



from **Research** to **Reality**

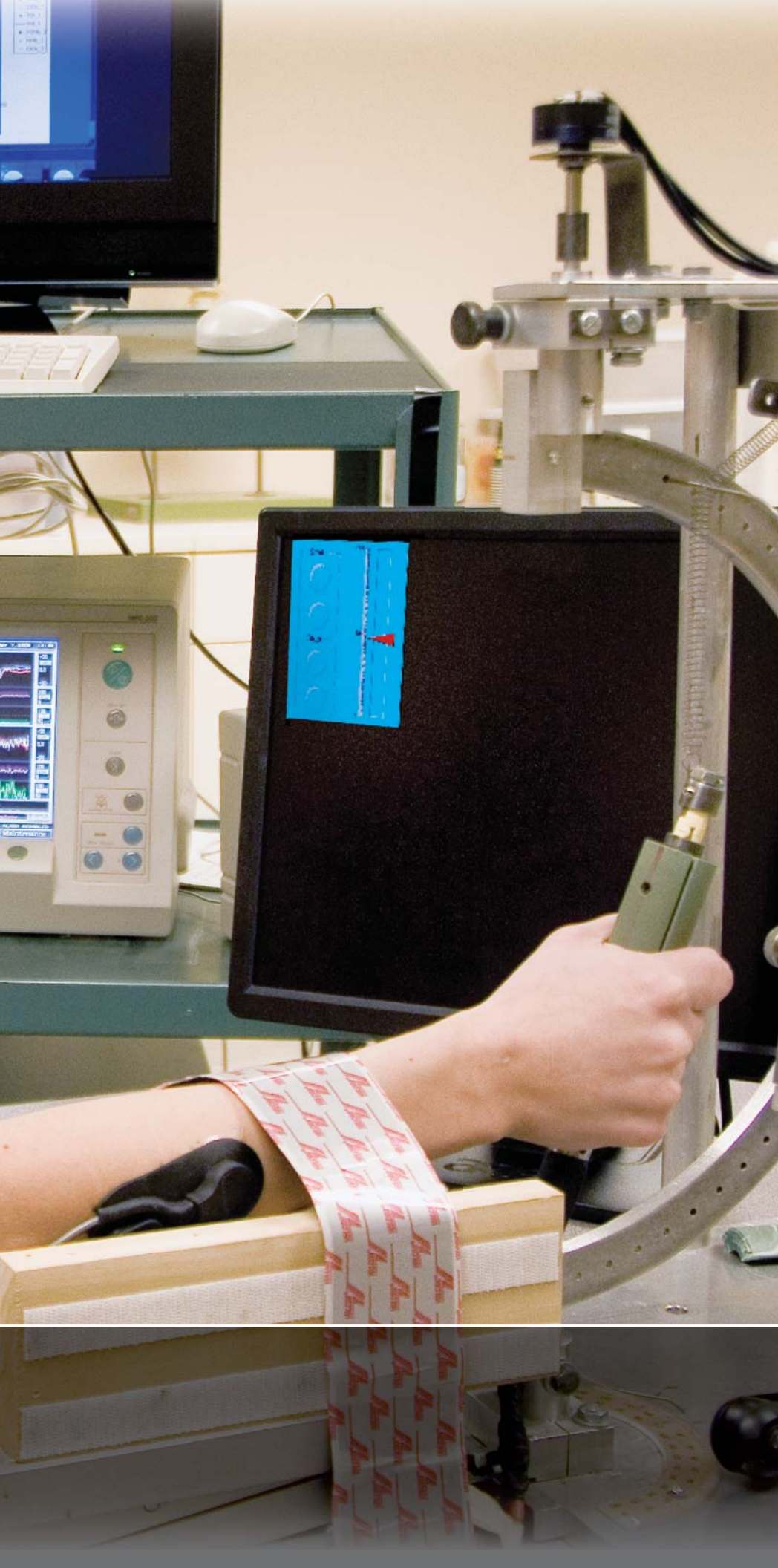
2008

**ANNUAL REPORT of
SCIENTIFIC ACTIVITIES**

LIBERTY MUTUAL RESEARCH INSTITUTE for SAFETY



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Owned and operated by Liberty Mutual Insurance Company, Boston, Massachusetts, the Liberty Mutual Research Institute for Safety has helped to improve the occupational safety and health of workers for more than 50 years. Through laboratory and field-based studies and global research collaborations, the Research Institute seeks to advance scientific, business-relevant knowledge in workplace and highway safety and work disability. To achieve this mission, the Research Institute operates four multidisciplinary centers:

- Center for Injury Epidemiology
- Center for Physical Ergonomics
- Center for Behavioral Sciences
- Center for Disability Research.

Research findings are shared with the worldwide health and safety community through peer-reviewed journals and conference presentations. This process ensures scientific validation of our work and supports the greater endeavor expressed in the Liberty Mutual Creed:

“...to help people live safer,
more secure lives.”

To learn more about the Liberty Mutual Research Institute for Safety and its programs, visit our website:

www.libertymutualgroup.com/researchinstitute.



Edmund F. Kelly
Chairman, President, and
Chief Executive Officer
Liberty Mutual Group

We take tremendous pride in the Liberty Mutual Research Institute for Safety. Through rigorous scientific research in workplace and highway safety and occupational disability, the Institute continues to contribute to the health and safety of our customers, their employees, and the broader community.

The Research Institute gained significant momentum in 2008 with the completion of a reorganization aimed at enhancing research capabilities and positioning Liberty Mutual to meet future occupational safety and health challenges. Institute scientists continued to collaborate extensively with partners both here and abroad. Furthermore, adding to the roster of honors earned over the past two decades, the Institute received the prestigious National Occupational Research Agenda Innovative Research Award.

I would like to congratulate and thank the staff of the Research Institute for their dedication to research excellence and their commitment to helping people live safer, more secure lives.

A handwritten signature in black ink that reads "Edmund F. Kelly". The script is fluid and cursive.



Karl A. Jacobson
Senior Vice President
Liberty Mutual Group

It has been an exciting year of strategic change, as the Liberty Mutual Research Institute for Safety aligned its organizational structure and staffing with the contemporary needs of safety research. The Institute's infrastructure, leadership, and multidisciplinary scientific staff not only support and enhance our efforts to lessen the burden of work injury today, but they will serve as a powerful model well into the future.

I want to thank Dr. Noy, the Institute management team, and the entire Institute staff for their dedication and commitment to research excellence as they explore the causes and mitigation of the occupational injuries that continue to plague the world's workforce. Businesses and workers alike benefit from Liberty Mutual's scientific findings, as safety and health professionals apply interventions that help control workplace risks.

A handwritten signature in black ink that reads "Karl A. Jacobson". The script is cursive and stylized.

The year 2008 was a turning point in the Research Institute's history. The successful staffing of four key leadership positions completes the Institute's reorganization and leaves us well positioned to realize our vision of becoming the world's premier research organization dedicated to the prevention of occupational injuries and disability. Joining the leadership team were Nils Fallentin, Ph.D., M.Sc. (Director, Center for Physical Ergonomics); Marvin Dainoff, Ph.D., C.P.E. (Director, Center for Behavioral Safety); and Theodore Courtney, M.S., C.S.P. (Director, Center for Injury Epidemiology). They joined Glenn Pransky, M.D., M.Occ.H., residing Director of the Center for Disability Research. We also welcomed Richard Fleck, M.B.A., Director of Research Operations.

We initiated a fellowship program with the Harvard School of Public Health and the University of Massachusetts-Lowell. Five post-doctoral fellows teamed up with Institute scientists to execute new field and laboratory studies on a broad range of topics from lifting exposure assessment and office ergonomics interventions to self-management strategies in return to work.

At the 2008 Hopkinton Conference, entitled *Future Directions in Fatigue and Safety Research*, we hosted 30 leading scientists from around the world. The participants collaborated in defining the research needed to address critical gaps in our understanding of fatigue and its consequences on transportation and work safety.

And, we were extremely honored to receive the National Occupational Research Agenda Innovative Research Award from the U.S. Centers for Disease Control for our Supervisor Disability Management Study.

A key aspect of our work is to communicate our research findings as widely as possible, and I encourage readers to visit our website, www.libertymutualgroup.com/researchinstitute, for more information about our research programs, newsletters, Annual Reports, and the Workplace Safety Index. As always, we welcome your feedback.



Y. Ian Noy, Ph.D., C.P.E.
Vice President, Director
Liberty Mutual Research Institute for Safety



INJURY EPIDEMIOLOGY

The Center for Injury Epidemiology (CIE) conducts original epidemiological research to examine occupational injury risk factors and to better understand the burden of workplace injury. Through injury data analysis and field studies, CIE research scientists seek to better understand the causes and distribution of work-related injuries. Study findings help to focus occupational safety research efforts and identify and develop promising design and analytical methods.



2008 marked a year of progress against well established research priorities. We saw the completion of several large field data collection efforts, continued studies involving existing data sets, and advanced our epidemiological methodologies.

Our collaborative efforts collectively yielded data on more than 11,000 participants in studies addressing a broad array of injuries and their mechanisms. Partners in these endeavors included the Harvard School of Public Health, University of Massachusetts-Lowell, Center for Construction Research and Training, U.S. Consumer Products Safety Commission, Fudan University, and national institutes addressing occupational safety and health in Vietnam, Finland, and the United States. We continued efforts to innovate and refine methodological approaches, including hosting our Visiting Scholar Mark Lehto, Ph.D., from Purdue University (see p. 33).

With the substantial field work of 2008, progress on existing studies, and our commitment to cross-center collaboration and methodological innovation, CIE is well positioned for continued success in the future.



Theodore K. Courtney, M.S., C.S.P.
Director, CIE

The Risk of Slips and Falls Among Restaurant Workers

Same-level slips and falls remain a significant contributor to the burden of workplace injury in the United States (see p. 6, *Workplace Safety Index*). Despite this fact, there has been relatively little field-based research to investigate how various individual, organizational, and environmental factors influence slipping. Prior Institute cross-sectional field research identified a high rate of slipping among limited-service restaurant workers and quantified associations between some floor surface characteristics (such as friction or surface contamination) and the odds of slipping.

Leveraging these prior Institute findings, we launched a prospective cohort field study with colleagues from the Centers for Physical Ergonomics and Behavioral Sciences and research partners at the Harvard School of Public Health. This multidisciplinary project aims to improve our understanding of the causes and prevention of same-level falls. The study observes limited-service restaurant employees at work to determine how factors such as floor surface characteristics, slip-resistant shoes, floor cleaning practices, and safety climate, as well as transient risk factors such as distraction and rushing, affect the risk of slipping.



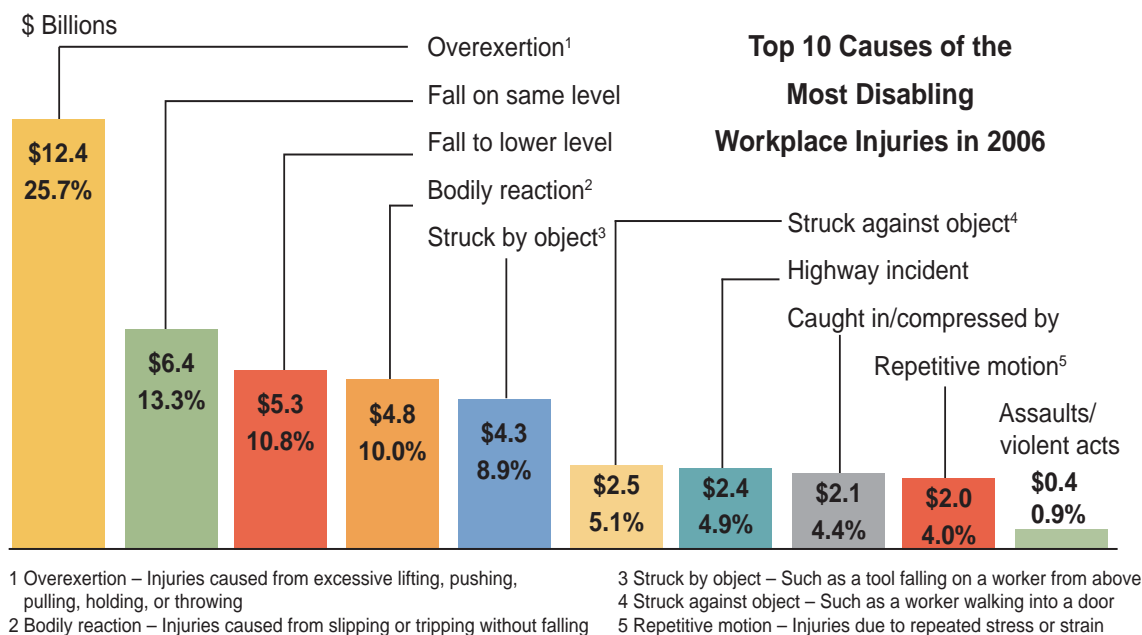
A researcher measures floor slip resistance at a limited-service restaurant.

Over the course of 2008, researchers collected data from 36 limited-service restaurants across six states (Connecticut, Massachusetts, New York, Pennsylvania, Tennessee, and Wisconsin) and 475 workers employed in those restaurants. At each restaurant, researchers measured floor surface roughness (average and peak) and coefficient of friction on selected tiles in nine targeted areas: front counter, drive-through, sandwich assembly, fry vat, grill, back vat, sink, cooler, freezer, and ice machine. They also examined participants' work shoes to determine whether the shoes were slip resistant or not, and they asked managers about floor cleaning frequency, product, and protocol. Participants reported their slip, fall, and injury experience every week over a 12-week period using either an interactive voice response system, a web-based survey, or paper forms through the mail. Baseline surveys and weekly reports were made available to participants in English, Spanish, and Portuguese.

