

from Research to Reality

*Slips and Falls
in Restaurants*

Reducing
Worker Risk

LIBERTY MUTUAL RESEARCH INSTITUTE FOR SAFETY

SCIENTIFIC UPDATE



Liberty
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Letter from the Director



Dear Readers

With the summer travel season upon us, the restaurant industry is in full swing. During peak seasons, restaurant operators must often step up their safety efforts to meet the needs of an increased number of employees and a faster pace of operations. Controlling hazards that can lead to same-level slips and falls—a leading cause of injury among restaurant workers—should top their safety lists. This issue highlights the findings from our recent study of worker slips and falls in limited-service restaurants (see pp. 4-7). Our findings provide the scientific basis for targeted safety interventions that can effectively reduce slip and fall hazards in restaurants and other at-risk industries.

However, generating scientific knowledge is only half the battle in combating workplace hazards. This knowledge must be translated into practical tools and recommendations that industries can use to enhance workplace safety. In an interview with Wayne Maynard, Manager of Technical Services and Product Development for Liberty Mutual's Loss Control Advisory Services, we take a glimpse at this research-to-reality translation process as it applies to the restaurant study findings (see p. 8).

In June, translation was highlighted as scientists joined forces with Liberty Mutual's loss-control technical specialists and service directors for the company's first-ever Knowledge Transfer and Exchange (KTE) Forum (see p. 10). Through the KTE process, professionals and scholars collaborate for the mutual enhancement of research and practice. As one KTE Forum participant remarked, "The ideas were flowing in both directions." I, too, was heartened by the level of engagement and energy at the Forum, which I believe strengthened both groups and will ultimately enhance workplace safety and related research.

I hope you enjoy this issue, and, as always, we invite your feedback.

Ian Noy, Ph.D.
Vice President and Director

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Same-Level Falls

Standard Fare for Restaurant Workers

For at least the past decade, same-level falls have consistently ranked second among the top 10 causes of serious workplace injuries in the United States (Liberty Mutual Workplace Safety Index, 2000-2010). High-risk industries include healthcare, hospitality, and construction, but the restaurant industry—which employs more than 6.5 percent of the nation’s workforce—is among those most burdened by injuries from same-level slips and falls.

“In 2009, the restaurant industry reported more than 50,000 cases of disabling work-related injuries. Nearly a quarter of those were attributed to same-level slips, trips, and falls,” notes the Institute’s Center for Injury Epidemiology (CIE) Director, Theodore Courtney, M.S., CSP, citing the most recent statistics on the subject (BLS Table R4, 2009). “The fast pace of restaurant operations, coupled with the reality of spills and floor contamination, can create an environment where fall risks are common – but that doesn’t mean slips and falls are inevitable or uncontrollable,” asserts Courtney. “By giving us a better understanding of the mechanisms and circumstances that lead to same-level slips and falls, our research provides an evidence base for interventions that can effectively reduce the risk of related injuries.”

The Liberty Mutual Research Institute for Safety has a distinguished history of research targeting same-level falls. In 1967, the Research Institute developed and tested the first Horizontal-Pull Slipmeter™, which enabled safety practitioners to obtain objective measures of floor slipperiness and thereby gauge the risk of slips and falls. Throughout the '70s, '80s, and '90s, Institute laboratory studies yielded valuable information about the interactions between floor and shoe surfaces as well as the impact of friction and surface roughness on slipping. More recently, the Research Institute has taken a multidisciplinary approach to the problem, applying tribology, biomechanics, epidemiology, and the behavioral sciences to

improve researchers’ understanding of the causes and control of same-level slips and falls.

In 2000, the Institute convened a Hopkinton Conference of prominent scientific experts from around the world to explore issues related to same-level falls and to identify new research opportunities. The conference proceedings, published as a special issue of the journal *Ergonomics* (Vol. 44, No. 13, 2001), identified a number of important research gaps, including a lack of field studies applying the best available research methods. “While considerable laboratory science on slipping and falling had been done, there was a clear need to move the research into actual workplaces,” explains Courtney.

The Institute responded to this need with a series of field research initiatives, including a large-scale study of restaurant workers conducted with the Harvard School of Public Health. Launched in 2007, this ongoing study is the largest study to date that examines and quantifies the factors that contribute to slip risk among limited-service restaurant workers. “Through this multifaceted research study,” notes Courtney, “we are gaining a more comprehensive understanding of the circumstances that lead to same-level restaurant falls and the impact of various risk factors. This knowledge will enable employers to make more informed decisions regarding worker safety, not only in restaurants but potentially in other high-risk fields, such as hospitality and healthcare.”

