

from Research to Reality

Safety Climate

New Promise
for Injury
Prevention

LIBERTY MUTUAL RESEARCH INSTITUTE FOR SAFETY

SCIENTIFIC UPDATE



Letter from the Director



Dear Readers

In the world of injury prevention, many new concepts and research initiatives come and go, but some stand the test of time. One such time-proven concept is safety climate. A relatively new area of research for the Liberty Mutual Research Institute, safety climate is a measurable construct that reflects employee perceptions of the true safety priorities within their organizations. It has significant implications for helping businesses improve their organizational safety cultures and outcomes.

In this issue, we profile our first large-scale field study on this topic, examining safety climate among lone mobile and remote workers (see pp. 4–6). Our research extends current methodology and reaffirms safety climate as a leading indicator of safety performance, even in atypical work environments. Ultimately, we aim to use the information gained to develop a scientifically sound approach to collecting safety climate data that is diagnostic enough to identify specific intervention opportunities.

In the news section (pp. 9–11), we announce the addition of Larry Hettinger, Ph.D., to the staff. As our newest research scientist, Larry brings extensive human systems integration experience to our program and is a positive addition to the Center for Behavioral Sciences.

I hope you enjoy this issue, and we continue to welcome your candid feedback.

A handwritten signature in black ink that reads "Ian Noy".

*Ian Noy, Ph.D.
Vice President and Director*

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Safety Climate

An Emerging Concept in Occupational Injury Research

In 1980, the Journal of Applied Psychology published a landmark study on a new concept called safety climate. The study's author, Dov Zohar, Ph.D., of Israel Institute of Technology, had developed and applied a safety climate scale at 20 industrial organizations, and his findings supported safety climate as a key construct for understanding occupational injuries. Since then, more than 200 scientific papers have been written on the subject of safety climate and the concept has gained increased importance in the safety research and practice community.

"We know that most companies espouse safety as a top priority in their formal communications, websites, meetings, policies and procedures," explains Zohar. "However, the *true* priority of safety is reflected in daily decisions made by management—from supervisors all the way up to senior managers—on whether to prioritize safety versus competing demands. That is what the safety climate scale measures."

Safety climate gained worldwide attention following the 1987 Chernobyl nuclear disaster. Several investigations, conducted by the International Atomic Energy Commission, cited a faulty safety culture as the underlying reason for the catastrophe. "The Chernobyl investigations revealed that in the daily routines of the workers, competing demands were often prioritized ahead of safety," notes Zohar. "It is a story that has been repeated in subsequent industrial disasters."

Defined as the shared employee perceptions of the true priority of safety in the workplace, safety climate is the only measurable aspect of safety culture. Researchers administer carefully crafted surveys asking workers to identify discrepancies between what management says and what they actually do on a daily basis when faced with production deadlines, delivery demands, personal comfort issues, or other workplace circumstances that may take precedence over safety.

Scientists throughout the world continue to explore the relevance of safety climate in injury prevention. Researchers

from several universities recently published a series of meta-analyses involving safety climate studies and found a strong association between safety climate and accidents and injury outcomes. "The results of these analyses underscored the value of our own involvement in this area of research," explains Marvin Dainoff, Ph.D., director of the Institute's Center for Behavioral Sciences (CBS).

With the arrival of Dr. Zohar as the Institute's 2009 Visiting Scholar, CBS researchers decided to study the impact of safety climate among non-traditional workers. "Prior to this point, safety climate research had focused exclusively on traditional work environments—no one had studied safety climate among workers who perform their jobs alone, on the road, or at off-site locations," notes Dainoff. With cooperation from eight national trucking companies and two utility companies, the Institute began field studies of safety climate involving more than 10,000 lone and remote workers.

"For many industries, safety climate is an indicator...like a thermometer. When a negative safety climate is indicated—meaning workers perceive safety to be secondary to other management demands—it's like a 'fever' indicating problems in the organization," explains Dainoff. "The ultimate goal of our safety climate research is to understand the issues that are causing the 'fever' so that companies can take proactive measures to avoid negative safety outcomes."

