NATIONAL OCCUPATIONAL RESEARCH AGENDA (NORA)

NATIONAL OCCUPATIONAL RESEARCH AGENDA FOR TRAUMATIC INJURY PREVENTION

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Developed by the NORA Traumatic Injury Prevention Cross-Sector Council

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INTRODUCTION

What is the National Occupational Research Agenda?

The National Occupational Research Agenda (NORA) is a partnership program to stimulate innovative research and workplace interventions. In combination with other initiatives, the products of this program are expected to reduce the occurrence of injuries and illnesses at work. Unveiled in 1996, NORA has become a research framework for the nation and the National Institute for Occupational Safety and Health (NIOSH). Diverse parties collaborate to identify the most critical issues in workplace safety and health and develop research objectives for addressing those needs.

NORA entered its third decade in 2016 with an enhanced structure. The ten sector councils formed for the second decade continue to prioritize occupational safety and health research by major areas of the U.S. economy. In addition, there are seven cross-sectors organized according to the major health and safety issues affecting the U.S. working population across all industry sectors. While NIOSH is serving as the steward to move this effort forward, it is truly a national effort. NORA is carried out through multi-stakeholder councils, which are developing and implementing research agendas for the occupational safety and health community over the decade (2016-2026). Councils address objectives through information exchange, partnership building, and enhanced dissemination and implementation of evidence-based solutions.

The Traumatic Injury Prevention Cross-Sector, one of the seven NORA health and safety cross-sectors, encompasses injuries and related deaths to workers due to sudden-onset events such as motor vehicle crashes, falls, violence, and being caught in or struck by machinery. It does not include injuries related to repetitive motion or cumulative trauma, which are addressed by the Musculoskeletal Health Cross-Sector. The Traumatic Injury Prevention Cross-Sector addresses multi-factorial contributors to traumatic work injuries, including hazards in the work environment and organizational and worker characteristics that increase or decrease injury risk.

What are NORA Councils?

Participation in NORA councils is broad, including stakeholders from universities, large and small businesses, professional societies, government agencies, and worker organizations. Councils are co-chaired by one NIOSH representative and another member from outside NIOSH.

Statement of Purpose:

NORA councils are a national venue for individuals and organizations with common interests in occupational safety and health topics to come together. Councils started the third decade of NORA by identifying broad occupational safety and health research objectives for the nation. These research objectives will build from advances in knowledge in the last decade, address emerging issues, and be based on council member and public input. Councils will spend the remainder of the decade working together to address the agenda through information exchange, collaboration, and enhanced dissemination and implementation of solutions that work.

Although NIOSH is the steward of NORA, it is just one of many partners that make NORA possible. Councils are not an opportunity to provide consensus advice to NIOSH, but instead a way to maximize resources towards improved occupational safety and health nationwide. Councils are platforms that help build close partnerships among members and broader collaborations between councils and other organizations. The resulting information sharing and leveraging efforts promote widespread adoption of improved workplace practices based on research results.

Councils are diverse and dynamic, and are open to anyone with an interest in occupational safety and health. Members benefit by hearing about cutting-edge research findings, learning about evidence-based ways to improve safety and health efforts in their organization, and forming new partnerships. In turn, members share their knowledge and experiences with others and reciprocate partnerships.

Traumatic Injury Prevention Council

The Traumatic Injury Prevention Council was formed in September-December 2016. The council currently comprises 33 members representing academia, industry, professional organizations, federal and state government, the military, and labor. (A list of the inaugural council members is included as Appendix A.) Our aim is to identify the most critical occupational traumatic injury research needs and leverage partnerships with a broad array of stakeholders to conduct, translate, and disseminate research and knowledge to promote a safe work environment for all workers.

More specifically, the purpose of the council is to:

- Provide a forum for identifying research priorities for the nation; discussing emerging issues, new research findings, and evidence-based solutions; and sharing expertise and lessons learned.
- Form partnerships through networking, discussing mutual interests, and leveraging each other's efforts.
- Disseminate and implement knowledge by sharing research ideas and findings; disseminating tools/resources, guidance, fact sheets, trainings and curricula, surveillance data and query tools, and other resources; and promoting the use of evidence-based interventions.

What does the National Occupational Research Agenda for Traumatic Injury Prevention represent?

