



# *Traumatic Occupational Injury Research Needs and Priorities*

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*A Report by the NORA Traumatic Injury Team*



**NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH**

**U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES**

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## FOREWORD

In April 1996, at the 25<sup>th</sup> Anniversary of the Occupational Safety and Health Act of 1970 in Washington, DC, the National Institute for Occupational Safety and Health (NIOSH) unveiled the National Occupational Research Agenda (NORA). NORA was developed by NIOSH and approximately 500 of its partners in the public and private sectors to provide a framework to guide occupational safety and health research in the United States over the next decade. This effort to guide and coordinate research nationally—not only for NIOSH, but for the entire occupational safety and health community—is focused on 21 priority areas identified as important and most likely to improve worker safety and health in the United States.

Among these 21 priority areas are 7 disease and injury categories, including the broad category of *traumatic occupational injuries*. Traumatic injuries have plagued workers in the United States, and all over the world, for centuries. Today, injuries and deaths resulting from motor vehicle crashes during work-related driving, workplace violence, falls, contact with industrial and agricultural machinery, electrical shock, fires and explosions, and many other causes of injury, continue to claim the lives, damage the physical and psychological well-being, and consume the resources of workers and their families. The overall human, social, and financial toll of traumatic occupational injury is enormous, rivaling the burden imposed by such health threats as cancer and cardiovascular disease.

A key part of implementing NORA was the formation of partnership teams to assist in the development, pursuit, review, and dissemination of research under each NORA topic. This report is a product of the NORA Traumatic Occupational Injury Team—a group of individuals representing government, industry, labor, and academia and a variety of backgrounds and disciplines associated with public health, safety sciences, engineering, and communications. The Traumatic Occupational Injury Team has compiled this report in an effort to describe the research needed to advance the knowledge, and thus the prevention, of traumatic occupational injuries. This document is not intended as a definitive or detailed listing of all necessary research tasks in occupational injury research. Rather, the intent is to present a broad framework of the objectives and research needed to begin filling the gaps in knowledge and furthering progress toward safer workplaces and practices. Government agencies, academic institutes, public and private research organizations, labor organizations, professional societies, and others might use this document as a basis for planning and prioritizing their own research, and as a basis for pursuing new partnerships and identifying topics for collaborative efforts. I encourage you to consider the research issues and needs described here, and to join our partnership efforts to reduce the toll of traumatic occupational injuries through research and prevention.



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Director

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# Traumatic Occupational Injury Research Needs and Priorities

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## *A Report by the NORA Traumatic Injury Team*

The National Institute for Occupational Safety and Health (NIOSH), and its partners in the public and private sectors, have developed the National Occupational Research Agenda (NORA) to provide a framework to guide occupational safety and health research through the next decade—not only for NIOSH but for the entire occupational safety and health community.<sup>1</sup> Approximately 500 organizations and individuals outside NIOSH provided input into the development of the Agenda. This effort to guide and coordinate research at a national level addresses those topics that are most likely to benefit the worker and the Nation. Fiscal constraints on occupational safety and health research reinforce the need for a coordinated and focused national research agenda.

Partnership teams are a key part of implementing NORA.<sup>2</sup> Twenty partnership teams have been formed to address the priority areas, including one focused on traumatic occupational injury. These teams are assisting in the development, pursuit, implementation, review, and dissemination of research under each NORA topic. The Traumatic Injury Team has compiled this report in an effort to describe the research needed to advance the knowledge, and thus the prevention, of traumatic occupational injuries. The team welcomes the input and assistance of occupational safety and health professionals and representatives of management, labor, professional societies, academia, and others in accomplishing these tasks.

This document is not intended as a definitive or detailed listing of all necessary research tasks in occupational injury research. Rather, the intent is to present a broad framework of the objectives and research needed to begin filling the gaps in knowledge and furthering progress toward safer workplaces and practices. We hope that the objectives and research framed by this document will be used by a wide variety of organizations as a basis for planning and prioritizing research and collaborative efforts. Government agencies, academic institutes, public and private research organizations, labor organizations, professional societies, and others might use this document to assist in focusing their own research activities, and as a basis for pursuing new partnerships and identifying topics for collaborative efforts. The greatest potential for progress in preventing occupational traumatic injuries will be realized when the many agencies and organizations with interest and expertise in this area coordinate their research efforts and pool their

resources and expertise in collaborative research projects. This document provides a reference and structure for traumatic occupational injury research that can be used to facilitate the initiation of new, and the rekindling of existing, partnerships and collaborative research to prevent worker injuries and deaths.

