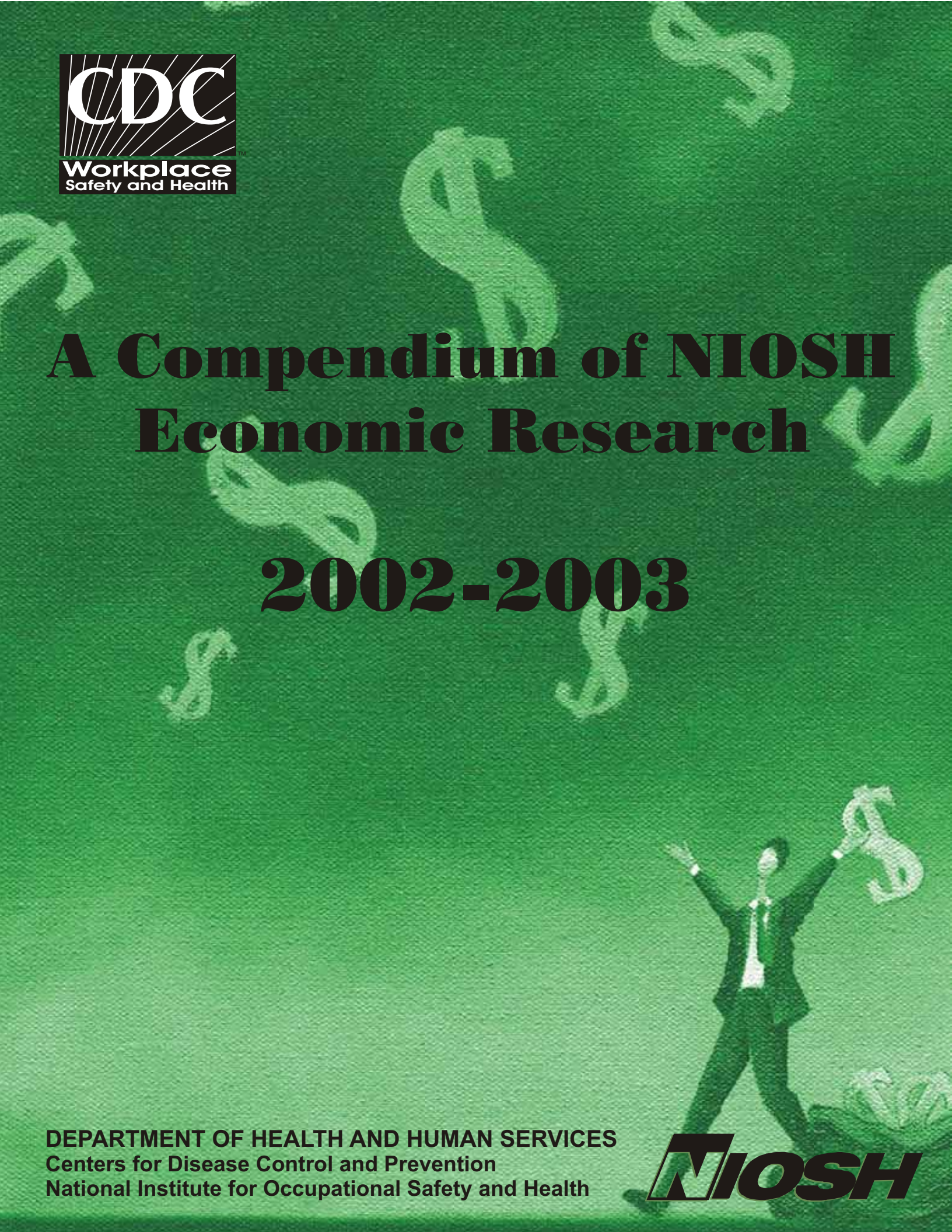

A Compendium of NIOSH Economic Research

2002-2003

DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health

NIOSH

A Compendium of NIOSH Economic Research

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

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Foreword

Occupational safety and health professionals in a variety of disciplines including epidemiology, occupational health nursing, industrial hygiene, safety engineering, occupational medicine, and related areas have worked tirelessly over the past 30 years to make the Nation's workplaces safer, and their advocacy and contributions have been widely recognized. Less well known is the role of economists, policy analysts, prevention effectiveness specialists, and social scientists in determining the economic burden of work-related illness and injury and the economic effects of introducing prevention and intervention efforts into the workplace.

This compendium of NIOSH intramural and extramural economic research is an effort to illuminate the vital research being done by these professionals. Their work will help determine the impact of occupational illness and injury on the Nation's workers, the commensurate burden upon our Nation's resources, and the cost effectiveness of introducing measures into the workplace that can alleviate this health burden. This area of research provides an important dimension and context for the work of the occupational safety and health community.

John Howard, M.D.
Director, National Institute for Occupational Safety and Health
Centers for Disease Control and Prevention

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Common Agency Acronyms Used In This Document

BLS	Bureau of Labor Statistics
EPA	Environmental Protection Agency
MSHA	Mine Safety and Health Administration
NIOSH	National Institute for Occupational Safety and Health
OSHA	Occupational Safety and Health Administration

Background

Each year, millions of occupational injuries and illnesses occur in the United States. The Liberty Mutual insurance company estimated that in 2001, the direct cost of workplace injuries and illnesses was $45.8 billion, and the indirect costs ranged from $137.4 billion to $229 billion. Estimates generated by the National Safety Council for the cost of work injuries in 2002 were $1,060 per worker, a national total of $146.6 billion. Moreover, according to the National Academy of Social Insurance, between 1998 and 2002, employer costs for providing workers' compensation rose from $52.8 billion to $72.9 billion. The costs of work-related illness and disability both in human and economic terms justify the allocation of substantial resources for the control of workplace hazards.

In addition to the direct costs of lost earnings and health care related to occupational injury and disease, there are numerous indirect economic costs. Employers sustain some of these, including additional hiring and training costs, disruption of work processes by workplace incidents, and the effects of workplace injuries or exposures on the productivity of coworkers who may feel at heightened risk. Other indirect costs are borne by the injured workers and their families—for example, loss of income, depletion of savings, and a reduced standard of living; increased expenditures for professional counseling and purchased caregiver services in the home; home modifications and equipment related to disability; and deferral or loss of education for family members. Other costs may fall on the community in the form of increased need for social service programs.

Understanding the total human and economic burdens of occupational injuries and illnesses is crucial to setting priorities and shaping other components of the occupational safety and health research agenda. Furthermore, determining the magnitude of these burdens is essential to the assessment of the economic effectiveness of safety and health interventions designed to reduce the number of occupational injuries and illnesses. Such evaluations provide decision makers in both the public and private sectors with necessary information to assess whether the outcomes of interventions justify the expenditures relative to other choices. Economic analysis is vital in preventing and controlling occupational injury and illness.

About the NIOSH Economics Interest Group

The National Institute for Occupational Safety and Health (NIOSH), established by the Occupational Safety and Health Act of 1970, has the primary responsibility of conducting research and making recommendations for the prevention of work-related disease and injury. NIOSH is committed to meeting its mission—to provide national and world leadership to prevent work-related illness, injury, and death by gathering information, conducting scientific research, and translating the knowledge gained into products and services.

In an effort to guide and coordinate research nationally, the National Occupational Research Agenda (NORA) was established in 1996. This agenda identified 21 research priorities, which included the social and economic consequences of workplace illness and injury. A partnership team, the Social and Economic Consequences of Workplace Illness and Injury (S/E Team) was formed to help develop, pursue, review, and disseminate research under this topic. An institute-wide workgroup, the Economics Interest Group (EIG), was formed under the auspices of the NORA S/E Team to address these tasks within NIOSH.

The EIG provides leadership for the advancement of economic research and evaluation at NIOSH with the further purpose of advancing science and informing decision makers. The EIG provides a forum for NIOSH researchers to discuss major issues in the fields of public health, economics, decision analysis, evaluation, and health services research as they apply to the practice of public health and safety research, and, more importantly, to provide a means to establish consensus on the best methods and practices available in these areas. This group assists other NIOSH researchers and encourages the use of economics in policy making, program development, and program evaluation. Current members include:

Elyce A. Biddle, Chair, Division of Safety Research
Laura Blanciforti, Health Effects Laboratory Division
Matt Bowyer, Division of Safety Research
Tim Bushnell, Division of Surveillance, Hazard Evaluations, and Field Studies
Thomas W. Camm, Spokane Research Laboratory
Barbara Fotta, Pittsburgh Research Laboratory
Dan Hartley, Division of Safety Research
Diana Hudson, Division of Safety Research
Ted Katz, Office of the Director
Paul R. Keane, Division of Safety Research
Rene Pana-Cryan, Office of the Director

Acknowledgments

The Economics Interest Group would like to thank Joyce Spiker and Herb Linn of the Division of Safety Research for their assistance with designing and assembling this document. We would also like to thank Janie Gittleman and Trish Quinn of the Center to Protect Workers' Rights and Gwendolyn Cattledge of the NIOSH Office of Extramural Programs for their assistance in providing information about the current NIOSH-funded economics extramural projects.

About the Compendium

The purpose of this compendium is to provide an overview of current research projects conducted or funded by NIOSH that focus on prevention and control of occupational injury and illness through economic analysis. The compendium includes 22 NIOSH intramural and 32 NIOSH-funded extramural economic projects or other research projects with a substantial economic component that were being conducted during 2002 and 2003.

The principal investigator of each NIOSH intramural project was asked to describe the project in one page. The description for each extramural project was extracted from the project protocol submitted for funding consideration.

In addition to this document, the following compendia of NIOSH research can be accessed on the NIOSH Web site at www.cdc.gov/niosh. Interested readers are encouraged to examine each research compendium for safety and health projects.

- A Compendium of NIOSH Mining Research 2002 (DHHS NIOSH Publication No. 2002–110).
- A Compendium of NIOSH Construction Research 2002 (DHHS NIOSH Publication No. 2003–103).
- A Compendium of NIOSH Health Care Worker Research 2001 (DHHS NIOSH Publication No. 2003–108).

About NIOSH Extramural Research

NIOSH extramural projects are based on proposals submitted by academic and other researchers through the NIOSH Office of Extramural Programs. Applications for research grants, cooperative agreements, training grants, and conference grants are accepted throughout the year, and researchers interested in economics are encouraged to apply. Additional details are available on the NIOSH Web site at www.cdc.gov/niosh/oep/.

Some extramural projects are conducted through a cooperative agreement with the Center to Protect Workers' Rights (CPWR), which is directed to encourage research on the following:

- Innovative pilot or feasibility studies to reduce injury and illness in construction
- Evaluations of interventions geared to developing and testing best practices
- Disseminating information and technology transfer
- Reviewing preventive systems (e.g., policies, procedures, organizational factors) that affect construction
- Ongoing surveillance
- Establishing and reviewing research priorities

CPWR supports an Economics Research Network that is dedicated to examining incentives and underlying economic determinants of safety and health outcomes in construction. Members include researchers from academia, private industry, labor organizations, government agencies, and other research organizations.

NIOSH Economic Research Projects: Intramural

Comparative Analysis of Methods for Calculating Employer Costs of Workplace Illness and Injury

Investigator(s): Tim Bushnell

Affiliation: National Institute for Occupational Safety and Health
Division of Surveillance, Hazard Evaluations, and Field Studies
(513) 841–4428

Partner(s): Larry Chapman
University of Wisconsin

Keywords: employer costs, cost accounting

Purpose:
This project will demonstrate the variety of methods and perspectives used in the United States and other countries for calculating employer costs of workplace illness and injury. The project is also intended to show common difficulties and pitfalls in calculating costs, and to help identify best practices for further development.

Research Summary:
Many attempts have been made to provide a general method or accounting framework for employers to calculate the cost of workplace illnesses and injuries. A number of them have been developed abroad or are otherwise not widely known. Within these methods, there are many differences in focus and emphasis. Many recommendations are conflicting and are questionable from a practical or theoretical standpoint.

This project will identify and characterize several of these methods used to provide guidance for employer cost calculations and systematically compare them. The basis of comparison will be the presence and absence of certain elements and the identification of points of agreement and disagreement. When methods are different, practical and theoretical issues raised by any disagreements will be identified and described. Examination of all of these methods as a group will also provide a picture of the common difficulties and key opportunities associated with employer efforts to calculate cost savings from reducing workplace injury and illness.

Cost Effectiveness of Fall Prevention Interventions for Aerial Lifts in the Construction Industry

Investigator(s): Paul Keane, Chris Pan

Affiliation: National Institute for Occupational Safety and Health
Division of Safety Research
(304) 285–5894

Partner(s): The Center to Protect Workers' Rights

Keywords: economic consequences, economic theory, economic methods, risk analysis

Purpose:
This study will focus on the economic component of a NIOSH Division of Safety Research project entitled the Fall Prevention for Aerial Lifts in the Construction Industry. This field and laboratory study will use engineering tools and methods to redesign equipment and improve work practice controls to reduce fatalities and injuries associated with aerial lifts.