Expanding the Scope of Safety Climate Research



Lone & Remote Workers

Occupational safety researchers have long focused on understanding the causes and predictors of work-related injuries. In recent years, they have gone beyond traditional engineering approaches that focus on identifying and addressing physical safety hazards to examine behavioral aspects of safety.

“Unless we understand what drives workers to engage in unsafe behaviors, traditional engineering and training solutions won’t have the impact they should,” says Marvin Dainoff Ph.D., director of the Research Institute’s Center for Behavioral Sciences (CBS). To illustrate this point, Dainoff cites the example of scientifically designed handrails to help commercial drivers exit and enter their vehicles more safely. “We know that properly designed and installed handrails, combined with training, can go a long way toward decreasing worker falls. We also know that many times drivers do not use the available handrails, and get injured as a result. Our research aims to find out what influences observed worker behaviors, so we can better address their safety needs.”

To better understand worker behaviors at both organizational and individual levels, researchers study safety climate—a measure of employee perceptions about safety priority in the workplace (see “Safety Climate: An Emerging Concept in Occupational Injury Research,” p. 3). Research has shown that a company’s safety climate can reliably predict its employees’ injury outcomes. However, most safety climate studies have focused on traditional work environments, in which supervisors and workers interact under the same roof throughout the day. Little research has been done to examine how a company’s

safety climate influences lone workers or those who work in remote locations with little or no direct supervision.

“We have known for a long time that we can apply a safety climate scale to predict injury outcomes in industries such as manufacturing or services,” says leading safety climate expert and study collaborator Dov Zohar, Ph.D. “But we didn’t know if safety climate could also be predictive for lone and remote workers who work away from peers and supervisors.”

To address the lack of safety climate research on lone and remote workers, the CBS researchers launched a large-scale field investigation involving long-haul truck drivers and utility workers. Yueng-hsiang (Emily) Huang, Ph.D., the study’s principal investigator, explains: “Truck drivers typically drive alone for long stretches of time, and utility workers work remotely, either alone or in small groups. Both types of workers lack direct supervisory interaction and often encounter time constraints, weather, speed limits, and traffic conditions, all of which can take precedence over safety. Our study examined whether workers in lone and remote work situations develop a sense of their employers’ true safety priorities, and if so, whether these perceptions ultimately link to safety behaviors and injury outcomes.”

Trucking Survey Development and Testing

In early 2009, CBS researchers developed and refined a scientific survey to assess safety climate among lone mobile workers and their supervisors (see Table 1). The initial survey consisted of 100 questions derived from extensive interviews with subject matter experts (e.g., supervisors and drivers from a national long-haul trucking company and truck drivers at truck stops). They then refined the survey questions based on cognitive evaluation and feedback and selected those that best captured employees' perceptions of the true priority of safety at both the direct supervisory level and at the top management level. "We knew from the literature that employees' safety perceptions differ with respect to these two levels, so it was important that we looked at both," notes Huang.

Researchers then pilot-tested the initial survey among 2,030 drivers employed by a national trucking company as well as 200 drivers randomly recruited from several New England truck stops. Based on statistical analyses of the survey responses, they selected the final 40 survey items. "Our pilot test results provided initial evidence that the survey was valid, intelligible, reliable, and feasible for use in large trucking companies," notes Huang. Towards the end of 2009, the CBS researchers recruited seven more trucking companies to participate in the main study.

Data Collection, Analysis, and Feedback Workshops

Throughout the first six months of 2010, researchers administered the safety climate survey to employees of seven additional long-haul carriers, bringing the total number of drivers surveyed to 8,095. That summer, they compiled the survey data and presented it to the top management of each