## **I. Background**

Injuries exact a huge toll in U.S. workplaces—on a typical day, an estimated 16 workers are killed and 36,000 workers are injured.<sup>3,4</sup> The associated economic costs are high, costing the nation more than AIDS and as much as cancer and heart disease.<sup>4</sup> Yet the investment in occupational injury prevention is minuscule compared to resources dedicated to disease prevention research.

Work-related injuries and fatalities result from multiple causes, affect different segments of the working population, and occur in a myriad of occupations and industrial settings. Multiple factors and risks contribute to traumatic injuries, such as hazardous exposures, workplace and process design, work organization and environment, economics, and other social factors. Prevention strategies are also varied, and multiple strategies may be applicable to many settings, including engineering controls, protective equipment and technologies, management commitment to and investment in safety, regulatory controls, and education and training. Research needs are thus broad, and the development and application of interventions involve many disciplines and organizations.

Efforts to set research and prevention priorities for traumatic injury must be driven by data that identify the nature and magnitude of these injuries. There are expanding sources of information to identify the industries and occupations where injuries occur most frequently and with greatest severity. The challenge is to move beyond this descriptive information to collection of risk factor data in order to develop specific strategies that actually prevent another warehouse employee from being crushed by an overturned forklift, prevent scaffolding from collapsing from under a mason, and keep convenience store clerks and taxi drivers from being shot.

At many worksites which have structured operational processes and established safety programs, the rates for life-threatening and fatal injuries are quite low. The rate of traumatic disabling injuries, however, remains high as do the costs associated with both temporary and permanent disability. Traumatic injury research in these settings must focus on the occupations that employ large segments of the working population and account for a substantial portion of occupational disability, even if fatality risks are low. In all

areas, research must focus on promoting the implementation of injury prevention strategies and the evaluation and refinement of these efforts.

Implementing, evaluating, and refining injury prevention strategies may include developing information systems to target high-risk worksites and to develop solutions that fit highly specific hazardous circumstances. These specific strategies are needed within work sectors (e.g., agriculture, construction, health care), as well as within individual companies, to address the complex interaction between workers, machines, tools, and behavioral, environmental, economic, and cultural factors contributing to injuries at a worksite. In many cases, understanding these factors will lead researchers and safety professionals to redesign work practices, work environments, equipment, and tools to eliminate hazards. For hazards that cannot be eliminated (such as exposure of fire fighters to fires and explosions, or fishermen to cold environments and rough seas), research can improve safety practices and the protective equipment and clothing worn by the worker.

## **II. Issues and Methods in Defining Research Needs**

The task of determining research needs and setting priorities for traumatic injury research in the United States is complex and encompasses many disciplines. There are several methodological issues that should be addressed in order to effectively advance research and prevention of occupational traumatic injuries.

***Priorities** for research and prevention efforts should be based on relevant data. The criteria for setting priorities should include the magnitude of the problem (frequency of injury and size of affected workforce), the risk to workers (rates of injury), injury severity, and amenability to prevention, including cost-effectiveness and likelihood for adoption of prevention strategies by industry.*

Effective use of scarce resources requires careful prioritization of research in order to maximize the value and impact of resource investments. The greatest impact on injury prevention will come from research efforts that focus on worker groups or hazards with high numbers of traumatic injuries, high rates or risk of injury, and a high probability of success in both developing effective prevention or control strategies and implementing them in the workplace.

Surveillance data should drive prevention efforts by identifying worker groups with high frequency and risk of injury. Assessing the leading causes of death and sources of non-fatal injuries within these groups will identify the areas where prevention efforts can have

the greatest impact. Amenability to prevention must consider the cost-effectiveness of prevention and control strategies, and the likelihood of acceptance and adoption, or resistance, by employers and workers. Prevention efforts developed in response to expressed needs and concerns will be more readily accepted and effectively implemented.

*Collaboration among multiple professional disciplines, industries, agencies, and groups is essential to developing research priorities and implementing prevention strategies aimed at reducing occupational injuries.*

Multidisciplinary approaches to designing and conducting research are critical. The disciplines of epidemiology, engineering, safety, and the medical, clinical, and social sciences all offer important expertise to occupational injury prevention. Likewise, management, labor, workers, and others in the workplace all have knowledge and experience beneficial to occupational injury research and prevention. A multidisciplinary approach allows for a larger community to “own” the issue, to help identify problems and solutions, and to implement the findings.