Research Summary:
Falls are one of the leading causes of injury and death in the construction industry. Occupational falls in construction are associated with high rates of days away from work, as well as insurance and workers' compensation costs. Aerial lifts are commonly used in construction. Newer lifts can elevate workers to increasing heights and thus represent a serious and emerging fall hazard. The Occupational Safety and Health Administration research identified 35 deaths between 1986–1990 that were associated with vehicle-mounted elevated work platforms. Approximately 40% of the deaths involved falls, and one third of the incidents involved equipment failures or were related to materials or facilities. When aerial lifts overturn or collapse, there is a high potential for loss of life or serious injury, as well as a high potential for destruction of large items of capital equipment and disruption of construction activities. This project will perform a risk assessment on the causes of occupational falls involving aerial lift platforms in the construction industry and assess the costs of an intervention in equipment design, redesign and retrofitting, as well as costs of interventions to address work practices. The cost effectiveness of each candidate intervention, which includes new designs and work practices, will be evaluated based on its potential to reduce falls and overturns in comparison with cost.

Cost Model for Traumatic Injuries in Mining

Investigator(s): H. Kenneth Sacks, Regina Pana-Cryan, Lynn Elinson, Audrey Podlesny

Affiliation: National Institute for Occupational Safety and Health
Pittsburgh Research Laboratory
(412) 386–6601

Keywords: cost model, mining, fatalities, lost time injury

Purpose:
This project will develop a cost assessment tool and generate cost estimates to help focus injury prevention research.

Research Summary:
The starting point for the cost model will be the Mine Safety and Health Administration (MSHA) injury and illness database. The database provides information about the injured worker's age, occupation, degree of injury, and time lost from work. The model will be based on a societal perspective and will calculate lost earnings and non-market loss (also known as home production). Lost workdays are used as a proxy for lost production, and the model will also include medical costs. Earnings will be derived from union contract data and commercial wage surveys. Future earnings estimates will be adjusted by the employment cost index and life cycle salary growth. Medical costs will be based on the days lost from work and the degree of injury. Aggregated data from the National Council on Compensation Insurance's detailed claims information will be analyzed. Prior analysis has shown that medical costs are linearly related to days lost and benefit class.

Following the cost model development, it will be applied to each injury in the MSHA database between 1997 and 1999. Using these data, the estimates from this model will be used to compare societal costs (medical costs, nonmarket loss, and lost earnings) of fatal and nonfatal lost-time injury by mining commodity sector, work location, and employer type (e.g., mine operator or contractor employer).

Economic and Social Consequences of Injury and Fatality in the Mining Industry

Investigator(s): Thomas W. Camm, Shann R. Ferch, Jami G. Dwyer

Affiliation: National Institute for Occupational Safety and Health
Spokane Research Laboratory
(509) 354–8001

Keywords: economic cost, social consequences, injury, fatality, stress, systems

Purpose:
This project will build on existing expertise at the Spokane Research Laboratory of NIOSH to examine the economic and social consequences of injuries and fatalities in the workplace with a focus on the mining industry.

Research Summary:
Millions of occupational injuries occur each year in the United States in addition to thousands of occupational fatalities. The direct medical costs of injury are often a small percentage of the total impact of occupational injury and death. Little attention is given to the social costs or the indirect and intangible costs associated with workplace injury and fatality. Heightened stress levels associated with high-risk occupations or working conditions, particularly in a setting where a serious injury or a fatality has recently occurred, can have a significant impact on both the productivity and long-term health of workers. The effects of low cognitive levels as a result of high stress levels and unsafe or unhealthy working conditions (whether real or perceived) can also adversely affect a worker's ability to pay attention to work, be aware of at-risk behavior, and work productively.

Using a multidisciplinary approach and research methodologies from systems engineering, the project will include the following interrelated tasks:

- Develop a cost-of-illness method for measuring economic impacts of injury and fatality
- Measure the stress level of workers at mine sites using standardized psychological tests for anger, anxiety, and depression
- Develop a measure for individual differentiation based on Bowen Systems Theory to demonstrate the relation of differentiation to working safely, attention to task, productivity, and personal health
- Apply grounded theory research design to identify why workers put themselves at risk

This project will provide qualitative data to enhance knowledge of the social consequences of occupational injury and fatality. Incorporating this information into existing training programs has the potential for increasing the effectiveness of those programs and reducing the number of occupational injuries and fatalities.

Economic and Social Consequences of Injury at Sand and Gravel Operations

Investigator(s): Thomas W. Camm, Shann R. Ferch

Affiliation: National Institute for Occupational Safety and Health
Spokane Research Laboratory
(509) 354–8001

Keywords: economics, cost of injury, social consequences, systems theory

Purpose:
This project will determine the economic and social costs of workplace injuries at sand and gravel operations.

Research Summary:
A system safety model will be developed to demonstrate how to integrate the safety factors of workers, equipment, and environment into a framework that will assess the social and economic consequences of an occupational injury. Economic costs will be measured based on the cost-of-illness method; social impacts will be measured based on levels of anger, anxiety, and depression as indicators of worker stress. The cost-of-illness approach is the most commonly used method for valuing the cost of an occupational injury. Based on this method, a list of indirect costs associated with injuries at sand and gravel mines will be developed for the project. These indirect costs will include lost earnings, lost fringe benefits, lost home production (e.g. laundry, cleaning, yard maintenance, etc.), employer costs of retraining and re-staffing, coworker costs of lost productivity, and time delays.

Three standardized questionnaires will be used to measure levels of depression, anger, and anxiety: the Beck Depression Inventory, the State-Trait Anger Expression Inventory-2, and the State-Trait Anxiety Inventory (Form Y). The three questionnaires typically take 20 minutes to administer and use indicators of work stress as proxies for social impacts of injury on the worksite. The systems methodology being used for the project, integrating a multidisciplinary approach to measuring the economic and social consequences of injury, will have potential applications for other economic projects within NIOSH.

Economic Cost of Fatal Occupational Injuries in the United States

Investigator(s): Elyce Biddle, Dan Hartley

Affiliation: National Institute for Occupational Safety and Health
Division of Safety Research
(304) 285–5894

Keywords: economic consequences, traumatic fatalities, socio-economic

Purpose:
This project will enhance a standardized method and an interactive desktop computer program that calculates the societal cost of fatal injuries as reported through the National Traumatic Occupational Fatalities (NTOF) surveillance system. The calculated costs from this research can be used in evaluation tools such as cost utility, cost effectiveness, cost benefit, and decision analysis to help allocate limited resources for research and prevention efforts more effectively.

Research Summary:
The NIOSH Division of Safety Research (DSR) recently developed a computerized costing model that calculates societal costs of fatal occupational injuries using the cost-of-illness method, which is based on human capital theory. This project will refine and enhance the computerized costing model previously developed by DSR. The study will focus on the following:

- Expanding the computerized costing model to calculate the cost of occupational fatal injury using Census of Fatal Occupational Injuries (CFOI) data and transferring the technology to each CFOI participating State
- Improving the specificity of the computerized costing model by estimating indirect costs using State-specific wage and benefit data
- Changing application coding from Power-Builder to SAS, which is a more widely used and more standardized application
- Improving the operational utility of the computerized costing model for end-users

In general, cost estimates provide additional information about how injuries affect society. Furthermore, they can improve injury prevention and control program planning, policy analysis, evaluation, and advocacy. With these enhancements, the computerized costing model will provide more accurate cost estimates and operate more efficiently.

Economic Impact Analysis for the Quality Assurance and Administrative Module on 42 CFR 84

Investigator(s): Elyce Biddle, Matt Bowyer, Thomas Camm, Dan Hartley

Affiliation: National Institute for Occupational Safety and Health
Division of Safety Research
(304) 285–5894

Partner(s): John Dacquisto, Gonzaga University
Jim Simon, National Highway and Traffic Safety Administration
Bob Burt, Occupational Safety and Health Administration

Keywords: economic impact, respirator, respiratory protection, quality assurance

Purpose:
This project will evaluate the economic impact of the proposed changes in the quality assurance and administrative module of 42 CFR part 84, Tests and Requirements for Certification and Approval of Respiratory Protective Devices.

Research Summary:
Employers, both large and small, rely on respirators to protect their employees from airborne toxic contaminants. As the last and sometimes the only defense against some acute and chronic health hazards at work, respirators must be reliable and perform in the expected manner. Respirator purchasers and users rely on the NIOSH performance standards and certification program to assure that respirators will perform with a specific efficiency for a definite purpose.

The NIOSH proposed regulatory change would implement new quality assurance requirements that parallel the certification requirements of the International Organization for Standardization (ISO).

This project will develop the economic impact statement to accompany the proposed regulatory changes in 42 CFR part 84. Economic considerations include the impact of the following:

- An annual maintenance fee for maintaining records based on a flat fee per approval
- An increased fee schedule for approval applications
- A quality-assurance fee based on the actual cost of audit
- Potential cost increases to manufacturers related to equipment/process change requirements to achieve regulatory approval for new standards
- Potential cost increases to manufacturers for new or upgraded test equipment to monitor respirators as required by the new regulations
- Potential indirect cost increases to manufacturers associated with the new regulations
- Increased barriers of entry into the respirator manufacturing market

Employers' Workers' Compensation Savings from Prevention

Investigator(s): Tim Bushnell

Affiliation: National Institute for Occupational Safety and Health
Division of Surveillance, Hazard Evaluations, and Field Studies
(513) 841–4428

Keywords: workers' compensation, experience rating, employer costs

Purpose:
This project will provide ways of estimating the impact of employer injury and illness prevention efforts on workers' compensation expenses. Financial arguments for prevention can be very effective, and knowledge of the overall magnitude and pattern of prevention incentives can help to form strategies for promoting prevention.

Research Summary:
A large part of this project will be the analysis of experience rating plans in many States. These plans consist of formulas that generate an insurance premium adjustment for an employer based on the number and cost of claims filed in the past by that employer's workforce. The size of the premium reduction resulting from a given reduction in workers' compensation claims depends on the size of the employer, the State, and the industry. This research will produce estimates of premium dollars saved per dollar of claims avoided and show how this varies by employer size, State, and industry.

Another part of this project will be to analyze data on premiums paid and the cost and number of claims for a large set of (nonidentified) employers in at least one State with a low level of rate regulation. The purpose of this analysis is to learn the extent to which premiums may be affected by claims experience other than through the experience rating mechanism. Insurance carriers in most States have the freedom to adjust premiums to meet competition or reflect their own assessment of employers' risk profiles.

The project will also include the collection and synthesis of information that is needed for estimating the premium savings available to any group of employers for preventing any type of illness or injury. Examples of needed information are costs of claims by claim type, proportion of workplace illnesses and injuries resulting in claims, geographical and employer size distribution of industries, and the relationship between industry classification systems.

Estimated Costs of Injuries Caused by Falling Through Roof Openings, Surfaces, and Skylights

Investigator(s): Thomas Bobick, Paul Keane, Elyce Biddle, James Spahr

Affiliation: National Institute for Occupational Safety and Health
Division of Safety Research
(304) 285–5894

Keywords: construction, falls through openings, costs

Purpose:
This research will assess the degree to which elevated costs can be associated with falls in the construction industry, specifically falls to lower levels through roof or floor openings or through skylights. These incidents are associated with injuries involving high numbers of days away from work.

Research Summary:
Fall-related occupational injuries are serious problems in the U.S. construction industry. An important subset of the fall-to-lower-level category involves workers falling through existing roof or floor openings and through roof or floor surfaces, including skylights. These fall-through injuries are among the most severe cases for median number of days away from work.

Data analyses will be conducted for injuries during 1992–2000 using the Survey of Occupational Injuries and Illnesses maintained by the BLS. This survey is an estimate of values from a sample of approximately 200,000 private establishments.

To obtain an estimate of costs related to fall-through incidents, the Liberty Mutual Workplace Safety Index will be used. This index used their claims information, along with data from the BLS and the National Academy of Social Insurance, to determine the total in wage and medical payments paid in 1998.

The total cost of a serious injury is the summation of direct and indirect costs. Generally, indirect costs are estimated to be 2 to 5 times the magnitude of direct costs. For this analysis, however, a very conservative estimate will be used that assumes direct and indirect costs are of equal magnitude. The dissemination of cost estimates will provide employers with the basis to conduct cost-effectiveness analyses for potential workplace interventions, such as guardrail systems or protective skylight screens.