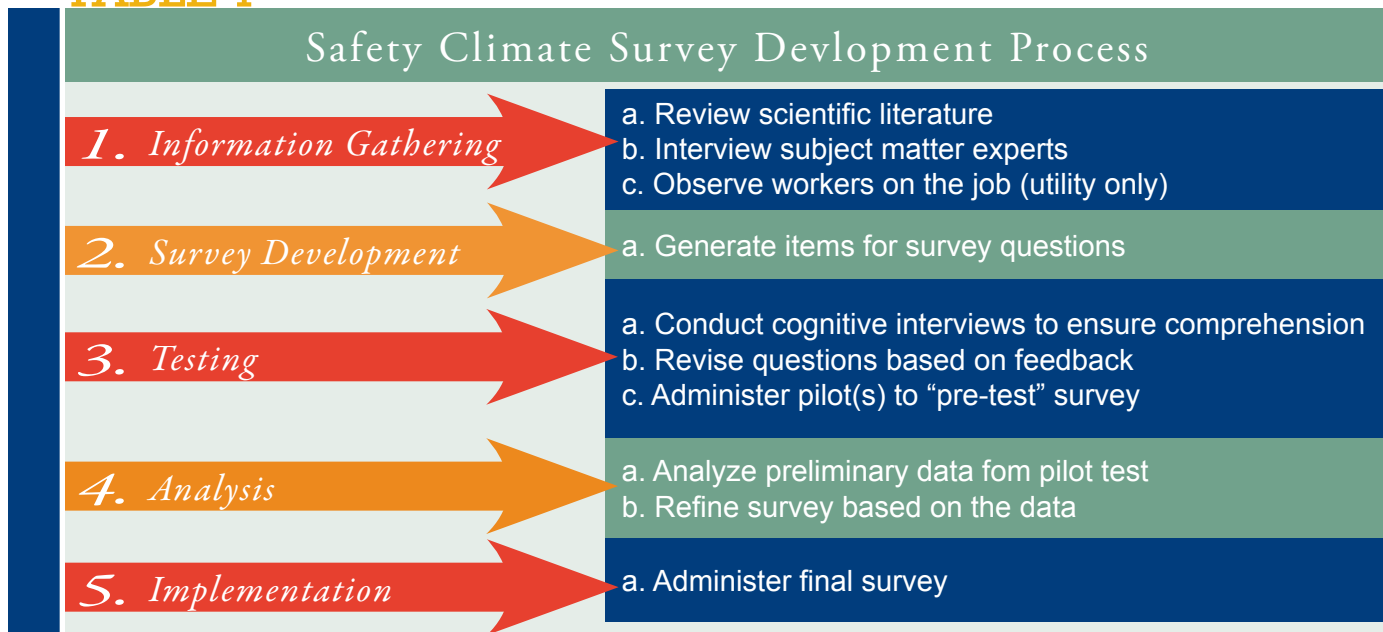
participating company in a series of individual debriefing workshops. "This was a very valuable exercise for the participants because they were able to benchmark their safety climate scores against other major trucking companies and identify their relative strengths and weaknesses," recalls Huang. "It was also a valuable exercise for us, because it reinforced the value of our research and the potential to ultimately use the information gained to shape interventions. Some of the companies in the study did, in fact, use the data as the basis for safety improvements."

As working partners in the study, the participating companies provided real-world, objective safety performance data (e.g., injury frequency and severity) over the subsequent six-month period. Researchers used this data to examine whether a link exists between drivers' perceptions of the company's safety climate and their actual safety performance. When the researchers compared the survey data with the objective data, they found a significant association between workplace safety climate and safety outcomes (see Chart 1, next page). "We now know that even though truck drivers work alone, they develop a sense of the true safety priorities of their companies, and their perceptions can be used to predict future safety outcomes," explains Huang.

The findings also indicated that a generic safety climate scale can be used to predict injury outcomes among lone mobile workers but that a scale incorporating various factors specific to the trucking industry provides much stronger predictive value. "We now have evidence that supports industry-specific safety climate scales as a powerful measure of employee safety perceptions and behaviors. This finding suggests a great potential for helping companies develop effective interventions," reports Huang.

(Continued next page)

TABLE 1



Preliminary data analyses also suggested that lone workers' perceptions of safety climate are highly reflective of top-level management messages. As Zohar explains, "In the case of trucking, the safety messages that are coming from upper management are aligned with actual safety practices. This is very good news for trucking companies, because it shows that consistent, clear communications combined with management's backing of safety priorities can be an effective approach to reducing injuries."