Study Serves Up New Insights



Restaurant Worker Slips & Falls

Because same-level falls are responsible for one of four disabling restaurant worker injuries in the United States, understanding the factors that contribute to such events is critical. Scientists at the Liberty Mutual Research Institute for Safety dedicate significant time and resources to studying the mechanisms and circumstances that lead to same-level falls. In addition to controlled laboratory investigations, Institute researchers conduct field studies in actual work environments, collecting data from restaurant workers during operating hours. These real-world studies provide the evidence base for safety protocols and best-practice recommendations that can help restaurants reduce the risk of same-level falls.

Initially, Research Institute scientists conducted a study involving 10 limited-service (a.k.a. fast-food) restaurants. Applying a unique approach, researchers collected workers' self-reports of slips and falls experienced during the four weeks prior to the study. The findings, published in *Injury Prevention* (Vol. 16, No. 1, 2010), revealed a high frequency of slipping among restaurant workers and quantified a significant association between a restaurant's mean coefficient of friction (COF) and workers' odds of slipping.

"Many laboratory studies have shown friction to be associated with slipping, but such studies are not necessarily representative of real-world conditions. We wanted to evaluate risk factors within active work environments," explains Theodore Courtney, M.S., director of the Institute's Center for Injury Epidemiology (CIE). "This study demonstrated that we could use self-reported slipping as a dependent variable to study the causes of same-level falls. Knowing this, we were able to design a more in-depth study in which we examined the impact of

multiple risk factors for same-level slips and falls over a longer period of time."

The Institute's next step was to launch a large-scale prospective field study of various risk factors for slipping. The study, conducted in collaboration with scientists at the Harvard School of Public Health, sought to assess whether, and to what extent, factors such as floor surface characteristics, slip-resistant shoes, floor cleaning practices, and safety climate impact a worker's risk of slipping.

"We recruited 36 fast-food restaurants across six states and gathered individual and environmental data at each site over a two-year period," relates the study's principal investigator, Santosh Verma, Sc.D., research scientist at the CIE. At baseline, participating restaurant workers completed a survey on demographics (age, gender, education, ethnicity, height, weight), job characteristics (tenure, primary location of work, number of hours per week, work hours), perceptions of floor



slipperiness, floor-cleaning practices, and slip-resistant shoe use. The study team also measured floor surface roughness (average and peak) and COF in selected areas (front counter, drive-through, sandwich assembly, fry vat, grill, back vat, sink, cooler, freezer, and ice machine).

During the subsequent 12 weeks, participants were asked to report their slip experiences each week through an online, telephone, or paper survey. A “slip” was defined as a loss of traction of the foot. “We made sure that study participants understood that we were interested in finding out about all slips, even those that didn’t result in a fall,” notes Verma. “That is important because slips occur at a higher frequency than falls, and many slips can result in injury without necessarily causing a fall.” Restaurant managers provided additional information on floor-cleaning protocols and shoe policies.

Initial Findings Suggest That Slips Are Controllable

Initial analyses, as published in the *Journal of Occupational and Environmental Hygiene* (Vol. 7, No. 9, 2010), indicated that the overall rate of slipping was 0.44 slips per 40 work hours during the 12 weeks of the prospective study. The individual rate of slipping was more than 100 times higher in the restaurant with the highest rate of slipping compared to the restaurant with the lowest rate of slipping (range 0.02 to 2.49 slips per 40 work hours).

“It is highly unlikely that this large between-restaurant variation could be attributed to chance alone,” notes Verma. “This

finding suggests that some restaurants are much more effective at controlling the risks than others, and it implies that adoption of best practices has considerable potential to reduce the risk of slipping.”

The study data also revealed that 25 out of the 36 restaurants used enzyme-based floor cleaners. Unfortunately, 62% of the participants who were responsible for using these cleaners reported using hot or warm water as part of their floor-cleaning protocol. “That’s a problem because—unlike traditional floor cleaning products—enzyme-based cleaners require cold water to work properly. Using hot or warm water can reduce the effectiveness of the cleaner by deactivating the enzymes,” explains Verma. “This finding indicates that training and enforcement of proper cleaning protocols are important aspects of reducing slip risk in restaurants.”