Evaluation of Injury Prevention Efforts in Nursing Homes

Investigator(s): Tim Bushnell, Robert Park

Affiliation: National Institute for Occupational Safety and Health
Division of Surveillance, Hazard Evaluations, and Field Studies
(513) 841–4428

Keywords: workers' compensation, musculoskeletal injuries, nursing homes, intervention effectiveness, employer costs

Purpose:
This project will evaluate whether a set of services and programs offered by the Ohio Bureau of Workers' Compensation (BWC) to Ohio nursing homes has succeeded in reducing musculoskeletal injuries among nursing home employees involved with lifting and transferring residents. A component of this project is the calculation of the workers' compensation premium savings that Ohio nursing homes may have realized as a result.

Research Summary:
In 2000 and 2001, the Ohio BWC made a special effort to increase the number of nursing homes taking advantage of its programs for the prevention of workplace injuries. Nursing homes with relatively high rates of injury were especially targeted. The principal programs involved the following:

- A variety of short safety and health courses, primarily for managers and supervisors
- Consulting services in the areas of ergonomics, safety and hygiene, and safety program development
- A safety grants program subsidizing the cost of patient lifting equipment

The principal data for this project will be provided by the Ohio BWC as a part of their effort to better understand the effectiveness of their injury prevention efforts. These data include the date, type, and amount of services received by each nursing home, and data on workers' compensation claims filed by nursing home employees both pre- and post-intervention (with personal identifiers removed). Additional expertise and data relating to Ohio nursing homes are being supplied by the Scripps Gerontology Institute.

Estimates will be made of reductions in the number of workers' compensation claims and in total benefit costs and days away from work due to increased BWC services to nursing homes. These estimates will be combined with data on nursing home premiums and their method of calculation to estimate the impact of Ohio BWC services on the workers' compensation expenses of nursing home employers.

Evaluation of the Effectiveness of a Logger Safety Training Program

Investigator(s): Jennifer Bell

Affiliation: National Institute for Occupational Safety and Health
Division of Safety Research
(304) 285–5894

Keywords: logging, training, injury prevention, costs

Purpose:
This project will determine the effectiveness of a logger safety training program in reducing logging-related injuries and injury costs. It will also determine which types of injuries are most affected after training.

Research Summary:
With an estimated lifetime fatality risk of 62.7 per 1,000 full-time workers, logging is one of the most hazardous occupations and industries. Of all small business industries, logging has one of the highest risks for occupational injuries and fatalities. Despite the widespread awareness of the occupational dangers of logging, fatality rates remain high. Because of the high risk for traumatic injuries, loggers have been identified by the National Occupational Research Agenda (NORA) as a priority research group. The state of West Virginia has one of the highest logging fatality rates in the nation based on 1992–1997 BLS Census of Fatal Occupational Injuries data.

This study will evaluate the effectiveness of a new logger safety training program started in West Virginia called the Loggers' Safety Initiative. Specialized training is provided for all members of the logging crew (fellers, skidder/dozer operators, trucker/loader operators, owner/operators). The results of this study will provide a definitive statement about the usefulness of the training program in reducing logging injury rates and associated injury costs based on workers' compensation claims data. The results will also identify the types of injuries most and least affected by the training in terms of reducing injuries and costs. The injury experience and associated injury costs of logging companies not in the training program will also be examined. The results of this study will be disseminated so that States and individual logging companies can use this information to initiate or refine logging safety efforts.

Exposure Assessment and Control Technology for Hexavalent Chromium

Investigator(s): Leo Blade, Marjorie Wallace, Jennifer Topmiller, Amir Khan, James Bennett, Keith Crouch, Anthony Martinez

Affiliation: National Institute for Occupational Safety and Health
Division of Applied Research and Technology
(513) 533–8462

Partner(s): Office of Regulatory Analysis
Occupational Safety and Health Administration

Keywords: lung cancer, hexavalent chromium, Cr(VI), engineering controls, control technology, economic feasibility

Purpose:
This study, funded under an interagency agreement between NIOSH and OSHA, will provide a characterization of occupational exposures to hexavalent chromium (Cr[VI]) and will document engineering exposure-control measures and work practices affecting those exposures by conducting field surveys in a variety of industries. OSHA will use the results of this study to determine the technical and economic feasibility of a new standard for occupational exposure to Cr(VI). NIOSH classifies Cr(VI) as a potential occupational carcinogen on the basis of observed increases in the risk of lung cancer among groups of exposed workers, and on other data.

Research Summary:
OSHA has requested assistance from NIOSH to obtain exposure and exposure-control information useful to the rulemaking for Cr(VI), particularly for the required technical and economic feasibility evaluation. The potential for worker exposures to Cr(VI) had been identified in industrial sectors represented by at least 46 different two-digit Standard Industrial Classification (SIC) codes, and OSHA has indicated that inadequate exposure and control information was available for many of these sectors. This study will conduct field industrial hygiene and engineering surveys at 21 selected sites, which represent a variety of industrial sectors, processes, and operations. A principal objective of this study is to measure full-shift personal breathing-zone exposures to particulate-borne Cr(VI) in air. Another principal objective is to identify and describe the exposure-control technology and work practices used in these operations, and to recommend additional control measures when appropriate. In addition, extensive supplemental information, including costs associated with the control measures, will be collected from participating sites and is intended to represent, to the extent feasible, typical conditions. OSHA will use the results of this study to determine the technical and economic feasibility of a new standard for occupational exposure to Cr(VI).

Exposure Assessment and Control Technology for Silica

Investigator(s): Alan Echt, Michael Gressel, Daniel Almaguer

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Division of Applied Research and Technology
(513) 533–8462

Partner(s): Office of Regulatory Analysis
Occupational Safety and Health Administration

Keywords: silicosis, crystalline silica, engineering controls, control technology, economic feasibility

Purpose:
This project will evaluate the technical feasibility of controlling occupational exposure to crystalline silica. Information from this study about the types and costs of engineering controls and the extent of exposure to silica in various industries will be provided to OSHA for their use in determining the technical and economic feasibility of the proposed standard for occupational exposure to silica.

Research Summary:
Occupational exposures to respirable silica in the form of quartz or cristobalite increase a worker's risk for silicosis and lung cancer. An estimated 2 million American workers are at risk for silicosis, 73% of whom are in manufacturing industries. OSHA has requested assistance from NIOSH to obtain information about exposure and engineering controls to establish the technical and economic feasibility of the proposed standard for silica. In this study, NIOSH will conduct industrial hygiene sampling surveys at more than 30 sites to assess worker exposures to crystalline silica under a variety of conditions and control measures. The principal objectives of these surveys are the following:

- Estimate full-shift respirable particulate exposures to crystalline silica in various industries including a representative sample of both small (fewer than 500 employees) and large employers in the United States
- Determine (or measure) the full-shift exposures associated with various processes and associated control techniques
- Identify short, high-exposure tasks that are amenable to control

Facilities and workers selected for sampling will include the different processes or jobs, exposures, and engineering controls commonly found where crystalline silica is used.

Feasibility of Forecasting U.S. Occupational Injuries and Illnesses: A Pilot Project

Investigator(s): Laura Blanciforti

Affiliation: National Institute for Occupational Safety and Health
Health Effects Laboratory Division
(304) 285–6121

Keywords: economic consequences, injuries, illnesses

Purpose:
This pilot project will explore the feasibility of updating an existing study using econometric techniques to predict the economic costs of occupational injuries and illnesses. Its main goal is to improve the economic information currently being used by NIOSH decision makers and other occupational researchers to answer questions related to the economic burden of all occupational injuries and illnesses.

Research Summary:
In the past, costs of occupational injuries and illnesses have been estimated using the human capital method, a statistical accounting approach. This method is understandable and straightforward, but it is a massive undertaking when considering all occupational injuries and illnesses. Such estimates, however, are important measures of overall cost and are useful when comparing the dollar costs of other injuries and diseases. Data series used in earlier cost estimation have since been revised and now provide additional information. Also, many data series useful in calculating related regressions have been revised or updated. For example, earnings, fringe benefits, medical costs, and insurance have all undergone revision. Furthermore, characteristics of the workforce have changed over the last 10 years.

This project has three tasks. The first will be the model-building segment of cases of occupational injuries and illnesses. Here, econometric models of occupational injuries and illnesses for the 1992 to 2000 time period will be developed using characteristic information gathered by BLS, NIOSH, and other government agencies, as well as regression and structural equation techniques. These models will generate estimates using data from 1973 to 1992, and they will be used to predict the 1992 and beyond values. This will provide data for a root mean square analysis comparing actual and forecasted values from 1997 to 2000. The second phase of the study will be the cost-generating segment and it will involve data collection of wages, medical costs, and other variables for 1997–2000. If necessary, price indexation methods and other common statistical procedures to link old and new data will be used. The third phase will be the forecasting segment which will combine both prior phases to develop total estimated costs of occupational injuries and illnesses. Forecasts will then be made over various time segments such as 1 to 3 years, 3 to 5 years, and 5 to 10 years.

Feasibility of Matching Administrative Database Records from Multiple Washington State Sources

Investigator(s): Elyce Biddle, Kristi Anderson

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Division of Safety Research
(304) 285–5894

Keywords: intervention evaluation, economic evaluation, apprenticeship, training programs

Purpose:
This project will determine the feasibility of collecting detailed administrative data from the State of Washington that could be used to evaluate the safety, health, and economic outcomes of apprenticeship and training programs overseen by the Washington State Apprenticeship and Training Council.

Research Summary:
In 1999, there were 297 programs with more than 10,000 active apprentices in Washington. On completion, the apprentice receives a State-issued certificate that identifies his or her qualifications as a journey-level worker. In 1999, 1,044 apprentices received such certification in 92 occupations. Occupations ranged from firefighters to dispensing opticians to watershed restoration/resource workers. Nearly 75% of the class of 1999 were certified in construction occupations.

Apprenticeship and training programs are usually developed with a primary focus on developing a highly skilled and diverse workforce. Although these programs may be evaluated for their ability to create such a workforce, they are rarely evaluated for their impact on the safety and health of the worker and the economic outcomes of the program.

The administrative information maintained in Washington include databases of completed apprenticeships, occupational injury and illness experience, and wages and hours. Matching individual worker records from each data collection system should be possible because each identifies a worker using a single common identifier.

Should the matching of data from multiple Washington administrative sources prove feasible, this information would provide the ability to conduct a training effectiveness evaluation using safety, health, and economic outcome measures. Results from such an evaluation could provide valuable information to similar programs in other States.

Followback Study of Assault Cases Reported to a Sample of Hospital Emergency Departments in the United States

Investigator(s): Dan Hartley, Lynn Jenkins, Kristi Anderson

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Division of Safety Research
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Partner(s): Tom Schroeder, Phil Travers
Consumer Product Safety Commission

Keywords: assaults, workplace violence, occupational injury

Purpose:
This followback study will examine the risk factors, circumstances, and economic outcomes of workplace violence incidents that resulted in treatment at a participating National Electronic Injury Surveillance System (NEISS) hospital emergency department. This project is a component of the Congressional directive for NIOSH to develop a workplace violence prevention initiative.

Research Summary:
NEISS is a database of injuries treated in a nationally representative sample of U.S. hospital emergency departments. This study uses narrative data from NEISS to determine potential cases for a followback study related to workplace assaults. For a 1-year period, the followback study will use a telephone interview survey to collect information related to the circumstances, risk factors, and outcome measures for workplace violence. This information will help fill the gaps in workplace violence research by describing the nature and magnitude of nonfatal injuries resulting from workplace violence, examining the economic burden of workplace violence to the injured worker, and identifying additional risk factors.

This study covers data collection for December 2002 through September 2003; approximately 1,000 interviews will be conducted. In addition to an extended narrative description of the injury incident, the followback interview will cover items such as general workplace organization, personal worker characteristics, perpetrator characteristics, security measures, prevention strategies, return to work, and bearers of the cost of the injury. The data collected will provide critical information for understanding the nature and impact of nonfatal workplace assault on a victim's ability to earn a living in his/her chosen profession, and will contribute to preventing violence in the workplace.

Interaction Between Safety and Productivity: A Case Study Using Lightweight Block

Investigator(s): Matt Bowyer, Elyce Biddle, Tom Bobick

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Division of Safety Research
(304) 285–5894

Partner(s): Michael McCann and Laura Welch, Center to Protect Workers' Rights
Dan Anton and John Rosecrance, University of Iowa

Keywords: safety, construction, economic consequences

Purpose:
This project will determine how the introduction of the new lightweight block technology affects worker productivity in construction and, in turn, how this productivity difference affects the safety of the workplace.

Research Summary:
The standard weight block is a plain-faced 8"x8"x16" concrete block with a weight of approximately 35–38 pounds. Recent production methods that use expanded shale lightweight aggregate or haydite produce an 8"x8"x16" block that usually weights 26 lb or less. This block, which is known as lightweight block, adheres to the ASTM–C90–99A standard of 105 lb/cubic foot density, is fire resistant and has good insulation capacity. The drawback to lightweight block is a higher price compared with standard weight block.