The National Occupational Research Agenda for Traumatic Injury Prevention is intended to identify the research, information, and actions most urgently needed to prevent occupational injuries. This agenda provides a vehicle for stakeholders to describe the most relevant issues, gaps, and safety and health needs for the cross-sector. Each NORA research agenda is meant to guide or promote high priority research efforts on a national level, conducted by various entities, including government, higher education, and the private sector.

Because the agenda is intended to guide national efforts for the Traumatic Injury Prevention Cross-Sector, it cannot at the same time be an *inventory* of all issues worthy of attention. The omission of a topic does not mean that topic was viewed as unimportant. Those who developed this agenda did, however, decide that the number of topics should be small enough that resources could be focused on a manageable set of objectives, thereby increasing the likelihood of real impact in the workplace.

NIOSH used the draft agendas created by the sector and cross-sector NORA councils as an input into the NIOSH Strategic Plan [NIOSH 2018]. NIOSH programs used burden, need and impact criteria (BNI) to write research goals that articulate and operationalize the components of the NORA sector and cross-sector agendas that NIOSH will take up. NORA agendas and the NIOSH Strategic Plan are therefore separate but linked.

Who are the target audiences?

- Researchers and professionals in safety, occupational injury epidemiology, engineering, statistics, economics, program evaluation, intervention evaluation, industrial/occupational psychology, dissemination/implementation science, and health communications fields

- Researchers in academia, labor and professional organizations, private research entities, and federal, state and local governments
- Safety and public health professionals in federal, state and local governments, labor and professional organizations, companies, and non-profit organizations
- Regulatory agencies and consensus standards committees
- Companies and professional organizations that promote policies designed to foster a safe work environment, as well as those who would like to develop such policies
- Educators and trainers of safety and public health professionals and researchers
- Workers in all industries and occupations and employment arrangements, representing all socio-demographic groups
- Students training to be occupational safety professionals or researchers

How was the research agenda developed?

The Traumatic Injury Prevention Cross-Sector Council began to develop this agenda with a series of virtual meetings, held in December 2016 and January and March 2017. The purpose of NORA and its evolution over the first two decades was discussed. The first task for the newly formed Traumatic Injury Prevention Council was to develop an agenda for the third decade of NORA. This agenda was to be based on the state of the science, stakeholder needs, and other relevant inputs. Meetings included presentations on work-related injury data and trends, progress on NIOSH's traumatic injury prevention goals from the previous decade, and a variety of topics and emerging issues.

Council members posited ideas for "strategic objectives," which are intended as broad research objectives for the nation. They were designed to build on advances in knowledge gained in the last decade, to address emerging issues, and to be reasonably achievable within the next decade. Council members' ideas were synthesized into eight overarching strategic objectives for traumatic injury prevention. There are some overlapping concepts in these objectives, but each was considered important and distinct enough to warrant its own objective. The first four objectives focus on leading causes of occupational injury. The remaining four objectives are cross-cutting and address all types of traumatic occupational injuries and work environments. Volunteer workgroups wrote descriptions for each objective, which were reviewed by the council. (A list of workgroup members is included as Appendix B.) These objectives form the basis for this agenda and are not listed in order of priority or importance.

After review and input from the council, public comment on the draft agenda was sought through a public docket identified in the Federal Register. Public comments were received and the agenda revised accordingly.

THE OBJECTIVES

Objective 1: Prevent work-related motor vehicle crashes and injuries

Motor vehicle crashes (MVCs) are the leading cause of occupational injury fatalities in the United States, accounting for 37% of all deaths in 2015 [BLS 2017a]. These deaths have an impact on workers, their families, businesses, and communities. In 2013 alone, MVCs at work cost U.S. employers $25 billion: $65,000 per nonfatal injury and $671,000 per death [NETS 2015]. MVCs accounted for 6.2% of serious nonfatal injuries at work in 2014, resulting in an estimated $3.7 billion in workers' compensation costs [Liberty Mutual 2017].