Slip-Resistant Shoes Cut Slip Rates in Half

In subsequent analyses, researchers examined the associations between floor surface characteristics, slip-resistant shoes, floor cleaning frequency, and slip risk. As published in *Occupational and Environmental Medicine* (Vol. 68, No. 4, 2011), slip-resistant shoes reduced the rate of slipping by more than 50%. “Ours is the first study to provide concrete evidence that slip-resistant shoes are effective in the field. This is a very exciting finding because slip-resistant shoes are a straightforward intervention,” states Verma, who notes that about 60% of study participants reported wearing slip-resistant shoes at the time of the investigation. “Based on our findings,

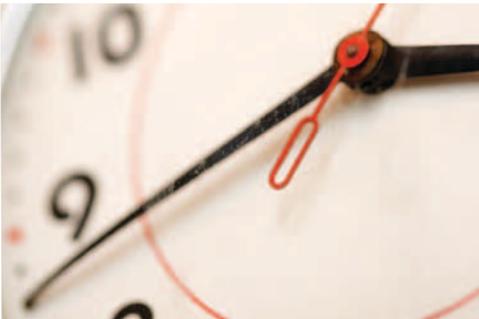
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Case-Crossover Study Links Transient Risk Factors to Slip Rates

As part of the field study of fast-food restaurant workers (see pp. 4-7), Institute researchers conducted a nested case-crossover study to explore how three transient risk factors—rushing, distraction, and walking on a contaminated floor—affect the rate of slipping among these workers. The study also examined whether individual variables such as use or non-use of slip-resistant shoes, weekly work hours, and job tenure altered the degree of risk. The findings were accepted for publication in *Occupational and Environmental Medicine*.

<i>What we looked at:</i>	<i>What we found out:</i>	<i>Conclusions:</i>
<p>Researchers analyzed baseline data provided by 396 workers, 210 of whom reported experiencing one or more slips, for a total of 989 slipping incidents.</p> <p>The data included:</p> <ul style="list-style-type: none"> • average work hours, • job tenure, • weekly slip experience, and • average weekly exposure duration to each transient risk factor. <p>Researchers were specifically interested in whether one or more transient risk factors were present at the time of slipping.</p>	<ul style="list-style-type: none"> • All three transient risk factors significantly increased the rate of slipping: <ul style="list-style-type: none"> – rushing by 2.9 times – distraction by 1.7 times – walking on a contaminated floor by 14.6 times • Slip-resistant shoes helped reduce the risks of both rushing and walking on a contaminated floor. • The effects of all three transient risk factors decreased monotonically as job tenure increased. 	<p>Based on these findings, our researchers concluded that the following could help reduce slipping incidents in fast-food restaurants:</p> <ul style="list-style-type: none"> • reducing the transient exposures, • encouraging the use of slip-resistant shoes, and • establishing a greater safety focus for new and part-time employees.



Continued from previous page

and earlier studies indicating the high costs associated with fall-related injuries, restaurants that provide slip-resistant shoes should see a return on their investment.”

Researchers also found that the mean COF among the studied restaurants ranged from 0.45 to 0.86. Further, they found that

for each 0.1 increase in the mean COF, the rate of slipping decreased by 21%. This finding is significant, because current guidelines cite 0.5 as a recommended COF. “Our study shows that there are significant reductions in risk for each 0.1 COF increase at values well above 0.5, suggesting that efforts to further improve friction can have an impact,” explains Verma.

Floor Cleaning – Is More Better?

According to the study findings, the rate of slipping was 15 times higher on contaminated floor surfaces, and workers were exposed to contaminated floors for 1/3 of their work time. After controlling for other factors, however, the association between floor-cleaning frequency and rate of slipping was not as clear-cut. Verma explains, “The cleaning process itself puts liquid ‘contaminants’ on the floor, which may increase slip risk in the short term. But your floor should be more slip-resistant once the contaminants are removed and the water has evaporated. So the question of how often the floor should be cleaned to minimize slips requires more study.”

Researchers continue to analyze the study data to explore the effects of safety climate and working hours on slips and falls, to identify who is wearing slip-resistant shoes, and to examine the relationship between perceptions of slipperiness and measured COF. “We still have a great deal to learn from this study,” concludes Verma, “but we are confident that our findings will result in the development of better prevention tools, training, and work processes to help reduce occupational slips and falls in restaurants.”

New Directions

On the heels of the limited-service restaurant study, Institute researchers have begun data collection for a prospective cohort study of risk factors for slips, trips, and falls among full-service restaurant workers. In addition to assessing floor surfaces, slip-resistant shoes, floor cleaning, and safety climate, this study will examine the effects of lighting, floor level and transition, as well as risk factors for tripping and slipping. “This new study expands the scope of research to a different type of restaurant environment and will examine additional factors related to slips, trips, and falls among restaurant workers,” concludes Verma, whose goal is to recruit 50 full-service restaurants for the study.