The primary objective of this study is to elucidate the potential relationship between new technologies, productivity, and safety using lightweight block as a case study. To determine this relationship the project will do the following:

- Determine differences in productivity between masonry workers using lightweight block and standard weight block
- Determine differences in injury incidence, duration, and type between workers using lightweight block and workers using standard weight block

For the productivity evaluation, a case-control study will determine productivity and injury differences between lightweight block and standard weight block. On selected field study sites, time study analysis will be used to determine the number of blocks laid during an 8-hour workday for both workers using lightweight block (cases) and workers using standard weight block (controls). Differences in rates and types of injury will also be analyzed using company records, including workers' compensation data.

Measuring the Direct and Indirect Costs of Asthma

Investigator(s): Laura Blanciforti

Affiliation: National Institute for Occupational Safety and Health
Health Effects Laboratory Division
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Keywords: economic costs, asthma, workplace exacerbation

Purpose:
This project will examine the hypothesis that the cost of care for asthma is greater for patients who report workplace exacerbation than others. It will focus on the economic component of a NIOSH Division of Respiratory Disease Studies project entitled Workplace Exacerbation of Asthma Study.

Research Summary:
This component of the Workplace Exacerbation of Asthma Study will look at the subjects' use of the health care system in the year before being interviewed, as determined by a search of computerized databases for out-patient care, in-patient care, and pharmacy dispensings. The study will estimate the cost or charge for each item listed, which can then be used to arrive at a total cost of asthma care for one year. The indirect cost of care will be based on items in a study questionnaire. The cost of care for those with work-related exacerbation of asthma will be compared with the costs for subjects without work-related exacerbation. The statistical significance of the difference in costs for those with and without workplace exacerbation will be accomplished using the Student's t-test. Also, economic costs will be modeled to examine whether workplace exacerbation and other factors (e.g., age, gender, etc.) are associated with cost.

Nursing Home Back Injury Intervention Study

Investigator(s): Jim Collins, Jennifer Bell

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Partner(s): BJC HealthCare

Keywords: low-back pain, nursing homes, workers' compensation, economic consequences

Purpose:
This study will evaluate the impact of engineering controls (lifting equipment) and medical management programs in reducing the incidence, severity, and costs associated with injuries to nursing aides and orderlies that occur during resident-transferring tasks in nursing homes.

Research Summary:
Nursing homes have the highest injury rate of all health services. Employees in nursing and personal care homes suffer an estimated 200,000 work-related injuries and illnesses a year. In addition, nursing aides, orderlies, and attendants suffer the highest prevalence (18.8%) and report the most annual cases of work-related back pain (n=269,000) among female workers in the United States. BLS reported that musculoskeletal injury rates for nursing homes are highest among all industries, surpassing even the construction industry.

In nursing homes, many residents require round-the-clock assistance with the basic activities of daily living. This study will evaluate the impact of engineering controls (lifting equipment) and medical management programs on reducing the incidence, severity, and costs associated with injuries to nursing assistants that occur during resident-transferring tasks in nursing homes. Workers' compensation records, OSHA injury records, nursing home demographic data, and nursing assistant demographic data will be collected to describe the injury experience and injury-related costs, pre- and post-intervention prevention programs, and risk factors. The findings from this study will provide recommendations on reducing the risk of back injury to nursing home workers.

Revision of the OSHA "$AFETY PAYS" E-Tool for Employers

Investigator(s): Elyce Biddle, Dan Hartley

Affiliation: National Institute for Occupational Safety and Health
Division of Safety Research
(304) 285–5894

Partner(s): Robert Burt, Jens Svenson, and Edward Stern
Occupational Safety and Health Administration

Keywords: cost of injury, cost of illness, employer costs, economic consequences

Purpose:
This collaborative project will update and enhance the capabilities of an existing electronic tool that provides employers with an economic measure of the impact of occupational injuries and illnesses on their profitability.

Research Summary:
Introduced in the 1980s by OSHA, $AFETY PAYS is an interactive software program that uses a company's profit margin, the average costs of an occupational injury or illness, and an indirect cost multiplier to project the amount of sales a company would need to generate to cover those costs. Since that time, substantial changes in levels of the average and indirect costs indicate the need for revision of the underlying components of the estimation process. Additional cost categories will be added to the original OSHA program, and the computer program will be enhanced by providing the ability to customize the program according to a firm's sophistication in capturing their costs. Firms that do not collect any cost information will be provided default values for estimation purposes.

Project goals are to raise awareness of the cost of occupational injury and illness and to increase the motivation for employers to adopt injury and illness prevention efforts. To accomplish these goals, the computer program will be widely disseminated to employers in the United States. CDs will be provided to nearly 100,000 employers from OSHA and NIOSH distribution lists and to OSHA staff for outreach and compliance efforts. This product will be made available on the NIOSH and OSHA Web sites.

Technology Investment Agreement with Advanced Technology Institute

Investigator(s): Stephen Hudock

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Division of Applied Research and Technology
(513) 533–8462

Partner(s): Advanced Technology Institute

Keywords: shipyard, ergonomics, intervention evaluations, cost-effective

Purpose:
This project will systematically study a variety of construction, repair, and recycling processes in the shipyard industries to assess job risk factors and devise and implement cost-effective ergonomic controls.

Research Summary:
The domestic shipbuilding, ship repair, and ship recycling industries have historically had injury and illness incidence rates 2–3 times higher than those of general industry, manufacturing, or construction. Approximately one-half of all shipyard injuries can be considered musculoskeletal disorders.

Because of the number of multifaceted job tasks performed by the various trades in the ship construction, repair, and recycling industries, fitting the job to the worker may not be practical or applicable. Additionally, ergonomic engineering controls employed in other industries are not unilaterally employable because of the diverse job activities in the shipyard industries. It is imperative that research be undertaken to better understand the high rates of musculoskeletal disorders and associated job risk factors.

This study will be conducted in three phases. The first phase will include conducting walk-through surveys of domestic shipyards to examine trade- or department-specific injury and illness rates, conducting job risk factor assessments of the various trades or job processes, and determining the willingness of shipyards to cooperate in the collection of the data and the implementation of pilot ergonomic interventions.

The second phase will quantify job risk factors by using exposure assessment tools for selected job processes in selected shipyards, recommend unique ergonomic engineering controls to reduce the exposure to the risk factors associated with the specific job processes, and implement pilot ergonomic interventions for the specific job processes.

The third phase will evaluate the cost-effectiveness of the ergonomic interventions and disseminate the results of the study to the public. The broader application of the developed ergonomic interventions will be used to transfer the lessons learned to other shipyards and boatyards and other industries such as manufacturing and construction.

Willingness-to-Pay for a Safer Work Environment in Alaska: A Pilot Study

Investigator(s): Elyce Biddle, Diana Hudson

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Division of Safety Research
(304) 285–5894

Partner(s): Alaska Marine Safety Education Association (AMSEA)

Keywords: willingness-to-pay, traumatic injury, fisherman

Purpose:
This pilot study will do the following:

- Identify the most efficient or appropriate survey method to determine willingness-to-pay for a safer work environment by commercial fishermen in Alaska
- Derive baseline measurements of the economic impact of injuries and deaths to commercial fishermen in Alaska, using contingent valuation and conjoint analysis methods

Research Summary:
Commercial fishermen in Alaska have some of the most dangerous jobs in the Nation. Commercial fishermen represented 217 (33%) of the 648 occupational fatalities that occurred in Alaska during 1990–1999. The annual fatality rate of 124 per 100,000 workers is 28 times the overall U.S. occupational fatality rate.

This project will survey commercial fishermen in Alaska using three different methods of survey administration—telephone, mail, and face-to-face interviews. Each of the survey groups will be administered one of two different survey instruments: either a closed-ended bid-type questionnaire, or an open-ended questionnaire to make up a total of six survey groups. The response rates for the survey and each survey item will be determined to derive variance estimates for future studies and to determine the most efficacious way to conduct a larger willingness-to-pay survey. Econometric models will be developed that are capable of producing estimates of willingness-to-pay by commercial fishermen should a more robust study be undertaken in the future. Cost estimations from the econometric model could then be used to compare Alaska commercial fishermen to other groups, both nationally and internationally.

NIOSH Economic Research Projects: Extramural

Adult Asthma as a Predictor of Work Loss and Disability

Investigator(s): Paul Blanc

Affiliation: University of California
(415) 476–7377

Keywords: social/economic consequences, asthma, risk factors, labor force participation

Research Summary:
Asthma is common and costly among adults at peak ages of labor force participation. The risk factors for adverse impacts or the factors promoting better occupational outcomes are not well delineated. In addition to illness severity, demographic and psychosocial factors and the nature of working conditions (work exposures, physical demands, job structure) have an impact on work disability. The proposed study will provide statistically powerful estimates of the occupational impacts of asthma among adults of working age and the factors associated with productivity, wage, and work loss.

A random sample of pulmonary and allergy internist specialists initially enrolled 601 persons with asthma identified in patient visit logs. This established panel has completed 45-minute baseline and followup computer-assisted telephone interviews. A supplemental sampling frame of persons with asthma identified from family practitioners is in progress (target baseline n=180). The interviews assess disease severity and other covariables using established survey instruments; work factors are assessed both by interview and by linking to established job factor matrix schemes. The study will carry out an extended longitudinal followup study of this cohort. The analysis will test predictive models for productivity, wage loss, and work disability among adults with asthma.

Causes and Effects of Compliance with OSHA Standards

Investigator(s): John Mendeloff

Affiliation: University of Pittsburgh
(412) 648–2651

Keywords: OSHA, compliance costs, productivity, regulation

Research Summary:
This project will provide new insights into the determinants of compliance with OSHA standards and into the effects of compliance on the total factor productivity and capital investment at inspected establishments. This information can, in turn, be used to estimate the costs of compliance. All of these contribute to our understanding of the OSHA enforcement process, which is arguably the central public policy intervention addressing occupational injuries and illnesses. The knowledge gained can also help OSHA target its enforcement efforts.

This project will create a dataset linking information about OSHA inspections from 1972 to the present with confidential establishment-level Census data, the Longitudinal Research Database, which combines economic data from the Census of Manufacturers, conducted every 5 years, and the Annual Survey of Manufacturers.

Although a similar dataset has been extensively used to study EPA enforcement over the last decade, this will be the first time it has been used to study OSHA. Until now, studies of the determinants of compliance have used only the information available in OSHA's own inspection data system. No prior studies of the determinants of compliance have used data on plant productivity.

In addition to examining overall patterns of compliance, this research will focus on compliance with health standards, compliance with new standards, and compliance with standards that are clearly related to injury prevention.

Regression analyses will examine several different measures of compliance, adding explanatory variables on establishment characteristics (plant age, wage levels, capital investment, and productivity) and firm characteristics (size and profitability) to the variables already in the OSHA file. Regressions will also be used to examine the effects of compliance on capital spending, productivity, and other measures of the establishment's economic performance. Adjustments to address the potential endogenity of these variables will be carried out.

The information on productivity and investment will be used to make estimates of the compliance costs entailed by the lead and cotton dust standards adopted in the late 1970s and compare them with prospective estimates of those compliance costs derived during the standard setting process.

Disability Risk in Work-Related Musculoskeletal Injuries

Investigator(s): Gary M. Franklin

Affiliation: University of Washington
(206) 685–7080

Keywords: carpal tunnel syndrome, low back disorders, long-term disability, economic consequences

Research Summary:
The vast majority of cost and lost productivity in workers' compensation is due to work-related musculoskeletal injuries. Among injured workers with these conditions, a small proportion (5%–10%) develop long-term disability, which accounts for most (80%–85%) of the cost and lost work. In the absence of an accurate method to identify workers at risk for long-term disability, secondary prevention efforts cannot be well targeted. This is a 5-year, population-based prospective study among Washington State workers with back injuries and carpal tunnel syndrome.

The principal aim is to develop an accurate predictive model of risk for long-term disability among five key risk dimensions: employment-related factors, biomedical- and health-care-related factors, sociodemographic factors, administrative and legal factors, and psychosocial factors. To accomplish this aim, a baseline interview among approximately 3,000 eligible workers will be conducted within 2–6 weeks of workers' compensation claim allowance. A continuous measure of disability outcome (lost time compensation) will be determined from a computerized database at one year. Additional important outcomes will be determined by a followup interview at one year (functional status, work status) and from computerized records (work status, wage status). Multivariate survival analysis within and across risk dimensions will be used to develop the principal risk models, including adjustment for injury severity. The reliability of determining severity from medical records will be determined as well.

Another aim of this study is to develop a brief risk assessment instrument for both low-back and carpal tunnel injuries, which would be useful to physicians when first treating injured workers. The main focus of these instruments would be on those risk factors that may be modifiable and that may be amenable to early intervention to prevent disability. Statistical analysis for this aim will focus on sensitivity and specificity of risk factor combinations. These risk assessment instruments will be pilot tested among physicians participating in an occupational health care quality improvement project. The last aim of this project is to determine the rate and predictors of reinjury among the original low back injury cohort 2 years after the initial injury.