Researchers have begun analyzing the data to determine whether the factors studied, such as slip-resistant footwear, floor surface characteristics, and floor cleaning protocol, impact the risk of slipping, and if so, to what extent. The findings will ultimately be used to determine ways to modify risk factors and organizational safety climate for enhanced worker safety.

2008 Workplace Safety Index

Every year, the Research Institute produces the Liberty Mutual Workplace Safety Index, a report of the leading causes and costs of the most disabling workplace injuries in the United States. The Index combines data derived from various sources, including Liberty Mutual claims, the U.S. Department of Labor's Bureau of Labor Statistics, and the National Academy of Social Insurance. Researchers, employers, practitioners, and others dedicated to workplace safety use the Index to better focus their research and injury prevention efforts.



According to this year's Index, the top 10 injury event categories produced 87.9 percent of the total cost burden of disabling workplace injuries in 2006 – the most recent year for which data were available. In keeping with prior years, *overexertion* maintained its ranking as the leading cause of occupational injuries. This event category, which includes injuries related to lifting, pushing, pulling, holding, carrying, or throwing, accounted for more than one-quarter of the overall national burden (25.7%), and produced \$12.4 billion in direct costs to business. *Fall on same level* events ranked second as a leading cause of disabling injury, generating direct costs of \$6.4 billion and accounting for 13.3 percent of the injury burden. *Fall to lower level* held the third-place ranking with \$5.3 billion in direct costs, and 10.8 percent of the total injury burden. Ranked fourth was *bodily reaction*, which includes injuries resulting from an incident of free bodily motion (such as bending, climbing, reaching, standing, sitting, or slipping or tripping without falling). Injuries in this category comprised 10 percent of the total injury burden at \$4.8 billion. *Struck by object* maintained its fifth place ranking, accounting for 8.9 percent of the total injury cost burden at \$4.3 billion.

The remaining five injury event categories (*struck against object*, *highway incidents*, *caught in /compressed by*, *repetitive motion*, and *assaults and violent acts*) together accounted for less than 20 percent of the direct cost of disabling injuries.

Case-Crossover Study of Risk Factors for Portable Ladder Falls

We completed data collection for our study of the risk factors that can trigger falls from ladders. The study, conducted with collaborators at the Harvard School of Public Health, the U.S. Consumer Product Safety Commission, the National Institute for Occupational Safety and Health, and the Center for Construction Research and Training, focuses on falls from portable ladders, which account for the majority of disabling ladder injuries. The findings will be used to help improve safety practices and interventions for portable ladder use.

Researchers recruited 310 workers who had sustained an injury as a result of a ladder fall and were subsequently treated at one of the hospital emergency departments sampled by the National Electronic Injury Surveillance System. Of these injured workers, 86 percent were male, 14 percent were female, and the average age was 38. Occupations represented included construction; installation, maintenance, and repair; sales; management; office and administrative; and building and grounds cleaning and maintenance. Most injuries occurred when workers were using step/trestle ladders (51%) or extension/straight ladders (40%).

A structured telephone interview was administered to workers a median of 34 days after their fall. The interview asked about specific work activities, ladder setup, and other conditions immediately prior to the injury, as compared to a designated pre-injury control period. Workers were asked about the presence of certain exposures in the hazard period, the control period, or both. The primary transient exposures of interest included excessive reaching, using unusual forces, rushing, being distracted, unusual ladder setup, ladder instability, having tools in hand, “jumping” the ladder, and failure to have another worker hold the ladder. These exposures will be analyzed using the case-crossover methodology to estimate their relative effect and magnitude as potential risk factors.

Development of a Public Health Model for Reporting Injuries in Vietnam

We continued to analyze data collected as part of a surveillance study of occupational injuries in Vietnam. A collaborative effort with Vietnam’s National Institute of Occupational and Environmental Health and the University of Massachusetts-Lowell, the study seeks to understand the nature and true scale of the injuries occurring in Vietnamese workplaces. The information gained will be used to develop a model for reporting such injuries in Vietnam, and potentially, other industrializing countries.

Researchers analyzed demographic, work, and injury data compiled from 2,615 household surveys administered in the Xuan Tien commune in 2005. Survey respondents reported a total of 591 injuries, for an annualized incidence rate of 681 injuries per 1,000 residents. Eighty-two percent of these injuries occurred during work activities. Nonagricultural work was found to be considerably more hazardous than agricultural work (1,033 vs. 844 injuries per 1,000 full-time equivalents, respectively), and working at home was prevalent, with 28 percent of surveyed households operating a family-owned business.

The injury incidence rates in this study were approximately 5 to 10 times higher than those reported in prior studies from Vietnam. This difference is likely due to our researchers’ efforts to better define the concept of occupational injury in the Vietnamese language and innovative efforts to improve the capture of work-related injuries. We concluded that these high injury rates represent a substantial economic and social burden on a rapidly industrializing country and underscore the importance of injury prevention efforts guided by surveillance data.

Reliability of O*NET-Based Physical Work Exposure Estimates

Occupational safety professionals and researchers are continually seeking new and more accurate approaches to assess physical work exposures, especially those associated with upper-extremity musculoskeletal disorders. Observations, direct measures, and self-reports are among the more traditional exposure assessment approaches, each offering various strengths and limitations. More recently, researchers have found a potentially promising source of physical work exposure assessment data in the Occupational Information Network (O*NET). O*NET is a US database that includes quantitative and qualitative information on a wide range of work variables for more

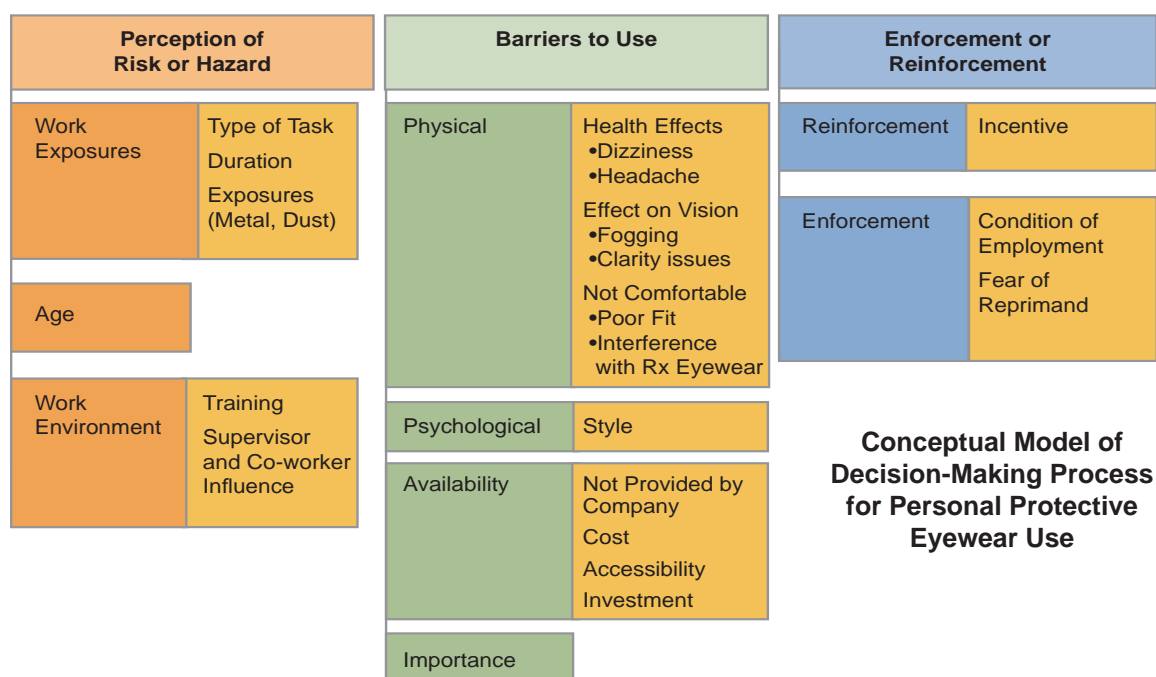
than 900 occupations. The O*NET database uses a statistically random sample of businesses employing the targeted occupations and a random sample of workers within those businesses and occupations.

In partnership with researchers at the Washington University School of Medicine, St. Louis, Missouri, we conducted a study to evaluate the reliability of O*NET-derived estimates of upper-extremity physical-work exposures for various occupations. The study compares the O*NET-derived estimates to estimates taken from self-reports and observational data collected in a separate study involving workers from a wide range of industries including construction, healthcare, manufacturing, and biotechnology. Researchers began comparing estimates from self-report exposure data collected from 972 workers, field observations collected from a subset of 396 of the workers, and job title-based physical work exposure data derived from O*NET. They are using statistical methodologies to examine whether O*NET is a potentially viable alternative to other methods of exposure assessment.

Factors Influencing the Use of Personal Protective Eyewear

We completed work on a study to identify and describe the factors that influence a worker's decision to wear or not to wear personal protective eyewear (PPE) and the barriers that may prevent its use. The study involved a series of seven focus groups involving 51 workers and supervisors primarily from manufacturing, construction, and service/retail industries. All study participants had potential exposure to eye injury hazards in their job tasks, and 78 percent were required to wear PPE on the worksite. Most of the participants were highly experienced in their occupation and had received some safety training in the past. However, only 55 percent had a dedicated safety officer at their place of work.

Researchers collected qualitative and quantitative data related to the factors influencing use of PPE and used their findings to create a conceptual model of the decision-making process for PPE use (see below). Based upon an earlier model describing the use of respiratory protective equipment among hazardous waste workers (Salazar, et al.), the new model consists of three primary branches: Perceptions of Hazards and Risks, Barriers to PPE Use, and Enforcement and Reinforcement (see chart below). The study results suggest that there are several modifiable factors (such as comfort, fit, training, and condition of eyewear) that could lead to an increase in PPE use among workers, and that continuous positive reinforcement by supervisors could also increase PPE use.



PHYSICAL ERGONOMICS



The Center for Physical Ergonomics (CPE) investigates the causes and mechanisms of workplace injuries and illnesses with an emphasis on musculoskeletal disorders. CPE research scientists investigate the physical demands and human capacities associated with various job tasks. Findings from laboratory and field studies in biomechanics, human-machine systems, repetitive work, tribology, and work physiology are used to develop interventions and job safety enhancements.



In many ways, 2008 was a defining year for the Center for Physical Ergonomics. We established research priorities, clarified the role of the Center, and made progress on new and ongoing studies in the areas of slips, trips, and falls; overexertion; postural stability; and repetitive work.

Our collaborative efforts included a joint research project with the Faculty of Human Movement Sciences at VU University (the Netherlands), participation in an international scientific forum on work-related musculoskeletal disorders, and the addition of three post-doctoral fellows from the University of Massachusetts-Lowell and the Harvard School of Public Health. Also, we completed two special journal issues for the international scientific community: the first on slips, trips, and falls and the second on noninvasive methods to measure muscle blood flow and oxygenation during work tasks.

Moving forward with a strong emphasis on teamwork and creativity, we are well positioned for continued progress in 2009.



Nils Fallentin, Ph.D., M.Sc.
Director CPE

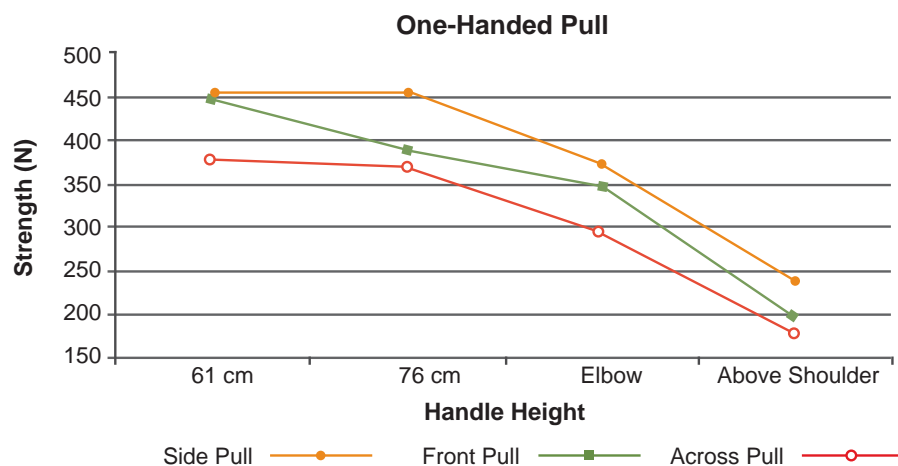
Effects of Handle Orientation on Push-Pull Efficiency

Hand trucks and pushcarts are used in various industries to assist workers in performing manual materials handling tasks. Most of these devices have handles parallel to the frontal plane of the operator. However, research shows that this design may lead to inefficient pushing postures. Our researchers launched a study in 2008 to examine whether different hand-to-handle interfaces could improve pushing efficiency. Unlike other studies, which have only measured forces in a typical front pulling direction, our investigation examines three different pulling directions for a more representative sample of real-world industry pulling tasks. The information gained from the study will be used to make recommendations for optimal handle angle, hand position, and orientation for industrial hand trucks and pushcarts. In addition, the study will gather strength information for several one-handed pushing tasks typically encountered in real jobs. The resulting information will be incorporated into a comprehensive database to help safety practitioners and workstation designers better understand the fit between human operator capacities and work demands related to industrial pushing and pulling tasks.