To advance the prevention of work-related MVCs and injuries, underreporting of injuries should be addressed and research and prevention should focus on several areas:

- **Characterizing known and hypothesized risk factors:** Research is needed to better characterize individual-level crash risk factors such as drowsy and distracted driving in the context of driving for work. Organizational-level factors (for example, shift work, training, safety climate, job demands and design, journey planning, employment arrangements, pay structures, and safety management) should be considered as part of this research, as well as road environment factors (for example, travel conditions, roadway design and infrastructure, and road construction). Of particular interest is risk-factor research that considers drivers for hire, truck and bus drivers, and the aging workforce.

- **Engineering and technology research:** Of high priority is research on highly automated vehicles and advanced driver assistance systems, which hold great promise for reducing crashes due to human performance limitations. Because fleet turnover is such that fully automated vehicles will not become commonplace for 20 to 30 years, continued attention should be given to active safety systems now available (for example, lane departure warning, autonomous emergency braking). Research should examine evidence that automated technologies improve safety while maintaining productivity, with attention paid to the potential for unintended consequences of automation. Research should also consider the workplace safety impacts of connected-vehicle technology and intelligent transportation systems. Also of interest is the safety of drivers of specialized work vehicles such as fire apparatus and police cruisers. Research results should be used to guide industry practice and support standards development, which will expand industry access and adoption of new technologies.

- **Intervention, implementation, and evaluation research:** Research is needed to demonstrate effectiveness and cost-effectiveness of a range of interventions to prevent work-related MVCs, from safety management strategies to new technologies. This should extend to implementation research that assesses compliance with and determinants of success of these strategies. As with engineering-related research, findings should be incorporated into industry practice and safety standards.

- **Research-to-practice strategies:** Dissemination research is needed to identify optimum methods for moving evidence-based crash prevention interventions into workplace practice. Strategies need to be developed to ensure that employers have access to evidence-based results and can successfully implement them. Those who communicate motor vehicle safety information should consider audience needs based on health and safety literacy, socio-demographic characteristics, and preferred communication channels.

Objective 2: Reduce falls and advance fall protection

Slips, trips and falls (STFs) took the lives of 800 workers in the U.S. in 2015, making STFs the second leading cause and accounting for 16.5% of all occupational injury deaths [BLS 2017b]. Most of these fatal falls involved falling

from a height. Construction and extraction (348), building and grounds cleaning and maintenance (88), and installation, maintenance, and repair (78) occupations had the highest counts of STF fatalities. Hispanic workers had a disproportionate amount of fall fatalities (212, or 26.5% of such deaths in 2015) [BLS 2017c], while comprising only 16.4% of the 2015 U.S. labor force [BLS 2016a]. Forty-three percent of occupational fall fatalities were age 55 and above. In addition, in 2015 there were 309,060 STF-related nonfatal occupational injuries resulting in days away from work (DAFW), which accounted for about 27% of all DAFW injuries that year [BLS 2016b]. Most of the nonfatal injuries involved falls on the same level. The incidence rate for STFs was 27.9 cases per 10,000 full-time workers. Painters, construction and maintenance workers (116.8), police and sheriffs' patrol officers (108.8), fire fighters (102.8), and truck drivers (101.1) had the highest rates of STF-related injuries. The 2017 Liberty Mutual Workplace Safety Index showed that the categories of slips and trips without falls, falls on same level, and falls to lower level were together the most disabling/costly U.S. workplace injuries in 2014, resulting in an estimated $18.42 billion in workers' compensation costs (30.7% of the total cost of the most disabling occupational injuries) [Liberty Mutual 2017].

Occupational falls can be reduced in a concerted fashion at the national level by focusing on the industries and groups that have the greatest magnitude or greatest risk of falls. Among the priorities are reducing fall incidents in the construction industry and among certain occupations: construction and maintenance workers, police and sheriffs' patrol officers, firefighters, and truck drivers. In addition, STF incidents involving older workers and Hispanic workers in the construction industry deserve special attention, as does the potential for underreporting of events. Safety standards (e.g. ANSI/ASSE Z359.2 – 2017 "Minimum Requirements for a Comprehensive Managed Fall Prevention Program") can be a useful resource when developing preventive programs, and can be improved by incorporating scientific findings. To advance the prevention of work-related STF-related incidents and injuries, research and prevention should focus on several areas:

- **Reducing construction-related STFs:** Research is needed in several areas to address construction-related STFs. The first is to understand biomedical characteristics of humans, social-organizational characteristics, and human-system interface traits that are common precursors to fall incidents among construction trade workers; this information can be used to design out fall risk in work equipment. The second is to identify and characterize fatal and serious injuries associated with construction falls among Hispanic construction workers. The third is to identify risk factors for fall fatalities among vulnerable populations, such as aging workers. The fourth is to identify current practices and emerging issues in fall injury control/protection and advance control measures.