Utility Worker Survey Development, Testing, and Implementation

Using a process similar to that used to develop the trucking survey, CBS researchers worked with a regional utility company to design a safety climate survey for utility workers. This time, however, they supplemented the survey questions with on-site field observations and input from individual utility workers. "The utility worker job is complex. We needed to understand what they do and how they do it in order to develop an effective safety climate survey for these workers," says Huang.

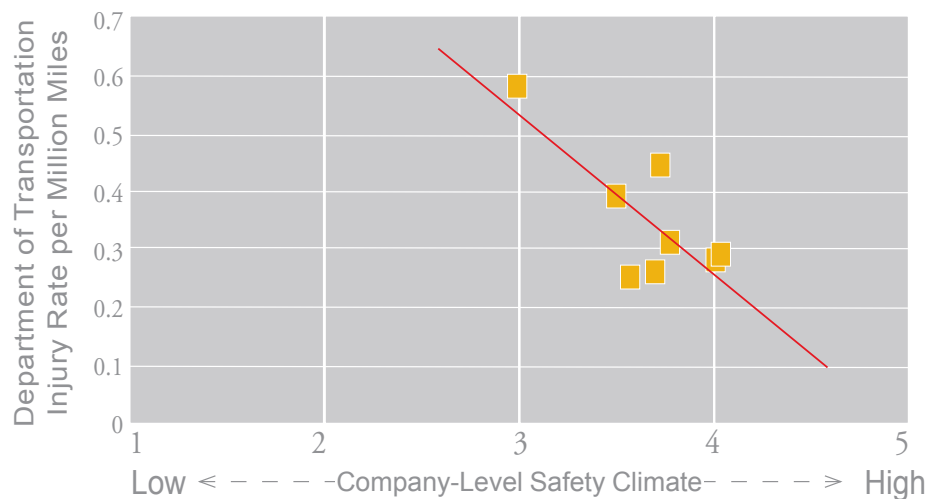
After testing a final version of the utility worker safety climate survey, researchers implemented it among more than 1,500 electrical workers at the pilot company along with 861 workers recruited from a second company. They then presented initial findings to officials at both participating companies and began to collect objective safety performance data. As with the trucking results, the utility worker data indicated a significant association between safety climate and safety performance.

"We now have clear evidence that safety climate is linked to workplace safety behaviors and to injury outcomes among lone and remote workers," says Huang. "This is very important because it gives companies a starting point. They now know that, among lone and remote workers, a negative safety climate is indicative of problems that need to be addressed. We hope that further research in this area will uncover effective ways to promote and sustain a positive climate in these types of non-traditional work settings."

“In the case of trucking, the safety messages that are coming from upper management are aligned with actual safety practices. This...shows that consistent, clear communications combined with management’s backing of safety priorities can be an effective approach to reducing injuries.”

CHART 1

Injury Rate Versus Safety Climate Score for the Eight Participating Carriers



Research to Reality

*Industry Experts
Discuss Safety
Climate Study
Findings*

A driver is en route to an important customer's site and something changes in road conditions—perhaps an accident scene, construction, a detour, or heavy traffic. Unless he speeds, the delivery will be late. The customer is waiting; the boss is expecting results. What does the driver do?.... The pressure is on all utility crews to restore power for an especially important customer. Despite having already worked a regular shift, the worker feels obligated to work longer. He knows the company's reputation is on the line, and the boss is being pressured, but exhaustion has set in and he can't even think straight...what should the worker do?

Every day, truck drivers, utility workers, and other lone workers encounter situations in which safety conflicts with the demands of the job. Because of their remote work environment, these workers must often resolve the conflicts alone—without the support or input of supervisors or management. Preliminary findings from the Institute's field study of truck drivers and utility workers showed that a company's safety climate is strongly associated with safety behaviors and injury outcomes among lone and remote workers.