For the push handle interface experiment, we recruited 30 male and female participants to perform two-handed pushing tasks using an instrumented test stand with an adjustable handle interface. Researchers varied conditions of forearm rotation angle (0, 45, and 90 degrees from the horizontal plane), wrist deviation (0 and 15 degrees from the frontal plane toward the operator), and handle distance (31 and 48.6 cm apart). Participants performed two replications of each condition for a total of 24 trials, while researchers recorded maximum isometric push strength and captured wrist postures using a camera mounted above the hand. Following each task, our research scientists asked participants to provide subjective ratings of their handle interface preferences.



For the one-handed pull activities, 48 male and female participants were asked to use their dominant hand to perform a pulling task from four handle heights (61 and 76 cm above floor, elbow height, and above shoulder height) in three directions: front (shoulder flexion/extension plane), side (dominant shoulder/adduction plane), and across (shoulder horizontally adducted). Researchers recorded strength measurements for two replications of each condition for a total of 24 trials. For each of the 12 test conditions, the stronger of the two replications was used as the strength for the pulling condition. Average strength and standard deviations were calculated for each age group and for all participants.



The preliminary results of the one-handed pull experiment (based on data from 26 males) indicated that, as the handle height increased from 61 cm above the floor to above the shoulder, the pulling capacity decreased in a non-linear fashion (see figure) regardless of the pulling direction. This finding was consistent with previous research which tested only for a typical front-pulling direction and suggests

that handles should be placed at 61 cm or as close to that height as feasible to optimize pulling strength capacity. We continue to collect pulling-strength data for a more representative database and have begun to analyze the data for the push handle interface part of the experiment.

Psychophysiological Responses During Industrial Cart-Pushing Tasks

We analyzed data from our study comparing physiological responses of healthy workers during simulated industrial cart-pushing tasks. The study employed a psychophysical methodology whereby participants (12 male and 15 female) were asked to choose a cart weight that they could push without strain, discomfort, or fatigue for a typical eight-hour shift. Participants selected different pushing workloads for two conditions: pushing on a high-friction plywood walkway or a low-friction Teflon® walkway. For each experimental trial, they pushed the cart a distance of 7.6 meters at a frequency of one push per minute for two hours. During the trials, researchers measured muscle responses, Tissue Hemoglobin Index (THI), and Tissue Oxygenation Index (TOI) from the right and left gastrocnemius (calf) muscles using near-infrared spectroscopy (NIRS).

Statistical analysis showed that both men and women chose a 27 percent higher cart weight for the plywood walkway than for the Teflon walkway. Additionally, for both groups, the resultant force exerted on the cart handle was 33 percent higher on the plywood walkway than on the Teflon walkway, with women exerting 21 percent less force than men on Teflon and 35 percent less force on plywood. Because of the lower cart weights and lower resultant forces exerted, women's TOI responses were 20 percent lower than men's on Teflon, and 22 percent lower on plywood. During cart pushing, THI (representing hemoglobin concentration) in the calf muscles was 35 percent lower for the women, but this gender difference in THI responses was nullified after adjusting for the resultant force. The net oxygen saturation was not influenced by the type of walkway. However, the force of exertion had a 31 percent stronger influence on oxygen saturation for women than for men, suggesting that pushing on the slippery surface results in higher metabolic demand in women.

The findings of this study indicate significant force- and physiologic-related differences between men and women. These differences highlight the importance of considering the functional abilities of both genders when designing pushing-related occupational tasks.

Hand-Tool Interface: Physical Capacity and Subjective Responses

We continued a laboratory investigation of hand tool users' physical capacities and subjective responses during simulated powered hand-tool tasks. For the study, 30 participants performed multiple trials of simulated, powered hand-tool tasks under various workstation configurations, while researchers measured grip forces, EMG, tool handle displacement, and tool-torque output at the hand-tool/operator interface. The participants also provided subjective ratings on discomfort level and reaction force acceptability after each hand-tool task trial.

We collected subjective data from 20 participants who had performed simulated hand-tool tasks using pistol grip and right angle pneumatic nut-runners on horizontal and vertical surfaces. Participants were asked to rate discomfort level resulting from the impulsive torque reactions and acceptability towards these reactions. Our results indicated that normalized grip force during the torque buildup period influenced subjective ratings of both discomfort and reaction force acceptability. The ratio of hand-moment impulse over tool-torque impulse was significantly greater for the unacceptable torque reactions across the three tool configurations than for the acceptable reactions. For pistol-grip tools used on the vertical surface, the odds of an unacceptable rating increased by a factor of 1.6 as the working height increased 30 cm.

These findings provide information for the development of exposure limits based on handle displacement and grip force.

Investigation of Optimal Work-to-Rest Ratio in Upper-Extremity Tasks

Certain upper-extremity tasks that involve the use of single-handed tools (such as screwdrivers, wrenches, hammers, or ratchets) require repeated gripping at the hand-to-tool interface. When performed repetitively over time, such tasks can produce localized muscle fatigue. As part of a broader laboratory investigation of the physiological responses of upper-extremity muscles during repetitive hand-grip work, we examined the impact of different handle diameters on oxygenation and blood volume in the flexor and extensor muscles during rhythmic, isometric gripping tasks. The information gained from this study will be used to help ascertain optimal work-to-rest ratios and conditions that minimize muscle fatigue for common upper-extremity, hand-tool tasks.

For this part of the study, 19 healthy participants performed low-level, repetitive hand-tool tasks using three different-sized instrumented tool handles (30-, 40-, and 50-mm diameter). For each 15-minute trial, participants performed the tasks at 15 percent of their maximum voluntary contraction for a work-to-rest cycle of 10:5 seconds. As the participants performed these tasks, researchers recorded muscle oxygenation and blood volume using near-infrared spectroscopy (NIRS).

Our preliminary analysis of the NIRS data indicated that the 40-mm diameter handle produced more favorable results in terms of greater tissue oxygenation index (an indicator of average saturation of the hemoglobin concentration) and decreased demand for blood flow to the extensor muscle. Our findings also indicated a significant physiological difference in the contribution of flexor and extensor muscles to achieve the same work output in a session. This latter finding points to the importance of examining the flexor and the extensor muscle responses separately, as these muscles are often implicated in upper-extremity, work-related musculoskeletal disorders.

Maximum Acceptable Forces for Upper-Extremity Repetitive Work Tasks

Upper-extremity cumulative trauma disorders have long been a problem for workers who perform repetitive tasks. These disorders fall within the broader category of repetitive motion injuries, which cost industry \$2 billion in 2006. During the 1990s, Institute researchers conducted a psychophysical study aimed at developing maximum acceptable force guidelines for upper-extremity repetitive tasks for the female population. In the ensuing years, businesses have used these research-based guidelines to improve the safety of female workers who perform such tasks in the workplace.

This year, we initiated a study aimed at determining similar guidelines for males. Like the earlier study, it uses a psychophysical methodology to determine maximum acceptable forces as workers perform a series of simulated industry tasks. The new study also applies NIRS technology to examine whether compromised delivery of oxygen to the forearm muscles may be a precursor of the injury process that can lead to cumulative trauma disorders.

In the Phase 1 data collection, five male industrial workers performed simulated repetitive work tasks using resistance-adjustable workstations. After training, the study comprised 12, seven-hour “work” days. Each day, participants performed six common repetitive work motions at rates of 15 and 25 motions per minute, for a total of 12 combinations. They were instructed to adjust the amount of resistance to what they considered an acceptable level and to work as hard as they could (against as much resistance as they could tolerate) without developing unusual discomfort in the hands, wrists, or forearms. At the beginning of each day, and during the last five minutes of each hour, participants filled out forms to record any symptoms of soreness, stiffness, or numbness they experienced. Following the psychophysical portion of the experiment, four of the five Phase 1 participants performed four more days of simulated, repetitive work tasks while researchers measured muscle oxygen consumption using NIRS.

Our research scientists continue to collect psychophysical and NIRS data for an expected sample size of 15 participants.

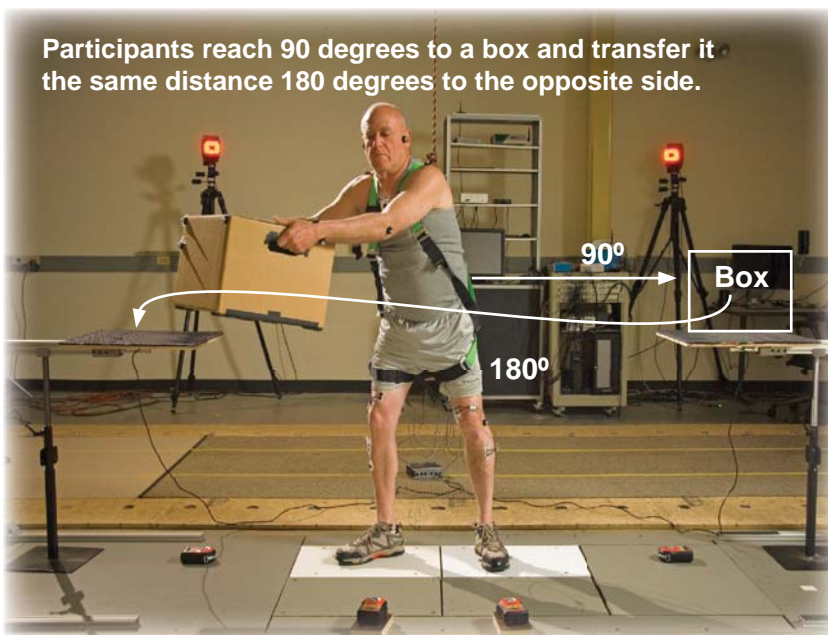
Factors Affecting Stability During Lateral-Load Transfers

Same-level slips and falls are the second leading cause of disabling workplace injuries (see p. 6, *Workplace Safety Index*). Within this category, there is a particularly high occurrence of falls among workers engaged in manual transfer of materials outdoors, such as delivery personnel and transportation cargo handlers. Most studies of such manual-load transfer tasks have focused on risks due to walking and holding or carrying loads under slippery conditions. However, current research suggests that the risks involved in lateral-load transfer under slippery conditions may be different from those of other handling tasks. To further investigate, we began a study examining the stability of individuals when transferring a load laterally from one side to the diametrically opposite side under slippery and non-slippery surface conditions.

With collaborators at the Harvard School of Public Health, we recruited and screened 30 of an expected 45 men and women between the ages of 18 and 67 to complete the study protocol. Over the course of approximately four hours, participants performed lateral-load transfer tasks at a self-selected pace under varied conditions of load and surface slipperiness.

Each task required participants to reach 90 degrees to a box and transfer it the same distance 180 degrees to the opposite side (see photo). During each task, research scientists measured center of mass using a 3D motion capture system and collected the forces and moments of the feet in contact with the ground using force plates. They also used electromyography to measure muscle activation of critical body stabilizers on both sides of the body.

Researchers began analyzing the data to assess the effects of load transfer (including no-load versus load), surface friction, and surface disparities on stability and the associated risk of slipping and falling.



Postural Stability Perceptions Among Construction Workers

Falls are the second most common cause of nonfatal workplace injuries and the leading cause of fatal injuries in the construction industry (*The Construction Chart Book: The US Construction Industry and its Workers*, Silver Spring, MD, 4th Edition, CPWR, 2007). Loss of balance is a major cause of worker falls and can occur for a variety of reasons. Among construction workers, one potential cause of loss of balance is transitioning from a non-standing working posture to a standing position. The movement involved in this type of postural transition affects different physiological systems and can make it difficult to retain stability immediately following the transition. To better understand this problem, we conducted a study aimed at identifying the postures and task parameters within the construction industry that lead to instability upon standing. The aim of this research is to determine which movements are most likely to provoke the responses that can lead to falls.

Researchers surveyed 189 workers in 10 construction trades using a questionnaire developed with the help of subject matter experts. In addition to questions about age, gender, and years of experience, the questionnaire asked workers to rate their perceived stability for 11 working postures and task parameters using a five-point Likert scale. Based on the questionnaire responses, researchers calculated a mean stability rating of 4.1 (SD 1.1),

corresponding to a rating of “somewhat stable,” for the 11 working postures evaluated. Participants reported the lowest stability ratings (mean values of approximately 3.8) for three common postures: bending over at waist, squatting, and forward kneeling (on hands and knees). Floor installers and sheet metal workers reported significantly lower stability ratings (mean 3.9) than carpenters and drywall installers, who reported the highest stability ratings overall (mean 4.4). The consistency of ratings within each posture suggests that differences between trades were due to the nature of the work rather than individual differences. Participants also identified the top three factors that made maintaining balance difficult: fatigue (52.5%), standing up fast (46.4%), and working on an uneven or irregular surface (43.9%). Future research will compare these findings with objective measures of stability to determine how well subjective measures represent actual risk.

Effect of Footwear Pad Size on Slipmeter Friction Measurements

Safety practitioners often use portable slipmeters to assess floor surface slipperiness at worksites. By measuring the available coefficient of friction at the shoe and floor interface, these devices can help identify potentially hazardous areas so that practitioners can suggest effective interventions. However, our researchers hypothesized that the “squeeze film effect” – a phenomenon in which a film of fluid becomes trapped between two surfaces – may distort the measurement accuracy of certain slipmeters, including the commonly used Brungraber Mark II. The footwear pad used in the Brungraber Mark II is substantially larger than the initial shoe contact during a slip event and may cause an excessive squeeze film effect on liquid-contaminated floors. This could result in an underestimation of the available friction coefficient, thus indicating a greater slip risk than is actually present.