- **Characterizing known and hypothesized risk factors among high-risk groups:** Research is needed to better characterize risk factors associated with high-risk occupational groups, including construction and maintenance workers, police and sheriffs' patrol officers, firefighters, and truck drivers. Studies of injury types, tasks, and organizational-level factors such as job activities, equipment use, shift work, long work hours, training, safety climate, and job design and management should be considered as part of this research.

- **Emerging technology development, evaluation, and implementation:** As technologies advance, new work methods (for example, advanced fall protection technologies and advanced worker assistance systems for working safely at height, including mast climbing work platforms, height access devices, energy diffusion bags, drones, and robots) offer improved worker safety and productivity but may also introduce unforeseen hazards. Efforts are needed to understand, evaluate, and communicate new solutions and guidelines to workers, employers, safety professionals, and research communities, with the goal of fostering adoption in the workplace and safe interactions between humans and new technologies.

- **Research-to-practice and communication:** To be effective in reducing STFs, evidence-based STF prevention and protective measures need to be transferred into practice in the workplace. First, STF prevention science

and solutions need to be developed into user-friendly guidelines for field implementation. Second, strategies need to be developed and evaluated to ensure that employers have access to evidence-based results and can successfully implement them. Among the factors to be considered are worker literacy (both general and safety-related), socio-demographic characteristics, and preferred communication channels. Third, research should extend to assessments of compliance and implementation of these strategies, especially for incorporation into industry practice and safety standards. Influencing safety standards is a good example of research-to-practice.

Objective 3: Reduce violence in the workplace

Violence can occur in any U.S. workplace**,** as evidenced by the over 16,000 intentional injuries by other persons that resulted in time away from work in 2015 [BLS 2016b]. Additionally**,** in 2015, about 10 percent of reported fatal workplace injuries were the result of workplace violence (WPV) [BLS 2017d]. Research has demonstrated that these statistics only describe part of the problem [Arnetz 2015]. It is important to note that many incidents of violence do not result in an injury requiring immediate medical treatment and therefore go unreported, demonstrating a need for improved surveillance efforts.

Intervention research is needed to determine the effectiveness and cost-effectiveness of efforts to minimize or eliminate risk factors for all workers, particularly those in high-risk socio-demographic groups based on sex, age, race/ethnicity, foreign-born status and geographic location**,** who are injured or killed at disproportionately higher rates [Steege et al. 2014; Chaumont Menéndez et al. 2013; Chaumont Menéndez et al. 2017]. Workers in many of these groups work in industries and occupations – such as education, healthcare, law enforcement, retail, and transportation – that are at higher risk of WPV. Evaluation of existing state-based and municipal legislation aimed at preventing violence to some high-risk groups, such as health care and retail workers, is needed. Additionally, feasible and effective interventions, including training, are available to reduce the risk of WPV in many work settings, and additional research that leverages safety communication methods is needed to demonstrate evidence-based approaches to achieve widespread and equitable implementation that is sustainable.

Objective 4: Prevent injuries related to human-machine interaction for current and evolving technologies

Research into human and machine interaction is needed to advance worker safety. Such research can be used to design safety into machines and industrial equipment, and into the systems in which they operate. Research can foster development of machines and industrial equipment with effective safety features that accommodate worker cognition, perceptions, preferences, and innate tendencies. Research into the basics of human-machine interaction can help us design systems that: encourage humans to comply with safeguards and safety systems intended to keep them from harm, prevent safeguards from being circumvented, and have built-in redundancies to prevent serious traumatic injuries when incidents do occur. This research is needed for machinery and equipment in today's workplaces, such as tractors and forklifts, as well as control systems, monitoring systems, supervisory systems, and machinery that will become more prevalent over the next decade. In this increasingly technological world, robots and automated systems are becoming more and more a part of the work environment. These systems include robots, automated control systems, powered exoskeletons, sensor-based systems, smart glasses, augmented reality, autonomous transportation, and other systems that use artificial intelligence and mobile platforms. This research objective includes surveillance (with attention to issues that can impact level and accuracy of reporting), trend analysis, intervention effectiveness evaluation, risk identification, standards and policy development, and health communication and dissemination.