Collaboration across Federal agencies, including those who may not focus specifically on occupational safety or injury, is also crucial to avoiding duplication of effort and enhancing the effectiveness of research and prevention efforts. Lessons learned, activities underway, or data collected in other agencies should be used to guide future efforts. Collaboration with industry and labor to design, implement, and evaluate injury prevention strategies is essential.

*New methods of data collection, data analysis, and information dissemination need to be developed to advance the field of occupational injury research.*

New methods for conducting occupational injury research must be pursued, including: exploring new sources of data, identifying ways to improve identification of work-related injuries in existing databases, linking data from various existing sources for improved information about injuries, and developing new and improved methods of assessing injury exposures and intervention outcomes. Data are especially lacking on worker exposure to hazards and the cost of occupational injury, so particular attention should be given to these areas.

The application of new and emerging technologies will be important not only in collecting and analyzing data but also in developing new research strategies (e.g., using tech-

nologies, such as virtual reality, which allow us to study tasks that are too hazardous for human exposure) and in refining information dissemination strategies. Efforts should also be directed at utilizing existing data sets more fully and taking advantage of natural experiments, for example, examining factors responsible for wide variations in injury rates between two or more companies or workplaces doing similar work.

### **The Public Health Model**

Toward the goal of setting priorities, developing collaborative efforts, and developing new research methodologies, the many scientific disciplines will apply different models to occupational injury research (e.g., the public health model, the risk management model, the safety sciences model). All of these are variations of the scientific model—an objective, problem-solving process. For this paper, the public health model is used as a framework to discuss occupational injury research and prevention.<sup>5</sup> The elements of this model include:

- A. Identify and prioritize problems (Injury Surveillance);
- B. Quantify and prioritize risk factors (Analytic Injury Research);
- C. Identify existing or develop new strategies to prevent occupational injuries (Prevention and Control);
- D. Implement the most effective injury control measures (Communication/Dissemination/Technology Transfer); and
- E. Monitor the results of intervention efforts (Evaluation).

The process is an iterative one requiring continuous monitoring to ensure that strategies implemented actually reduce or eliminate the exposure or outcome as the intervention progresses and do not create unacceptable new risks. There are specific traumatic occupational injury research needs within each of these phases of the public health model.

### **III. Research Objectives**

The following provides a framework of important research objectives, based on the public health model, that must be addressed in order to further advance occupational injury prevention efforts. The research needs discussed here are not an exhaustive or detailed list, but reflect the important next steps the Team has identified as high priorities in

furthering research progress toward the prevention of workplace injuries. In order to define specific tasks that address each of these research needs, more detailed analyses of existing data, identification of critical gaps, and inventories of research efforts pertinent to the specific component, may be required.

### *A. Identify and Prioritize Problems (Surveillance)*

Identifying problems in traumatic injury research, as in much of public health, is driven by surveillance. Surveillance is “the ongoing collection, analysis and interpretation of health data in the process of describing and monitoring a health [injury] event.”<sup>6</sup> For occupational safety research, this refers to the collection, analysis, and interpretation of data on injuries, hazards, and exposures for identifying potential risk factors for further research, and for prevention planning and intervention evaluation.

### **Research Needs:**

#### National Surveillance

- Improve national-level surveillance of non-fatal injuries by including work-related identifiers in existing injury databases, such as hospital discharge data, hospital emergency department records, and trauma registries, so that existing systems can be used for occupational injury surveillance.
- Collect more detailed information on the circumstances of traumatic occupational injury (e.g., task of workers at the time of injury, specifics regarding machines, tools, protective equipment, etc.).
- Assess whether temporary workers, migrant laborers, and other special working populations are accurately captured in occupational injury surveillance systems and augment systems to address identified gaps.

#### Detailed (State-, Local-, and Company-level) Surveillance

- Improve state- and regional-level occupational injury surveillance by coordinating, improving and linking existing sources of information, such as workers’ compensation data, hospital discharge records, trauma registries, health care data, etc.
- Develop and increase emphasis of on-site or company-wide surveillance systems to identify emerging problems and capture exposure information for risk assessment.