To examine how footwear pad size impacts slipmeter friction measurements, our researchers conducted a study in a controlled laboratory setting. Using the Brungraber Mark II slipmeter, we measured the friction coefficient of five walkways under three surface conditions (dry, water contaminated, and glycerol contaminated). Each walkway was specially constructed from one of five materials: standard quarry tile with raised-profile tread lines, standard flat quarry tile, vinyl, marble, or glazed porcelain. For each measurement condition, researchers sequentially reduced the slipmeter footwear pad (in 1.27-cm decrements) from 7.62 cm square (conventional size) to 2.54 cm square to reduce the squeeze film effect.

An analysis of the slipmeter measurements indicated that, as the size of the footwear pad was reduced, friction coefficient increased and eventually plateaued. Furthermore, the effect of the footwear pad size on the measured friction coefficient was found to be statistically significant, suggesting a potential problem in the Brungraber Mark II measurements. The differences in absolute friction coefficient were small, however, and more data are needed before any redesign recommendations can be made. Since contact pressure was affected by changes in contact area, further research is needed to distinguish between these factors.

Development of a Statistical Model to Estimate Slip and Fall Probability

We continued our work on the development of a statistical model for estimating the probability of slips and falls associated with various activities and conditions. The model compares the available friction coefficient (the maximum friction coefficient that can be supported at the shoe and floor interface without a slip) with the required friction coefficient (the minimum friction coefficient needed to support human locomotion on dry floor surfaces). This comparison is based on the assumption that both coefficients have stochastic distributions. In a prior study, our research scientists investigated the stochastic properties of the required friction coefficient to determine which statistical distribution best fit the data. We found that the normal, log-normal, and Weibull distributions fit the required friction coefficient data with few exceptions. This year, we investigated the stochastic distributions of the available friction coefficients under three floor surface conditions to determine which statistical distributions best fit these data.

A 6-m by 80-cm standard quarry tile walkway was constructed. Researchers used the walkway to collect friction measurements on 50 selected tiles under the three surface conditions (dry, water contaminated, and glycerol contaminated). We then quantified the stochastic distributions of the available friction coefficient under each

surface condition. Our findings indicated that the normal distribution was a good fit for water- and glycerol-contaminated conditions, whereas the log-normal and Weibull distributions seemed to fit the data only for some of the conditions. However, none of the three statistical distributions studied seemed to fit the dry condition data.

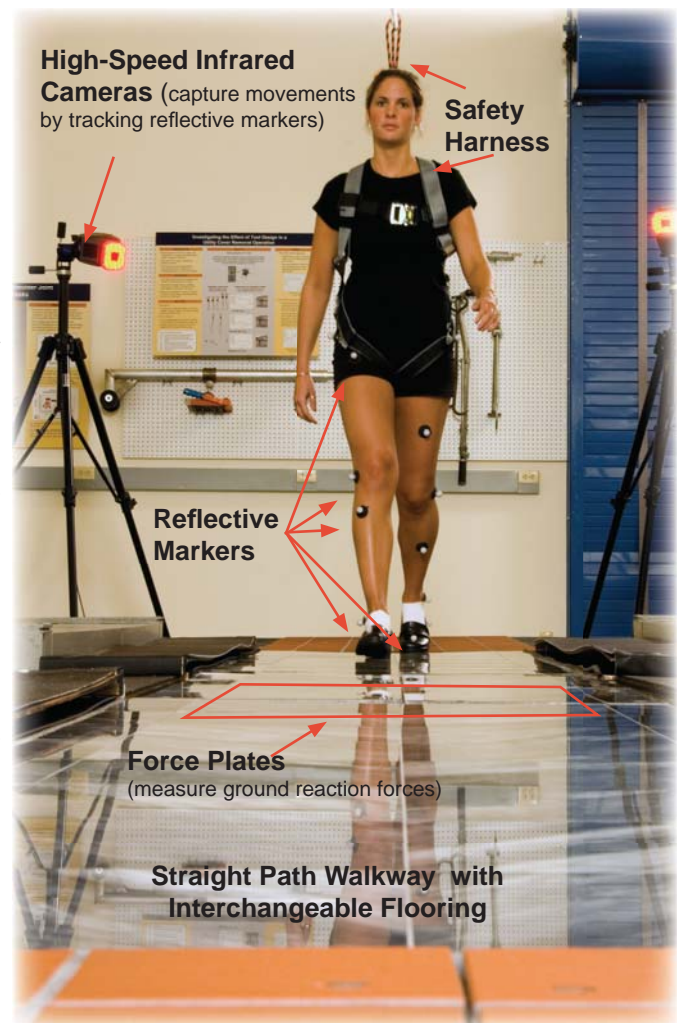
We continued to collect and analyze additional measurements, including those taken from other floor surfaces and conditions. Ultimately our findings from this data will be used to develop generic statistical methods for estimating the probability for slips and falls.

Biomechanical Assessment of Floor Slipperiness

We continued our biomechanical study of the effects of friction and perception on gait adjustment during continuous walking. The study aims to determine whether certain floor materials and contamination conditions affect a person's gait, and if so, what strategies people use to avoid falling while walking on those surfaces. The study also examines the relationship among the available coefficient of friction of the floors, the sensory feedback received by participants, and their corresponding gait adjustments.

Thirty participants performed walking trials on a straight path walkway designed to allow researchers to quickly change out floor materials for randomized presentation. During testing, researchers presented three floor conditions (dry, water contaminated, and glycerol contaminated), and measured the actual available coefficient of friction for each of five floor surfaces (standard quarry tile with raised tread lines, standard flat quarry tile, vinyl composition, marble tile, and glazed porcelain tile) for each condition. Equipped with a safety harness, participants were asked to walk repeatedly from one end of the walkway to the other, as quickly as possible without slipping. They performed a walking trial for each floor condition and surface while researchers collected ground reaction force (GRF) data from force plates embedded under the walkway. Participants rated the perceived slipperiness of the floor they had just walked on, and researchers used GRF data to calculate the normalized normal force and utilized coefficient of friction at the heel strike phase.

Researchers began statistical analyses of the data to determine the effects of sensory feedback and available coefficient of friction on gait. The information gained will increase our understanding of the factors that contribute to same-level slips and falls, and provide insights into which floor surface features may offer increased protection.



BEHAVIORAL SCIENCES



The Center for Behavioral Sciences (CBS) studies the impact of behavioral, cognitive, and organizational factors surrounding workplace injuries and highway collisions. By carefully examining individuals within their work environments, CBS research scientists identify behavioral and organizational factors that can contribute to injuries. CBS findings provide the scientific basis for guidelines and recommendations that are designed to minimize injuries at worksites and on the roadways.



The Center for Behavioral Sciences made significant advancements in new and continuing research in 2008. While we moved forward with our driver distraction, warning comprehension, and office ergonomics research, we laid the groundwork for future studies on workplace safety climate for lone workers. We also refined our studies of workplace interventions, developing and applying a fresh approach that integrates practical knowledge and scientific theory.

We were honored to host 30 prominent occupational safety research scientists from around the world for a conference, entitled, "Future Directions in Fatigue and Safety Research," (see p. 32). The results of this conference will appear in a special issue of *Accident Analysis and Prevention*. And, we expanded cross-collaborative efforts, working closely with other Institute Centers, as well as with partners at Tsinghua University (China) and Technion University (Israel).

The efforts and accomplishments of 2008 have provided a solid foundation for even greater success in 2009.



Marvin Dainoff, Ph.D., C.P.E.
Director CBS

Longitudinal Laboratory Study of Office Ergonomics Interventions

With more than 45 million computers in workplaces across the United States, many employers are becoming increasingly concerned about computer-related musculoskeletal disorders. Studies examining the relationship between musculoskeletal discomfort and computer work have revealed various contributing factors, including long hours, poor work organization, psychological stress, lack of optimal workstation ergonomics, and poor computing postures. However, most of what we know about computer-related musculoskeletal disorders (MSDs) is based on cross-sectional investigations. Few studies have investigated the cumulative effects of intensive computer work over several days, and even fewer studies have examined the effectiveness of comprehensive training programs (e.g., those that involve initial training as well as experiential exposures) on reducing MSDs.

To address this gap, we began a controlled intervention study of the effects of ergonomics training on worker discomfort, computing postures, and performance. We recruited 22 healthy women for the 15-day study and provided each with a highly adjustable workstation setup (see photo). Researchers then randomly assigned participants to either the comprehensive ergonomics training intervention (experimental) group or the no-training (control) group. The experimental group received an initial 1.5-hour training session consisting of an interactive lecture, video, case examples, active demonstration, and individual practice. Following a three-day baseline condition, participants in the experimental group worked for a nine-day period during which they received intermittent ergonomic reminders (coaching) and were also periodically required to use the adjustable workstation in a standing configuration. After that, there was a final three-day period which involved neither coaching nor standing. The control group received no training, no coaching, and were not required to stand during the 15 work days. Both groups performed simulated computer data processing tasks for eight hours a day in a controlled laboratory setting as researchers captured data on keying and mousing activities and workstation configurations, and observed computing postures. Every hour, participants completed a survey rating their level of pain/discomfort on a 10-point scale, anchored by eight pain descriptors ranging from None (0) to Extreme (10) for 60 body regions (front, back, left, and right). They rated visual discomfort with a Yes/No response for six symptoms (blurry, difficulty focusing, itching, aching, sensitive, and burning). Researchers also collected data on performance, muscle activation, psychological strain, and computing postures.



Initial findings suggested that overall, the participants receiving the ergonomics training reported fewer musculoskeletal and visual symptoms than the non-trained control group. These symptoms manifested themselves over time. Starting on Day 4, significant differences were found between the groups for seven body parts, including the upper neck left and right, lower neck left and right, back shoulder left and right, and lower back. The most significant comparisons between the groups for these seven body parts were for the upper back and lower neck on the right side of the body. The non-trained group exhibited significantly greater symptoms for these seven body regions near the end of the workday. A similar

pattern of symptom reporting, in which the control group reported more symptoms for these seven body parts than the experimental group, occurred over the last three days of the experiment. Overall, participants in the

control group reported significantly more visual discomfort for the two symptoms (blurry and difficulty focusing) than the experimental group.

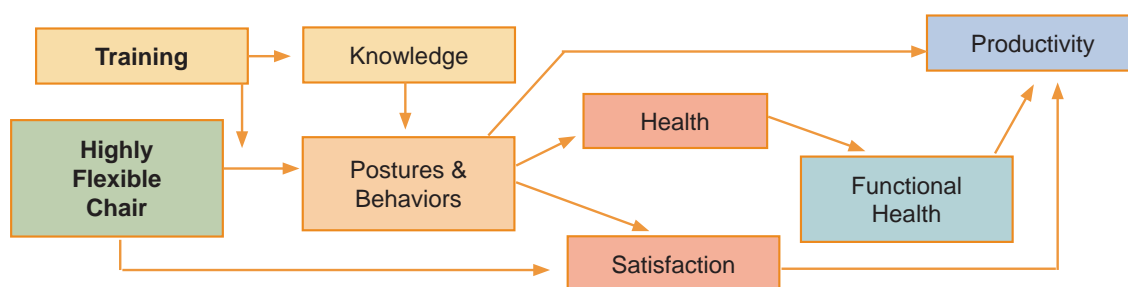
These findings indicate that the ergonomics training coupled with an adjustable workstation enabled participants to appropriately change and adjust their workstation and helped them to adopt healthy computing behaviors. This suggests that this type of intervention may play a significant role in preventing musculoskeletal and visual discomfort among intensive computer workers.

Field Study of Office Ergonomics Interventions

We completed the second of four field experiments aimed at identifying ergonomic interventions that can help reduce computer-related musculoskeletal injuries or symptoms and visual discomfort in the workplace. This series of studies examines the effects of different combinations of office ergonomics interventions on the musculoskeletal and visual health of workers whose jobs involve more than four hours of computer work each day. The first study looked at the effects of combining ergonomics training with a move to a newly designed workspace. This second study investigated the effects of ergonomics training coupled with the provision of a highly adjustable chair. A third study will replicate the second study, but in a different organization and setting. A fourth study will examine the impact of the combination of adjustable chair and workstation with ergonomics training. Together, the findings from this series of studies will provide the basis for office ergonomics recommendations to help improve workers' musculoskeletal and visual health and work effectiveness.

For the latest study, which lasted a total of 16 months, we recruited 219 employees of a public sector company. Participants were assigned to one of three groups: training plus adjustable chair (dual intervention), training only (single intervention), or the control group (no intervention). The training program was aimed at motivating employees to conduct self-evaluations and to reorganize and change their workspace as needed (see below model). Researchers observed body postures as employees worked at the computer and documented workstation setups before and after the intervention. They also administered online work environment and health surveys to participants at two months and one month pre-intervention, and again at two, six, and twelve months post-intervention.

Our data analysis indicates that the increased knowledge provided through ergonomics training led to positive changes in workstation configuration and positive behavioral changes. Over each workday, we also observed a reduction in the growth of musculoskeletal and visual symptoms for the chair-plus-training group only, as well as a reduction in average pain levels for both the chair-plus-training and the training-only intervention groups. The study results suggest that ergonomics training used in conjunction with highly adjustable office furniture can help to reduce musculoskeletal injuries and visual discomfort in intensive computer users.



