duguay.patrice@irsst.qc.ca</u>

Teresa Dwornick

Secretary to the Director Division of Safety Research NIOSH 1095 Willowdale Road, MS 1900 Morgantown, WV USA 26505 PH: 304-285-6170 Email: <u>tkd6@cdc.gov</u>

Ava Dykes, PhD

Researcher Health Effects Laboratory Division NIOSH 1095 Willowdale Road, MS 3014 Morgantown, WV USA 26505 PH: 304-285-6371 Email: ylg2@cdc.gov

Scott Earnest, PhD

Deputy Director Coordinator for Safety and Health Office of Construction NIOSH 1090 Tusculum Avenue Cincinnati, Ohio USA 45226 PH: 513-841-4539 Email: <u>GEarnest@cdc.gov</u>

Brianna Eiter, PhD

Office of Mine Safety and Health Research NIOSH 626 Cochrans Mill Road Building 152, Room 212 Pittsburgh, PA USA 15236 PH: 412-386-4954 Email: <u>BEiter@cdc.gov</u>

Behzad Esmaeili, PhD

Assistant Professor University of Nebraska Lincoln 113 Nebraska Hall Lincoln, NE USA 68512 PH: 402-472-5504 Email: <u>besmaeili2@unl.edu</u>

Cheryl Estill, MS, PE

Supervisor Division of Surveillance Health Evaluations and Field Studies NIOSH 1090 Tusculum Avenue Cincinnati, OH USA 45242 PH: 513-841-4476 Email: <u>clf4@cdc.gov</u>

Bradley Evanoff, MD, MPH

Professor Washington University School of Medicine in St. Louis Campus Box 8005, 600 South Euclid St Louis, MO USA 63110 PH: 314-454-8638 Email: <u>bevanoff@dom.wustl.edu</u>

Roger Evans

12 Lakeside Drive Morgantown, WV USA 26508 PH: 304-276-5287 Email: roger.evans@ge.com

Kathleen Fagan, MD, MPH

Office of Occupational Medicine Occupational Safety and Health Administration 200 Constitution Avenue NW Room N3457 Washington, DC USA 20210 PH: 202-693-2486 Email: Fagan.kathleen@dol.gov

Desta Fekedulegn, PhD

Health Effects Laboratory Division NIOSH 1095 Willowdale Road, MS 4200 Morgantown, WV USA 26505 PH: 304-285-6258 Email: <u>DFekedulegn@cdc.gov</u>

Hamid Fonooni, PhD

Associate Professor Occupational Safety East Carolina University 233 Slay Hall Greenville, NC USA 27858 PH: 252-328-9716 Email: <u>fonoonih@ecu.edu</u>

Tiffani Fordyce, PhD, MPH

Managing Scientist, Epidemiology Exponent, Health Sciences 475 14th Street, Suite 400 Oakland, CA USA 94612 PH: 510-268-5035 Email: <u>tfordyce@exponent.com</u>

Linda Forst, MD, MPH

Environmental and Occupational Health Sciences University of Illinois at Chicago School of Public Health 2121 West Taylor, MC 922 Chicago, IL USA 60645 PH: 312-355-3826 Email: forst-l@uic.edu

Stacy Freeman

East Carolina University 2240 Greenville Boulevard Apartment 104 Greenville, NC USA 27858 PH: 910-918-124 Email: freemanst14@students.ecu.edu

Mark Fullen, EdD, CSP

Associate Professor Safety and Health Extension West Virginia University 3604 Collins Ferry Road Morgantown, WV USA 26505 PH: 304-293-3200 Email: <u>m.fullen@mail.wvu.edu</u>

Bertrand Galy, PhD

Mechanical and Physical Risk Prevention Institut de Recherche Robert-Sauvé en Santé et Sécurité du Travail 505 Boulevard de Maisonneuve Ouest Montréal, Québec Canada H3A 3C2 PH: 514-288-1551 Email: <u>bertrand.galy@irsst.qc.ca</u>

LCDR Elizabeth Garza, MPH

Construction Safety and Health Office of the Director NIOSH 395 E Street SW, Suite 9200 Washington, DC USA 20201 PH: 202-245-0668 Email: <u>EGarza@cdc.gov</u>

Jeanne Geiger Brown, PhD, RN

School of Nursing University of Maryland - Baltimore 655 West Lombard Street, W213 Baltimore, MD USA 21201 PH: 410-706-5368 Email: jeiger@son.umaryland.edu

Michael Goldcamp, PhD

Epidemiologist Division of Safety Research NIOSH 1095 Willowdale Road, MS 1808 Morgantown WV USA 26501 PH: 304-285-5951 Email: <u>ehg8@cdc.gov</u>

Ahmed Gomaa, MD, ScD, MSPH

Division of Surveillance, Hazard Evaluations and Field Studies NIOSH 1090 Tusculum Avenue, MS R17 Cincinnati, OH USA 45226-1998 PH: 513-841-4337 Email: ayg0@cdc.gov

Gabriela Gracia

Environmental and Occupational Health Sciences University of Illinois at Chicago School of Public Health 5710 North Wayne, Unit 3 Chicago, IL USA 60660 PH: 798-655-7925 Email: ggraci2@uic.edu

Michael Grant

Environmental Health Harvard School of Public Health 7 Pryor Road Leicester, MA USA 01524 PH: 508-847-8828 Email: <u>mgrant@mail.harvard.edu</u>

Janessa Graves, PhD, MPH

Assistant Professor College of Nursing Washington State University PO Box 1495 Spokane, WA USA 99210-1495 PH: 509-324-7257 Email: janessa.graves@wsu.edu