Economic and Job Hazard Analysis of Sandblasting Substitutes

Investigator(s): Beth Rosenberg

Affiliation: Tufts University
(617) 636–6709

Keywords: economic impact, effectiveness research, sand, silica substitutes, sandblasting

Research Summary:
Silicosis is a disabling and often fatal lung disease that is completely preventable. The recent designation of silica as a lung carcinogen by the International Agency for Research on Cancer (IARC) makes the control of silica urgent. The connection between silica and tuberculosis is well known, and with the rise of drug-resistant tuberculosis, the need to control silica is clear.

Sandblasting results in high silica exposures. NIOSH has produced excellent research on the industrial hygiene aspects of using blasting substitutes, yet little research has been done on the health effects of substitutes not associated with chemical exposures.

With all the much needed focus on technologies to reduce silica exposure, we must be mindful that we do not introduce new hazards into the workplace. Numerous unintended consequences have resulted from well intentioned interventions because the focus has been on controlling a single hazard rather than assessing the full range of impacts in a work environment. To evaluate an intervention fully, we need an integrated approach to the workplace. Furthermore, before any research can be useful in helping contractors decide which method to choose, the economics of each technology must be assessed.

This study will address the potential health and economic impacts associated with substituting other materials for silica sand and the technologies to deliver those substitutes in abrasive blasting.

Economic Analyses of Engineering Control Interventions for Drywall Sanding Construction Activities

Investigator(s): Joseph Ventura (Principal Investigator, United Labor Agency), Dan Ashyk (Cleveland State University), Leo M. Blade (NIOSH), Tim Bushnell (NIOSH)

Affiliation: Painters Health and Safety Fund
(404) 239–4575

Keywords: drywall finishing, engineering hazard controls, productivity, respirable particulate, crystalline silica

Research Summary:
In the first phase of this project, questionnaire-survey instruments were developed to query drywall contractors and drywall-finishing workers about practices, costs, experiences, and attitudes associated with conventional techniques and with the use of the proven engineering control devices. The survey instruments were administered to union drywall finishers and union drywall contractors in several areas of the country in 2001. These surveys revealed that engineering controls (vacuum attachments) have been used by most respondents to protect property and other building occupants, but rarely used to protect workers. Opinions vary widely on whether and how much these controls reduce productivity, but many perceive them to be slow, awkward, and cumbersome.

The next phase of this project is a field study to document drywall contractors' and drywall-finishing workers' practices, costs, productivity, and quality of work with and without dust-control devices. Drywall contractors and owners of properties needing drywall finishing are being enlisted to provide construction sites where field tests of drywall sanding with dust controls can be carried out alongside drywall finishing with conventional techniques. Secondary factors being evaluated during the field surveys include workers' exposures to noise, airborne respirable particulate and crystalline silica, and other hazards. Real-time video exposure monitoring is being employed to collect data for multiple aspects of the field study. Advantages of using controls, as well as reasons for any drawbacks of using controls will be identified and documented. The findings will be disseminated to building owners, drywall finishing contractors, drywall finishers, and other interested parties.

This project will characterize and address real and perceived barriers (economic and other) to the adoption and use of proven engineering dust-control measures for the protection of the health of workers performing drywall-finishing operations in construction projects. Findings are expected to lead to suggestions concerning marketing, training, or engineering to overcome these barriers.

Economic Impact of Occupational Injury and Illness

Investigator(s): Sue Dong

Affiliation: Center to Protect Workers' Rights
(301) 578–8500

Keywords: economic impact, injury and illness, cost, workers' compensation, self-employment

Research Summary:

The more than 194,000 annual lost-workday injuries and illnesses in construction result in considerable economic costs to workers, their families, employers, and society, yet little research has been done on describing and measuring these costs. Currently, information about the costs of injuries and illnesses derives mainly from workers' compensation, but workers' compensation does not address all costs, nor does it cover all workers. For example, little information has been available about more than 2 million self-employed workers in the construction industry.

This project is expected to accomplish the following:

- Quantify costs of occupational injury and illness and the burden on construction workers and their families, especially the costs incurred by workers not typically addressed in existing approaches to the problem
- Determine who pays the costs of occupational injury, illness, and disability according to workforce characteristics
- Estimate the costs of leading injuries and illnesses in construction

The Medical Expenditure Panel Survey (MEPS) and the National Health Interview Survey (NHIS) will be linked together for this study.

The initial investigation of the data sets has been done. Variables related to occupational injuries and medical expenditures selected from the Medical Condition File and Full-Year Consolidated Data File have been merged. Because of constraints under the confidentiality guidelines of the Agency for Healthcare Research and Quality (the agency sponsoring the survey), some MEPS data cannot be released to the public. An application for using this confidential data has been submitted and approved. Currently, the linkage file—1996 NHIS/1997 MEPS Public Use Record Linkage—has been obtained and will be used to link MEPS and NHIS for the data analysis.

Employment Impact of Workplace Injuries in Five States

Investigator(s): Leslie I. Boden

Affiliation: Boston University
(617) 638–4620

Keywords: social/economic consequences, intervention impacts, workers' compensation, earnings differentials

Research Summary:
This study will develop standardized methods to measure the impact of workplace employment and earnings that can be used in a variety of settings where different data are available. These measures allow more effective targeting of prevention resources. The study also will quantify the impact on earnings when employers promote rehiring of injured workers, and it will measure the differential impact of workplace injuries and illnesses on men and women and on younger and older workers. Finally, it will develop methods for comparing average lost earnings among States that differ in important ways—with disparate industrial mixes, unemployment rates, and so on. This should improve our understanding of how interstate variation in laws, practices, and regulation affect consequences of workplace injuries and illnesses.

To accomplish these goals, both parametric and nonparametric statistical methods will be used that are designed to provide unbiased measures of the impacts of interventions (which, in this case are the workplace injuries and illnesses). This study will compile and analyze individual longitudinal data on more than 500,000 injured workers in 5 States. The primary data on injured workers in each state will consist of workers' compensation administrative records on all lost-time injuries and unemployment compensation longitudinal quarterly earnings and employment data covering at least 7 consecutive years. Comparison groups will include workers with very-short-term injuries, workers with workers' compensation claims involving only medical payments, and uninjured workers matched on preinjury employer and preinjury earnings. The sensitivity will be tested of the results to the choice of statistical method and comparison group.

Geographic Variation in Spine Care Among Injured Workers

Investigator(s): D. Rischitelli

Affiliation: Oregon Health and Science University
(503) 494–4398

Keywords: health services research, low-back pain, workers' compensation

Research Summary:
This proposal addresses two National Occupational Research Agenda (NORA) priority areas: Health Services Research and Low-Back Pain. Back pain among workers is an enormous medical, social, and economic burden in the United States. Back disorders account for 27% of all disabling occupational injuries in the United States and the average direct cost of low-back-injury claims is more than twice that of other occupational injury claims combined. The primary goal of the study is to examine community differences in the rate and types of spinal surgery performed on injured workers, using small-area analysis. Small-area analysis is a commonly employed method in health services research, but there have been limited applications of this technique in occupational health research. Oregon, as well as a number of neighboring Western States, has elevated rates of spine surgery compared with the rest of the Nation. Significant local variation exists among communities based on prior analyses of Medicare claims data. We plan to evaluate whether a similar pattern of local variation exists for workers' compensation claims and to evaluate factors contributing to observed variations including physician specialty, physician supply, source of payment, and the effect of managed care. This project will pilot the use of an existing comprehensive state database of workers' compensation medical payments that provides rich opportunities for health services and outcomes research in occupational health. The methods described in this application can be applied to other geographic units or other diagnoses and thereby serves as a model for analyzing the individual, community, and provider variables that influence the treatment of work-related injuries and illnesses.

Health and Socioeconomic Consequences of Nonspecific Building-Related Illness (NSBRI)

Investigator(s): Carrie Redlich

Affiliation: Yale University
(203) 737–2817

Keywords: socioeconomic consequences, nonspecific building-related illness, risk factors

Research Summary:
This study will determine the health and socioeconomic consequences of nonspecific building-related illness (NSBRI or sick building syndrome) in workers diagnosed with this prevalent disorder. More than half of the U. S. workforce is now employed in indoor nonindustrial environments. Various symptoms and illnesses have increasingly been reported in such nonindustrial indoor environments. NSBRI refers to a common nonspecific disorder that is usually associated with a particular building. Although objective physiologic abnormalities are generally not noted, NSBRI can be extremely unpleasant and an important cause of disability and lost work time. Despite this, NSBRI has received scant scientific attention from a clinical and economic perspective. Little progress has been made in establishing the following:

- Diagnostic criteria
- The natural history or clinical course of NSBRI
- The social and economic consequences of this common and important occupational health problem
- The predictors of adverse outcomes

Our aims are as follows:

- Identify and classify NSBRI cases using several different case definitions of NSBRI
- Determine associations between the different case definitions of NSBRI
- Characterize the natural history of NSBRI following diagnosis
- Determine which host factors (i.e. age, marital status, initial symptoms) and workplace factors (i.e., job stress, work environment) are associated with disease progression and severity
- Determine the effect of NSBRI on socioeconomic outcomes (i.e., work disability, employment status, financial status)
- Determine which host factors and workplace factors are associated with more adverse socioeconomic outcomes

The overall study design will be a retrospective longitudinal followup study of 75 patients diagnosed with NSBRI at the YOEMP Clinic from 1994 to 1999. A similar group of 75 musculoskeletal patients matched on age, gender and year of diagnosis will be used as controls for the socioeconomic analysis. Phone interviews will assess symptoms, general health, functional status, disability, stress, and socioeconomic status since diagnosis of NSBRI. This study should identify diagnostic criteria, increase our understanding of the natural history and socioeconomic consequences of NSBRI, as well as identify risk factors associated with worse outcomes. This information is critical for the development of interventions to prevent and/or ameliorate the adverse consequences of NSBRI.

Health Disparities Among Health Workers

Investigator(s): Craig Slatin

Affiliation: University of Massachusetts
(978) 934–3291

Keywords: socioeconomic determinants, health care workers, physical and social functional capacity

Research Summary:
Socioeconomic position (class, gender, and ethnicity) is correlated (associated) with risk of morbidity and mortality due to various conditions. Some of these risks or health outcomes are not immediately life threatening but have a major impact on health-related quality of life and affect the physical and social functional capacity of a substantial proportion of the population. Health outcomes include musculoskeletal disorders, various types of acute injury (both intentional and unintentional), and mental health conditions. All three of these have been associated with environmental conditions in the workplace, which themselves show a marked socioeconomic gradient because of widespread occupational segregation. We propose to examine the work environment as a primary mediator of the effect of socioeconomic position on population health. The study will involve a combination of quantitative and qualitative data and will support a contextual analysis set within a broader ecological and political theoretical framework. Multiple data sources will be used to evaluate job features such as physical load (e.g., heavy lifting), shift work, high psychological job demands coupled with low decision autonomy, threat of interpersonal violence, and facility characteristics such as adequacy of staffing, management commitment to occupational health and safety programs, and policies concerning gender and racial discrimination and sexual harassment. Morbidity will be assessed by survey instrument as well as from facility records of absenteeism, work-related injury and illness, and compensation claims. In a series of three panel surveys, we will seek to maximize the number of subjects responding more than once to permit longitudinal analysis. An outcomes sub-study will sample employees reporting health problems at baseline; additional information about their health and employment status will be sought about two years later. By conducting the study in multiple facilities and job groups, it will be possible to compare the effects of job and individual exposures as well as the effect of different management policies and workplace climates that have the potential to determine the magnitude and impact of hazardous exposures. The study will be conducted in the health care industry, which employs a large proportion of the working population in Massachusetts (and nationally) and is an increasingly important employer of minority workers. This workforce has substantial variability in socioeconomic status, gender, and ethnicity and is exposed to a variety of known health and safety hazards at work. This setting should provide an adequate multidimensional range of facts to permit a meaningful examination of physical and social/behavioral risks and the complex pathways that produce disparities in population health status.

Impacts of Demanding Work Schedules: National Survey Findings

Investigator(s): Allard E. Dembe

Affiliation: University of Massachusetts
(508) 856–6162

Keywords: occupational stressor, circadian rhythm, injury prevention, shift work, occupational disease/disorder

Research Summary:
The study will use data from the National Longitudinal Survey of Youth (NLSY) to analyze the impact of demanding work schedules on employee safety and health. The NLSY contains extensive information about worker's employment history, job experiences, occupational injuries and illnesses, along with a variety of social, economic, vocational, and disability outcomes. Using these data, we will be able to categorize work schedules according to the type of shift work performed (day, evening, night, split, rotating), overtime work, extended hours per week (60+), and extended hours per day (12+). The longitudinal nature of the NLSY will allow us to retrospectively track work experiences over a 13-year observation period (1987–2000). Our analysis will answer the following questions:

- Does shift work and irregular schedules increase the likelihood of suffering occupational injuries and illnesses?
- Does overtime and extended work hours increase the likelihood of suffering occupational injuries and illnesses?
- What types of shift work, overtime, and extended hours schedules are most hazardous? and
- Does working a demanding schedule increase the severity of the social, economic, vocational, and disability consequences of occupational injuries and illnesses?

