CDC Acute Injury Care Research Agenda: Guiding Research for the Future

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Foreword

Injuries are the number one killer of children and young adults in the United States. More than 28 million injuries serious enough to require emergency medical care occur annually. The lives of millions of others have been dramatically affected by injuries to themselves or someone they love. The prompt provision of emergency medical care, both in and out of the hospital, can limit the consequences of injuries and mitigate disability.

In 2003, the National Center for Injury Prevention and Control—CDC's Injury Center—embarked on a process to update the *CDC Injury Research Agenda* (2002) in the area of acute injury care and identified gaps that exist and need to be addressed through research. We have separated the acute injury care research needs from their previous inclusion in the *CDC Injury Research Agenda* chapter titled, "Acute Care, Disability, and Rehabilitation," and created a distinct chapter. This new chapter articulates CDC's highest priorities in acute injury care—those questions that we *must* answer to fulfill our public health responsibilities.

The care of the acutely injured is a public health issue and involves bystanders and community members, health care professionals, and health care systems. It encompasses prehospital care, through the provision of land- or air-based emergency medical services; emergency department assessment, treatment, and stabilization of injured patients; and in-hospital care for the surgical and medical management of acute injuries among all age groups. The importance of trauma care systems in managing injured persons became increasingly clear in the aftermath of the events of 9/11 and subsequent episodes of mass casualties. The effects of overburdening the trauma care system during normal daily operations are magnified during disasters; these effects can ripple through the entire prehospital, hospital, and non-hospital medical system. It is also clear that we can learn important care lessons from other nations that have suffered from terrorist and disaster events; these lessons learned will benefit the care of U.S. citizens.

Many people with wide-ranging backgrounds in public health and acute injury care helped develop the acute injury care chapter for the research agenda. Injury Center staff worked extensively through planning, writing, discussing, and revising. Many individuals from a variety of organizations served on work groups, attended meetings, and reviewed documents. Under the leadership of Dr. Brent Eastman, Chair, and Dr. Ralph Frankowski, Vice-Chair, members of the Acute Injury Care Research Agenda Steering Committee shared perspectives that were extremely important in shaping the agenda. Special appreciation is expressed to Dr. Richard W. Sattin for his vision and leadership, to Dr. Scott M. Sasser for his organizational skills and subject matter input, to Stacy L. Harper and Angela Marr, for their administrative and logistic skills, and to Jane Mitchko for her communication expertise in the development of this agenda. Many others provided comments and participated in discussions that proved vital to the agenda-setting process. The names of individuals who were most involved in the process are listed in the acknowledgments.

Implementing this agenda will be challenging. Increased infrastructure support, together with additional resources for carrying out acute injury care research, will be needed to learn how to significantly improve the outcomes of persons who are injured. Investing in the priorities noted in the acute injury care chapter will help to prevent needless deaths, lessen adverse health effects from injuries, and lessen the cost of medical care to the injured. We look forward to working with the injury prevention and control community to implement this acute injury care chapter for a safer, healthier nation.

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Background

Injuries have a substantial impact on the lives of individual Americans, their families, and society. The consequences of injuries can be extensive and wide ranging. They are physical, emotional, and financial; in the case of disabling injuries, the consequences are enduring.

The mission of CDC's Injury Center is to prevent premature death and disability, and to reduce the human suffering and medical costs caused by injuries. To prevent injuries and minimize their consequences when they occur, the Injury Center uses the public health approach, a systematic process to—

- define the injury problem;
- identify risk and protective factors;
- develop and test prevention interventions and strategies;
- ensure widespread adoption of effective interventions and strategies.

To reach its goal of translating science into effective programs and policies, the Injury Center collaborates with other federal agencies, academia, state agencies, and other partners to document the incidence and impact of injuries, understand the causes, identify effective interventions, and promote their widespread adoption.

The importance of research in reducing the problem of injuries has been described before. For example, the 1985 Institute of Medicine (IOM) report, *Injury in America*, concluded that supporting injury research is necessary to substantially reduce injury rates; the Injury Center's formation was, in part, a result of this IOM finding. Fourteen years later, another IOM report, *Reducing the Burden of Injury*, re-emphasized the importance of a scientific foundation for injury prevention and called on the Injury Center to work with foundations, states and communities, businesses, and other federal agencies to stimulate and facilitate investment in injury research activities. As with the original research agenda, this revised acute injury care chapter is a step toward meeting that goal.

Public Health Burden

In 2002 in the United States, more than 160,000 people died from injuries, and people experienced more than 28 million nonfatal injuries serious enough to require a visit to the emergency department. Injuries—including unintentional injuries, homicide, and suicide—are the leading cause of death for people ages 1 to 44. Injury is the leading cause of years of potential life lost before age 65. Approximately one third of all emergency department visits and 8% of all hospital stays result from injuries.