We asked three Liberty Mutual industry safety experts, with a combined 118-plus years of field experience, to comment on the initial findings of our safety climate research project:

"Very often, top-level managers want assurance that the safety changes they are considering will have a positive impact on their business. The findings from this study provide real evidence that safety climate can be measured effectively and used to predict injury outcomes, even among those who work alone, away from peers and supervisors," says Liberty International Managing Director of Global Road Safety, David Melton, who served as an advisor to the research team. "This is powerful and actionable information that should help convince companies to take proactive measures to correct a negative safety climate, rather than just reacting when injuries occur."

"Safety climate is really the starting point that most organizations are looking for when they talk about changing their safety culture," states Loss Control Advisory Services (LCAS) Technical Director, James Houlihan, who notes that the terms

"climate" and "culture" are often mistakenly interchanged. "Unlike safety culture, which can be interpreted to mean many different things, safety climate is tangible. It can be measured, and the data obtained through surveys can identify significant discrepancies between a company's safety message and its actual safety practices."

Houlihan, who served as an internal consultant to the study, believes the promise of safety climate research resides in these discrepancies, which once identified, can be addressed. "Imagine a company that has a policy prohibiting cell phone use while driving. But within that same company, supervisors routinely call their drivers, clearly violating the policy. That would show up as a discrepancy in a safety climate survey. Once brought out into the light, this problem could be addressed appropriately."

"The lone or unsupervised worker develops a view of the organization through minimal contact with management but must carry out their duties based on the philosophy of that organization. As a result, the message coming down the management chain is extremely important," notes LCAS Technical Director and transportation industry expert David Money, CDS, CDT. The study findings suggest that drivers' perceptions of their companies' true safety priorities reflect top-level management's safety messages. "That's important information for trucking companies because it reaffirms the fact that consistent safety communication, supported and lived out by management, can and does make a difference."

(Continued on next page)

Five Tips to Promote a Positive Safety Climate Among Lone Mobile Workers...

1. Orientation

Provide information on the organization's philosophy and beliefs to all new employees entering the organization. Make sure the orientation includes contact with top management, and well as other employees, to demonstrate both safety attitudes and processes.

2. Expectations

Communicate the organization's and department's safety expectations, not only for new employees, but for all. Be sure they are written and performance rewarded.

3. Supervisor Contact

Plan for lone or mobile workers to have frequent contact with their supervisors. Make it reflective of the safety culture/climate of the organization.

4. Tools & Equipment

Provide appropriate tools for the task (vehicles, mechanized equipment, hand tools, etc.). Then, ensure that these are maintained and replaced as necessary.

5. Follow Up

When processes change, or new equipment is purchased to correct safety program deficiencies, follow up with the employee to ensure that they understand the new methods and expectations.

Concludes Money, "We are on the leading edge of discovery in the area of safety climate. I believe that the insights gained from this research will be beneficial to a variety of industries that are working to improve safety at the organizational level."

David F. Melton, CRSP, CDS, CCSP

As Managing Director, Global Road Safety for Liberty International, David Melton is responsible for implementing an internal roadway safety strategy within the Liberty International group of companies. He supports transportation-related safety services delivered by Liberty Mutual consultants around the world. He also advocates and participates in research projects at the Liberty Mutual Research Institute for Safety, is a frequent speaker at national and international conferences, and a contributor to numerous articles on transportation safety. During his 42-year career with Liberty Mutual, Mr. Melton has held positions in both field and executive management.



James J. Houlihan, CSP, ARM, MA

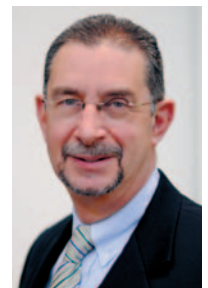


With more than 33 years of safety consulting and management experience, James Houlihan serves as technical director – organizational safety performance for Liberty Mutual Loss Control Advisory Services. In this role, he is responsible for developing strategies and resources to support organizational safety performance consulting services

delivered to companies worldwide. His extensive work designing and helping companies implement process improvement strategies has yielded tangible and measurable benefits for several large, multi-site, national and international companies. Mr. Houlihan has delivered more than 100 presentations, including over three dozen keynote addresses, at professional and customer conferences.