Related Papers

Courtney, T.K., Verma, S.K., Huang, Y.H., Chang, W.R., Li, K.W., and Filiaggi, A.J., “**Factors Associated with Worker Slipping in Limited-Service Restaurants,**” *Injury Prevention*, Vol. 16, No. 1, pp. 36-41, 2010

Verma, S.K., Chang, W.R., Courtney, T.K., Lombardi, D.A., Huang, Y.H., Brennan, M.J., Mittleman, M.A., and Perry, M.J., “**Workers’ Experience of Slipping in U.S. Limited-Service Restaurants,**” *Journal of Occupational and Environmental Hygiene*, Vol. 7, No. 9, pp. 491-500, 2010

Verma, S.K., Chang, W.R., Courtney, T.K., Lombardi, D.A., Huang, Y.H., Brennan, M.J., Mittleman, M.A., Ware, J.H., and Perry, M.J., “**A Prospective Study of Floor Surface, Shoes, Floor Cleaning and Slipping in U.S. Limited-Service Restaurant Workers,**” *Occupational and Environmental Medicine*, Vol. 68, No. 4, pp. 279-285, 2011

Verma, S.K., Lombardi, D.A., Chang, W.R., Courtney, T.K., Huang, Y.H., Brennan, M.J., Mittleman, M.A., Ware, J.H., and Perry, M.J., “**Rushing, Distraction, Walking on Contaminated Floors and Risk of Slipping in Limited-Service Restaurants: A Case-Crossover Study,**” *Occupational and Environmental Medicine*, [Epub ahead of print], 2010

“...we are confident that our findings will result in the development of better prevention tools, training, and work processes to help reduce occupational slips and falls in restaurants.”

Using Science to Reduce Restaurant Worker Falls



Research to Reality

As Manager of Technical Services and Product Development for Liberty Mutual's Loss Control Advisory Services, Wayne Maynard, CSP, CPE, ALCM, oversees the development of consulting tools, resources, and training used by Liberty Mutual loss control consultants to help companies reduce risk. He works closely with Research Institute scientists to integrate findings from published studies into effective loss control solutions, products, and tools. We asked Mr. Maynard to comment on the Institute's field investigation of slips and falls among restaurant workers and how its findings impact safety practice.

Q In your experience, what is the most significant aspect of slips-and-falls management in restaurants?

A The most valuable aspect of an effective slips-and-falls safety management program is sound policy, properly implemented, with accountability from all major stakeholders. This is a considerable challenge because safety policies tend to get lost in the restaurant business, which is fast-paced and which focuses, appropriately, on customer service. However, once managers recognize the potential to make an impact on the bottom line, they begin to understand the value of sound safety policy, reinforced by proper training and accountability.

Q How does the restaurant study address that aspect?

A The findings of the restaurant study provide quantifiable evidence that certain practices—proper floor maintenance and cleaning, along with slip-resistant shoe use—can effectively reduce the risk of slipping. This

evidence is used to inform and support safety policies and practices that can make a real difference in the field. Company stakeholders are more apt to take safety recommendations seriously when there is supporting evidence of their effectiveness.

Q Which findings were the most surprising or intriguing to you?

A Without a doubt, the most intriguing finding was that incremental increases in a floor's coefficient of friction, or COF, can make a real difference in lowering slipping rates. We learned that for every 0.1 increase in a kitchen floor's mean COF, there was a corresponding 21 percent decrease in slips reported by workers. That's much greater than what might have been expected. This finding tells us that any efforts to improve floor COF—keeping the floor clean and dry, applying floor surface treatments, or selecting slip-resistant floorings—can enhance worker safety and produce savings by reducing the rate of slipping.

Q Which findings from the restaurant study impact safety practices the most? Explain.

A The study showed that wearing slip-resistant shoes can reduce employees' risk of slipping by half. With this knowledge, restaurant operators can create sound policies to facilitate slip-resistant shoe use, and they may be more likely to provide or help finance slip-resistant shoes for their employees, knowing that doing so could provide a return on their overall investment.

The study also showed a 15-fold increase in the rate of slipping when employees were working on contaminated floor surfaces—which occurred during one-third of their work time. It also indicated that enzyme-based floor cleaners are used incorrectly more often than not and that this misuse compromises their effectiveness. These findings make a strong case for the development of effective floor-cleaning policies that include procedures for removing debris such as food, spilled drinks, and other objects from the floor.

Q What is the central message of the study?

A Essentially, the study shows that a strategy aimed at maintaining the best possible COF in restaurant kitchens can reduce the risk of injuries from slips and falls, and that slip-resistant shoes and proper floor cleaning are two very important and effective components of such a strategy.