Injuries, similar to disease processes, involve an interaction between host, agent, and environment. Their impact is physical (tissues, organs, and systems), emotional, and psychological. They are both predictable and preventable. They can have both short-term and long-term effects, not only on the lives of injured individuals but also on their families, health care workers, and society. Due to the extensive nature of the injuries, outcomes are dependent on a broad continuum of multidisciplinary care.

The estimated direct medical costs for the care of the acutely injured in the United States alone is $80 billion per year (82% of which is for injuries requiring an emergency department visit or hospitalization). By implementing the research priorities fully, the nation could save a significant percentage of the cost of acute injury care, leading to billions of dollars saved each year. The cost of not investing in the research priorities will lead to even greater individual and societal costs.

The Injury Center's Niche in Acute Injury Care

The Injury Center is the only organization within the federal government with the responsibility to address all phases of the injury research framework—from foundational research through dissemination research, as described in the 2002 *CDC Injury Research Agenda*—for all major causes of injury among all age groups. As part of this responsibility, the Injury Center focuses on the entire continuum of acute injury care (e.g., emergency medical services, emergency medicine, and trauma surgery) as it relates to public health. Staff of the Injury Center has extensive experience working with organizations responsible for the care of the acutely injured at local, state, and national levels. This experience positions the Injury Center well to help set research priorities, provide technical assistance for research programs, and facilitate translation of new findings into practical methods for evaluating outcomes of the acutely injured. The Injury Center's partnerships with state health agencies, academic injury research programs, and health care practitioners provide a vital foundation for establishing and fostering a broad-based, multidisciplinary approach to acute injury care. These relationships also help provide unique opportunities to catalyze, coordinate, and disseminate innovations in the care of the acutely injured, including the best ways of managing persons injured from the unfortunate episodes of terrorism occurring worldwide.

The Injury Center focuses on the development and evaluation of public health systems research across the continuum of acute injury care in order to prevent premature death and disability. The Injury Center's research and programs in the area of acute injury care are designed to inform efforts to reduce the impact or prevent the development of secondary conditions and other adverse outcomes of acute injuries. This focus differs from and complements the activities of other federal agencies involved in acute injury care. For example, federal responsibility for supporting trauma care systems in order to administer quality, cost-effective care at the local level resides with the Health Resources and Services Administration, whereas the Injury Center supports research in the evaluation of the effectiveness of trauma systems and the outcomes of acutely injured persons. The Injury Center's focus on applied acute injury care research in the civilian sector complements the National Institutes of Health's focus on basic scientific research and the Department of Defense's focus on studying prehospital acute injury care to improve outcomes on the battlefield.

The Injury Center has a strong partnership with the National Highway Traffic Safety Administration (NHTSA) which has developed several national standard curricula for prehospital emergency care personnel. NHTSA is completing work on a National EMS Research Agenda, which addresses several areas related to acute injury care in the prehospital setting only.

The Injury Center reviewed its current *CDC Injury Research Agenda* chapter on acute care, disability, and rehabilitation and found that, of the 13 priority areas for research in that chapter, only 3 deal specifically with acute injury care, and none deal with acute injury care in the context of terrorism preparedness and response. Our federal partners agree that there are critical gaps in the care of the acutely injured and the systems that manage that care. Recognizing these gaps, the Injury Center, together with support from our federal partners and national organizations representing the full spectrum of acute injury care, developed a plan to supplement the current *CDC Injury Research Agenda* with a revision of the acute injury care chapter.

The Agenda Development Process

To ensure consideration of a broad range of research, the Injury Center invited a wide array of constituents to participate in developing the acute injury care research agenda chapter. Throughout the process, the Injury Center relied on guidance from individual members of its Acute Injury Care Research Agenda Steering Committee, the 13 members of which included leaders in emergency medical services, emergency medicine, trauma surgery, epidemiology, and public health, and included other federal agency partners. Additionally, members of the Advisory Committee on Injury Prevention and Control (ACIPC) commented on the content of the draft research agenda chapter and provided advice about its implementation.

The Steering Committee first identified thematic research areas in acute injury care not currently addressed within the existing *CDC Injury Research Agenda*. The five thematic areas selected for further discussion included: 1) information and data systems for injury studies; 2) measurement of quality and outcomes; 3) clinical intervention and prevention services; 4) best or needed practices—characteristics of successful models; and 5) systems effects of mass casualties, disasters, and overcrowding.

Injury Center staff then asked key partner organizations and agencies that represented researchers, practitioners, and policy makers to recommend working group members. Individual working group members represented the broad spectrum of public health and acute injury care, and included representatives of professional organizations, academic institutions, federal agencies, private corporations, and consumers. Working groups, each composed of 8 to 10 members, focused on the five thematic areas, exploring each further, developing the theme and research priorities within that specific area, and then presenting those research priorities to the general session for feedback and revision.