Deirdre Green

Environmental Health Sciences University of Minnesota 1260 Mayo Building, Mail Code 807 420 Delaware Street SE Minneapolis, MN USA 55455 PH: 630-991-3383 Email: gree1982@umn.edu

James Green, BSME, MBA

Safety Engineer (Research) Division of Safety Research NIOSH 1095 Willowdale Road, MS G800 Morgantown, WV USA 26505 PH: 304-285-5857 Email: JGreen@cdc.gov

Ja (Jack) Gu, MSPH

Associate Service Fellow Health Effects Laboratory Division NIOSH 1095 Willowdale Road, MS 4050 Morgantown WV USA 26505 PH: 304-285-5793 Email: gum4@cdc.gov

Matthew Gunter

Occupational Safety and Health Statistics US Bureau of Labor Statistics 2 Massachusetts Avenue NE Washington, DC USA 20212 PH: 202-691-6211 Email: gunter.matt@bls.gov

Melody Gwilliam

Data Manager Division of Safety Research NIOSH 1095 Willowdale Road Morgantown, WV USA 26505 PH: 304-285-6007 Email: <u>yhw7@cdc.gov</u>

Emily Haas, PhD

Office of Mine Safety and Health Research NIOSH 626 Cochrans Mill Road PO Box 18070 Pittsburgh, PA USA 15236 PH: 412-386-4627 Email: EJHaas@cdc.gov

Amy Harper, PhD

Workplace Safety National Safety Council 16110 Pebblestone Cove Frisco, TX USA 75035 PH: 972-505-0620 Email: amy.harper@nsc.org

Daniel Hartley, EdD

Epidemiologist Division of Safety Research NIOSH 1095 Willowdale Road, MS 1811 Morgantown, WV USA 26505 PH: 304-285-5812 Email: <u>DHartley@cdc.gov</u>

Veronique Hauschild, MPH

Injury Prevention Program U.S. Army Institute of Public Health Building E1570 ABD, MD USA 21085 PH: 410-937-8889 Email: veronique.hauschild@gmail.com

Tanya Headley, MS

Health Communication Specialist Communication Office Office of the Director NIOSH 1095 Willowdale Road, MS 1109 Morgantown, WV USA 26505 PH: 304-285-6278 Email: <u>THeadley@cdc.gov</u>

Karen Heaton, PhD

Assistant Professor School of Nursing University of Alabama at Birmingham 1812 Parc Ridge Circle Warrior, AL USA 35180 PH: 502-664-1463 Email: <u>kharnp@uab.edu</u>

John Heberger, MA

Epidemiologist Office of Mine Safety and Health Research NIOSH 626 Cochrans Mill Road Pittsburgh, PA USA 15236 PH: 412-386-6620 Email: jvq4@cdc.gov

Kitty Hendricks

Epidemiologist Division of Safety Research NIOSH 1095 Willowdale Road, MS 1808 Morgantown, WV USA 26505 PH: 304-285-6252 Email: <u>kjt1@cdc.gov</u>

Olga Herrera

Health Management East University 11491 Columbia Pike Road Apartment C2 Silver Spring, MD USA 20904 PH: 240-355-5108 Email: olgalehesa@gmail.com

Deborah A. P. Hersman, MS

President & CEO National Safety Council 1121 Spring Lake Drive Itasca, IL USA 60143 PH: 630-775-2238 Email: <u>anna.wolak@nsc.org</u>

John Howard, MD

Director NIOSH 395 E Street SW, Suite 9200 Washington, DC USA 20201 PH: 202-245-0625 Email: JHoward1@cdc.gov

Hongwei Hsiao, PhD

Chief, Protective Technology Branch Division of Safety Research NIOSH 1095 Willowdale Road, MS G800 Morgantown, WV USA 26505 PH: 304-285-5910 Email: <u>HHsiao@cdc.gov</u>

Joy Inouye

Research Associate National Safety Council 1121 Spring Lake Drive Itasca, IL USA 60137 PH: 630-775-2294 Email: joy.inouye@nsc.org

Emma Irvin-Sinkins

Director, Research Operations Institute for Work and Health 481 University Avenue, 800 Toronto, Ontario Canada M5G 1E9 PH: 416-927-2027 x2109 Email: <u>eirvin@iwh.on.ca</u>

Katherine Jacobs

Director of Research and Operations Ontario Construction Secretariat 180 Attwell Drive, Suite 360 Toronto, Ontario Canada M9W 6A9 PH: 416-620-5210 Email: kjacobs@iciconstruction.com

Tonya Jacquez

Division of Safety Research NIOSH 1095 Willowdale Road, MS 1900 Morgantown, WV USA 26505 PH: 304-285-6173 Email: tjc1@cdc.gov

Lisa Jaegers, PhD, OTR/L

Assistant Professor Department of Occupational Science and Occupational Therapy St. Louis University 3437 Caroline Street, Suite 2020 St. Louis, MO USA 63104 PH: 314-977-8572 Email: <u>ljaegers@slu.edu</u>

Charles Jennissen, MD

Department of Emergency Medicine University of Iowa Carver College of Medicine 2841 Skyview Drive NE Swisher, IA USA 52338 PH: 319-384-8468 Email: <u>charles-jennissen@uiowa.edu</u>

Roger Jensen, PhD

Professor Safety Health and Industrial Hygiene Montana Tech 1300 West Park Street Butte, MT USA 59701 PH: 406-496-4111 Email: rjensen@mtech.edu

Bochen Jia, PhD

Assistant Professor Industrial and Manufacturing Systems Engineering University of Michigan Dearborn 2340 Engineering Complex 4901 Evergreen Road Dearborn, MI USA 48126 PH: 540-239-7581 Email: <u>bochenj@umich.edu</u>