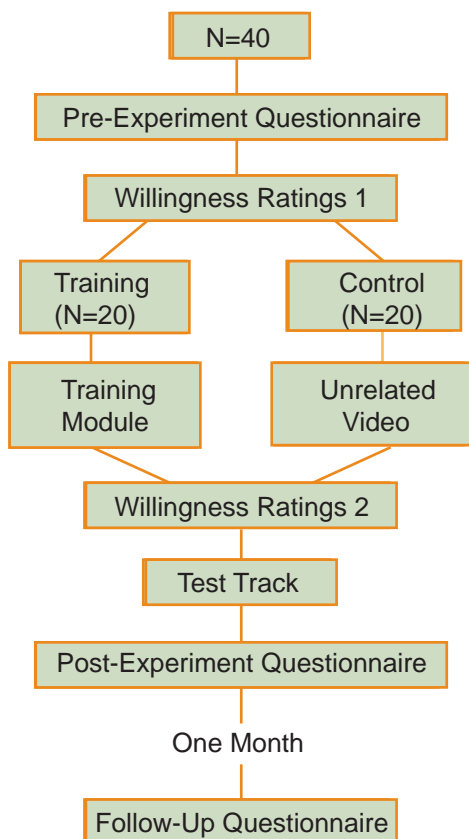
Adjustable Chair Plus Training Intervention

This model depicts the expectation that when an office ergonomics training program is implemented, an increase in ergonomics knowledge will motivate employees to modify working postures and behaviors.

Driver-Based Interventions for Mitigating the Effects of Distraction

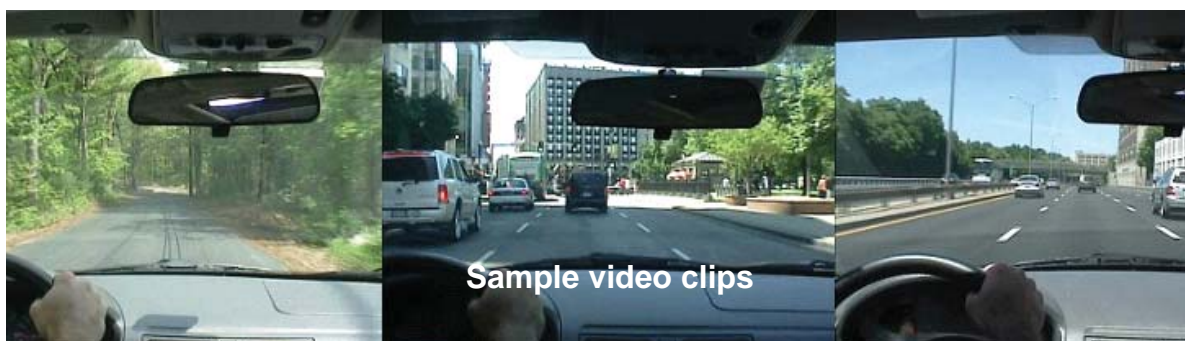
The risks associated with driving while distracted are well documented in the scientific literature. Our research indicates that despite these risks, many drivers continue to perform distracting tasks, and some overestimate their ability to drive safely while engaged in such tasks. To help keep our roadways safer, our researchers are studying ways to potentially mitigate the negative effects of distracted driving on safety. In a study launched this year, we examined the use of a computer-based training module to change drivers' attitudes and behaviors associated with distracted driving. If proven successful, employers could use this type of training to help reduce the risks of distracted driving.

Experiment Overview



We recruited 40 drivers, ages 18 to 20 years, to participate in the study. Participants were divided into a training group and a control group (see Experiment Overview, left). The training group completed an interactive, computer-based training module aimed at improving decision-making with respect to potentially distracting tasks. The control group viewed an unrelated video. Both before and after the training intervention, researchers administered a detailed questionnaire in conjunction with a series of short video clips, to assess drivers' willingness to perform in-vehicle activities while driving. After the intervention, drivers completed two experimental blocks in which they performed one of two in-vehicle tasks (dialing a phone number or reading a text message) while driving a closed-loop test track. Drivers were instructed to perform the tasks however and whenever they wanted, provided they finished them before they reached their destination. Researchers monitored and recorded the location where the driver initiated the in-vehicle tasks and measured driving errors, such as lane departures and traffic light violations.

Researchers began the process of analyzing the self-report data to determine whether training impacted drivers' willingness to engage in distracting activities or helped to change their risk perceptions. They also began examining the test track data to determine whether drivers who received the training were more likely to perform the tasks under safer circumstances, such as when the vehicle was parked at the side of the road or on easier parts of the test track.



Driver Performance Perceptions After Continued Exposure to Distraction

Our researchers continue to study the effects of distraction on driving performance perception. In a prior study, we found that drivers were not good judges of the degree to which distraction affected their driving performance and that, in general, younger male drivers tended to overestimate their ability to drive safely while performing distracting tasks. However, that study only evaluated drivers' estimates of distracted driving performance at a single point in time. In 2008, we conducted a study to examine whether drivers' perceptions of their ability to drive while distracted change over time with increased exposure to distracting tasks.

Twelve drivers (9 female, 3 male) between the ages of 20 and 24 volunteered to complete four experimental driving sessions, while researchers recorded objective measures of lane keeping and speed control. Each session consisted of three experimental blocks of 10 laps with the participant driving an instrumented vehicle around a closed-loop test track. In one block, the drivers performed only the driving tasks; in another, they answered math problems (designed to simulate distraction) with the car in 'Park'; and in another block, they performed the driving tasks and the math tasks concurrently. After each block, drivers estimated their performance on lane keeping, speed control, and/or the math task by placing a tick mark along a continuum ranging from "Total Failure" to "Perfect."

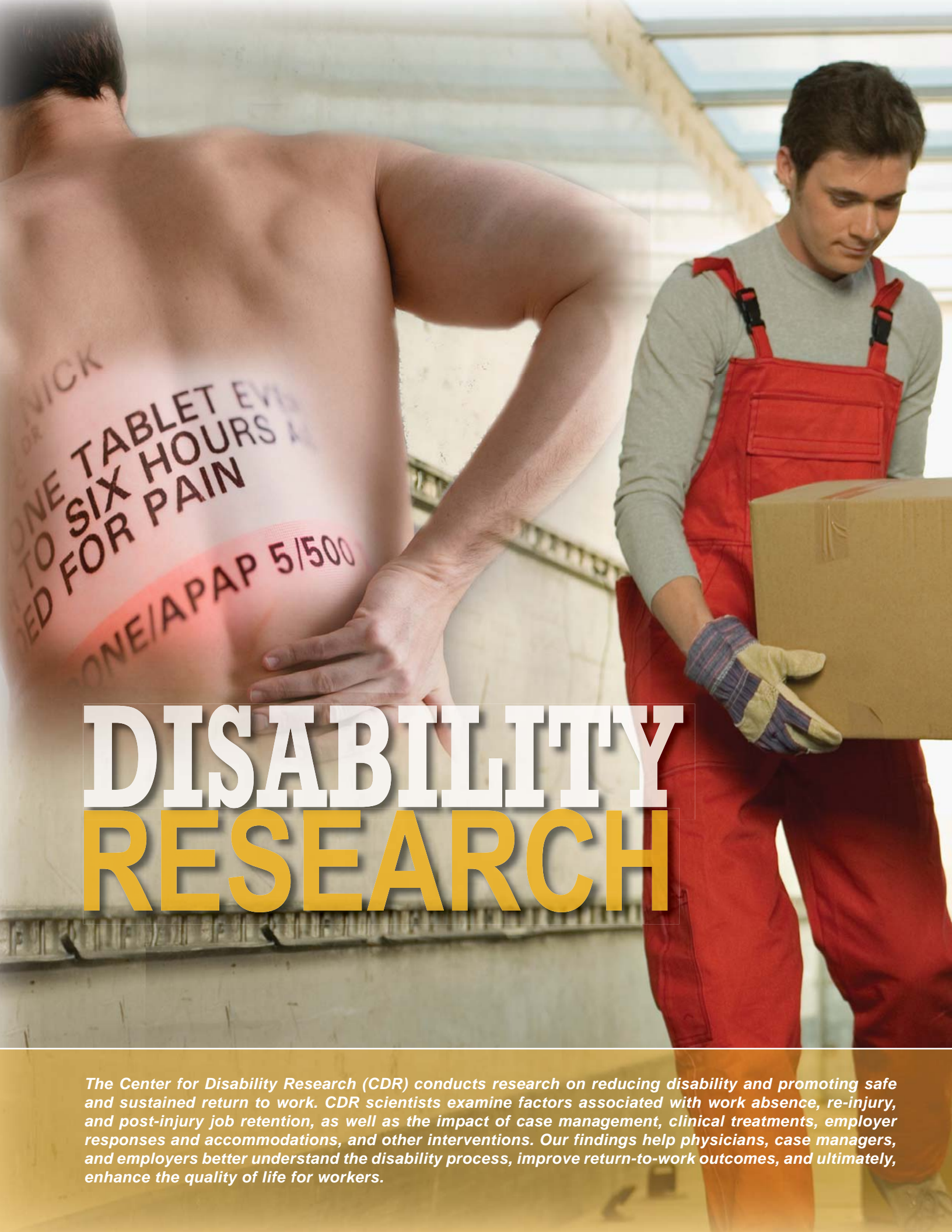
Our data analysis indicated that the drivers' estimates of the effects of distraction on lane keeping, speed control, and math performance did not change significantly from the first session to the last. These findings suggest that, for the conditions presented in this study, continued exposure to distraction does not enhance drivers' perception of their distraction-related performance deficits. Additional research is needed to further explore this issue.

Demonstrating the Risks of Distracted Driving Through Simulation

We began a related study with research partners at Tsinghua University in China, examining the impact of a simulation-based approach on drivers' attitudes toward cell phone use while driving. We recruited 30 experienced drivers (ages 23 to 50 years) for the study. Half the participants were assigned to the treatment group and received post-driving video feedback on their performance. The other half were assigned to the control group and received no feedback. Both groups were asked to complete a pre-drive and post-drive questionnaire, giving subjective ratings of their attitudes toward cell phone use while driving, so that we could determine the effect of feedback on changes in attitudes for the two groups.

The drive consisted of a 10-minute warm-up in the driving simulator, after which the participants performed a total of 10 experimental blocks. During five of the blocks, they carried on a cell phone conversation and answered phone calls on a hand-held phone while driving (dual-task), and during the other five, they performed driving only (single task). Upon completing the experimental tasks, the treatment group watched video playback of their simulator-based driving. The feedback incorporated all of the driver's experimental data (including dangers, errors, accidents, and violations), with and without cell phone conversations. The control group watched television or read magazines for the same amount of time.

Researchers began examining the data to determine whether the participants' attitudes toward cell phone use while driving changed as a result of their experience and the performance feedback they received.



DISABILITY RESEARCH

The Center for Disability Research (CDR) conducts research on reducing disability and promoting safe and sustained return to work. CDR scientists examine factors associated with work absence, re-injury, and post-injury job retention, as well as the impact of case management, clinical treatments, employer responses and accommodations, and other interventions. Our findings help physicians, case managers, and employers better understand the disability process, improve return-to-work outcomes, and ultimately, enhance the quality of life for workers.



2008 was a year of continued progress and new beginnings for the Center for Disability Research. We advanced several projects addressing the impact of clinical, workplace, and contextual factors on return-to-work outcomes and began studies on pain self-management, supervisor decision making, and the role of return-to-work coordinators.

Our collaborative efforts flourished with the addition of a post-doctoral fellow from the Harvard School of Public Health and continued joint research with the University of Massachusetts-Lowell, the University of Massachusetts Medical School, Orebro University (Sweden), and Keele University (U.K.). And, we were honored to receive the 2008 Kehoe Award of Merit and the National Occupational Research Agenda Innovative Research Award (see page 34).

These and other milestones achieved in 2008 helped set the stage for increased research capacity and impact in the coming years.



Glenn S. Pransky, M.D., M.Occ.H
Director CDR

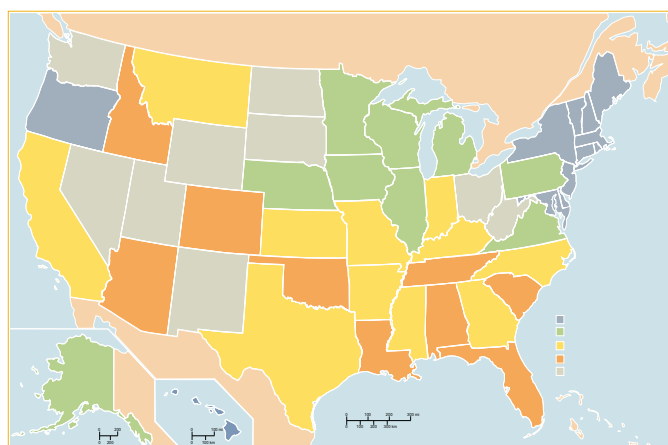
Geographic Variation in Opioid Prescribing for Acute Occupational Low Back Pain: A Multi-Level Analysis

Low back pain (LBP) is one of the most common reasons for work disability, and there are numerous evidence-based guidelines for care to achieve prompt resolution of symptoms and disability. Most guidelines have suggested that opioids are an acceptable option for managing severe acute pain, but only for a limited period of time, and only in certain cases. Recent studies suggest that clinical prescribing of opioids for acute LBP may lead to prolonged disability, higher medical costs, higher risk for surgery, and/or opioid use beyond the suggested time-limited course. However, other studies suggest that withholding opioids may lead to insufficient pain control. In order to better understand the factors related to opioid prescribing and how they affect outcomes, we conducted a data-based study of geographic variation and associated factors in early opioid prescribing among a selected workers compensation population.