Upon recommendations of the ACIPC, the Steering Committee also incorporated the three research priorities related to acute injury care from the previous Injury Research Agenda into the updated acute injury care chapter. This process led to seven research priorities.

The Injury Center announced the development of the Acute Injury Care Research Agenda chapter in the Federal Register, inviting public comment. Through correspondence with all current grantees, relevant federal agencies, researchers, practitioners, and professional organizations and through presentations at major acute injury care professional conferences, the Injury Center solicited input from the injury care community.

Acute Injury Care Research Agenda

CDC, with guidance from members of the Acute Injury Care Research Agenda Steering Committee and the Advisory Committee for Injury Prevention and Control, discussed many research areas for acute injury care, but only those that were of highest priority were included in this chapter. These highest-priority research areas are similar to those noted with an asterisk in the 2002 *CDC Injury Research Agenda*.

A. Evaluate strategies to translate, disseminate, implement, and adopt science-based recommendations and guidelines for the care of the acutely injured.

New treatments involving acute injury care are often not adopted uniformly. Important research may be conducted and published or guidelines developed, yet the results may not be widely used because there are no existing mechanisms or infrastructure to ensure their translation, dissemination, implementation, and adoption. For example, it has been shown that many patients with traumatic brain injury transported to acute injury care facilities are being hyperventilated, which is contrary to existing guidelines. Another example is the delay of transfer while waiting for diagnostic test results of acutely injured patients even after the necessity of transfer is recognized. The lack of mechanisms and infrastructure between large, urban academic centers; between large, urban academic centers and smaller, community hospitals; and between hospitals in different regions and locales is a major barrier for using current science-based recommendations and guidelines. As a result, a need remains, throughout the country and at all levels of care, for better translation of knowledge into patient care and for dissemination, implementation, and adoption of resulting care strategies. To achieve these goals, several steps must be undertaken. First, acute injury care researchers must examine successful models and methods used currently or previously in other arenas for dissemination, implementation, and evaluation of evidence, protocols, and guidelines to identify key principles that may be used in acute injury care. Based on these analyses, strategies should be developed for effective dissemination, including not only the use of existing and future technology and specialty journals, but also the identification of new and novel approaches to dissemination. It is critical that the efficacy, effectiveness, and impact of each strategy be determined. Second, a research approach must be developed to identify and overcome the barriers (administrative and legal) to effective translation and subsequent use. Finally, methods to validate protocols and guidelines before and after dissemination should be developed.

B. Develop and evaluate acute injury treatment strategies that will result in defining evidence-based management protocols for persons who sustain life-threatening injuries, injuries that could lead to significant disability, or both.

As the initial step in identifying and ensuring best practices, clinical studies have the potential to decrease mortality and to improve the outcome of serious injuries. Therefore, they provide the basis for other priorities in this research agenda. These studies might focus on treating or reducing the effects of specific injuries (e.g., the effectiveness of specific interventions on outcomes across the spectrum of acute injury care, on outcomes from organ-specific injuries such as traumatic brain injury and long bone fractures in the multiply injured patient, and on outcomes from blast injuries after explosions); or they may investigate the management of an injury or a combination of injuries on specific populations (based on life stages, gender, genetics, and the like). Other examples may include the optimal means of airway support in the prehospital setting, optimal fluid management across the spectrum of acute injury care, and optimal management of severely injured elderly patients. It is recognized that multi-center investigations might be required to provide sufficient statistical power to support scientific recommendations.

C. Determine and evaluate the components of trauma systems that contribute to improved outcomes for the acutely injured.

Some investigators have shown that trauma systems save lives, but which components of a trauma system improve health outcomes other than mortality remain unknown. Therefore, research is needed to identify and evaluate the specific components of trauma systems across the continuum of care (from prehospital through hospital and rehabilitation) that contribute to improvements in outcomes for the injured, and to determine how specific components can be tailored to improve system performance. It is critical to evaluate clinical care provided in different aspects of the system, including prehospital, hospitals (emergency departments, trauma centers, operating theaters, intensive care units, and burn units), and rehabilitation facilities.

Research is needed to evaluate data collection and use across the system; evaluate field triage and inter-hospital transfer guidelines; determine the potential for using the existing trauma care infrastructure in any disaster event, including chemical, biologic, nuclear, and conventional; compare urban and rural environments; determine the health outcome effects of dispatch, response, scene time, and other prehospital system components; and evaluate the impact of prehospital care on overall trauma care and outcomes. Determining morbidity, quality of life, functional status, and cost will help define the benefits and costs of trauma care systems and their components, including determining which patients benefit most from trauma care systems. In all aspects of trauma care, studying outcomes and costs will likely yield insights that influence policies and practices at the national, state, and local levels. These insights can be applied in ongoing efforts to monitor and improve system performance and may be useful in research conducted about specific clinical interventions.