Our study has several important design features that will significantly advance scientific understanding in this important area of research, including large sample sizes, a wide range of industries covered, a relatively long period of observation to examine the time dependencies between events, the ability to control for important covariates, and an extremely large array of significant outcome measures. To conduct this study, we have assembled a highly qualified research team with experts in work organization and the analysis of large databases from the University of Massachusetts Medical School, the RAND Institute, and Applied Epidemiology, Inc. Our study will result in policy-relevant publications and reports that will include research-based recommendations for practical interventions to prevent or minimize risk from these exposures.

Injuries and Cost Shifting in the Construction Industry

Investigator(s): Cleve J. Waddoups

Affiliation: University of Nevada, Las Vegas
(702) 895–3497

Keywords: uncompensated care, workers' compensation insurance, cost shifting, health insurance coverage

Research Summary:
Conventional measures of the incidence of health insurance coverage are correlated with employment in construction and other industries. Analysis of Current Population Survey data demonstrates that compared with workers in most other industries, construction workers and their dependents generally have a lower incidence of health insurance coverage. Regression analysis using data from a large public safety-net hospital demonstrates that patients employed in the construction sector are more likely to be found in the uncompensated care (bad debt) files, after holding other variables constant. Thus it may be argued that the institutional configuration of the construction industry causes the costs of health care for its workers to be shifted to public safety-net health care facilities, paying patients, companies that offer insurance to their workers, and to the public through higher taxes.

Analysis of the data also suggest that a substantial number of injuries among construction workers appear to be job-related, yet are still being treated without compensation. When work-related injuries fall into uncompensated care accounts at the public safety-net hospital, then perhaps employers are not purchasing the requisite workers' compensation insurance, injured workers feel it is to their advantage to avoid financing their injuries with workers' compensation insurance, or injured workers do not understand their rights to file workers' compensation claims. Without such financing, they often become self-pay patients and tend to amass bills that cannot be paid.

This project will establish a link between uncompensated care at public health facilities and employment in the construction industry. Particular emphasis is placed on the potential for avoidance of workers' compensation insurance to finance workplace injuries in favor of uncompensated care at public safety-net hospitals.

Job-Related Arthritis and Disability in Retirement

Investigator(s): J. Paul Leigh

Affiliation: University of California
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Keywords: low back pain, lost productivity, cost of injury, functional disability

Research Summary:
Two widely shared medical views motivate the proposed study:

- Injuries to joints at some time in life can produce osteoarthritis in those joints later in life.
- Perhaps the best predictor of future low-back pain is prior low-back pain.

For our purposes, the time dimension is important. The initial injury or pain could occur on the job, whereas the subsequent osteoarthritis or pain could occur much later, perhaps during retirement years. These subsequent osteoarthritis and pain events will generate direct costs (doctor visits, hospitalizations, drugs) and indirect costs (lost productivity on the job and in the home). The first aim is to estimate the costs of job-related osteoarthritis. Current estimates of all job-related injuries and illnesses ignore these costs. The second aim is to investigate the connection between employment in injury-producing jobs before retirement and functional disability after retirement.

Costs of job-related osteoarthritis and functional disability in retirement are important for at least three reasons. First, ignoring them leads to a significant underestimate of the overall costs of job-related injuries and illnesses. Second, these costs are largely borne by victims, families, and taxpayers, not by workers' compensation systems.

Prevalence and costs of osteoarthritis will be estimated with primary data from the National Health Interview Surveys, National Center for Health Statistics, the Bureau of Labor Statistics, and the Agency for Healthcare Research and Quality and with secondary data from published studies. We will present a range of estimates under clearly stated assumptions so readers can select the scenario they find most reasonable.

The connection between employment in injury-producing jobs and subsequent functional disability will be investigated with the National Health and Nutrition Examination Survey III (NHANES III). The NHANES III has information on the functional disability (activities of daily living) of retirees, as well as information on subjects' longest held jobs before retirement.

Low Back Pain: Physical and Psychosocial Job Factors

Investigator(s): Niklas Krause

Affiliation: University of California, San Francisco
(510) 231–9540

Keywords: backache, ergonomics, functional ability, occupational psychology, work site clinical research

Research Summary:
This project will prospectively examine the role of physical and psychosocial job factors in the development of occupational low-back pain during successive phases:

- The pre-disability symptom phase
- The pre-disability formal injury report phase
- Three disability phases:
  —acute
  —subacute
  —chronic, which is defined by increasing durations of lost work time

It is hypothesized that both physical and psychosocial job factors are independent predictors of low-back pain at all five phases and that their relative effect sizes change across phases. The main objective is to determine phase-specific risk factor profiles with particular focus on the relative impact of psychosocial and biomechanical risk factors. The long-term goal is to yield useful information for the design of workplace interventions which combine organizational and ergonomic job redesign to prevent low back injuries and work disability. This project combines the resources of two existing data sets - two prospective cohorts of San Francisco urban transit operators (n = 1,449, n = 1,640). These two longitudinal studies provide workers' compensation data with 3 to 5 years of follow-up, allowing for the study of each phase of the disability process, including the chronic disability phase (greater than 90 days off work), which accounts for 80 percent of the costs associated with work-related low back injuries. Both studies provide comparable information on job-related, sociodemographic, injury, medical legal, and economic factors. Primary analyses will examine the independent and combined effects of physical and psychosocial job factors, including psychological and physical job demands, job control, job strain and social support at work. In addition, unique data on job stress, measured by independent observers with an innovative job analysis instrument, will be used for agreement analyses with self-reported measures to evaluate the predictive validity of survey instruments used in large epidemiological studies of occupational low-back pain.

Occupational Fatality Trends: A Contextual Analysis

Investigator(s): Dana Loomis

Affiliation: University of North Carolina
(919) 966–7433

Keywords: labor-force factors, economic factors, traumatic injuries, surveillance, fatalities

Research Summary:
The rate of fatal occupational injuries in the United States has been declining since the 1970s. At the same time, the structure of the economy has undergone profound changes that affect worker safety and health and the ability to monitor and ensure them through public health interventions. We propose an epidemiologic study of the relationship of long-term trends in fatal occupational injury to economic and labor-force factors at national and regional levels. The overall goal of the research is to examine the context of trends in fatal injury rates. We will consider differences among industrial sectors, worker groups, and geographic regions. We will examine potential causes, focusing on structural changes in the economy and the workforce. Specifically, we seek to answer the following research questions:

- What was the average annual change in the rate of fatal occupational injury from 1980 to 1994 for the Nation, for its principal geographic regions, and for specific sectors of industry, major occupational groups, and worker groups defined by sex, age, and race?
- Did characteristics of States and regions, including compensation levels, population mobility, the proportion of women and minorities in the labor force, educational attainment, the power of labor relative to capital and regulatory climate, predict differences in occupational fatality trends between 1980 and 1994?
- Was the relative decline in fatal occupational injury rates from 1980 to 1994 equal for potentially vulnerable groups of workers and for other worker groups with greater historical advantages?
- Would the overall rate of fatal occupational injury observed toward the middle of the 1990s have been the same as the rate in the early 1980s if there had been no restructuring of the labor force?
- How are trends modified by the interplay of factors on regional, industry, and individual levels of organization?

To address these questions, we will conduct a contextual analysis using data collected by U.S. government agencies. In evaluating regional patterns, we will devote attention to the South as a region that has led some current trends. The research has the potential both to produce greater knowledge of the relationship of worker safety to larger trends beyond the workplace, and to identify steps that can be taken to maintain or improve safety as other conditions of work change.

On-the-Job Injury: Employment History and Hidden Losses

Investigator(s): Monica Galizzi

Affiliation: University of Massachusetts
(978) 934–2790

Keywords: social/economic consequences, labor force participation, occupational injury, workers' compensation

Research Summary:
This research project will test the hypothesis that a worker's personal characteristics and pre-injury labor market experience, together with employers' characteristics, behaviors, and working conditions, will determine the long lasting social and economic consequences of workplace injuries. The study aims are as follows:

- Estimate the effect of a job-related injury or illness on the worker's future employment given information on workers' preinjury labor force participation, employment relations, and working conditions
- Determine the factors that may explain recurrent episodes of work-related injury and illness
- Estimate the effect of a job-related injury/illness on future earnings and on other hidden economic consequences (such as loss of fringe benefits and the need to rely on government assistance programs)
- Evaluate the effect of an injury on the families of injured workers (in terms of changes in spouses' employment and children's well-being)
- Measure variation in outcomes among workers who receive or do not receive workers' compensation benefits

To study these topics, the research will use several probability models and models describing the variation of continuous dependent variables over time.

Organizational Predictors of Successful Return to Work

Investigator(s): Benjamin C. Amick, III

Affiliation: University of Texas
(713) 500–9496

Keywords: job performance, income insurance, job satisfaction, quality of life, socioeconomics

Research Summary:
The long-term goal of this research is to identify organizational practices and policies that effectively support the injured worker's return to a productive work role. The research has two aims:

- To determine the relationship between organizational practices and policies and successfully returning to work and reduced work disability
- To examine the validity and reliability of workers reported organizational practices and policies

This research builds on an ongoing cohort study of 250 physician-reported carpal tunnel syndrome cases in Maine funded by the Arthritis Foundation that follows workers at baseline, 2, 6, and 12 months post surgery. Information is collected about worker, job, and economic factors that predict work disability and return to work. Augmentation of worker-level health data with employer-level data on organizational practices and policies creates an opportunity to examine heretofore unanswered research questions. The investigators will interview 80 key organizational informants (representing 80 different employers) to collect employer-level data on eight organizational practices and policies (people-oriented culture, active safety leadership, safety diligence, safety training, standard ergonomics practices, disability case monitoring, proactive return to work, and labor-management safety and health committees) and use the employer-level data to predict return to work, lost work days, and work disability (carpal tunnel syndrome symptoms, paid and unpaid work functioning incidents). The investigators hypothesize that organizational practices and policies will be associated with fewer lost work days, a quicker return to work, improved work, and unpaid work role functioning and fewer carpal tunnel syndrome symptoms. They will also compare employer with worker organizational practices and policies reports. Additional hypotheses are that worker reports of organizational practices and policies will significantly co-vary with employer reports of organizational practices and policies; and workers of organizational practices and policies will predict fewer total lost work days, earlier return to work, improved paid and unpaid work functioning and fewer carpal tunnel syndrome symptoms. Employer interviews will be conducted as an additional step with the purpose of demonstrating that worker self-reports are valid and reliable and will provide new measurement tools heretofore unavailable in occupational health research. In addition, the investigators will collect workers' compensation data from employers and OSHA reportable data to replicate research conducted among Michigan employers. A second unique feature of the proposed research is the use of new measures of successful return to work that measure more than the fact of returning. In summary, this research will validate a critical new instrument (worker assessment of organizational practices and policies), and by defining the association between organizational practices and policies and health outcomes, open avenues for interventions to enhance the well being of injured workers.

Psychosocial Outcomes in Working Farm Children Age 10-12

Investigator(s): Sharon J. Barton

Affiliation: Ohio State University
(859) 323–6650

Keywords: socioeconomics, environmental exposure, ergonomics, psychological stressor, quality of life

Research Summary:
The goal of this program of research is to improve the health of children working on farms. Across the 2.2 million farms in the United States, nearly 1.3 million children live, play, and work. In addition to children who live on America's farms and ranches, more than a half million children who do not reside there work as hired farm labor. Despite the popular view of farms as pastoral and serene, farmers know that the daily challenges of weather and economy make their work and home environments less than ideal. The purpose of this pilot study is to examine the physical, psychosocial and economic consequences of farm work on children aged 10–12. This proposal directly addresses the NORA priority areas of special populations at risk, social and economic consequences of work, and indirectly, traumatic injuries. The proposed study also directly addresses Objective 6 of the National Action Plan of the Childhood Agricultural Injury Prevention Initiative to "conduct research on costs, risk factors and consequences associated with children and adolescents who participate in agricultural work." This proposal falls within the focus area of the Great Lakes Center to protect the agricultural safety and health of farm families. Specifically, this proposal will provide the center with important information to address pesticide exposure of children and to further understand acute unintentional injury and ergonomics of farm work performed by children. A cross-sectional survey of 330 children will be used to collect data on general demographics of the sample, stress and depressive symptoms, risk behaviors, previous injuries, economics, and psychosocial variables. The findings will provide the basis for developing and testing interventions to improve psychosocial outcomes of working farm children.