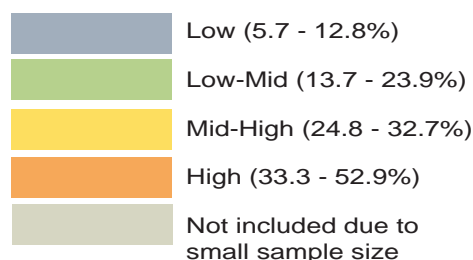
Based on analysis of more than 21,000 workers compensation LBP claims filed from 2002 to 2003, we identified 8,262 claimants who were treated for new-onset disabling LBP. Using a weighted coefficient of variation (wCOV), we estimated the amount of geographic variation across 39 states for receiving at least one opioid prescription in the first 15 days post-injury. States with fewer than 40 cases were excluded from the data set. We then employed multi-level modeling to examine the impact of individual factors (age, gender, job tenure, average weekly wage, and industry type) and state-level contextual factors (economic indicators, illicit drug use rates, prevalence rate of physicians, presence of a statewide prescription monitoring program, and workers compensation cost-containment efforts).

In the sample of 8,262 claimants, most were male (71.8%), with an average age of 40.3 years. A quarter of the sample was in the high-severity injury group. Our analyses indicated that 21.3 percent received at least one opioid prescription in the first 15 days post-injury. Significant between-state variation (wCOV = 53%) was found, with the percentage of workers being prescribed early opioids ranging from 5.7 to 52.9. The highest proportion of opioid prescribing was found in the southern region and the lowest in the northeast. More than three quarters of the between-state variation was explained by three contextual factors: state income household inequality, number of physicians per capita, and workers compensation cost-containment effort score. Individual-level factors, including severity, explained only a small portion of the geographic variability.

Our study found that geographic variation in early opioid prescribing for acute LBP is significant and strongly related to state-level contextual factors such as social conditions and control systems. The results suggest that surveillance of early opioid prescribing may be a useful trigger for closer case review.



Regional Variation in Opioid Use for Acute Low Back Pain



Competencies and Practices for Effectively Facilitating Return to Work

Prior research has shown that involving a return-to-work (RTW) coordinator in complex, work-related disability cases can lead to shorter disability duration, lower costs, and more sustained return to work. Despite documented outcome improvements, little is known about the practices or attributes that make an individual RTW coordinator successful. To address this knowledge gap, we are conducting a study that aims to define the role and identify the core competencies of the RTW coordinator.

This year, we completed a review of published studies involving RTW coordination to determine whether prior investigators had reported on these processes or competencies. We identified 40 articles (reflecting 22 studies) that met the criteria for inclusion. The studies provided data on coordination processes, but provided scant information on coordinator core competencies. To find out more, we interviewed the principal investigators of 13 of these studies, each of whom identified the RTW coordinator as key to the success of their intervention programs. Most identified several categories of essential competencies, including: specific inherent individual traits, relevant knowledge base about RTW issues, maintaining an RTW focus, strong organizational and administrative skills, a broad range of communication skills, and good interpersonal, problem-solving, and conflict resolution skills. Although most of the investigators recommended similar competencies, there was some variation based on setting or scope of RTW intervention.

Work is underway on the last phase of this study, in which our researchers will conduct focus groups with RTW coordinators to further develop information on their role, training, and perception of the competencies required for success. Using the focus group results, we will develop a questionnaire to survey a large international sample of RTW coordinators. The survey will help determine whether the identified competencies are important across a range of settings.

Urban-Rural Differences Following Occupational Injury

We continued to analyze the data from our retrospective cohort study of the association between residential location and work-disability outcomes. The study examined whether the disability outcomes of injured workers from rural areas differed from those of similarly injured urban workers. The initial findings, based on workers compensation data from 11,576 claimants who had suffered a work-related fracture, indicated that rural workers, on average, experienced less work disability following injury than did their urban peers. To further explore this topic, we examined the differences in health care utilization between the two groups following compensable work-related injury. Our goal was to establish whether the differences in work disability outcomes were related to differences in health care utilization.

Using a subset of the initial data, we analyzed workers compensation claims of 4,889 individuals who had experienced a work-related bone fracture and had seven or more days of compensated time off from work. Using regression analyses, we tested the associations between rurality, work disability, and health care utilization while controlling for demographic and work-related covariates. We then used multivariate linear regression models to examine the relationship between health care utilization, rurality, and length of work disability, and we applied stratified analyses to observe the association between rurality and length of disability across different levels of medical utilization.

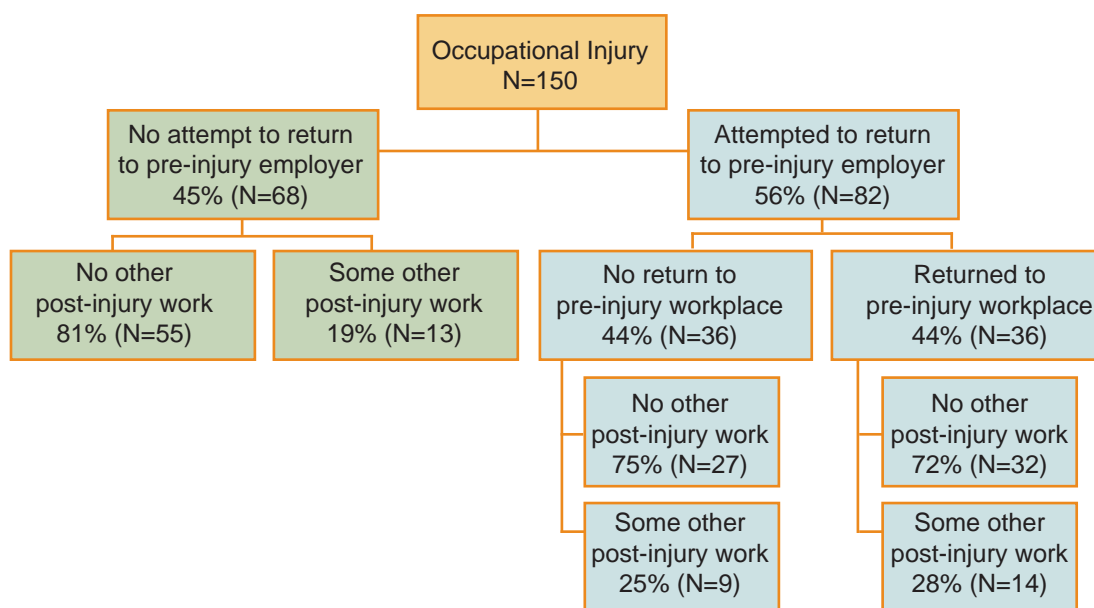
Our results indicated that place of residence was related to post-injury health care utilization and work disability duration. However, the direction of this relationship depended on the amount of health care used. For example, at lower levels of health care use, more rural residents had less time off, but as health care use increased, this trend reversed. Further research is needed to explore the reasons behind the interaction among health care use, work disability, and rurality. A clearer understanding of this phenomenon could help providers better meet the different needs of urban and rural residents.

Return-to-Work Experiences Following Prolonged Work Disability

With research partners at Boston University and the Massachusetts Department of Industrial Accidents, we completed a study of factors impacting the durability of an injured worker's employment when returning to work following a prolonged period of work disability. Researchers interviewed injured workers to collect information on factors that might support or hinder sustained employment. Ultimately, the findings will be used to help those involved in the return-to-work (RTW) process make more informed decisions when designing and implementing RTW programs.

Researchers interviewed 150 workers who had experienced an injury resulting in an extended period of time off from work (mean = 3.17 years; minimum 106 days; maximum 8.76 years). Each interviewee had received vocational rehabilitation services and found post-injury employment. Researchers asked the participants a series of open-ended questions about their pre-vocational rehabilitation RTW experiences (as detailed in the chart below) and their reasons for leaving work found post-injury.

In total, 45 percent (n=68) had worked at some stage after their injury but prior to receiving vocational services. While 82 workers had attempted to return to their pre-injury employer prior to receiving vocational rehabilitation services, only 36 had been successful. The reasons why people left their post-injury jobs included, physiological body function problems, inability to perform work-related tasks, and personal factors. However, by far, the most commonly referenced reasons for leaving work were environmental factors, including health care provider/ employer recommendations, lack of suitable work, having been replaced, or company closing. The findings suggest a number of interventions that could be put in place to improve RTW outcomes following periods of prolonged work disability.



Representation of the proportions of the study sample returning to their pre-injury employer and/or initiating other post-injury work prior to the receipt of vocational services.

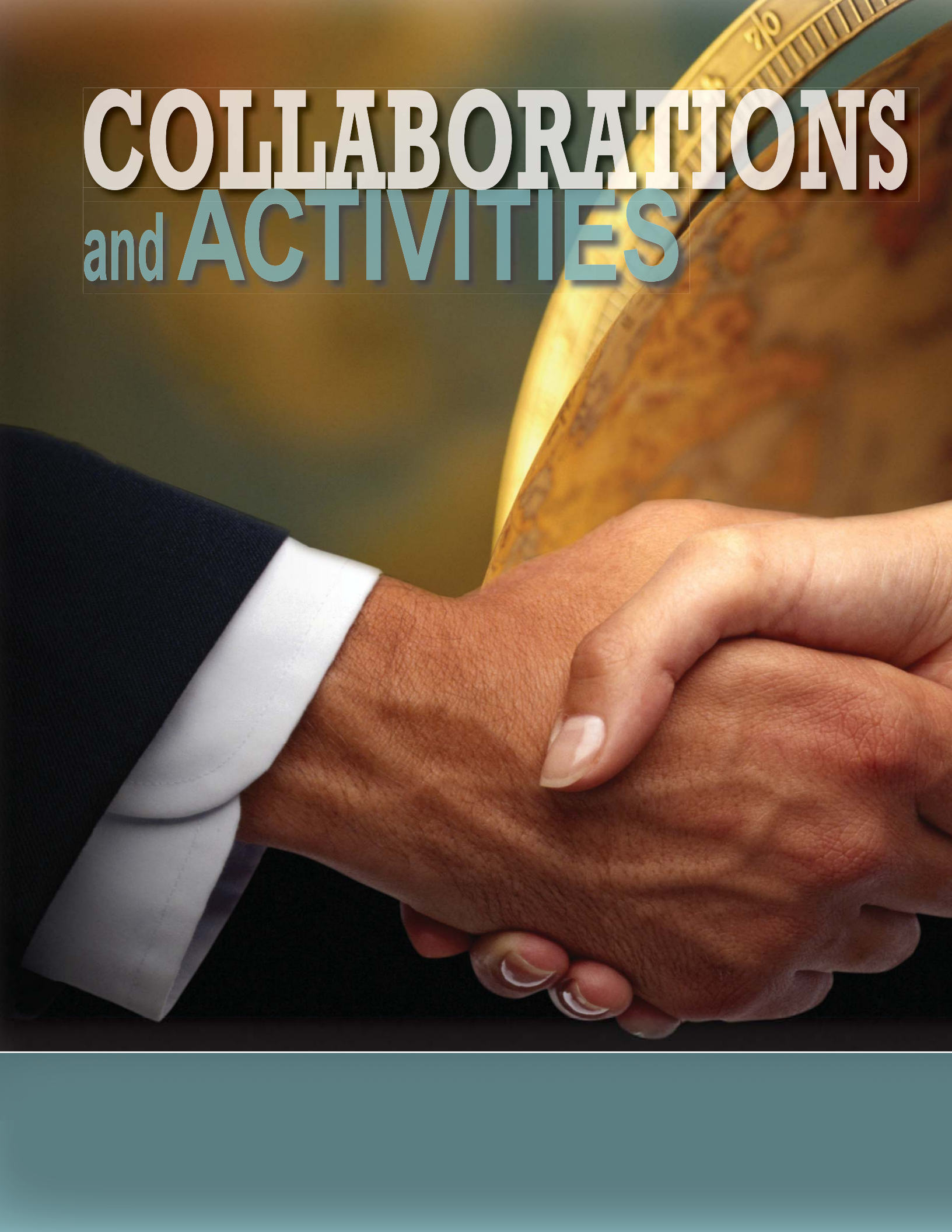
Low Back Pain Self-Management Practices to Prevent Work Disability

We began a multi-part study aimed at determining whether a group intervention based on self-management principles might be a feasible and acceptable approach for preventing work disability among individuals with recurrent low back pain. The study will involve a qualitative assessment of workplace self-management strategies and opportunities for intervention, development of a group intervention employing self-management concepts to overcome workplace problems, and pilot testing of the intervention with an initial group of workers experiencing back pain.

Researchers completed six, two-hour focus groups aimed at gathering information for the development of a self-management intervention. Each focus group consisted of seven to nine male and female workers ages 18–65, representing a variety of work settings and physical demands. All participants had experienced persistent or recurrent back pain problems that had affected their work over the past year, with or without significant work absence due to pain. Researchers asked participants in the focus group to identify problems associated with recurring back pain in the workplace and typical strategies for dealing with physical demands, organizational challenges, social and interpersonal issues, and any other factors influencing the quality of work life.