Jennifer Jones

Injury Prevention Research Center University of North Carolina 137 East Franklin Street, Suite 500 Chapel Hill, NC USA 27599 PH: 678-793-7141 Email: jjones86@live.unc.edu

Martha Jones, PhD

Associate Professor, Center for Medicine, Health and Society Vanderbilt University PMB 351665, 2301 Vanderbilt Place Nashville, TN USA 37205 PH: 510-301-2830 Email: martha.w.jones@vanderbilt.edu

May Kaewken

Mechanical and Industrial Engineering University of Illinois at Chicago Engineering Research Facility 842 West Taylor Street Chicago, IL USA 60517 PH: 630-804-9115 Email: may.kaewken@gmail.com

Vicki Kaskutas, OTD, MHS,

OTR/L, FAOTA Occupational Therapy and Medicine Washington University School of Medicine 4444 Forest Park Avenue Campus Box 8505 St. Louis, MO USA 63108-2292 PH: 314-286-1672 Email: <u>kaskutasv@wustl.edu</u>

Paul Keane, MBA

Health Communications Division of Safety Research NIOSH 1095 Willowdale Road, MS G800 Morgantown, WV USA 26505 PH: 304-285-5901 Email: prk0@cdc.gov

Geeta Kersellius, MPH, MBS

Epidemiology Fellow Injury Prevention U.S. Army Public Health Command 5158 Blackhawk Road ATTN: MCHB-IP-DI, Building 1570 ABD, MD USA 21010 PH: 410-436-9287 Email: geeta.d.kersellius.ctr@mail.mil

Ujwal Kharel, MEM, MPhil

Doctoral Fellow Pardee RAND Graduate School 1776 Main Street Santa Monica, CA USA 90401 PH: 310-393-0411 Email: <u>ukharel@rand.org</u>

Laurel Kincl, PhD

College of Public Health and Human Sciences Oregon State University 101 Milam Hall Corvallis, OR USA 97331 PH: 541-737-1445 Email: laurel.kincl@oregonstate.edu

CAPT Margaret Kitt, MPH, MD

Deputy Director for Program Office of the Director NIOSH 1095 Willowdale Road Morgantown, WV USA 26505 PH: 304-285-6368 Email: <u>ajy8@cdc.gov</u>

John Koch, CSP, CHMM, CFPS

Risk Management GNC 300 Sixth Avenue Pittsburgh, PA USA 15222 PH: 412-288-4604 Email: john-koch@gnc-hq.com

Srinivas Konda, MPH

Associate Service Fellow Division of Safety Research NIOSH 1095 Willowdale Road Morgantown, WV USA 26505 PH: 304-285-6011 Email: SKonda@cdc.gov

Kasandra Lambert

Environmental and Occupational Health University of Kentucky 1625 Nicholasville Road, #401 Lexington, KY USA 40503 PH: 606-776-3314 Email: kasandra.lambert@uky.edu

Michael Lampl, MSOH

Ohio Bureau of Workers' Compensation 13430 Yarmouth Drive Pickerington, OH USA 43147 PH: 614-995-1203 Email: <u>michael.1.1@bwc.state.oh.us</u>

Andre Lan, MSc

PRMP IRSST 505 de Maisonneuve Boulevard West Montréal, Québec Canada H3A 3C2 PH: 514-288-1551 Email: <u>lan.andre@irsst.qc.ca</u>

Julie Largay, MPH

CPWR - The Center for Construction Research and Training 8484 Georgia Avenue, Suite 1000 Silver Spring, MD USA 20910 PH: 301-495-8529 Email: jlargay@cpwr.com

Jennifer Lau

Employee Health Services Cedars-Sinai Medical Center 8723 Alden Drive, Suite 200 Los Angeles, CA USA 90048 PH: 310-423-3322 Email: jennifer.lau@cshs.org

Larry Layne, MS

Researcher Division of Safety Research NIOSH 1095 Willowdale Road, MS 1808 Morgantown, WV USA 26505 PH: 304-285-6008 Email: LLayne@cdc.gov

Megan Leonhard

Health Sciences, Epidemiology Exponent 15375 SE 30th Place, Suite 250 Bellevue, WA USA 98007 PH: 425-324-6178 Email: <u>mleonhard@exponent.com</u>

Nancy Lessin

United Steelworkers Tony Mazzocchi Center 12 Park Lane Boston, MA USA 02130 PH: 617-320-5301 Email: <u>nlessin@uswtmc.org</u>

Mariana Lever

University of Illinois at Chicago School of Public Health 75 Blackhawk Drive Park Forest, IL USA 60466 PH: 612-845-3042 Email: janette.lever@gmail.com

Amy Liebman

Migrant Clinicians Network 100 West Maine Street, Suite 206 Salisbury, MD USA 21801 PH: 512-579-4535 Email: <u>aliebman@migrantclinician.org</u>

Tin-chi Lin, PhD

Research Scientist Center for Injury Epidemiology Liberty Mutual Research Institute for Safety 71 Frankland Road Hopkinton, MA USA 01748 PH: 508-497-0266 Email: <u>tin-chi.lin@libertymutual.com</u>

Jennifer E. Lincoln, BSF, MSSM

Health Scientist Division of Safety Research NIOSH 1095 Willowdale Road, MS 1808 Morgantown, WV USA 26505 PH: 304-285-6185 Email: <u>axi5@cdc.gov</u>

Jennifer M. Lincoln, PhD

Acting Deputy Director Western States Division NIOSH 4230 University Drive, Suite 310 Anchorage, AK USA 99508 PH: 907-271-2383 Email: JLincoln@cdc.gov

Herb Linn

Injury Control Research Center West Virginia University 3606 Collins Ferry Road Morgantown, WV USA 26505-9151 PH: 304-293-6682 Email: hlinn2@hsc.wvu.edu