Sentinel Event Notification Systems for Occupational Risk (SENSOR): Oregon

Investigator(s): Michael Heumann

Affiliation: Department of Human Services
(503) 731–4025

Keywords: economic costs, dermatitis, burns, priority populations, surveillance

Research Summary:
The Oregon Department of Human Services' Environmental and Occupational Epidemiology (EOE) section will collaborate with a wide range of State and private partners to track workers' compensation claims data and direct reports of occupational dermatitis, burns, and pesticide-related illness and injury. The sentinel and population-based data for each condition will be analyzed to characterize demographic patterns and causal factors in specific industries and occupations. Economic costs and case rates will be calculated. Particular attention will be paid to specific populations, including youth, temporary and migrant, and seasonal workers. Data for target conditions will be reviewed and selected case investigations conducted to identify underlying causes and new hazards. Results of these analyses and intervention recommendations will be shared with those stakeholders who have demonstrated interest in preventing targeted work-related illness and injury. EOE will work with partners to prioritize and pursue strategies to prevent the targeted conditions in high-risk populations. The project will be evaluated for the efficiency and usefulness of the model and its components. This evaluation will serve to improve Oregon's surveillance system and demonstrate its reproducibility for other states. EOE's surveillance methods, data findings, and intervention experiences will be disseminated through local publications, peer-reviewed journals, and shared with NIOSH and other States.

Sharp Instrument Injuries and Use of Clinical Services

Investigator(s): Gerardo Maupome

Affiliation: Kaiser Foundation Research Institute
(503) 335–6625

Keywords: economic impact, sharp instruments injuries, health care workers, health services research

Research Summary:
The present study proposes to use detailed health records to explore links between sharp instrument injuries and exposure to blood and body fluids among health care workers and their personal use of clinical services. Such research will result in a more accurate assessment of the economic and health impacts of sharps injuries and body fluid incidents, as well as an estimation of the current systems in place to address the sequels of such incidents. By means of sophisticated electronic health information technology, detailed data will be obtained to explore the selection, design, and implementation of engineering systems, clinical protocols, and subsequent research efforts in the future. We will be using records from the Kaiser Permanente Northwest health maintenance organization clinical services, so barriers to access to care, lack of standardization of clinical/laboratory data and data entry procedures, and other confounders will be controlled for in the research design. More stringent measures than the already high standards currently in place will be employed to maintain the anonymity and confidentiality of these records during the investigation.

In the present study, we will undertake both a case-referent study and a pre-post study using electronic records of health care workers with a clinical position at Kaiser to establish and characterize whether an association exists between sharps injuries and body fluid incidents reported and the increased short- and long-term use of clinical services. We will also establish a classification of risk in terms of circumstances of sharps injuries and body fluid incidents by evaluating the relative contribution of the factors making up an employee profile (job description; mechanism of injury; purpose of offending device; and so on).

The results from this exploratory investigation will identify research opportunities to fill some of the gaps outlined in the National Occupational Research Agenda (www.cdc.gov/niosh/nora). We hope that these opportunities will lead in the future to a more accurate body of knowledge for policy makers, clinicians, and health plan administrators to ensure that timely interventions to ameliorate the effect of health hazards may be planned and implemented for at-risk employees. This study will provide important information to establish the current impact of sharps injuries and body fluid incidents in health care workers in terms of their use of clinical services and associated costs.

Social/Economic Impact of Injury/Illness in Career Roofers

Investigator(s): Laura Welch

Affiliation: Center to Protect Workers' Rights
(301) 578–8500

Keywords: economic impacts, social impacts, roofers

Research Summary:
Standard, well developed instruments and techniques will be used to survey union construction workers at the time they leave their trade and 1 year later. Questions will include reason for leaving, nature of injury or illness if present, functional limitations at the time of leaving and after 1 year, and the social and economic consequences of their decisions. This study will focus on three groups of roofers:

- Those who leave the trade at any time in their careers before retiring
- Those who take early retirement
- Those who apply for disability retirement

A comparable group of roofers who continue to work will be interviewed also.

This project will develop a credible measure of the amount of disability, disability retirement, early retirement, and job change caused by injury, illness, and musculoskeletal disease among roofers. We will do the following:

- Determine what proportion of roofers leave the union before retirement age, retire early, or apply for disability retirement because of a work-related injury, work-related disease, or chronic medical condition
- Determine what proportion of roofers who continue to work in the trade have chronic symptoms from a work-related injury, work-related disease, or chronic medical condition
- Describe the social and economic impact of a work-related injury, illness, or premature retirement caused by a medical condition
- Evaluate changes in the social and economic status over time in roofers who leave the union, retire early, or take disability retirement
- Assess and describe the impact of work-related conditions and aging on the ability of roofers to remain employed in their trade

Social Inequalities in Occupational Health and Health Safety

Investigator(s): Allard E. Dembe

Affiliation: University of Massachusetts
(508) 856–6162

Keywords: occupational disease/disorder, racial/ethnic difference, socioeconomics, occupational health

Research Summary:

The specific aim of this study is to determine whether there are disparities in the occurrence of occupational injuries and illness and in associated medical care for work-related disorders, based on workers' race, ethnicity, and socioeconomic status. This exploratory study will do the following:

- Advance the NORA health services research mission by illuminating socially based patterns of disease occurrence and medical care delivery
- Test a novel research methodology that employs large national health care databases to collect and analyze information about the health and health care experiences of injured workers

The proposed investigation also directly applies to the NORA focus on social and economic consequences. Social disparities in the incidence of work-related injuries and illness and inequalities in health care services are potentially a significant social impact of workplace accidents that must be considered when evaluating the overall human burden imposed on workers suffering job injuries. The study methodology is based on the use of three national population-based surveys of patients and health care providers containing information about patient sociodemographic attributes, employment experiences, and medical care services. Data sources include the National Ambulatory Medical Care Survey, the National Longitudinal Study on Youth, and the Health and Retirement Survey. Pilot studies conducted by this research team have demonstrated the usefulness of these databases in providing an innovative source of new information about this topic. The studies have provided initial evidence suggesting that blacks, Hispanics, and those of low socioeconomic status are more vulnerable to sustaining workplace injuries and receiving inferior medical care. This study will result in a descriptive analysis of work-related-cases databases and selected multivariate analyses to assess the interactive effect of patient sociodemographic characteristics with employment experiences, occupational health events, medical services, and vocational outcomes. This study has significant policy implications related to the NORA health services research objective of collecting new information about the determinants of health services for injured workers and thereby help to eliminate barriers to securing appropriate care. Eliminating social disparities in health is one of the two overarching national goals articulated in Healthy People 2010 and the focus of President Clinton's and the Department of Health and Human Service's national initiative, Eliminating Racial and Ethnic Disparities in Health.

Social Security Disability Insurance (SSDI) Benefit Impacts of Occupational Injuries/Illnesses

Investigator(s): David S. Salkever

Affiliation: Johns Hopkins University
(410) 955–3141

Keywords: social security benefits, disability, workers' compensation, economic consequences

Research Summary:
This project will explore the use of several large databases for developing national estimates of the impact of occupational injuries and illnesses on Social Security Disability Insurance benefit payments. The cost of the Insurance program has increased rapidly in the past decade and it is likely that a large portion of these benefits are attributable to occupational injuries and illnesses. The need to fund these Insurance benefits out of payroll taxes is a major concern in the national efforts to stabilize Social Security. Estimates of Insurance benefit savings that result from controlling occupational injuries and illnesses will be important for Federal health policy and priority setting.

Measurement of Social Security Disability Insurance benefit impacts requires data on individual workers covering a long enough time period to capture their progression from the onset of an occupational injury or illness to their receipt of Insurance benefits. Two data sources that capture data for large numbers of workers over a sufficiently long time period are private long-term disability claims data and large-scale panel surveys such as the Survey of Income and Program Participation. In this project, we will develop and test methods for generating national Insurance benefit impacts of occupational injuries and illnesses from both types of data. Long-term disability claims data represent the claims experience for one large insurer of policies covering approximately 500,000 workers of more than 1,400 employers during 1992–1997. Survey data will be analyzed from the 1996 Survey (a 4-year panel survey) and data from the 1992 and 1993 Surveys (including an extended followup for respondents to the Survey of Program Dynamics). Long-term disability claims data will be used to develop national estimates of Insurance benefit impacts of occupational injuries and illnesses for all U.S. workers covered by private long-term disability insurance. We will also examine variations in these estimates by diagnostic category of injury or illness, by region, and by industry. Insurance benefit impact estimates based on the Survey will cover occupational injuries and illnesses to all workers for which workers' compensation benefits were received. We will also examine variations in these estimates by region, industry, worker demographics, and health problem category. We will examine strategies for benchmarking estimates from both Survey and long-term disability data against other national data sets. Exploratory statistical models will also be developed to explore the interaction of workers' compensation program characteristics and Insurance benefit impacts.

Surveillance of Mortality and Morbidity in U.S. Workers

Investigator(s): Lora Fleming

Affiliation: University of Miami
(305) 243–5912

Keywords: trends of U.S. worker health and safety, morbidity and mortality, costs of injury and disease

Research Summary:
The databases available to examine national patterns and trends of U.S. worker health and safety are outdated, and in general, incomplete. The National Health Interview Survey (NHIS) is a multipurpose household survey of the U.S. civilian noninstitutionalized population conducted annually since 1957 by the National Center for Health Statistics (NCHS) of the Centers for Disease Control and Prevention (CDC). NHIS has collected demographic, health, and employment data on more than 450,000 U.S. workers aged 18 and older in probability sampling of the entire U.S. population, with a mortality followup with cause of death from 1986 through 1995. Therefore, the NHIS database allows for longitudinal analysis of mortality data as a retrospective cohort study, as well as cross-sectional and trend analysis of the aggregate morbidity data collected annually from a representative sample of all U.S. workers for the past two decades. Using this uniquely representative and large database of the NHIS 1986–1994 surveys with mortality followup, the objectives of this proposed study are to evaluate the time trends for morbidity, and the longitudinal mortality associated with industry and occupation for the U.S. worker. After assembling the cohort of employed persons aged 18 and older, the investigators will examine the cause of specific mortality, and reported health and disability as summarized data for all annual NHIS interviews from 1986 to 1994, as well as the morbidity time trends by industry and occupation.

Hypotheses have been generated based on the historical literature and can be tested not only in terms of industry or occupational subgroups, but also in subgroups determined by important confounding variables such as age, gender, race/ethnic, socioeconomic status, and geographic region (depending on the subgroup sample size). The costs of injury and disease in terms of lost work time and use of medical services can be evaluated by industry or occupational subgroups. Cause-specific mortality will also be determined by industry or occupation subgroups, as well as by the same confounding variables. The investigators will create two study monographs, one on morbidity and one on mortality, to be made publicly available in a linked study Web site for researchers and the occupational health community. These data can be used to compare with prior studies, to develop new research hypotheses, and as a surveillance tool to evaluate time trends and occupational disease in the United States for the past two decades in both genders and in a variety of race-ethnic subpopulations. This study satisfies at least three NIOSH/NORA research priority areas:

- Surveillance research methods providing unique mortality and morbidity data on the entire U.S. workforce
- Unique mortality and morbidity data on older, race-ethnic, lower socioeconomic and gender-specific worker subpopulations in the United States
- Unique data on social and economic costs of workplace disease and injury

Sustained Work Indicators of Older Farmers

Investigator(s): Deborah Reed

Affiliation: University of Kentucky
(859) 257–9636

Keywords: priority populations, farmers, safety programs

Research Summary:
This prospective panel study will focus on the most rapidly aging workforce in the U.S.: the family farmer. This special population is known to suffer one of the highest rates of occupational injury and mortality. Farmers rarely retire from their vocation and work long past usual retirement age. A longitudinal design to track the sustained work patterns of aging farmers and to identify factors that influence their decision to remain in farm work will be used. The specific aims of this study are as follows:

- Identify factors that influence the sustained work of older farmers
- Develop health profiles (including physical and mental indicators) of older male and female farmers
- Develop exposure profiles for tasks related to agricultural work of older farmers
- Explore the sociocultural, family, and economic factors that influence the work practices and health of older farmers

The aims are congruent with the *Healthy People 2010* objectives 20.1 and 20.2 to reduce farm worker fatalities and injuries. This study will enroll a partial sample from the Kentucky Farm Family Health and Hazard Surveillance Study (data collected 1994–1996) and their spouses (n=914) and an oversample of African American farmers and spouses (n=914), for a total of 1,828 persons enrolled from Kentucky and South Carolina. Measures on sociocultural, health and behavioral, and work environment factors will be collected through 6 waves of mailed surveys over 50 months. Hierarchical regression analysis will provide a quantitative model of the sustained work of older farmers. Descriptive and predictive analyses will be conducted by gender and race. Focus groups of male farmers, farm women, and farm couples will address items not obtainable from survey research. Attachment to farm life and the land, farm enterprise transfer, and the meaning of work will be explored in 18 focus-group sessions. Findings from the study will be used to design occupational counseling appropriate to age, gender, and race, as well as health and safety programs for aging farmers.