It is important to note, however, that neither slip-resistant shoes nor proper cleaning protocols offer a “silver-bullet” solution to the problem of slips and falls. These solutions must be incorporated into a comprehensive slips-and-falls management process that incorporates many other components, including management responsibility, education and training, floor surface selection and treatments, hazard surveillance and assessment, and warning signs and instructions.

Q How is Loss Control Advisory Services (LCAS) using the study's findings to help improve worker safety in restaurants?

A When research is completed in a specific area, LCAS product directors take action to incorporate the findings into practical resources that help companies better control risks. In the case of the restaurant study, this integration has occurred on several levels. For example, we have integrated the study findings on slip-resistant shoe use and floor cleaning protocols into our Slips and Falls Prevention Toolkit. This toolkit includes assessment tools, solution guides, and training programs designed to help companies take a more proactive approach to controlling workplace slips and falls. We are also incorporating the findings into our education and training programs for LCAS field consultants and service directors.

Our most recent program, VantageControl for Restaurants™, will incorporate findings from this study, and other studies related to slips and falls prevention in restaurants. Delivered through a variety of channels, including Liberty Mutual's SafetyNet.com, the VantageControl program provides policyholders with telephonic and onsite consults from LCAS specialists, as well as focused training through interactive webinars and online discussion boards.

Q In your opinion, do any of the study findings have implications for other industries or for general liability concerns?

A Although the study findings are directly transferable to the restaurant industry only, I believe that they also have potential implications for other industries—particularly the finding that incremental increases in COF are associated with decreased rates of slipping. The study provides a scientific basis for saying that even small improvements to a floor's COF can reduce the rate of slips and falls. This has important implications not just in restaurants, but also in the healthcare, hospitality, retail, and grocery industries, as well as other industries challenged by slips and falls, not only in relation to workers compensation, but also from a general liability standpoint.

*Researchers &
Practitioners
Address Key
Safety Issues*



More than 70 representatives from Liberty Mutual's Loss Control Advisory Services (LCAS) and Research Institute for Safety convened in June for the company's first-ever Knowledge Transfer and Exchange Forum.

Held at the Research Institute in Hopkinton, Mass., the conference was the first formal Institute event dedicated to knowledge transfer and exchange (KTE), a practice that differentiates Liberty Mutual in both the insurance and the safety research communities. Technical specialists, service directors, and research scientists, as well as several representatives from Risk Quality Assessment and Liberty Mutual Agency Corporate Loss Prevention Technical Services, attended two and a half days of intensive workshops, sessions, and roundtable discussions on key safety topics.

"It is so important that our specialists and service directors take what they learn here and bring it to the field to help reduce risk at our policyholders' locations," said Connie Bayne, Liberty Mutual senior vice president of Underwriting Support Services,

evolving safety concerns that may require scientific study. The ability to generate and share our knowledge and expertise in this way is unique, and it's just one way that Liberty Mutual sets itself apart in the property and casualty marketplace."

Research Institute Director Ian Noy, Ph.D., welcomed the LCAS specialists and service directors, noting, "The Institute's mission is to conduct research to help reduce workplace injuries and workplace disability and to share that research with the worldwide community. It's a very noble mission that supports Liberty Mutual's core commitment to helping people live safer, more secure lives."

Over the course of the two-day event, attendees worked together to address five critical safety areas: Overexertion

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noting the opportunities for learning and enhanced customer service offered by the Forum's focus on KTE. "It's equally important that researchers connect to the field to learn about

(the number one cause of serious workplace injury), Falls (the second leading cause of serious workplace injury), Workforce Fitness and Return to Work, Driver Safety and Safety Climate,

and Workplace Innovations. For each area covered, Institute researchers teamed up with LCAS technical directors to present workshops on the following topics:

- Design of Manual Materials Handling Tasks
- Human Strength and Design of Upper Extremity Work
- Prevention of Same-Level Slips, Trips, and Falls
- Safe Work Methods and Falls-From-Height Prevention
- Driver Distraction
- Organizational Safety Climate
- Electrical Injuries, Safety Warnings, and Shiftwork
- Macroergonomics
- Return-to Work (RTW)
- RTW, Health Promotion, and Wellness

Each workshop series concluded with an exchange workshop in which participants shared their insights and ideas on the topics presented.

“The participative format encouraged a lively exchange of information and knowledge among the scientists, who pursue science-based evidence to support sound safety practices and tools, and the field specialists, who are in the trenches every day recommending safety protocols and practices to help customers improve their operations,” said Wayne Maynard, Liberty Mutual Loss Control Advisory Services, Manager of Technical Services and Product Development. “Our hope is that attendees not only learned from each other but also will continue to explore opportunities for new LCAS service products and potential new research directions.”