- Develop hazard surveillance systems to identify and monitor injury hazards at the local (e.g., state-wide, industry, company, or workplace) level.
- Collect more detailed information on the circumstances of traumatic occupational injury incidents (e.g., task of workers at the time of injury, specifics regarding machines, tools, protective equipment, etc.).

### Exposure and Labor Force Data

- Develop and/or utilize exposure (denominator) data that can be used for calculating injury risks based on actual units of time of exposure to hazards or risk factors. Length of employment in an occupation can serve as a useful measure of exposure. More specific exposure measures, such as number of hours worked on a specific machine will provide a more accurate assessment of risk than rates based on injuries per total number of workers in an occupational category which may use that machine.
- Assess whether temporary workers, migrant laborers, and other special working populations are accurately captured in labor force and employment data. Develop methods for addressing identified gaps. These exposure data are needed at both the national and local levels.

### Coordination and Integration of Surveillance Systems

- Collect information that permits linkage (while maintaining confidentiality) to other relevant data systems and follow-back to the workers involved in the injury incident in order to collect more detailed information on the circumstances of occupational injuries. Creating this linkage will require case identifiers that can link to other databases that may contain exposure or risk characterizations for the job or operation where the injury occurred and information on workers' compensation or other injury-related costs.
- Accelerate efforts to include work-relatedness, occupation, and industry in new and existing health care data sets, so that these systems could be used for occupational injury surveillance.
- Focus surveillance efforts on how to capture data as health care changes. The rapid changes taking place in health delivery systems and the introduction of managed care may have major impacts on ongoing surveillance. The potential for new data collection efforts to include occupational injury information should be

pursued prior to, or in parallel with, the development and implementation of new or improved health care data systems.

- Use hospitalization discharge data in non-fatal injury surveillance efforts in addition to other sources already in use (e.g., hospital emergency department records) for more complete ascertainment of occupational injury cases.
- Initiate collaborative surveillance efforts between federal agencies that use common sources of information for distinctive surveillance needs. Numerous agencies independently obtain data from the same source documents (e.g., vital records, hospital data, trauma registries, insurance claims) to fulfill diverse needs. Collaboration between agencies to tailor surveillance sources to meet multiple needs can result in increased usefulness and comparability, and decreased per-agency costs for improved surveillance systems.

#### Increase Utility of Surveillance Data

- Improve the timeliness of existing and newly-developing surveillance systems. Collecting additional data that are factually accurate becomes more difficult with every day that passes after an injury has occurred. As well, prevention efforts will be most effective if implemented soon after a risk is identified.
- Broaden or develop surveillance systems to obtain information about minor injuries. The traditional focus has been on fatal and seriously disabling injuries which are relatively “rare” and thus difficult to analyze unless cases were collected over a number of years or on a national basis. By capturing information about less serious injuries that could have resulted in greater harm, the number of cases to study will be increased and further insight will be gained into the broad range of risk factors that result in injuries. Such information will also allow for identification of prevention strategies that address risks earlier in the cycle of injury.
- Where possible, further broaden data collection efforts to include system failures or property damage incidents in which no injuries occurred, but that signal problems in work processes or environments that pose potential injury risk. Such incidents may also serve as useful surrogates for identifying potential risk factors.
- Increase efforts to improve the accuracy and completeness of information on

traumatic occupational injury incidents, and encourage the use of narrative information for the detailed analysis of injury events.

### ***B. Quantify and prioritize risk factors (Analytic Injury Research)***

Although the descriptive epidemiology of injuries and safety engineering studies have been reported for decades, improved prevention efforts will require new methodological approaches. Identifying and defining injury risk factors (the elements that cause or contribute to an injury) will require examination of non-traditional factors including social, cultural, and economic characteristics of industries and worksites. This will require a multidisciplinary approach to injury research and risk factor identification. Collaboration between epidemiologists, ergonomists, engineers, psychologists, economists, sociologists, and public health professionals will be necessary to understand the multiple and varied factors that contribute to injury and prevention, and to effectively reduce the burden of workplace injuries.

#### **Research Needs:**

- Increase the application of a multidisciplinary approach to injury prevention research. Efforts that combine the approaches and methods of epidemiology (public health), engineering (safety sciences), and the social sciences will be most successful.
- Expand research aimed at identifying risk factors to include determining the roles of work organization, management commitment to safety, socioeconomic factors, and industry or company culture, in addition to characteristics of workers, workplaces, and jobs.
- Expand the traditional epidemiologic approach for identifying risk factors to include new and innovative analytic methods and approaches to study design for occupational traumatic injury research.
- Take advantage of variations in injury rates between individual worksites doing similar tasks to begin to assess the role of “best practices” and other factors that contribute to lower injury rates in some work environments.
- Foster international collaborative and comparative studies to identify factors responsible for wide variations in industry- and occupation-specific injury rates between countries.