Researchers began analyzing the focus group data to build a conceptual framework for the proposed intervention program. In general, focus group discussions confirmed that workers with recurrent musculoskeletal pain do find ways to manage workload requirements and deal with pain in individual and informal ways, often without the need for explicit employer consent. Many of the discussions revolved around the concept of “leeway,” the degree to which workers in a particular work setting are able to adjust work methods, vary work activities, and make other adjustments on their own to reduce discomfort while still meeting job requirements.

COLLABORATIONS and ACTIVITIES





Collaborative research partnerships are vital to the Research Institute's overall mission to help improve occupational safety and health around the world. These alliances facilitate the exchange of ideas and technologies with fellow scientists and increase our scientific potential.

In addition to formal partnerships, we promote occupational safety through a variety of extramural activities, including our Visiting Scholar program, awards programs, and involvement in scientific and professional associations and conferences. These activities help us to further workplace safety and increase awareness of occupational safety and health issues.

RESEARCH PARTNERS

Liberty Mutual-Harvard Program in Occupational Safety and Health

In 2008, the first cohort of post-doctoral fellows arrived as part of our enhanced joint program with the Harvard School of Public Health (HSPH) Department of Environmental Health and the Harvard Occupational Safety and Health Education and Research Center. The enhanced program, established in 2007, helps to advance the field by developing promising new investigators. HSPH post-doctoral fellows complete joint research projects with scientists from the Research Institute and publish their work in peer-reviewed, scientific journals. During the year, the Liberty Mutual-Harvard fellows began collaborative efforts with Research Institute scientists on several projects, including studies examining lateral load transfers in materials handling (see p. 14); approaches to improve lifting exposure assessment; improvements in interface approaches and methods for intensive computer users; and self-management strategies to prevent work disability from low back pain (see p. 28). In 2008, we also saw the completion of an earlier fellowship involving our Fudan University partners which focused on traumatic hand injuries in China (see Research in Asia, below).

Additionally, we advanced a number of prior Liberty Mutual-Harvard Program research initiatives in 2008. We completed data collection in our epidemiological study of portable ladder fall-related injuries, which involves collaboration with U.S. Consumer Products Safety Commission, the U.S. National Institute for Occupational Safety and Health, and the Center for Construction Research and Training (see p. 7). We also launched a prospective cohort field study to improve our knowledge of the causes and prevention of same-level falls in limited-service restaurants (see p. 5).

University of Massachusetts-Lowell

Our relationship with the University of Massachusetts-Lowell (UML) Department of Work Environment continues to build momentum through the joint post-doctoral program formalized in 2007. Similar to the Liberty Mutual-Harvard Post-Doctoral Program, the UML Program seeks to provide opportunities for recent doctoral graduates to collaborate with Institute and UML scientists to further their experience in independent research, publication, and development. In 2008, we completed one fellowship focused on the impact of medications in return-to-work outcomes, and welcomed a new fellow whose focus will be the biomechanics of cart pushing and pulling in health care settings.

Research in Asia

After more than a decade of successful collaborative research in China and Vietnam, 2008 saw the strategic transition of the research programs to our scientific partners in the respective SafeWork Centers. The SafeWork Centers at Tsinghua University (Beijing, China) and the Vietnamese National Institute of Occupational and Environmental Health (Hanoi, Vietnam) will continue the safety research programs independently.

We continued analysis with scientists at Fudan University (Shanghai, China) on a joint investigation of acute occupational hand trauma in the People's Republic of China. The study, which also involves collaborators from the Harvard School of Public Health and the Johns Hopkins Bloomberg School of Public Health, evaluates the frequency and predictors of severe hand injuries in China and seeks to identify potentially modifiable risk factors.

Researchers have made good progress towards completing several driver behavior and traffic safety initiatives underway with partners at Tsinghua University. Joint research efforts include studies of the impact of demonstrating driver distraction through simulation (see p. 22), perception and comprehension of traffic signs, behavior and attitudes regarding seatbelt use, and identifying contributing factors to risky pedestrian behavior. In addition, we completed a joint study of balance control on scaffolds.

Along with our research partners from the Vietnamese National Institute of Occupational and Environmental Health (NIOEH) and the University of Massachusetts-Lowell, we completed analysis of occupational injury surveillance data collected in Xuan Tien Commune in Vietnam (see p. 7). In October, Institute Director Ian Noy and Research Scientist Helen Marucci-Wellman participated in the NIOEH 3rd International Conference on Occupational and Environmental Health. Dr. Noy delivered the keynote address, “Shaping Research to Address National Occupational Injury Research Needs,” and Dr. Marucci-Wellman presented the study “Occupational Safety Surveillance in the 21st Century: Xuan Tien Commune, Vietnam.”

Also in October, Liberty Mutual and the NIOEH co-hosted and developed a workshop entitled, “The Next Steps in Injury Surveillance in Vietnam”. The event gathered leading Vietnamese health and safety organizations to develop a proposed concept for building a national system for occupational injury surveillance in Vietnam. Along with Liberty Mutual and NIOEH, participating organizations included the Vietnam Ministry of Health, Vietnam Ministry of Labor Invalids and Social Affairs, Hanoi Medical University, Hanoi School of Public Health, Vietnam Occupational Safety and Health Association, World Health Organization of Hanoi, National Institute of Labour Protection, Hanoi International Labor Organization, Nam Dinh Preventive Medicine Center, and organizations from the Xuan Truong District and Xuan Tien Commune.

Scientific Visitors Advisory Board

The Scientific Visitors Advisory Board (SVAB) convened at Hopkinton in March to review the Research Institute’s programs and to help advance the dissemination and application of research findings. The board, comprised of prominent leaders within the health and safety field, meets periodically with Research Institute directors and staff to appraise the Institute’s research programs. The 2008 report noted the successful implementation of the Centers for Behavioral Sciences and Physical Ergonomics. It also commended Research Institute Director Ian Noy for his leadership in designing a new mission and research profile, strategy, and agenda. The SVAB welcomed two new members in 2008: Cam Mustard, Sc.D., president of the Institute for Work and Health and professor of the Department of Public Health Sciences, University of Toronto (Canada) and Professor Willem van Mechelen, M.D., Ph.D., VU University Medical Center and EMGO Institute (Amsterdam, Netherlands). Additional board members include Professor Jorma Rantanen, M.D., Ph.D., president of the International Commission on Occupational Health (Helsinki, Finland), Professor Barry Bloom, M.D., dean of the Harvard School of Public Health (Boston, MA, USA), and Dr. Jean-Claude André, Ph.D., research director of France’s National Centre for Scientific Research (Paris, France).

Fourth Hopkinton Conference on Fatigue and Safety Research

In November, the Research Institute hosted its fourth Hopkinton Conference, “Future Directions in Fatigue and Safety Research”. Attended by more than 30 leading researchers from around the world, this conference was designed to identify the critical gaps in our understanding of fatigue and its consequences on transportation and work safety and to outline future research aimed at addressing these gaps. The topics of discussion included fatigue prediction, demographic issues, fatigue management through organizational factors and technological approaches, and the link between fatigue and safety. Manuscripts from the conference are expected to appear in a special issue of *Accident Analysis and Prevention*.

The Hopkinton Conference paradigm brings together leading experts on a key research area. Over the course of several months, participants draft state-of-the-art reviews covering various aspects of the research topic. The participants then convene for a two-day conference at the Research Institute in Hopkinton to review, debate, and revise, examine global issues, and discuss research priorities. Results are published in a special issue of a leading, peer-reviewed scientific journal and may also extend into monographs or books. The Hopkinton Conference serves as a stimulus for further collaboration, as contributors form a new research network.

VISITING SCHOLAR



Each year, we select a senior researcher to participate in our Visiting Scholar Program, which provides a unique opportunity for a Visiting Scholar and our own Institute scientists to collaborate in an area of mutual interest. The Scholar spends approximately three months at the Research Institute, after which the program encourages a longer collaborative relationship with the Scholar's home institution. In 2008, we hosted Mark R. Lehto, Ph.D., a professor from Purdue University.

Dr. Lehto (left) collaborated with our research scientists to refine epidemiological research methods for analyzing injury narratives. Together, they developed a semi-automated approach for classifying workers' compensation claim narratives into the Bureau of Labor Statistics event classifications. The resulting computer algorithms classified many of the narratives with high accuracy, and ultimately, may reduce the difficulty of reviewing and classifying large administrative datasets.

Dr. Lehto also worked with Institute scientists to explore new uses of the Bayesian methodology, a statistical theory that starts with a known belief and uses conditional probabilities to derive a new outcome. The resulting submitted paper ("Electronic Application of Bayesian Methods is a Useful Tool for Classifying Injury Narratives into Cause Groups") compares and contrasts the application of two different Bayesian methods for classifying injury narratives from large administrative databases into event cause groups.

At Purdue, Lehto is an associate professor in the School of Industrial Engineering. He also serves as the co-chair of the Interdisciplinary Graduate Program in Human Factors and technical advisor in Industrial Engineering for the Purdue Technical Assistance Program. His research focuses on human decision-making, hazard communication, safety, and ergonomics. Currently, he is the president of Consumer Research, Inc., (West Lafayette, IN) and a principal at Miller Engineering, Inc. (Ann Arbor, MI). In addition to publishing in the peer-reviewed press and presenting to international audiences, Dr. Lehto has authored five books and 19 book chapters. His volumes on the subject of warnings have become standard field references.

Dr. Lehto received a Ph.D. in Industrial and Operations Engineering from the University of Michigan, an M.S.I.E. from Purdue University, and a B.S.I.E. from Oregon State University. A past director of both the Institute of Industrial Engineers and the Human Factors and Ergonomics Society Forensics Group, he is involved with a number of professional organizations including the American Society of Safety Engineers, Society for Hazard Communication, International Society for Occupational Ergonomics and Safety, and Association for Computing Machinery.

AWARDS and HONORS

Awards Presented

The Research Institute's awards program aims to promote research excellence in occupational safety and health and enhance workplace safety worldwide. In 2008, we sponsored two awards: The Liberty Mutual Best Paper Award, in partnership with the Ergonomics Society, and the International Ergonomics Association (IEA)/Liberty Mutual Medal in Occupational Safety and Ergonomics.

Liberty Mutual Best Paper Award

The 2008 Liberty Mutual Best Paper Award winners were Dr. Sylvie Leclercq, and ergonomists Sandrine Thouy and Emmanuel Rossignol from the French National Research and Safety Institute, Vandoeuvre, France. The Award recognizes the paper published in the journal *Ergonomics* over a given 12-month period, that best contributes to the advancement of the practice of ergonomics. The researchers were selected for their paper, "Progress in Understanding Processes Underlying Occupational Accidents on the Level Based on Case Studies" (*Ergonomics*, Vol. 50, No. 1, pp. 59-79, 2007). The paper provides an in-depth analysis of same-level trips, slips, and falls.

IEA/Liberty Mutual Medal in Occupational Safety and Ergonomics

An Australia-based research team received the 2008 IEA/Liberty Mutual Medal in Occupational Safety and Ergonomics for their work on a large-scale study of occupational health and safety in the Australian mining industry. The Medal recognizes outstanding original research leading to the reduction of work-related injuries and/or to the advancement of theory, understanding, and development of occupational safety research. The winning research project, titled “Digging Deeper,” was commissioned by the New South Wales Mine Safety Advisory Council. The report provided detailed information about the effectiveness of occupational health and safety management with respect to work hours and fatigue management, production bonus and safety incentive schemes, and occupational health and safety management systems, including consultation. The winners were Project Leader Andrea Shaw, (Shaw Idea Pty Ltd); Associate Professor Verna Blewett, Ph.D. (New Horizon Consulting Pty Ltd); Laurie Stiller, (Beyond Words); Christine Aickin, M.P.H., O.H. (Workability Pty Ltd); Professor Drew Dawson and Sally Ferguson, Ph.D. (Centre for Sleep Research, University of South Australia); Stephen Cox, Ph.D. (Stephen Cox Consulting); and Professor Kaj Frick Ph.D. (Malardalen University, Vasterås, Sweden).

Awards Received

Since its inception, the Research Institute and its staff have received awards from a number of prominent organizations. In 2008, we received four honors, as described below.

2008 National Occupational Research Agenda (NORA) Innovative Research Award

The Research Institute’s scientific study, “Optimizing Supervisor Response to Workplace Injury,” won the 2008 NORA Innovative Research Award for Worker Health and Safety. The award, presented by the U.S. Centers for Disease Control, honors innovative and creative occupational health and safety research in a NORA priority area, and recognizes the development of, or encourages continued work with, a new approach to prevent or reduce occupational illness and injuries. The winning study developed and tested a successful strategy for strengthening the role of supervisors in reducing workers’ risk for work-related musculoskeletal injuries. Contributing scientists included, William S. Shaw, Ph.D., P.E., Michelle M. Robertson, Ph.D., C.P.E., Santosh K. Verma, M.B.B.S., M.P.H., Glenn S. Pransky, M.D., M.Occ.H., and Mary Jane Woiszwillo, B.A., all with the Liberty Mutual Research Institute for Safety; Robert K. McLellan, M.D., M.P.H., with Dartmouth-Hitchcock Medical Center, and Ronald Woo, with Liberty Mutual Insurance Company. The NORA Liaison Committee, in cooperation with the National Institute for Occupational Safety and Health, presented the award at the NORA Symposium held in Denver, Colorado, on July 29, 2008.