Murrey Loflin

Associate Service Fellow Division of Safety Research NIOSH 1095 Willowdale Road, MS 1808 Morgantown, WV USA 26505 PH: 304-285-6253 Email: <u>MLoflin@cdc.gov</u>

Jacqueline Longton

Office of Safety and Health Statistics US Bureau of Labor Statistics 2 Massachusetts Avenue NE Washington, DC USA 20212 PH: 202-691-5787 Email: <u>longton.jacqueline@bls.gov</u>

Devin Lucas, PhD

Health Statistician Western States Division NIOSH 4230 University Drive, Suite 310 Anchorage, AK USA 99508 PH: 907-271-2386 Email: <u>DLucas@cdc.gov</u>

Ge Ma, MD

Occupational Medicine West Virginia University 1 Hospital Dive., PO Box 9145 Morgantown, WV USA 26501 PH: 917-379-2409 Email: gama@hsc.wvu.edu

Sithembile Mabila, MS

Environmental and Occupational Health Sciences University of Illinois at Chicago School of Public Health 2121 West Taylor, Office 431 Chicago, IL USA 60612 PH: 314-295-9656 Email: smabil2@uic.edu

Dana Madigan, DC, MPH

Environmental and Occupational Health Sciences University of Illinois at Chicago School of Public Health 2121 West Taylor Street Chicago, IL USA 60612 PH: 773-680-9955 Email: dmadig2@uic.edu

Dr. Olalekan Makinde

College of Medicine, UNILAG Department of Community Health Lagos University Teaching Hospital Lagos, Nigeria 23401 PH: +234-80-64695319 Email: <u>lekmak@gmail.com</u>

Suzanne Marsh, MPA

Health Statistician Division of Safety Research NIOSH 1095 Willowdale Road, MS 1808 Morgantown, WV USA 26505 PH: 304-285-6009 Email: smm2@cdc.goy

Helen Marucci-Wellman, ScD

Work Environment University of Massachusetts, Lowell Liberty Mutual Research Institute for Safety 71 Frankland Road Hopkinton, MA USA 01748 PH: 508-497-0206 Email: helen.wellman@libertymutual.com

Krystal Mason

Epidemiology Western States Division NIOSH 4230 University Drive, Suite 310 Anchorage, AK USA 99508 PH: 907-271-1567 Email: <u>xlp5@cdc.gov</u>

Pam Mason

Savannah Sugar Refinery 201 Oxnard Drive Port Wentworth, GA USA 31407 PH: 912-721-3382 Email: pam.mason@ldcom.com

Joan Mazur, PhD

Professor Southeast Center for Agricultural Health and Injury Prevention University of Kentucky 151 Washington Avenue, Suite 225 Lexington, KY USA 40503 PH: 859-481-1413 Email: jmazur@uky.edu

Tony McKenzie, PhD

Safety Engineer Division of Safety Research NIOSH 1095 Willowdale Road, MS G800 Morgantown, WV USA 26505 PH: 304-285-6064 Email: <u>elm6@cdc.gov</u>

Dr. Kenan Melemez

Bartin University Faculty of Forestry Bartin, Turkey 74200 PH: +90-378-2235168 Email: <u>kmelemez@hotmail.com</u>

John Mendeloff, PhD

Professor Graduate School of Public and International Affairs University of Pittsburgh 3619 Posvar Hall Pittsburgh, PA USA 15260 PH: 412-648-2651 Email: jmen@pitt.edu

Tim Merinar

Safety Engineer Division of Safety Research NIOSH 1095 Willowdale Road Morgantown, WV USA 26505 PH: 304-285-5965 Email: trm2@cdc.gov

David Michaels, PhD, MPH

Assistant Secretary of Labor for Occupational Safety and Health US Department of Labor Occupational Safety and Health Administration 200 Constitution Avenue NW Washington, DC USA 20210 PH: 202-693-2000 E-mail: PublicMichaelsDavid@dol.gov

Melanie Moore

Environmental Health Officer Division of Safety Research NIOSH 1095 Willowdale Road, MS 1808 Morgantown, WV USA 26505 PH: 304-285-5742 Email: <u>MMoore9@cdc.gov</u>

Paul Moore

Safety/Occupational Health Manager Division of Safety Research NIOSH 1095 Willowdale Road, MS 1808 Morgantown, WV USA 26505 PH: 304-285-6016 Email: phm0@cdc.gov

Majed Moosa

Industrial and Manufacturing Systems Engineering University of Windsor 380 Pelissier Street, Apartment 905 Windsor, Ontario Canada N9A 6V7 PH: 226-345-5555 Email: <u>majed.moosa@gmail.com</u>

Thais Morata, PhD

Senior Service Fellow Division of Applied Research and Technology NIOSH 1090 Tusculum Avenue, MS C27 Cincinnati, OH USA 45226 PH: 513-533-8487 Email: <u>TMorata@cdc.gov</u>

Douglas Myers, ScD

Assistant Professor Occupational and Environmental Health West Virginia University 1 Medical Center Drive, PO Box 9190 Morgantown, WV USA 26506 PH: 304-581-1152 Email: <u>djmyers@hsc.wvu.edu</u>

John Myers, MS

Chief, Surveillance and Field Investigations Branch Division of Safety Research NIOSH 1095 Willowdale Road, MS 1808 Morgantown, WV USA 26505 PH: 304-285-6005 Email: JRMyers@cdc.gov

Sharon Newnam, PhD

Accident Research Centre Monash University Building 70 Melbourne, VIC Australia 3800 PH: +61 (0) 3 99054370 Email: <u>sharon.newnam@monash.edu</u>