- Develop economic indicators that can be used to help prioritize injury research issues and intervention efforts.

### *C. Identify or Develop Injury Prevention Strategies (Prevention and Control)*

Research that will increase the understanding of occupational injury mechanisms is needed to serve as the basis for developing interventions to reduce injury incidence and severity. Occupational injury control requires a multidimensional approach including education, engineering, and enforcement efforts. Any single strategy may not be sufficiently effective, but when combined, can result in substantial reductions in occupational injuries.

#### **Research Needs:**

- Design workplaces, machines, and equipment to remove the possibility of making unsafe choices or actions (engineer-out hazards) through the application of the principles of anthropometry, ergonomics, biomechanics, and safety engineering. In designing and modifying workplaces to improve safety, “passive controls,” those which do not require choices or actions by workers in order to be protective, should take priority over “active controls,” which require workers to take action or change behavior.
- Develop models and simulations for the safe design of workplaces and equipment that include operational and maintenance concerns.
- Define acceptable levels of hazard exposure and energy transfer through biomechanical study. The occurrence and severity of traumatic injuries depends upon the amount of energy transferred during an exposure or contact. Determining the amount of energy required to cause injury, from the cellular to the whole body levels, will allow for the design of safer machines, tools, engineering controls, and protective equipment.
- Develop an accurate anthropometric database which reflects the diversity of the U.S. working population and can be used to improve the design of machines, workstations, tools, and personal protective equipment. Workplace safety and productivity is dependent upon the appropriate fit between workers and their environments, tools, and protective equipment.
- Determine the costs and benefits of various prevention strategies, including: the adoption of safe practices or activities; the acquisition of interventions and safety

equipment; the design of safety into activities, practices, equipment, and machines; and enforcement measures.

- Develop injury prevention models and guidelines for application by safety and health practitioners in the field. These models and guidelines should be applicable by practitioners with readily available information and knowledge.
- Develop and provide training to safety practitioners in industrial settings in quantitative methods and intervention evaluation. This will enhance the ability of those working directly with hazards and prevention efforts in the workplace to assess injury hazards, prevention strategies, and intervention successes and failures, and to contribute to the larger body of knowledge regarding injury risks and prevention effectiveness.

#### ***D. Implement the Most Effective Injury Prevention Measures***

##### *(Communication/Dissemination/Technology Transfer)*

One of the principal factors affecting the reduction of occupational injuries is the effective organization and communication of knowledge and technology related to occupational risks and prevention. Knowledge and technology developed through research must be communicated or transferred to employers, workers, and others who can apply this information to prevent injuries.

There are various levels of knowledge and understanding about risk and prevention, each of which can affect injury experience. Employers and workers may not be aware of the risk(s) associated with specific work, the characteristics and relative importance of the risk, methods of reducing the risk, or the value of implementing prevention efforts. Lack of knowledge at any of these levels will inhibit the application of safety measures and the reduction of risk. Effective communication of knowledge and technology is evidenced when workers and employers understand the relative injury risks associated with work tasks, are well informed regarding prevention options and their relative costs and benefits, receive or have immediate access to the latest information and knowledge related to risks and prevention, and are therefore capable of making timely and informed risk management decisions.

#### **Research Needs:**

- Develop and conduct demonstration prevention programs to implement new prevention strategies or technologies in the field. Demonstration projects should

be rigorously evaluated using sound epidemiologic principles. Prevention efforts that are demonstrated and tested in real work settings, and found to be effective in reducing the risk of injury, will be more readily adopted by others than prevention technologies or recommendations developed and evaluated only in the lab or the literature. Demonstration projects provide an effective means of communicating the value of specific interventions and prevention programs to the wider population of workers facing the same or similar risks across industry and occupation groups.