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Researcher Rammohan Maikala, Ph.D., engages participants during a session on human strength and design of upper extremity work at the KTE Forum held at the Research Institute.

Liberty Mutual Award Recognizes Shift-Work Study

Researchers from the Netherlands received the 2011 Liberty Mutual Award for their scientific paper, “Effects of the New Fast Forward Rotating Five-Shift Roster at a Dutch Steel Company.” The paper—published in *Ergonomics* (Vol. 53, No. 6, 2010)—investigated the impact of a shift roster change at a large Dutch steel producer. The winning researchers included John Klein Hesselink, Ph.D., and Anneke Goudswaard, Ph.D., of TNO (an independent Dutch research organization), and Jan de Leede, Ph.D., of the University of Twente, Institute for Innovation and Governance Studies, and ModernWorkx.

The winning study investigated the effects of shift systems on worker health and safety. Researchers examined a new five-shift roster at Corus Steel (the Netherlands). In the new roster, employees worked successively four (two morning, two evening) and two (night) consecutive shifts, followed by three days off. The old roster used a three-shift format with only two days off following the night shifts.

The investigation included more than 4,600 shift workers, primarily men (more than 97%) with an average age of 45 years. Almost all of the workers were full time. The study examined data on reported accidents and absenteeism (due to illness), as well as information from health interviews. Researchers compared the data obtained one year after the new roster implementation to data from the prior year. Further, the researchers evaluated the data of the experimental group (the five-shift workers) with the data of the day workers to control for general company developments.

The researchers found a 0.6% decrease in absentee figures, particularly in mid-term absence due to illness. Findings also revealed improvements in the year after implementation of the new roster for health indicators, such as, fatigue, musculoskeletal complaints, relationship of work and health, and workload. These positive effects were also stronger for older workers (50+). The results were significantly

more positive for the shift workers than for the control group.

Corresponding author Jan de Leede accepted the award at the Annual Conference of the Institute of Ergonomics and Human Factors, held at the Stoke Rochford Hall, Lincolnshire, United Kingdom. Roger Haslam, coordinating editor of *Ergonomics*, commented, “The Liberty Mutual Award celebrates the best research published in *Ergonomics*. The winning paper presents the findings of a major field study that examined a large population of workers. We were impressed by its scope, scale, and outcomes. It is an excellent demonstration of the positive impact of ergonomics.”

“We are honored to win this award,” said de Leede. “Our findings confirm current ergonomics shift-work recommendations and are especially meaningful for older workers.”

For more information on the Liberty Mutual Best Paper Award, presented in conjunction with the UK Institute for Ergonomics and Human Factors, please visit www.libertymutualgroup.com/researchinstitute.



Photo courtesy of IEHF

Professor Peter Buckle (left), president of the Institute of Ergonomics and Human Factors, presents the 2011 Liberty Mutual Award to Dr. Jan de Leede (right).

Slip-and-Fall Study Earns Top Award



Dr. Verma

Research Scientist Santosh K. Verma, Sc.D., M.D., M.P.H., received the Research Institute's 2011 Internal Best Paper Award. Dr. Verma was selected for the paper entitled "A Prospective Study of Floor Surface, Shoes, Floor Cleaning and Slipping in U.S. Limited-Service Restaurant Workers," which was published in *Occupational and Environmental Medicine* (Vol. 68, No. 4, 2011). The study examined the associations between floor surface characteristics, slip-resistant shoes, floor-cleaning frequency, and the risk of slipping for limited-service restaurant workers. The findings provide support for the use of slip-resistant shoes and measures to increase the coefficient of friction as preventive interventions to reduce slips, falls, and injuries.

Two additional research scientists earned merits for their work. Manuel Cifuentes, M.D., M.P.H., Sc.D., received second-place honors for the paper "The Course of Opioid Prescribing for a New Episode of Disabling Low Back Pain: Opioid Features and Dose Escalation," published in *Pain* (Vol. 151, No. 1, 2010). Raymond W. McGorry, M.S., P.T., received third place for the paper "Correlations Between Pain and Function in a Longitudinal Low Back Pain Cohort," published in *Disability and Rehabilitation* (Vol. 33, No. 11, 2010).

The internal award program promotes excellence in health and safety research. Each year, Research Institute directors evaluate all accepted papers from the previous year for experimental design, scope, and overall quality.