Maryalice Nocera

Injury Prevention Research Center University of North Carolina 137 East Franklin Street Suite 500, CB 7505 Chapel Hill, NC USA 27599-7505 PH: 919-966-9769 Email: mnocera@unc.edu

Ian Noy, PhD

Director Liberty Mutual Research Institute for Safety 71 Frankland Road Hopkinton, MA USA 01748 PH: 508-497-0215 Email: <u>ian.noy@libertymutual.com</u>

Arthur Oleinick, MD, JD, MPH

2016 Vinewood Boulevard Ann Arbor, MI USA 48104 PH: 734-665-7693 Email: <u>aoleinic@umich.edu</u>

Christopher Pan, PhD

Safety Engineer (Research) Division of Safety Research NIOSH 1095 Willowdale Road, MS G800 Morgantown, WV USA 26505 PH: 304-285-5978 Email: <u>CPan@cdc.gov</u>

Rene Pana-Cryan, PhD

Economic Research and Support Office NIOSH 395 E Street SW Washington, DC USA 20201 PH: 202-245-0669 Email: rfp2@cdc.gov

Pat Parker

Personnel City of Dothan Employee Health 126 North Saint Andrews Street Dothan, AL USA 36303 PH: 334-615-3196 Email: paparker@dothan.org

Avni Patel

U.S. Army Public Health Command: Injury Prevention Program Oak Ridge Institute of Science and Education 1300 Baylis Street Baltimore, MD USA 21224 PH: 678-467-4880 Email: <u>avni1229@gmail.com</u>

Kara Perritt

Supervisory Statistician Division of Safety Research NIOSH 1095 Willowdale Road, MS 1808 Morgantown, WV USA 26505 PH: 304-285-5943 Email: <u>KPerritt@cdc.gov</u>

Kristina Peterson, PhD

Workplace Safety and Health Program RTI International 3040 East Cornwallis Road Research Triangle Park, NC USA 27514 PH: 919-485-7722 Email: <u>kpeterson@rti.org</u>

Timothy Pizatella

Deputy Director Division of Safety Research NIOSH 1095 Willowdale Road, MS 1900 Morgantown, WV USA 26505 PH: 304-285-6003 Email: tjp2@cdc.gov

Keshia Pollack, PhD

Health Policy and Management Johns Hopkins Bloomberg School of Public Health 624 Noth Broadway, Room 557 Baltimore, MD USA 21205 PH: 410-502-6272 Email: <u>kpollac1@jhu.edu</u>

Dr. Gerald Poplin

Center for Applied Biomechanics University of Virginia 4040 Lewis and Clark Drive Charlottesville, VA USA 22911 PH: 434-296-7288 Email: poplin@virginia.edu

Stefano Porru

Professor Department of Medical and Surgical Specialties Radiological Sciences and Public Health University of Brescia P.le Spedali Civili, 1 Brescia, Italy 25125 PH: + 39 030 3995 735 Email: <u>stefano.porru@unibs.it</u>

Eric Porter

Safety Sauer Inc. 30 Fifty First Street Pittsburgh, PA USA 15201 PH: 412-687-1662 Email: eporter@sauer-inc.com

John Powers

Supervisory General Engineer Division of Safety Research NIOSH 1095 Willowdale Road, MS G800 Morgantown, WV USA 26505 PH: 304-285-6219 Email: jop5@cdc.gov

Stephanie Pratt, PhD

Epidemiologist Division of Safety Research NIOSH 1095 Willowdale Road, MS 1808 Morgantown, WV USA 26505 PH: 304-285-5992 Email: sgp2@cdc.gov

Christopher Pritchard

Lead General Engineer Spokane Mining Research Division NIOSH 315 East Montgomery Street, P11 Spokane, WA USA 99021 PH: 509-354-8021 Email: hvp4@cdc.gov

Rick Puckett

Ford Motor Company One American Road Dearborn, MI USA 48126 PH: 313-390-1744 Email: <u>rpucke10@ford.com</u>

Erik Rader, PhD

Associate Service Fellow Health Effects Laboratory Division NIOSH 1095 Willowdale Road, MS 3014 Morgantown, WV USA 26505 PH: 304-285-6242 Email: wlz4@cdc.org

Kimberly Rauscher, ScD

Occupational and Environmental Health Sciences West Virginia University PO Box 9190 Morgantown, WV USA 26506 PH: 304-293-0254 Email: krauscher@hsc.wvu.edu

Timothy Read

Southwest Center for Occupational and Environmental Health University of Texas School of Public Health 1200 Herman Pressler, W-1004 Houston, TX USA 77030 PH: 307-214-8629 Email: texassafetytim@gmail.com

Mark Redfern, PhD

Vice Provost for Research William Kepler Whiteford Professor Department of Bioengineering University of Pittsburgh 826 Cathedral of Learning 4200 Fifth Avenue Pittsburgh, PA USA 15260 PH: 412-624-9019 Email: mredfern@pitt.edu

Deborah Reed, PhD

College of Nursing University of Kentucky 761 Rose Street, 553 CON Building Lexington, KY USA 40536 PH: 859-257-9636 Email: <u>dbreed01@uky.edu</u>

Rustin Reed

Community, Environment and Policy University of Arizona 1656 East Mabel, Suite 113 Tucson, AZ USA 85724 PH: 520-626-8879 Email: <u>rustin2@email.arizona.edu</u>

Audrey Reichard, MPH, OTR

Epidemiologist Division of Safety Research NIOSH 1095 Willowdale Road Morgantown, WV USA 26505 PH: 304-285-6019 Email: <u>akr5@cdc.gov</u>