Machines and industrial vehicles contribute to considerable numbers of worker deaths and injuries each year [Marsh and Fosbroke, 2016], illustrating the continued need for research on the human-machine interface for machines commonly used in today's workplaces. The body of knowledge on new automated and robotic system risks is not yet well-established or, in some cases, not even well-defined. Therefore, research will be necessary to develop hazard identification strategies and hazard mitigation methods [Murashov et al. 2016]. While some suggest that the worker is being displaced by robots and automation, it is more correct to say that the worker's role is changing and integration with robots and the automated environment is becoming increasingly important. In that transforming role, workers may have an unrealistic understanding of the risks of working within this more automated work environment as they strive to remain productive contributors to the overall system. So this research objective is to promote and allow more and different kinds of research in the pursuit of a better understanding and quantification of the current state of risks in today's and tomorrow's workplaces. Research is needed to better understand the types and magnitudes of risk relating to the complex nature of these systems, the complex nature of the interface between humans and machines, and the ever-changing interaction between the two. In this continually changing work environment, research that is robust and fast-paced must be supported and promoted in order to keep up with a rapidly changing risk profile.

Objective 5: Promote safety in non-standard work arrangements

This objective is proposed to investigate, analyze, and evaluate practices that affect the safety and health risks of workers in non-standard work arrangements. These include temporary workers from agencies who supplement an organization's employee rolls on a non-permanent or intermittent basis, independent contractors who provide services to a business but are not part of the employment rolls, and gig workers, often referred to as "app-based" workers because of the use of technology connecting them to customers [Howard 2017]. Workers in these non-standard arrangements may be referred to as "day laborers," "temporary," "seasonal," "contractors," "contingent," "on-call," or "freelancers." In many instances, non-standard work arrangements are found in higher-risk industries such as construction, landscape services, agriculture, and transportation. A common feature of these work arrangements is that there is no expectation of permanent employment. Records of injuries and illnesses among temporary worker populations are inconsistent, but over the past 20 years, studies have shown increased occupational safety risks [Benavides et al. 2006; Smith et al, 2010]. In addition, the number of workers in temporary positions has increased significantly in recent years [BLS 2017e; Nicholson 2015].

Increased occupational safety risks may be attributed to the worker's lack of knowledge about how to identify hazards and how/where to report injuries; lack of knowledge about workers' rights; worker failure to recognize or raise concerns about safety and health risks; worker concerns about reprisal, dismissal, and future employment; language or cultural barriers; employer costs associated with training temporary workers; employers' reluctance to record injuries or illness of temporary workers; and non-traditional employers (for example, homeowners) with little understanding of worker safety and health [Howard 2017]. Additional research is needed to identify and reduce risks associated with non-standard work arrangements. This should include efforts to obtain consistent data regarding temporary workers who are paid in cash or in-kind benefits and therefore not included in traditional surveillance data sources such as BLS and workers' compensation [Kosny et al. 2012]. Research could also explore economically driven risks and failures.

Objective 6: Improve occupational safety equity across worker populations

Risk of occupational injuries and fatalities differs greatly depending on the industry or occupation in which a worker is employed [BLS 2016b; BLS 2017f, 2017g]. Examples of workers at disproportionately higher risk due to hazards inherent in their work (for example, violence, extreme weather, working alone) include home health care

workers, emergency responders, taxicab drivers and other drivers-for-hire, and construction workers. In addition, socio-demographic factors such as age, sex, race and ethnicity, nativity, immigration status and type of work arrangement have been shown to play a role in a worker's injury risk, due in part to certain demographic groups being over-represented in higher-risk, low paying jobs [Steege et al. 2014].

Addressing disparate rates of injuries and fatalities within high-risk worker groups requires improved surveillance that addresses underreporting and misclassification of employees to better identify trends in occupational injury across socio-demographic groups. In addition to surveillance, research evaluating the effectiveness and cost-effectiveness of interventions in use is crucial, as is the development and evaluation of innovative, culturally appropriate interventions. Translational research focusing on novel approaches for successful implementation of occupational safety solutions for these diverse worker groups is imperative.