Unclaimed Injuries and Workers' Compensation Adequacy

Investigator(s): Darius N. Lakdawalla

Affiliation: Institute for Civil Justice
(310) 393–0411

Keywords: health services, injuries, economic consequences

Research Summary:
The workers' compensation system is designed to provide health care and compensation to all American workers who suffer injuries or illnesses in the workplace, without regard to fault. However, preliminary analysis suggests that only half of injured workers file claims. In light of this fact, we propose research with two key goals:

- To understand the economic, demographic, and policy factors that cause workers with occupational injuries and illnesses not to file claims
- To reassess the adequacy of workers' compensation wage replacement rates, in light of the fact that many workers do not file claims or receive benefits of any kind

Consideration of the first goal reveals the surprising finding that the most vulnerable workers—those with the least alternative insurance against workplace injuries and illnesses—may be the ones least likely to file for workers' compensation. They may face higher costs of filing workers' compensation claims. To pursue the second goal, we calculate the total wages lost over several years as a result of a workplace injury, which we will compare with the benefits paid by workers' compensation. These calculations will include the zero benefits paid to workers who do not file claims.

We will use the National Longitudinal Survey of Youth (NLSY), a public-use database sponsored by the United States Department of Labor, to explore the economic, demographic, and policy factors that affect filing claims. Use of the NLSY breaks new empirical ground in two important ways. First, the NLSY is a nationally representative database, containing extensive information about more than 4,000 workplace injuries, while previous analyses of workers' compensation filing have been limited to the use of site-, firm-, or region-specific data. Second, the NLSY has longitudinal data on earnings as well as unclaimed injuries, while previous analyses of the adequacy of workers' compensation have been limited to workers who file claims.

Understanding Occupational Injury and Illness Trends

Investigator(s): Ted R. Miller

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Keywords: injury, occupational disease/disorder, occupational health/safety, socioeconomics

Research Summary:

This study will conduct longitudinal and cross-sectional analyses of the striking decline in occupational injury and illness rates in the United States during the 1990s by using a richer set of controls than in prior studies. Understanding the causes and economic consequences of these changes in injury rates is critical. Are gains concentrated among establishments of certain sizes, or in specific industries? Why are restricted work cases rising? Are tools like drug testing, formal and informal workplace safety training, OSHA inspections, and changes in state workers' compensation systems helping to improve a firm's injury experience? How have employee assistance program existence, scope, administrative structure, and in-house versus vendor operation affected occupational injury and illness rates? What cost savings have resulted for employers and society? We will study these questions using a set of surveys conducted at the establishment level by the Bureau of Labor Statistics (BLS). Although these surveys were conducted for different purposes, establishments in them can be linked using common identification variables. This provides a unique opportunity to study a wider range of questions than could be accommodated by any single survey. The primary dataset we will use is the Annual Survey of Occupational Injuries and Illnesses during 1987–1997. Each year, the Survey samples approximately 250,000 establishments and collects information about their injury experience for that year. While the Annual Survey is not designed to be a longitudinal survey, exploratory work on 1992–1996 data leads us to expect that a sizeable number of establishments will have injury information for the 11 years from 1987 to 1997. We will conduct separate longitudinal and cross- sectional analyses after linking the establishments in the Annual Survey to BLS surveys on their safety training, anti-drug programs, employee benefits, and other characteristics, as well as to information on OSHA inspections, and the characteristics of state workers' compensation systems.

Our analysis will improve on prior studies of injury rates in the following ways:

- Linking different surveys provides us with a richer set of establishment-level information on workplace practices and job-related benefits that can be combined with information about OSHA inspections and workers' compensation variables to provide a more detailed study of injury rates than is generally possible.
- By assembling a longitudinal dataset both at the industry and establishment level, we can estimate fixed- and random-effects models to mitigate the biases that commonly occur in cross-sectional analyses due to unobserved heterogeneity.
- We have estimates of both employer and societal cost per diagnosis that allow us to weight different injuries by their severity and estimate the cost-savings resulting from various policy measures.

We also will pilot test use of an input-output model to assess the impact of occupational injury/illness on the economy.

Use of Health and Social Services Following Work Injury

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Keywords: social/economic consequences, social service utilization, mental health, health service utilization

Research Summary:
The main aim of this study is to investigate the health, economic, and social consequences of workplace injury for workers and their families, with particular emphasis on mental health and social service utilization. We propose using a linked database of administrative records developed in British Columbia, that includes Workers' Compensation Board, public insured health services, income assistance, and vital statistics records. We will investigate the use of health and social services for 5 years before and after an injury for both workers and their families. These patterns will be compared to selected control groups. The major focus of the study will involve examining the following:

- Changes and patterns over time in health and social service utilization and suicide rates for injured workers and their controls
- Changes and patterns over time in health and social service utilization, and suicide rates for families of injured workers and families of controls
- Risk factors associated with increased utilization of health and social services for injured workers
- Risk factors associated with increased utilization of health and social services for families of injured workers

Outcomes to be examined include changes in, and specific types of uses of physician services, hospital services, income assistance, prescription drugs, continuing care services, and mental health care episodes will be explored for workers, their families, and controls. Mortality data, specifically suicide as cause of death, for 1994 to 2000 will also be examined for all groups. A number of potential confounders, such as age, sex, and income will be examined for all groups. Worker characteristics such as, age, sex, income, industry or job type, time on job before injury, type of injury (acute or chronic), and Workers' Compensation Board costs, length of claim, and occurrence of other claims will also be examined. The substantial economic and social consequences of workplace injury underscore the need to document such consequences and how injuries affect the overall quality of life of workers and their families. By identifying characteristics of workers and their families who are most at risk (increased mental health and social assistance utilization) of being severely affected by a workplace injury, specific interventions can be targeted to provide services to help vulnerable families to better cope with workplace injuries and illnesses.

World Health Organization (WHO) Global Occupational Health Programme

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Keywords: occupational injuries, economic costs, economic evaluation methods, work-related diseases, global burden of work-related disease and injuries

Research Summary:

Safe and healthful work should be a fundamental right, yet every year, millions of people worldwide are denied that right. It is estimated that occupational injuries affect more than 250 million workers, and occupational diseases affect 160 million people annually. More than one million workers lose their lives from work-related causes every year. The human and economic costs are larger in developing countries, where many workers are concentrated in the informal sector or small scale enterprises, or in traditionally dangerous industries such as agriculture, logging, fishing, and mining.

In 1996 the World Health Assembly approved and endorsed the *Global Strategy on Occupational Health for All*. This Strategy has become the mandate of the Occupational Health Programme in the WHO Headquarters, the WHO Regional Offices, and the global Network of the WHO Collaborating Centres in Occupational Health. In 1999, following consultations with several partners, including NIOSH, it was agreed that WHO's program on occupational health would focus its activities mostly on issues of increasing global concern, under three main areas:

- Evidence for policy, legislation, and support to decision-makers
- Capacity building
- Protection and promotion of workers' health

Under the first area, sound information on the global burden of work-related diseases and injuries has been developed. A methodology is then developed for assessing economic impact, and that methodology is used along with the information on the global burden to estimate the economic impact of occupational illness and injury. In three countries, national plans of action will be prepared based on these analyses. Another proposal will study the impact of globalization and trade on occupational health, and develops recommendations for action. Under the second area, proposals to increase the national capacity of developing countries to strengthen occupational health by providing relevant and timely information in a usable format, and to enable members to build collaborative partnerships. Under the third area, proposals for the Regional Initiatives in Occupational Health, especially the Africa Initiative for occupational health in small-scale industries and in the informal sector, and related components of Practical Solutions, and workplace health promotion.

Workplace Safety in Atlanta's Construction Industry: Institutional Failure in Temporary Staffing Arrangements

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Atlanta Labor Pool Workers' Union
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Keywords: temporary work, temporary staffing agencies, construction, workplace safety, workers' compensation

Research Summary:
Demand for temporary workers in Atlanta's building and construction industry is raising substantial concerns about safety conditions for this segment of the low-wage workforce. Data on workplace injuries, safety concerns, and provisions for safety equipment and job training suggest that workers supplied by temporary staffing agencies to building and construction contractors work in substandard safety conditions. Agency-supplied temporary workers cite insufficient job training and provisions for safety equipment as reasons for their safety concerns.

It is hypothesized that temporary agency workers in Atlanta's building and construction industry experience substandard safety conditions in part because nonstandard employment arrangements between building contractors and temporary agencies undermine the efficacy of regulatory forces designed to improve workplace safety standards. Research has shown that the triangular employment arrangement between temporary workers, temporary agencies, and building contractors confounds the system of accountability successfully enforced by a system of safety-inducing incentives shaped by labor market forces, workers' compensation insurance, and occupational safety and health regulations. Supply-side forces do not exert safety-inducing pressures on client-employers in temporary labor markets. Experience-rating workers' compensation premiums paid by temporary agencies do not necessarily influence safety conditions at their client-employers' job sites. Occupational safety and health regulations have only recently begun to adapt to the presence of multiemployer job sites. The result is that temporary agency workers, compared with their counterparts in standard employment arrangements, may have less access to appropriate safety equipment and more often work without proper training and supervision.

This project will examine the impact of the temporary staffing industry on workplace safety for temporary workers in the construction industry in the Atlanta metropolitan area. Particular emphasis is placed on examining how nonstandard employment arrangements undermine the system of incentives that encourage employers to adopt higher workplace safety standards.

Work-Related Motor Vehicle Crashes: Reducing the Burden

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Keywords: occupational motor vehicles, municipal employee injuries, workers' compensation

Research Summary:
Motor vehicle crashes are the single major occupational cause of death for U.S. workers. A great deal has been learned about prevention of motor vehicle crashes for the general public; much less is known about the underlying causes and effective preventive strategies for work-related motor vehicle crashes. Few studies have focused on nonfatal motor vehicle injuries in the workplace, and there is no comprehensive information about morbidity and costs of work-related motor vehicle crashes. This study represents an extension of our currently funded project *Analysis of Capitated Payments in Workers' Compensation* through which we have developed a database and prospective record linking system to capture comprehensive data on the number, magnitude, and economic impact of work-related injuries for the 29,000 employees of the city of Philadelphia.

This project expands that database through additional record linking of existing databases to comprehensively analyze the nature and causes of occupational motor vehicle crashes involving city vehicles and to develop a risk factor model that accounts for morbidity and economic burden of these events. This proposal addresses the National Occupational Research Agenda (NORA) priority research areas of Traumatic Injuries; Health Services Research; Intervention Effectiveness Research; Social and Economic Consequences of Worker Illness and Injury; and Surveillance Research Methods. To achieve these goals, there are three highly focused aims:

- *To create a comprehensive database of municipal employees and their work-related motor vehicle crashes*—The database should be suitable for risk factor analysis using existing data on municipal workers in the city of Philadelphia. It should include a broad range of information about all city drivers and vehicles, focus on the morbidity and economic impacts of crashes, and provide the foundation for an ongoing crash surveillance system.
- *To develop predictive models to define the determinants of work-related motor vehicle crashes*—Models can be developed by examining risk factors related to driver characteristics, vehicle factors, and crash factors using retrospectively collected data on the city's workforce and vehicles. Predictive models of work-related motor vehicle crashes should be tested and validated by using prospectively collected data on the city's workforce and vehicles.
- *To test and validate predictive models of work-related motor vehicle crashes by using prospectively collected data on the city's workforce and vehicles*

Work Scheduling, Overtime, and Work-Related Injuries in Construction

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Keywords: economic conditions, work hours, overtime, work organizations

Research Summary:
Research has shown that work organization factors, including work schedules and working extended periods of overtime, may be detrimental to the safety and health of workers. As described in the National Occupational Research Agenda, these factors may contribute to occupational injury, work-related musculoskeletal disorders, cardiovascular disease, and other occupational health concerns. Very few studies, however, have looked at this particular work organization variable within the construction environment and identified whether it has any negative impact on the safety and health of construction workers.

This study tries to answer the following research questions:

- What are typical work schedules in construction and what differences in work scheduling exist between construction and other industries?
- How is work scheduling influenced by factors such as economic conditions, technology, demographics, and employment performance?
- How does work scheduling and overtime affect the safety and health of construction workers?

The National Longitudinal Survey of Youth (1979 cohort) was used for this study. Initial findings are as follows:

- Work scheduling in construction is different from scheduling in other industries.
- Hours worked per week and weeks worked per year increased steadily for all workers (construction and other industries) in this cohort during the study period.
- Injured workers were more likely to have worked overtime before being injured.
- Overtime was significantly associated with work-related injuries in construction, especially for construction laborers, after controlling for sex, age, occupation, employment size, and other potential confounders.