DiDomenico Receives Honor



Dr. DiDomenico

Women in Safety Engineering (WISE), a common interest group of the American Society of Safety Engineers (ASSE), recently named Research Scientist Angela DiDomenico, Ph.D., C.P.E., as one of 100 women who are making a difference in safety. The honor celebrates 100 women who have made a difference through their work and who have shown dedication to protecting people, property, and the environment. The WISE honor, part of ASSE's 100th anniversary celebration, recognizes women who have made contributions in areas related to safety, health, and environmental issues.

WISE selected DiDomenico for her occupational biomechanics research and for providing field safety professionals the information they need to help reduce workplace incidents. Since joining the Research Institute in 2003, DiDomenico has focused her investigations on helping reduce workplace

injuries in the area of construction. Her research includes seeking ways to prevent loss of balance to help reduce falls from elevations in the workplace, learning why truck drivers fall from their vehicles, and finding methods to reduce injuries related to falls from ladders.

DiDomenico came to safety research through her interests in mathematics and physical therapy. Prior to joining the staff, she served as a research assistant in the Industrial Ergonomics Laboratory at Virginia Polytechnic Institute and State University (Virginia Tech) Blacksburg. Her work involved measuring and predicting forces produced by the upper extremities, interactions between physical and mental workloads, and postural sway. Her academic credentials include a B.A. in mathematics from the University of Connecticut – Storrs, an M.S. in mathematics from Virginia Tech, and an M.S. and a Ph.D. in industrial and systems engineering, also from Virginia Tech.

A certified professional ergonomist (CPE), DiDomenico was selected as a member of the National Academies' Committee to Review the NIOSH Construction Research Program. She is an active member of the International Society of Biomechanics, the American Society of Biomechanics, the Human Factors and Ergonomics Society, the Gait and Clinical Movement Analysis Society, and the International Society for Posture and Gait Research. As a student at Virginia Tech, she served as Vice President and President of the ASSE Student Chapter.

"It's humbling to be recognized among some of the greatest women in safety," says DiDomenico. "Safety research is a team effort; we have to be responsible to help ourselves and others. As long as injuries occur, I'm going to do my best to help prevent them."

WISE will consolidate the profiles of the selected women into a single publication, *100 Women—Making a Difference in Safety*.

Institute Seeks Visiting Scholar for Unique Collaborative Opportunity

Each year, the Research Institute's Visiting Scholar Program hosts a prominent researcher to collaborate on a scientific initiative of mutual interest. The program provides a unique opportunity for a senior research scientist to spend three or more months at the Hopkinton, Mass., facility. The visiting scholar will work with Institute researchers on a joint research project and publish the results in a peer-reviewed journal. The program also encourages a longer collaborative relationship between the Institute and the visiting scholar's home institution.

Currently, we are seeking applicants from senior research scientists around the world. The Research Institute will screen applications for scientific and business relevance. For more information about the program or to apply, please visit our website at www.libertymutualgroup.com/researchinstitute.

New Annual Report of Scientific Activities Now Available

Do you want to learn more about the Liberty Mutual Research Institute and its scientific investigations? The latest Annual Report of Scientific Activities summarizes the Institute's 2010 research in injury epidemiology, physical ergonomics, behavioral sciences, and disability and return to work.



The report features more than 20 research projects, including studies on balance control and risk perception, the impact of safety climate on remote and lone mobile workers, early interventions for patients with low back pain, and more. The report also lists the Institute's 2010 accepted and published scientific peer-reviewed papers and provides updates on our extramural activities, conference presentations, research collaborations, and awards.

To download a PDF version or to order a copy, please visit our website at www.libertymutualgroup.com/researchinstitute.

Fatigue and Safety Research Proceedings Published

Accident Analysis and Prevention recently published a special issue containing the peer-reviewed proceedings of our 2008 Hopkinton Conference, Future Directions in Fatigue and Safety

Research. This special issue, titled "Advancing Fatigue and Safety Research" (Vol. 43, No. 2, 2011), includes the eight collaborative manuscripts that resulted from the conference. The manuscripts cover key areas, such as the links between fatigue, safety, and performance; demographic issues; chronic medical conditions and sleep disorders; fatigue modeling; and technological and organizational approaches to fatigue management. Papers include:

- Future Directions in Fatigue and Safety Research
- The Link Between Fatigue and Safety
- The Challenges and Opportunities of Technological Approaches to Fatigue Management
- Demographic Factors, Fatigue, and Driving Accidents: An Examination of the Published Literature
- Modelling Fatigue and the Use of Fatigue Models in Work Settings
- Fatigue Risk Management: Organizational Factors at the Regulatory and Industry/Company Level
- Sleep Disorders, Medical Conditions, and Road Accident Risk
- Research Needs and Opportunities for Reducing the Adverse Safety Consequences of Fatigue

For complete citations and abstracts of the above papers, please visit www.libertymutualgroup.com/researchinstitute and click on the link under "Featured Scientific Publications."