David Rempel, MD

Professor, Bioengineering University of California, Berkeley UC - RFS 1301 South 46th Street, Building 163 Richmond, CA USA 94804 PH: 510-703-2484 Email: <u>david.rempel@ucsf.edu</u>

Mark Resser, MS

Health and Safety Honda North America 24000 Honda Parkway Marysville, OH USA 43040 PH: 937-642-5000 Email: mark_resser@hna.honda.com

Iris Anne Reyes

National Farm Medicine Center Marshfield Clinic Research Foundation 1000 North Oak Avenue, ML1 Marshfield, WI USA 54449 PH: 715-387-5923 Email: reyesi@marshfieldclinic.org

Tiffany Rice

Safety and Health Extension West Virginia University 3604 Collins Ferry Road Morgantown, WV USA 26508 PH: 304-293-2852 Email: <u>Tiffany.Rice@mail.wvu.edu</u>

Scott Richardson

Bureau of Labor Statistics Department of Labor 2 Massachusetts Avenue NE Room 3180 Washington, DC USA 20212 PH: 202-691-6165 Email: richardson s@bls.gov

Rosa Rodríguez-Acosta, PhD

Epidemiologist Division of Safety Research NIOSH 1095 Willowdale Road, MS 1808 Morgantown, WV USA 26505 PH: 304-285-6299 Email: rer3@cdc.gov

Elizabeth Rogers, MSc

Bureau of Labor Statistics Department of Labor 2 Massachusetts Avenue NE Room 3180 Washington, DC USA 20212 PH: 202-691-5098 Email: rogers.elizabeth@bls.gov

Nancy Romano, MS, CSHM

Safety and Occupational Health Specialist Division of Safety Research NIOSH 1095 Willowdale Road, MS 1808 Morgantown, WV USA 26505 PH: 304-285-5889 Email: ndr4@cdc.gov

Mahmood Ronaghi, MSAE, MSME, MBA

Safety Engineer (Research) Division of Safety Research NIOSH 1095 Willowdale Road, MS G800 Morgantown, WV USA 26505 PH: 304-285-6054 Email: <u>MRonaghi@cdc.gov</u>

Kenneth Rosenman, MD

Professor, Medicine Michigan State University 909 Fee Road, Room 117 West Fee East Lansing, MI USA 48824 PH: 517-353-1846 Email: rosenman@msu.edu

Tonya Rowan

Division of Safety Research NIOSH 1095 Willowdale Road Morgantown, WV USA 26505 PH: 304-285-5904 Email: <u>TRowan@cdc.gov</u>

Andy Ryan

Division of Environmental Health Sciences University of Minnesota 1260 Mayo Building, MMC 807 420 Delaware Street SE Minneapolis, MN USA 55441 PH: 612-625-1443 Email: ryanx029@umn.edu

Iris Sanchez

11203 Killearn Court Riverview, FL USA 33569 PH: 813-571-1117 Email: <u>iss1520@yahoo.com</u>

Scott Sandberg, MPH

National Farm Medicine Center Marshfield Clinic Research Foundation 1000 North Oak Avenue Marshfield, WI USA 54449 PH: 715-387-5752 Email: sandberg.scott@mcrf.mfldclin.edu

Dr. Yusef Sayeed

Emergency Medicine Division of Occupational Medicine West Virginia University 1 Medical Center Drive Morgantown, WV USA 26506 PH: 502-419-4514 Email: <u>yusef1@hotmail.com</u>

Frederick (Ted) Scharf, PhD

Division of Applied Research and Technology NIOSH 1090 Tusculum Avenue, MS C-24 Cincinnati, OH USA 45226 PH: 513-533-8170 Email: <u>TScharf@cdc.gov</u>

Jeffrey Schiffman, PhD

Director Center for Physical Ergonomics Liberty Mutual Research Institute for Safety 71 Frankland Road Hopkinton, MA USA 01748 PH: 508-497-0225 Email: jeffrey.schiffman@libertymutual.com

Scott Schneider, CIH

Director Occupational Safety and Health Laborers' Health and Safety Fund of North America 905 Sixteenth Street NW Washington, DC USA 20006 PH: 202-628-5465 Email: <u>schneider@lhsfna.org</u>

Dr. Katie Schofield-Larson

2640 Salem Avenue Minneapolis, MN USA 55416 PH: 612-205-5621 Email: <u>kteschofield@hotmail.com</u>

Anna Schuh, PhD

Injury Prevention Program U.S. Army Public Health Command 5158 Blackhawk Road ABD, MD USA 21010 PH: 410-417-2886 Email: <u>anna.k.schuh.civ@mail.mil</u>

Christine Schuler, PhD

Associate Director for Science Division of Safety Research NIOSH 1095 Willowdale Road, MS 1900 Morgantown, WV USA 26505 PH: 304-285-6072 Email: <u>CSchuler@cdc.gov</u>

Laura Schwab Reese, MA

Department of Community and Behavioral Health The University of Iowa 145 North Riverside Drive N475 CPHB Iowa City, IA USA 52240 PH: 515-491-1399 Email: laura.m.schwab@gmail.com

Adam Schwartz

Environmental Health Science University of Minnesota 1260 Mayo Building 420 Delaware Street SE Minneapolis, MN USA 55414 PH: 423-243-4523 Email: <u>schw1562@umn.edu</u>

Kenneth Scott, MPH

Epidemiology Colorado School of Public Health 13001 East 17th Place, B119 Aurora, CO USA 80045 PH: 303-565-7993 Email: <u>kenneth.scott@ucdenver.edu</u>

Lori Severson, CSP

Risk Control Services Lockton Companies 8110 East Union Avenue, Suite 700 Denver, CO USA 80237 PH: 303-414-6000 Email: <u>lori.severson@lockton.com</u>