- Identify and characterize specific occupational audiences (i.e., workers, managers, employers, safety and health professionals, researchers, industry associations, labor unions, and others who represent working groups) in order to tailor information to their specific characteristics and needs. In addition to demographics, characteristics should include lifestyles, values, beliefs, and attitudes, sources of information and knowledge, and degree of knowledge about workplace risks and prevention. Audience research is most often associated with marketing, and many of the associated research tools and techniques have application in the arenas of health communication and social marketing. Audience-specific information enables researchers and communicators to address specific information and knowledge gaps, to assess incentives and disincentives, and to tailor messages with the aim of influencing positive changes in safety-related behavior, such as acceptance and implementation of effective prevention methods. The prevention efforts that will be most effectively adopted and implemented will be those that are developed for a specific audience with an expressed need.

- Investigate the processes and influences by which effective prevention innovations come to the attention of, and are adopted (or not adopted) by occupational audiences. Diffusion research shows that innovations are generally not accepted and implemented quickly in a given population. Generally, innovations come to the attention of “early adopters,” who see the benefit of the innovation and use it immediately. The rate of innovation acceptance is affected by the influence and experience of these early adopters in the relevant population.

- Assess the relative effectiveness of different formats and channels of communicating information and transferring knowledge and technology to specific occupational audiences. Pilot test and evaluate the communication and transfer of prevention strategies, risk messages, information products, training

materials, educational curricula, and informational campaigns to determine optimal communication strategies.

- Identify potential sources of timely and reliable occupational risk and prevention information and knowledge for specific occupational audiences and develop effective methods of monitoring, evaluating, selecting, obtaining, organizing, and distributing the information. The key is getting timely, reliable, and useful information to those who make risk decisions affecting themselves or others in the workplace.
- Conduct studies to determine whether educating youth about occupational risks and prevention at different educational levels (i.e., elementary, secondary, vocational-technical, etc.) contributes to higher awareness of occupational risks and higher acceptance and implementation of prevention as the youth mature and enter the workforce.

### ***E. Monitor the Results of Intervention Efforts (Evaluation)***

Evaluation is essential in determining the effectiveness of interventions. Many injury prevention and intervention programs and mechanisms have been implemented in workplaces, yet few have undergone rigorous evaluation to determine their effectiveness. As we can increase the number of injury prevention strategies that *effectively* reduce the incidence and severity of worker injuries in specific settings, investment in prevention will increase and adoption of strategies will become more widespread.

### **Research Needs:**

- Evaluate the effectiveness of existing interventions, including worker training and safety programs, that are being used for prevention but have not been evaluated.
- Include assessment of cost effectiveness and identification of adverse or unexpected outcomes when conducting intervention effectiveness studies. Analyses should include pre- and post-intervention costs, with assessment of the social and economic cost/benefit of the intervention.
- Determine the effectiveness of different types of worker training and optimal intervals for re-training.
- Conduct research to evaluate safety programs and identify the critical factors for

effective safety programs in various industry groups.

- Conduct research to identify and evaluate incentives and disincentives for investing in injury prevention, including regulations, enforcement, insurance premiums, etc.
- Evaluate communication strategies and activities to determine characteristics that result in reduced risk or reduced injuries.
- Take advantage of “natural experiments,” when changes are made in the workplace (e.g., automation) or in work practices (e.g., installation of lifting devices) to determine their effects on injury rates. Changes made for economic or production reasons may also unexpectedly decrease or increase injury rates.
- Develop partnerships between researchers, industry, and labor unions or other worker organizations to evaluate interventions in real work settings. Industry will benefit from providing “laboratories” for evaluation studies by gaining cost savings through effective injury prevention mechanisms. Researchers must include assessment of the cost effectiveness and impact in intervention evaluation studies to provide incentive for industry to both partner in evaluation, and to adopt and implement interventions.

#### **IV. Conclusions**

For any specific research task, multiple stakeholders will have roles to play in collecting and analyzing data, implementing and evaluating interventions, and developing and disseminating informational or educational materials. The fiscal and intellectual investment of workers, labor organizations, managers, private companies, academia, government agencies (local, state, and federal) and numerous others will be required to advance the field of traumatic occupational injury research. A multidisciplinary approach will also be required to accomplish the objectives and tasks set forth here. Only through the collaborative efforts of epidemiologists, ergonomists, engineers, psychologists, sociologists, economists, occupational physicians and nurses, and others, can we reduce the burden of workplace injuries on our society. The objectives and research needs outlined here provide the framework for interdisciplinary collaboration which can be used to initiate and facilitate research partnerships by identifying issues and priorities for collaborative research efforts. We urge you to join us in advancing research to prevent the tragic and unnecessary injuries and deaths of American workers.

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