David M. Money, CDS, CDT

David Money has more than 35 years of experience in the traffic safety field and is currently the technical director, transportation services, for Liberty Mutual's Loss Control Advisory Services Group. In this position, he manages transportation related products and services and develops new systems, methods, technologies and other support materials to enhance customer training. In addition to producing technical references on numerous driving related topics, Mr. Money is responsible for Liberty Mutual's award-winning Decision Driving Training programs, attended by hundreds of commercial vehicle driver trainers each year.



Hettinger Joins Research Institute Staff



Dr. Hettinger

The Research Institute is pleased to welcome Lawrence J. Hettinger, Ph.D., to the staff. Dr. Hettinger is working with the Center for Behavioral Sciences as a principal research scientist. His work involves analysis of human and sociotechnical systems as they relate to the design of safe work environments. "We are fortunate to have Larry join our staff,"

says Marvin Dainoff, Ph.D., director of the Institute's Center for Behavioral Sciences. "His background and experience will allow us to expand our focus in the areas of organizational and systems impact on safety."

Dr. Hettinger brings a rich background in human experimental psychology, human factors engineering, and in the design, testing, and analysis of complex systems. His investigations will examine issues such as human-machine and human-computer interface design, factors influencing effective training, and organizational decision-making and communication. Since coming on board, he has been collaborating with his fellow scientists on safety climate issues and is organizing a Hopkinton Conference on the topic of Sociotechnical Systems and Safety.

"The Research Institute enjoys a tremendous reputation in the human factors and ergonomics community," says Dr. Hettinger. "I am delighted and privileged to have the opportunity to make meaningful contributions to workplace safety and the scientific literature. It's the best of both worlds."

Since 1985, Dr. Hettinger has conducted research on human-system performance issues in the design and use of advanced technical systems, principally at the U.S. Navy's Visual Technology Research Simulator (Orlando, FL), NASA Ames Research Center (Moffett Field, CA), Wright-Patterson Air Force Base (OH),

and most recently for the U.S. Navy's Future Surface Combatant Program (Washington, D.C.). He has also performed human-systems integration analysis and design support for numerous organizations in the public and private sector, including medical systems design and chemical and petroleum processing. Throughout his career, Dr. Hettinger has overseen and directed multi-disciplinary research and design teams devoted to the optimization of human-system performance through effective human-systems integration. He has also taught graduate and undergraduate courses in psychology and human factors engineering at The Ohio State University, Wright State University, and the University of Cincinnati.

Dr. Hettinger received his Ph.D. and M.A. degrees in psychology from The Ohio State University, where he focused his studies on visual perception and human performance. He earned his B.A. in psychology from the University of New Hampshire. Currently, he serves as chair of the Human Factors and Ergonomic Society's Test and Evaluation Technical Group. He is also a member of the American Psychological Society and Cognitive Science Society. Dr. Hettinger has published more than 75 scientific papers, one book, and several book chapters, and he has presented his work extensively.

Doctoral Students Participate in Safety Fellowship Program

The Research Institute and the American Society of Safety Engineers Foundation (ASSEF) selected two doctoral students to participate in their annual safety research fellowship program. The fellowships enable students Shannon Roberts, M.S., from the University of Wisconsin – Madison, and Jennifer Bruno, B.S., from the Harvard School of Public Health, to collaborate with Research Institute scientists for four to six weeks in Hopkinton, MA. The program encourages safety research; familiarizes graduate students, faculty members, and other researchers with current scientific projects, research models, and applications; expands and stimulates research understanding; provides a forum for linking safety professionals,

(Continued on next page)

industry needs, and quality research programs; and lays the groundwork for graduate students and faculty members to pursue selected safety and health applied research projects.

Examining Driver Perception and Feedback



Ms. Roberts

Ms. Roberts spent the early part of the summer collaborating with Institute researchers William J. Horrey, Ph.D. and Yulan Liang, Ph.D. on a driver safety investigation. The study examines the effect of feedback on driver calibration. The researchers aim to determine the degree that drivers are calibrated to their driving performance (i.e., how the drivers perceive their performance) and whether performance feedback will alter their calibration. The study also applies a set of known metrics specifically designed to measure calibration in the driving domain.