Katie Shahan

Health Communication Specialist Communication Office Office of the Director NIOSH 1095 Willowdale Road, MS 1109 Morgantown, WV USA 26505 PH: 304-285-5805 Email: wfa9@cdc.gov

Dr. Bahar Sharafi

Liberty Mutual Research Institute for Safety 71 Frankland Road Hopkinton, MA USA 01748 PH: 508-497-0260 Email: Bahar.Sharafi@LibertyMutual.com

Derek Shendell, DEnv, MPH

New Jersey Safe Schools Program Center for School and Community-Based Research and Education Environmental and Occupational Health Rutgers School of Public Health 335 George Street, Suite 2200 Liberty Plaza New Brunswick, NJ USA 08903 PH: 732-235-4988 Email: <u>shendedg@sph.rutgers.edu</u>

Dr. Veronica Silva

Center for Physical Ergonomics Liberty Mutual Research Institute for Safety 71 Frankland Road Hopkinton, MA USA 01748 PH: 508-497-0285 Email: veronica.silva@libertymutual.com

Peter Simeonov, PhD

Safety Engineer (Research) Division of Safety Research NIOSH 1095 Willowdale Road, MS G800 Morgantown, WV USA 26505 PH: 304-285-6268 Email: <u>PSimeonov@cdc.gov</u>

Hilery Simpson

Occupational Safety and Health Statistics Bureau of Labor Statistics 2 Massachusetts Avenue NE Room 3180 Washington, DC USA 20212 PH: 202-691-5184 Email: simpson.hilery@bls.gov

Sergey Sinelnikov, MPH

Research Director National Safety Council 1121 Spring Lake Drive Itasca, IL USA 60143 PH: 630-775-2069 Email: sergey.sinelnikov@nsc.org

Susan Skelly

Health Services MITRE Corp 8311 Quince View Lane Owings, MD USA 20736 Ph: 443-975-4331 Email: <u>smskelly@verizon.net</u>

Todd Smith, PhD, CSP

Dept of Graduate Studies, MS in Occupational Safety Management Program Embry-Riddle Aeronautical University 515 Saint Ives Drive Athens, GA USA 30606 PH: 706-540-2520 Email: todd.smith2@erau.edu

Robert Snyder, MD

Division of Workers' Compensation State of Tennessee 220 French Landing Drive, 1-B Nashville, TN USA 37243 PH: 615-523-6700 Email: <u>robert.b.snyder@tn.gov</u>

Christina Socias, DrPH

EIS Officer Division of Safety Research NIOSH 1095 Willowdale Road, MS 1811 Morgantown, WV USA 26505 PH: 304-285-6180 Email: <u>CSocias@cdc.gov</u>

Emily Sparer

Environmental Health Harvard School of Public Health 401 Park Drive, Landmark Center 3rd Floor West #112 Boston, MA USA 02115 Ph: 845-551-3858 Email: emily.sparer@mail.harvard.edu

Lisa Steiner, PhD

Office of Mine Safety and Health Research NIOSH 626 Cochrans Mill Road Pittsburgh, PA USA 15236 PH: 412-386-6446 Email: LSteiner@cdc.gov

Nancy Stout, EdD

Retired (NIOSH/DSR) 127 Quail Road Morgantown, WV USA 26508 PH: 304-296-5362 Email: <u>nancystout@comcast.net</u>

Jessica Streit, MS

Psychologist Division of Applied Research and Technology NIOSH 1090 Tusculum Avenue, MS C24 Cincinnati, OH USA 45226 PH: 513-533-8107 Email: JStreit@cdc.gov

Jiahuan Sun

1860 Charmeran Avenue San Jose, CA USA 95124 PH: 408-666-5195 Email: <u>sunxx762@umn.edu</u>

David Swedler, PhD, MPH

Environmental and Occupational Health Sciences University of Illinois at Chicago School of Public Health 2121 West Taylor Street Chicago, IL USA 60612 PH: 630-254-5560 Email: <u>dswedler@gmail.com</u>

Laura Syron, MPH

College of Public Health and Human Sciences Oregon State University 101 Milam Hall Corvallis, OR USA 97333 PH: 541-513-1710 Email: <u>laura.syron@oregonstate.edu</u>

Jennifer Taylor, PhD, MPH

Occupational and Environmental Health Drexel University School of Public Health 3215 Market Street Nesbitt Hall, Room 655 Philadelphia, PA USA 19104 PH: 267-359-6046 Email: jat65@drexel.edu

Hope Tiesman, PhD

Epidemiologist Division of Safety Research NIOSH 1095 Willowdale Road, MS 1811 Morgantown, WV USA 26505 PH: 304-285-6067 Email: <u>HTiesman@cdc.gov</u>

Theresa Tonozzi, MPH

Associate Service Fellow Division of Safety Reseach NIOSH 1095 Willowdale Road, MS 1808 Morgantown, WV USA 26505 PH: 304-285-5941 Email: <u>ybj6@cdc.gov</u>

Jack Trackemas

Office of Mine Safety and Health Research NIOSH 626 Cochrans Mill Road Pittsburgh, PA USA 15236 PH: 412-386-6781 Email: JTrackemas@cdc.gov

Dwayne Van Eerd

Institute for Work and Health 481 University Avenue, Suite 800 Toronto, Ontario Canada L9H 6X9 PH: 416-927-2027 Email: <u>dvaneerd@iwh.on.ca</u>

Santosh Verma, ScD, MD, MPH

Center for Injury Epidemiology Liberty Mutual Research Institute for Safety 71 Frankland Road Hopkinton, MA USA 01719 PH: 508-497-0213 Email: santosh.verma@libertymutual.com