External Scientific Advisory Panel Meets

An external scientific advisory panel recently met at the Research Institute to review the Center for Physical Ergonomics' (CPE) research program. The panel, comprised of five scientists with broad expertise in ergonomics, met with Institute Director Ian Noy, Ph.D., CPE Director Nils Fallentin, Ph.D., and staff to assess the Center's facilities, capabilities, and research objectives.



Pictured (left to right): Laura Punnett, Sc.D., University of Massachusetts Lowell, CPHNEW Center; Dr. Noy; Thomas Armstrong, Ph.D., University of Michigan; Jaap van Dieen, Ph.D., VU University Amsterdam; Dr. Fallentin; Thomas R. Waters, Ph.D., CPE, National Institute for Occupational Safety and Health; and Barbara Silverstein, Ph.D., M.P.H., Washington State Department of Labor and Industries Safety and Health Assessment and Research for Prevention Program.

Melbourne International Forum XI- Primary Care Research on Low Back Pain: March 15-18, Melbourne, Australia

- Low Back Pain Recurrence: Do the Measures We Use Capture the Worker's Experiences? – A.E. Young, Ph.D.
- Hot Topics in Low Back Pain Research: Focus on Primary Care Issues – G.S. Pransky, M.D., M.Occ.H.
- Medical Utilization Cascade Effect Following Early Magnetic Resonance Imaging for Work-Related Acute Low Back Pain – B.S. Webster, B.S.P.T., P.A.-C.

International Conference on Slips, Trips, and Falls: April 6-8, Buxton, United Kingdom

- Comparison of Methods to Extract the Required Coefficient of Friction for Level Walking – W.R. Chang, Ph.D.

10th International Symposium on Human Factors in Organizational Design and Management: April 23-27, Grahamstown, South Africa

- Using Participatory Ergonomics and Cognitive Work Analysis to Redesign Computer Task Exposures in Radiologists and Workplace Safety and Health Promotion through Participatory Ergonomics: A Systems Approach for Effectiveness and Sustainability – M.M. Robertson, Ph.D., C.P.E.

American Industrial Hygiene Conference and Exposition: May 15-18, Portland, OR

- Factors Associated with Worker Slipping in Fast Food Restaurants – T.K. Courtney, M.S., C.S.P.

9th International Conference on Work Stress and Health: May 18-22, Orlando, FL

- Safety Climate for Mobile Lone Workers (Truck Drivers) – Y.H. Huang, Ph.D.

2nd International Conference on Ambulatory Monitoring of Physical Activity and Movement: May 21-27, Glasgow, United Kingdom

- Assessment of L5/S1 Moments Due to Trunk Motion Using an Inertial Sensor – C.C. Chang, Ph.D., CPE

International Conference on Stairway Usability and Safety: June 9-10, Toronto, Canada

- Implementing/Funding Research Agendas: Research Institute Leaders and Discussion – Y.I. Noy, Ph.D., C.P.E.

20th International Symposium on Shift-work and Working Time: June 28- July 1, Stockholm, Sweden

- Sleep Duration, Body Mass, and the Risk of a Work-Related Injury: Results From The U.S. National Health Interview Survey (2004-2009) – D.A. Lombardi, Ph.D.
- The Effects of Lifetime Exposure to Shift Work on Fitness for Duty and Health In The Police Force of a Federal State of the Federal Republic of Germany and Long Working Hours, Gender and the Risk of Occupational Injury in the U.S. Working Population – A. Wirtz, Dr. phil.

23rd Congress of the International Society of Biomechanics: July 3-7, Brussels, Belgium

- Changes in Postural Sway Related to Age in Adults 18-65 Years Old – A. DiDomenico, Ph.D., C.P.E.
- The Relationship of Flexion Relaxation to Pain and Disability Measured Over the Course of an Episode of Low Back Pain – R. McGorry, M.S., P.T., C.P.E.

14th International Conference on Human-Computer Interaction: July 9-14, Orlando, FL

- Digital Modeling of Manual Lifting Joint Trajectories Using Two Different Interpolation Approaches – C.C. Chang, Ph.D., C.P.E.
- Dynamic Power Tool Operation Model: Experienced Users vs. Novice Users – J.H. Lin, Ph.D., C.P.E.
- Postural Observation of Shoulder Flexion During Asymmetric Lifting Tasks – X. Xu, Ph.D.

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