With the data collection phase completed, Roberts will continue to work with Drs. Horrey and Liang to compile the test results and write a manuscript. “I hope to collaborate on additional projects beyond this study given that my research interests are directly in line with this type of research,” says Roberts. “My time as an ASSEF fellow has allowed me to work with excellent researchers, and I have learned a great deal. It has been a valuable experience.”

At the University of Wisconsin – Madison, Roberts is working on her doctoral degree in industrial engineering. She also received her Master’s of Science in industrial engineering from the university in 2011. In 2009, she earned a Bachelor of Science degree in mechanical engineering from the Massachusetts Institute of Technology (MIT). Roberts has worked as a research assistant at both universities and completed internships with Anheuser-Busch, Inc. and General Motors Corporation. She is a current member of the Human Factors and Ergonomics Society.

A Closer Look at Repetitive Motion Fatigue

Jennifer Bruno began her fellowship at the Research Institute in August, collaborating with Nils Fallentin, Ph.D., M.Sc., on a pilot study of work-related repetitive motion injuries. The project seeks to determine what adaptations occur in the wrist flexor and extensor muscles in response to a low-force task designed to fatigue the wrist flexor muscles.

Study participants perform a low-frequency wrist flexion task previously shown to induce fatigue in the muscles. From the data obtained, researchers will test the hypothesis that adaptations enable people to continue performing tasks after fatigue. These adaptations may relate to the development of musculoskeletal disorders, which are common among workers performing low-force, repetitive tasks. While the study is in its early phases, Bruno is fine-tuning the experimental procedures and apparatus. “This is an exciting opportunity to expand my research interests and develop new research skills,” says Bruno. “It’s an honor to receive this fellowship and have the opportunity to work with such knowledgeable researchers.”

Bruno, a native of Massachusetts, is a fourth-year doctoral student in the field of ergonomics and safety at the Harvard School of Public Health (HSPH). The purpose of her thesis is to quantify the physical and psychosocial exposures of computer workers in the field and to link these exposures to musculoskeletal disorders. At HSPH and Harvard College, she is a teaching fellow for several courses. In 2008, Bruno earned a Bachelor of Science in biomedical engineering from the University of Connecticut – Storrs. She is a member of the American Public Health Association.



Ms. Bruno

For more information on the Liberty Mutual/ASSEF Fellowship program, please visit our website at www.libertymutual.com/researchinstitute. Candidate recruitment for the 2012 fellowships will begin in the early part of next year.



External Scientific Advisory Panel Meets

An external scientific advisory panel recently met at the Research Institute to review the Center for Injury Epidemiology’s (CIE) research program. The panel, comprised of five scientists with broad expertise in injury epidemiology, met with Institute Director Ian Noy, Ph.D., Center Director Theodore Courtney, M.S., CSP, and CIE staff to assess the Center’s capabilities, facilities, and research objectives. Pictured (left to right) are Mr. Courtney, Robert Herrick, Sc.D., Harvard University, Murray Middleman, M.D., Dr.P.H., Beth Israel Deaconess Medical Center and Harvard University, David Wegman, M.D., MPH, University of Massachusetts-Lowell (emeritus), Susan Gerberich, Ph.D., University of Minnesota, James Collins, Ph.D., MSE, U.S. Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, and Dr. Noy.

Conferences

39th Annual Meeting of International Society on Oxygen Transport to Tissue: July 24-27, Washington, DC

- Tissue Oxygen Saturation in Flexor and Extensor Muscles During Repetitive Hand Movements for Eight Hours – R.V. Maikala, Ph.D.

35th Annual Meeting of the American Society of Biomechanics: August 10-13, Long Beach, CA

- Are Age-Related Modifications During a Squatting Task Implemented By Working-Age Men? - A. DiDomenico, Ph.D., C.P.E.