2008 Robert A. Kehoe Award of Merit

Center for Disability Research Director Glenn S. Pransky, M.D., M.Occ.H., received the 2008 Robert A. Kehoe Award of Merit. Presented by the American College of Occupational Environmental Medicine, the award recognizes Dr. Pransky’s significant contributions to the field of occupational and environmental medicine. In April, he accepted the honor at the opening session of the American Occupational Health Conference in New York City.

American Academy of Physician Assistants Distinguished Fellowship

In 2008, the American Academy of Physician Assistants (AAPA) named Institute Research Scientist Barbara S. Webster, B.S.P.T., P.A.-C., a Distinguished Fellow. AAPA bestows the honor on members who have distinguished themselves among their peers, within their communities, and through their profession. This honor recognizes Ms. Webster’s contributions to the PA profession throughout her 33 years of AAPA membership, including leadership roles with the Massachusetts Association of Physician Assistants (MAPA), the Commonwealth of Massachusetts Board of Registration of PAs, and the American Academy of Physician Assistants. The award also acknowledges Ms. Webster’s significant research contributions to clinical practice, back pain disability interactions, and disability interventions aimed at reducing worker suffering and long-term disability, enhancing quality of life, and increasing productive employment.

PROFESSIONAL ACTIVITIES

Research Institute scientists participate in various professional organizations, societies, and activities related to their respective areas of expertise. These opportunities allow our researchers to interact with their peers, gain valuable scientific input, and recommend change in the standards and practices applicable to their fields. In addition, many Institute researchers serve on review committees and editorial boards for leading health and safety scientific journals. Listed here are the organizations to which our scientists belonged, the activities in which they participated, and the journals for which they served as reviewers in 2008.

Memberships and Committees

10th International Forum for Research on Low Back Pain in Primary Care

– Committee: Local Organization (Chair)

American Academy of Physician Assistants

American College of Occupational and Environmental Medicine

– Committees: Guidelines; Work Fitness and Disability; Health and Productivity Management

American College of Sports Medicine

American Industrial Hygiene Association

– Committee: Construction

American Psychological Association

American Public Health Association

American Society for Testing and Materials

– Committees: Polishes (D21); Safety and Traction for Footwear (F13)

American Society of Biomechanics

American Society of Mechanical Engineers

American Society of Safety Engineers

– Committee: Research

American Statistical Association

Association for Physiological Science

Board of Certification in Professional Ergonomics

– Committee: Examination (Director, Chair)

Board of Certified Safety Professionals

Ergonomics Society (UK)

Gait and Clinical Movement Analysis Society

– Outreach Domain Leader

Harvard School of Public Health Center for Work, Health, and Well-Being

– Committee: External Advisory

Human Factors and Ergonomics Society

– Committees: Fellows Selection (Chair); Publications; Proposal Review

– Technical Groups: Environmental Design (Chair); Industrial Ergonomics, Macroergonomics (Chair); Safety, Surface Transportation (Chair)

– Reviewer: *Human Factors and Ergonomics Society Proceedings*

Indian Society of Ergonomics

Institute for Health and Productivity Management

Institute of Industrial Engineers

– Reviewer

International Association for the Study of Pain

International Commission on Occupational Health

– Founding Secretary

– Committee: Work Disability Prevention

International Ergonomics Association (IEA)

– Technical Committees: Organizational Design and Management (Chair); Slips, Trips, and Falls (Chair)

International Society for Posture and Gait Research

International Society for Quality of Life Research

International Society of Physical and Rehabilitation Medicine

Massachusetts Association of Physician Assistants

Massachusetts Department of Public Health

– Occupational Health Surveillance Program

Massachusetts Medicaid Infrastructure and Comprehensive Employment Opportunities Grant

– Committee: Scientific Advisory

Massachusetts Medical Society

– Committee: Physician Health Advisory

Massachusetts Working Group on Falls in Construction

National Academy for Social Insurance

National Institute for Occupational Safety and Health

– National Occupational Research Agenda:

Liaison Committee Steering Board;

Construction and Wholesale/Retail Councils

– National Occupational Injury Research

Symposium, Reviewer

Society for Behavioral Medicine

Society for Industrial and Organizational Psychology
 Society for Occupational and Environmental Health
 Society for Occupational Health Psychology
 – Committees: Scientific Advisory; Executive
 – Conference Chair
 Society of Photo-Optical Instrumentation Engineers
 Transportation Research Board
 – Committee: Vehicle User Characteristics
 Workers Compensation Research Group
 – Steering Committee

Journal Reviews

Accident Analysis and Prevention

*American Journal of Industrial Medicine**

Applied Ergonomics

Assessment

*Australian Journal of Environmental Health**

Clinical Biomechanics

Clinical Journal of Pain

*Disability and Rehabilitation**

*Ergonomics***

*Human Factors**

Human Factors and Ergonomics in Manufacturing

IET Intelligent Transport Systems

Industrial Health†

*International Journal of Human-Computer Interaction**

International Journal of Industrial Ergonomics

International Journal of Non-Linear Mechanics

Journal of Applied Physiology

Journal of Biomechanics

Journal of Experimental Psychology: Applied

Journal of Occupational and Environmental Health

*Journal of Occupational and Environmental Hygiene**

*Journal of Occupational and Environmental Medicine**

Journal of Occupational Health Psychology

*Journal of Occupational Rehabilitation**

Journal of Sports Sciences

*Journal of Testing and Evaluation**

Journal of Tribology

Materials and Structure

Neuroepidemiology

Oxford Handbook of Cognitive Engineering

Pain

Perception

Professional Safety

Psychosomatic Medicine

Safety Science

Social Science and Medicine

*Spine**

*Theoretical Issues in Ergonomics Science**

Transportation Research Record

Tsinghua Science and Technology

**Editor/Editorial Board*

†Guest Editor: Special Issue

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Young, A.E., Cifuentes, M., Wasiak, R., and Webster, B.S., "Urban-Rural Differences in Work Disability Following Occupational Injury: Are They Related to Differences in Healthcare Utilization?" accepted for publication in the *Journal of Occupational and Environmental Medicine*

Young, A.E., Wasiak, R., Webster, B.S., and Shayne, R.³⁷, "Urban-Rural Differences in Work Disability After an Occupational Injury," *Scandinavian Journal of Work, Environment, and Health*, Vol. 34, No. 2, pp. 158-164, 2008

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PRESENTATIONS

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"Falls From Ladders: Preliminary Results From a Case-Crossover Study of Emergency Room Cases" – 18th Annual Construction Safety and Health Conference and Exposition, Rosemont, IL, February 12-14, 2008

Chien-Chi Chang, Ph.D., C.P.E.

"A Novel Approach of Using a Portable Laser Scanner for Three-Dimensional Hand Anthropometric Measurement" – 2nd International Conference on Applied Human Factors and Ergonomics, Las Vegas, NV, July 14-18, 2008

"Assessing Floor Slipperiness: The Effects of Friction and Perception on Gait" – National Occupational Injury Research Symposium, Pittsburgh, PA, October 21-23, 2008

Wen-Ruey Chang, Ph.D.

"The Stochastic Distribution of Available Friction Coefficient for Human Locomotion" – National Occupational Injury Research Symposium, Pittsburgh, PA, October 21-23, 2008

Theodore K. Courtney, M.S., C.S.P.

"Events, Sources, and Disability Duration" and "Worker Slips and Falls in Limited Service Restaurants" – National Occupational Injury Research Symposium, Pittsburgh, PA, October 21-23, 2008

Marvin Dainoff, Ph.D., C.P.E.

"Human Systems Integration: Safety and Occupational Health Perspective" – 52nd Annual Meeting of the Human Factors and Ergonomics Society, New York, NY, September 22-26, 2008

Angela DiDomenico, Ph.D., C.P.E.

"Perceived Postural Instability Upon Standing – A Possible Influence of Falls Within the Construction Industry" – American Industrial Hygiene Association, Minneapolis, MN, May 31-June 5, 2008

"Self-Reported Postures and Task Parameters Within the Construction Industry That Lead to Instability Upon Standing" – National Occupational Injury Research Symposium, Pittsburgh, PA, October 21-23, 2008

William J. Horrey, Ph.D.

"Adaptive Task Management for Driver-Initiated Distractions" – 4th International Conference on Traffic and Transport Psychology, Washington, DC, August 31-September 4, 2008

Yueng-Hsiang Huang, Ph.D.

"Interventions to Improve Safety Climate and Safety Behaviors and New Developments in the Conceptualization of Safety Climate" – 7th International Congress on Occupational Stress and Health, Washington DC, March 6-8, 2008

"Industry Type and Perceived Injury Risk: The Moderating Role of Safety Climate" – 23rd Annual Society for Industrial and Organizational Psychology Conference, San Francisco, CA, April 10-12, 2008

Jia-Hua Lin, Ph.D., C.P.E.

"Perspectives in Powered Nutrunner Torque Reaction: The Effect of Operator Experience on Hand Reactive Moment and Displacement" – 7th International Scientific Conference of the International Occupational Hygiene Association, Taipei, Taiwan, February 18-22, 2008

"Predicting Subjective Perceptions of Powered Tool Torque Reactions Based on Work Locations" – 2nd International Conference on Applied Human Factors and Ergonomics, Las Vegas, NV, July 14-18, 2008

David A. Lombardi, Ph.D.

"Weekly Working Hours and Risk of Work-Related Injury: U.S. National Health Interview Survey (1997-2004)" – 9th World Conference on Injury Prevention and Safety Promotion, Merida, Mexico, March 15-18, 2008

"Etiology of Work-Related Electrical Injuries: A Novel Taxonomy and Narrative Analysis of Workers Compensation Claims" – National Occupational Injury Research Symposium, Pittsburgh, PA, October 21-23, 2008

Glenn S. Pransky, M.D., M.Occ.H.

“Occupational Issues in an Aging Workforce” – American Osteopathic College of Occupational and Preventive Medicine Annual Conference, Savannah, GA, March 27-30, 2008

“Return to Work Coordinators: What Are the Key Competencies?” – 3rd Annual Disability Management Employers’ Coalition International Conference, Denver, CO, August 10-12, 2008

“Job Lock in Older Workers With Work Injuries” – 61st Annual Scientific Meeting of the Gerontological Society of America, National Harbor, MD, November 20-25, 2008

Michelle M. Robertson, Ph.D., C.P.E.

“Effects of a Quasi-Experimental Field Office Ergonomics Intervention Study” – 7th International Congress on Occupational Stress and Health, Washington, DC, March 6-8, 2008

“Examining the Macroergonomics and Safety Factors Among Teleworkers” – 9th International Symposium on Human Factors in Organizational Design and Management, Sao Paulo, Brazil, March 19-21, 2008

William S. Shaw, Ph.D., P.E.

“A Systematic Review of Workplace Interventions Employing Return-to-Work Coordinators” – 7th International Congress on Occupational Stress and Health, Washington DC, March 6-8, 2008

“Initial Consultation for Acute Low Back Pain: Impact of Psychosocial Factors on Provider and Patient Communication” – 12th World Congress on Pain, Glasgow, Scotland, August 17-22, 2008

“The Back Disability Risk Questionnaire: Predicting Persistent Pain and Dysfunction” – 3rd International Commission on Occupational Health International Conference on Psychosocial Factors at Work, Quebec City, Quebec, Canada, September 1-4, 2008

Santosh K. Verma, M.B.B.S., M.P.H.

“Circumstances of Occupational Same-Level Falls and Risk of Wrist, Ankle, and Hip Fracture in Women Over 45 Years of Age” – 9th World Conference on Injury Prevention and Safety Promotion, Merida, Mexico, March 15-18, 2008

“Design and Evaluation of Multi-Modal Methods to Follow-Up Multilingual Fast-Food Workers in a Prospective Cohort Injury Study” – National Occupational Injury Research Symposium, Pittsburgh, PA, October 21-23, 2008

Radoslaw Wasiak, Ph.D.

“The Association Between Timing and Duration of Chiropractic Care and Work-Disability Outcomes” – 25th Annual Research Meeting of AcademyHealth, Washington, DC, June 8-10, 2008

“Measuring Return to Work” – 3rd International Commission on Occupational Health International Conference on Psychosocial Factors at Work, Quebec City, Quebec, Canada, September 1-4, 2008

Barbara S. Webster, B.S.P.T., P.A.-C.

“What Factors are Associated with Geographic Disparity in Early Opioid Prescribing for Acute Occupational Low Back Pain?” – 25th Annual Research Meeting of AcademyHealth, Washington, DC, June 8-10, 2008

“From Pain to Function? The Impact of Opioid Prescribing on Outcomes for Acute Low Back Pain” – McKenzie Institute Conference of the Americas Mechanical Diagnosis and Therapy, Orlando, FL, July 25-27, 2008

“Early Use of MRI for Work-Related Acute Low Back Pain” – Fall Meeting of the Workers’ Compensation Research Group, Hopkinton, MA, November 14-15, 2008

Amanda E. Young, Ph.D.

“Durability of Employment Following Prolonged Work Absence” – 3rd International Commission on Occupational Health International Conference on Psychosocial Factors at Work, Quebec City, Canada, September 1-4, 2008

“Urban-Rural Differences in Work Disability Following Occupational Injury: Are They Related to Differences in Healthcare Utilization?” – Fall Meeting of the Workers’ Compensation Research Group, Hopkinton, MA, November 14-15, 2008

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