Gabriela Villanueva

Medicine University of Texas Health Science Center San Antonio 505 Avenida de Oro Brownsville, TX USA 78521 PH: 956-371-2244 Email: villanuevag@livemail.uthscsa.edu

John Violanti, PhD

Epidemiology and Environmental Health SUNY at Buffalo 270 Farber Hall, EEH Buffalo, NY USA 14214 PH: 716-829-5367 Email: <u>violanti@buffalo.edu</u>

Vitaly Volberg, PhD

Epidemiology and Computational Biology Exponent 475 14th Street, #400 Oakland, CA USA 94610 PH: 510-268-5072 Email: vvolberg@exponent.com

James (Terry) Wassell, PhD

Associate Director for Biostatistical Science Division of Safety Research NIOSH 1095 Willowdale Road, MS 1811 Morgantown, WV USA 26505 PH: 304-285-5946 Email: jtw2@cdc.gov

Jennifer Watson

College of Public Health University of Kentucky Bowman Hall 151 Washington Avenue, Room 225 Lexington. KY USA 40536 PH: 859-492-7759 Email: jmwats02@uky.edu

Joanna Watson, PhD

Western States Division NIOSH 4230 University Drive, Suite 310 Anchorage, AK USA 99508 PH: 907-271-2388 Email: wgg6@cdc.gov

Darlene Weaver

Technical Information Specialist Division of Safety Research NIOSH 1095 Willowdale Road, MS 1808 Morgantown, WV USA 26505 PH: 304-285-6354 Email: tzw6@cdc.gov

Sydney Webb, PhD

Communications Specialist Division of Safety Reseach NIOSH 1095 Willowdale Road, MS 1900 Morgantown, WV USA 26505 PH: 304-285-6006 Email: <u>yht4@cdc.gov</u>

Chia Wei, PhD

Division of Surveillance, Hazard Evaluations and Field Studies NIOSH 1090 Tusculum Avenue, MS R-14 Cincinnati, OH USA 45226 PH: 513-841-4562 Email: <u>CWei@cdc.gov</u>

Jeffrey Welsh

Associate Director for Science Office of Mine Safety and Health Research NIOSH 626 Cochrans Mill Road Pittsburgh, PA USA 15236 PH: 412-386-4040 Email: juw5@cdc.gov

Charles Werntz, DO

Occupational Medicine West Virginia University PO Box 9145 Morgantown, WV USA 26506 PH: 304-293-3693 Email: <u>cwerntz@hsc.wvu.edu</u>

Bryan Wimer

Division of Safety Research NIOSH 1095 Willowdale Road, MS G800 Morgantown, WV USA 26505 PH: 304-285-6267 Email: gia3@cdc.gov

Janice Windau, MS

Office of Safety, Health and Working Conditions Bureau of Labor Statistics 2 Massachusetts Avenue NE Room 3180 Washington, DC USA 20212 PH: 202-691-6160 Email: windau.janice@bls.gov

Gary Winn, PhD

Professor Industrial Management and Safety Engineering West Virginia University P O Box 6070 Morgantown, WV USA 26506 PH: 304-293-2742 Email: gary.winn@mail.wvu.edu

Oliver Wirth, PhD

Research Psychologist Health Effects Laboratory Division NIOSH 1095 Willowdale Road, MS 4050 Morgantown, WV USA 26505 PH: 304-285-6323 Email: oaw5@cdc.gov

Christie Wolfe

Division of Safety Research NIOSH 1095 Willowdale Road Morgantown, WV USA 26505 PH: 304-285-6231 Email: <u>cek1@cdc.gov</u>

Sara Wuellner, MPH

SHARP Program Washington State Dept of Labor and Industries P O Box 44330 Olympia, WA USA 98504 PH: 902-360-6727 Email: <u>sara.wuellner@lni.wa.gov</u>

Brian Zaidman

Senior Research Analyst Minnesota Department of Labor and Industry 443 Lafayette Road St Paul, MN USA 55155 PH: 651-284-5568 Email: <u>brian.zaidman@state.mn.us</u>

Shengke Zeng, PhD

Biomedical Engineer Division of Safety Research NIOSH 1095 Willowdale Road, MS G800 Morgantown, WV USA 26505 PH: 304-285-6103 Email: <u>SZeng@cdc.gov</u>

Motau Zhu, PhD

Injury Control Research Center West Virginia University PO Box 9151 Morgantown, WV USA 26506 PH: 304-293-6682 Email: mozhu@hsc.wvu.edu

Joyce Zwiener

Health Scientist Division of Safety Research NIOSH 1095 Willowdale Road, MS G800 Morgantown, WV USA 26505 PH: 304-285-5814 Email: jcz1@cdc.gov

NOIDC
NOIKS
National Occupational Injury Research Symposium
2015

NOIRS
National Occupational Injury Research Symposium
2015

NOIDS
National Occupational Infury Research Symposium
2015

NOIDC
2015
2010

NOIDC
NOIKS
2013

WE WANT YOUR FEEDBACK!



Please complete the online symposium evaluation by June 4, 2015. To access the evaluation, scan the QR code above or visit http://noirs2015.questionpro.com. The evaluation takes approximately 10 minutes to complete.

Stay connected and spread the word . . .





Delivering on the Nation's promise: Safety and Health at work for all people through research and prevention.

To receive NIOSH documents or more information about occupational safety and health topics, contact NIOSH at: 1-800-CDC-INFO (1-800-232-4636); TTY 1-888-232-6348

E-mail: cdcinfo@cdc.gov OR visit the NIOSH Web site at www.cdc.gov/niosh

For a monthly update on news at NIOSH, subscribe to NIOSH e-News by visiting <u>www.cdc.gov/niosh/enews</u>

SAFER ● HEALTHIER ● PEOPLE™