Objective 7: Improve organization-based injury prevention

It is generally understood that safety in the workplace requires input and engagement from employees at all levels of the organization. Establishing a safety and health program to protect workers involves both leadership from management and the participation of workers. A proactive, collaborative approach to addressing hazards before they result in injury is preferred to a reactive approach once injuries have occurred.

Management leadership includes a commitment to implementing a safety and health program and to seeing that it is maintained, evaluated, and, where necessary, improved. Some specific management-driven activities include: using available surveillance data to identify trends, identifying best practices to plan and implement interventions, determining compliance on an ongoing basis, evaluating the impact of any intervention that is implemented to determine if it reduces risk and is cost-effective, using that evaluation to refine the intervention as necessary, and maintaining up-to-date awareness of current standards and policy development. Management commitment to worker safety is often operationalized as a comprehensive safety management system.

A workplace environment that enables and supports a culture of safety, where workers at all levels can speak up without fear of retribution when they identify issues that need to be addressed, has been encouraged by OSHA and others [OSHA 2016]. This includes: encouragement for workers to participate in and provide input to the program, have access to information they need to participate effectively, have opportunities to participate in all phases of program design and implementation, and to not experience retaliation when they raise safety and health concerns; report injuries, illnesses, and hazards; participate in the program; or exercise safety and health rights.

Research is needed to:

- Develop and evaluate leading indicators of occupational safety, including employee-management safety committees, incident investigation and response, pre-job planning, adherence to equipment maintenance, and training
- Evaluate risk factors for injury associated with work organization, such as shift work, fatigue, and safety culture and climate
- Evaluate safety management systems and other organization-based interventions, including prevention through design, safety audits, and worker training
- Understand effective ways of communicating information to workers at all levels (for example, addressing language issues, communication styles, use of mobile vs. print-based methods)
- Understand the full financial impact of injuries and illness (for example, including indirect costs such as lost production time)

Objective 8: Promote rigorous evaluations of occupational injury prevention programs and efforts

Rigorous evaluations of occupational injury prevention programs and efforts are needed to ensure that they are effective and a worthwhile use of resources. Well-intended efforts are not always effective in practice, and can sometimes have unintended consequences (such as underreporting of injuries to receive safety incentives).

Many evidence-based interventions for preventing work-related injuries have been identified. These interventions include: safety devices, training and education, policies and programs, and strategies that incorporate a combination of interventions to maximize their effectiveness. Occupational safety and health operates on the paradigm that solutions that can successfully eliminate or substitute a risk are the most practical and effective compared to interventions that require workers or employers to adopt or change behaviors. Occupational safety training can be effective for specific worker safety behaviors [Robson et al. 2010], that occupational health and safety management systems increase safety activities and reduce injury costs [Robson et al, 2005], and that return-to-work/disability management programs can reduce injuries and illnesses and decrease workers' compensations costs [Tompa et al. 2007; Brewer et al. 2007]. Small business establishments may have limited understanding of responsibilities and hazards for workplace safety [MacEachen et al. 2008]. Age in and of itself is not a risk factor for injuries among teenagers, but rather the occupations or work hazards and industries in which they work is [Curtis Breslin et al. 2006]. While these findings from systematic reviews provide a basis for effective injury prevention efforts, more research is needed on these and other topics that include organizational-level work environments and individual worker characteristics such as anthropometry and socio-demographics. Systematic exploration of loss prevention strategies and interventions to ensure that all interactive effects are considered as much as primary effects and their results is also needed. The additional research will ultimately yield systematic reviews, and meta-analyses when possible, with stronger evidence based on a wider range of safety outcomes that would include implementation, sustainability, and cost-effectiveness.

There is a need for dissemination and implementation research to identify effective and promising strategies to translate evidence and promote the reach, adoption, and sustainability of interventions, as well as barriers and facilitators to effective implementation [Rogers 2003; Tabak et al. 2012; Neta et al. 2015]. Future dissemination research should include as a focus the effectiveness of health communications and emerging technologies such as mobile apps and digital toolbox kits. Additional research determining measures for effectiveness is also crucial and should include cost-effectiveness, solutions appropriate for small businesses, new approaches to hazard or risk identification and assessment, and the role of external influences such as insurance schemes and organizational and public policy. A systems-based approach to evaluating injury prevention efforts and their dissemination and implementation is crucial for rigorous findings needed to advance injury prevention efforts.