5th World Congress on Bioengineering: August 18-21, Tainan, Taiwan

- Gait Adjustments While Walking on Flexible Scaffolding Boards – C.C. Chang, Ph.D., C.P.E.

2nd International Conference on Driver Distraction and Inattention: September 5-7, Gothenburg, Sweden

- Calibration and Distracted Driving: Theory and Implications – W.J. Horrey, Ph.D.

National Occupational Research Agenda (NORA) Manufacturing Sector Conference: September 7-8, Cincinnati, OH

- Reducing Injuries from Falls in the Manufacturing Sector - Y.I. Noy, Ph.D., C.P.E.

The 22nd International Conference on Epidemiology in Occupational Health: September 7-9, Oxford, England

- The Changing Structure of Work and Implications for the Risk of Work-Related Injury in Developing Countries: Lessons Learned from Xuan Tien, Vietnam – H. Marucci-Wellman, Sc.D.

9th Triennial Meeting of the International Association of Forensic Sciences: September 12-17, Madeira, Portugal

- Ergonomics and Human Factors Contributions to Forensics - Y.I. Noy, Ph.D., C.P.E.

55th Annual Meeting of the Human Factors and Ergonomics Society: September 19-23, Las Vegas, NV

- Maximal Acceptable Torques of Highly Repetitive Screw Driving, Wrist Flexion and Extension with a Pinch grip, Ulnar Deviation, and Handgrip Tasks for Seven – V.M. Ciriello, Sc.D., C.P.E.
- Use of the Systems Analysis Tool for Macroergonomic Evaluations and Interventions – M.M. Robertson, Ph.D., C.P.E.

3rd International Symposium on Visual Image Safety: September 22-23, Las Vegas, NV

- Visually-Induced Motion Sickness: Safety and Product Liability Issues and Research Requirements – L.J. Hettinger, Ph.D.

National Occupational Injury Research Symposium (NOIRS): October 18-20, Morgantown, WV

- An Investigation of Stochastic Distribution of the Required Coefficient of Friction for Level Walking – W.R. Chang, Ph.D.

- Moving Upstream: Using Slipping as an Outcome Measure in Epidemiologic Research on Fall-Related Injuries • Slips Trips and Falls in Health Care Workers – T.K. Courtney, M.S., C.S.P.

- Development and Validation of a Safety Climate Scale for the Trucking Industry – M. Dainoff, Ph.D., C.P.E.

- Effects of Motivation and Acclimation on Lateral Reach Distances While Standing on a Stepladder - A. DiDomenico, Ph.D., C.P.E.

- Perceptions of Slipperiness as a Function of Visual Cues and Available Coefficient of Friction – M.F. Lesch, Ph.D.

- Sleep Duration, Body Mass and the Risk of a Work-Related Injury: Results from the U.S. National Health Interview Survey (2004-2010) Work-Related Falls from Ladders: A Follow-Back Study of U.S. Emergency Department Cases – D.A. Lombardi, Ph.D.

- An Accurate Semi-Computerized Approach to Classifying Injury Narratives of Large Administrative Datasets into Bureau of Labor Statistics Occupational Injury and Illness Classification System (OIICS) 2 Digit Event Categories – H. Marucci-Wellman, Sc.D.

- Future Directions in Occupational Injury Prevention Research - Y. Ian Noy, Ph.D., C.P.E.

- Factors Associated with Use of Slip-Resistant Shoes in U.S. Limited-Service Restaurant Workers and Fixed Transient Risk Factors for Slipping in U.S. Limited-Service Restaurant Workers – S.K. Verma, Sc.D., M.D., M.P.H.

- Long Working Hours and Sleep as Direct and Indirect Risk Factors for Work-Related Injury – a Structural Equation Modeling Approach – A. Wirtz, Dr. phil.

139th Annual Meeting and Exposition of the American Public Health Association: October 29-November 2, Washington, D.C.

- Rushing, Distraction, Walking on Contaminated Floors and Risk of Slipping in Limited-Service Restaurants – a Case-Crossover Study – S.K. Verma, Sc.D., M.D., M.P.H.

Publications

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