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Appendix A: Members of the Inaugural Traumatic Injury Prevention Council

Name	Affiliation
Gouranga Banik, PhD, PE, PMP, F.ASCE	Oklahoma State Univ/College of Engineering, Architecture & Technology/Div of Engineering Technology
Aaron Cameron, CSP	Ansaldo STS (a Hitachi Group Company) and American Society of Safety Professionals
Dawn N. Castillo, MPH *(council co-chair)*	NIOSH
Michelle Canham Chervak, PhD, MPH	US Army Public Health Center
Cammie Chaumont Menéndez, PhD, MPH, MS	NIOSH
Jerry Davis, PhD, CSP, CPE	Auburn Univ/Dept of Industrial & Systems Engineering
Michael E. Formaini, CSP	Matrix North American Construction
Carole Franklin	Robotic Industries Association
Susan Gould, CSP, CHST, OHST	Parsons/Infrastructure Group
Joel M. Haight, PhD *(council co-chair)*	University of Pittsburgh/Dept of Industrial Engineering
Robert J. Harrison, MD, MPH	California Dept of Public Health
Daniel P. Hartley, EdD	NIOSH
Hongwei Hsiao, PhD	NIOSH
Tianyan Hu, PhD	Florida International Univ/Robert Stempel College of Public Health & Social Work/Dept of Health Policy & Mgmt
Andrew Levinson, MPH	OSHA/Directorate of Standards & Guidance
Jennifer M. Lincoln, PhD, CSP	NIOSH
Christopher A. Monk, PhD	National Highway Traffic Safety Administration
John R. Myers, MSF	NIOSH
Stephen Newell, JD	ORCHSE Strategies, LLC
Ian Noy, PhD, CPE	Liberty Mutual Research Institute for Safety
Keshia M. Pollack Porter, PhD, MPH	Johns Hopkins University/Bloomberg School of Public Health/Dept of Health Policy & Management
Stephanie G. Pratt, PhD	NIOSH
Rebecca L. Reindel, MS, MPH	AFL-CIO
Kevin Riley, PhD, MPH	UCLA/Labor Occupational Safety & Health Program (UCLA-LOSH)
Linda Rowley, PhD, CSP, CET	Trinidad State College/Occupational Safety & Health Tech
Christine R. Schuler, PhD	NIOSH
Sergey Sinelnikov, MPH	National Safety Council
Treasa M. Turnbeaugh, PhD, MBA, CSP, ASP, CET, CAE, IOM	Board of Certified Safety Professionals
Sydney Webb, PhD	NIOSH
Matthew Zock, MS, CIH	FedEx Ground/Safety Advisory Center

Appendix B: Strategic Objectives Workgroups

Objective 1: Prevent work-related motor vehicle crashes and injuries

Stephanie Pratt (lead), Gouranga Banik, Hongwei Hsiao, Cammie Chaumont Menéndez, Keshia Pollack Porter, Matthew Zock

Objective 2: Reduce falls and advance fall protection

Hongwei Hsiao (lead), Aaron Cameron

Objective 3: Reduce violence in the workplace

Dan Hartley (lead), Robert Harrison, Cammie Chaumont Menéndez

Objective 4: Prevent machine-related injuries

Joel Haight (lead), Jerry Davis, Carole Franklin, Hongwei Hsiao, Matthew Zock

Objective 5: Promote safety in non-standard work arrangements

Jennifer M. Lincoln (lead), Aaron Cameron, John Myers, Linda Rowley

Objective 6: Improve occupational safety equity across worker populations

John Myers (lead), Susan Gould, Cammie Chaumont Menéndez, Kevin Riley

Objective 7: Improve organization-based injury prevention

Christine Schuler (lead), Michael Formaini, Susan Gould, Joel Haight, Andrew Levinson

Objective 8: Promote rigorous evaluations of occupational injury prevention programs and efforts

Cammie Chaumont Menéndez (lead), Michelle Canham Chervak, Joel Haight, Keshia Pollack Porter