D. Determine and evaluate how acute injury care is affected by mass casualty and disaster situations.

Mass casualty situations and disasters, related to conventional weapon terrorism (explosions), military conflicts (declared or undeclared), natural phenomena (e.g., hurricanes, tornadoes, earthquakes, tsunamis), or other events (e.g., structural collapse, plane or railway crash) remain a real and ongoing concern for acute injury care providers both in the United States and abroad. The injuries, death, disability, and emotional stress that result from such events may create both real and perceived difficulties in accessing medical care and vital services. As a result, there are multiple concerns about how best to provide acute injury care in such situations. The impact of these events upon already fragile, overburdened, and under-funded or nonexistent systems of trauma care—with regard to operations, surge capacity, staffing, and logistical concerns—remains unknown. Further examination and evaluation of these "systemic" effects of mass casualties is warranted, including learning from other nations that have experience caring for victims of terrorist acts.

Optimal data systems for use in mass casualty and disaster events remain a challenge. There is a need to identify and evaluate strategies to enhance methodologies for data collection and use, maximize the use of existing data systems, and achieve the real-time use of data during an event. Effective communication is often difficult during a mass casualty or disaster event. Strategies to maximize communication through improving systems interoperability and eliminating redundancy must be developed and evaluated. Often, trauma systems are not integrated with disaster planning which focuses more on law enforcement, fire prevention, power supply and other infrastructure issues than on the care of the acutely injured. Strategies to integrate trauma systems with disaster planning need to be developed and evaluated. Current models of field triage, which may triage certain individuals to die at the scene, must be reexamined and evaluated in the context of current community resource availability, specialty services, and legal constraints. Despite the multiple educational programs currently available, the exact type and extent of education for various providers (prehospital and hospital) is unknown. Researchers must identify and evaluate the core competencies for those responding to or involved in a mass casualty or disaster event to ensure an appropriate level of knowledge and expertise. Many serious secondary injuries may occur after a disaster; improvements in acute injury care management of these difficult environments and situations need to be developed and evaluated.

E. Develop and evaluate protocols that provide on-site interventions in acute care settings or linkages to off-site services for patients at risk of injury or psychosocial problems following injury.

Clinical preventive services for patients treated in emergency departments, hospital trauma units, and other acute care settings can help reduce the risk of injury and mitigate the effects of injuries that do occur. Such services might include instruction in the proper use of safety restraints and screening and interventions for alcohol problems, intimate partner violence, or child maltreatment. For injured patients, emergency department visits and inpatient hospital admissions for trauma care may provide crucial opportunities for early identification of and intervention for post-traumatic stress disorder and other psychosocial problems that can follow or be exacerbated by injury.

Assessing the baseline mental health status of trauma patients and determining intervention needs (e.g., for alcohol, post-traumatic stress disorder, illicit drug use) is needed.

Decision makers are often reluctant to fund clinical preventive services because they believe the investment needed to implement a single service in one clinical setting is too high. Research should demonstrate the effectiveness and value of such services and examine ways to implement multiple services simultaneously to amortize operational costs.

F. Develop and evaluate interventions for the individual, sociocultural, and community consequences of acute injury.

The emotional, financial, and psychosocial effects of an acute injury may be more debilitating than the actual physical injury. The severity of these effects is an essential determinant of long-term functionality. An acute injury has not just an immediate effect on the injured person, but also a long-term "ripple effect" on that person's life and the lives of others in his or her family and community. For example, an injured father may face temporary or permanent loss of income, changes in the relationship with his wife, and an inability to care for his children. His wife may shift from spouse to caregiver and may take on responsibility for the family's income. His children may experience emotional trauma not only from their father's injury but from changes in their routine or living situation. Health care providers are also subject to psychosocial problems resulting from caring for the acutely injured and their families on a daily basis. In the event of a mass casualty or disaster event, these "ripple effects" may affect a community's societal and functional infrastructure extensively. It is important to identify and evaluate strategies that will mitigate damage to individuals, families, and society following injury, and to assess the cost effectiveness of these strategies.

G. Identify and evaluate new or existing health measures to better assess both short-term and long-term outcomes for persons treated in a prehospital and hospital acute injury care setting.

Determining improvements in outcomes for the acutely injured may be difficult, when trauma centers, emergency care facilities, and hospitals focus on reducing mortality alone without focusing on morbidity and other health outcomes. There is, therefore, a need to develop in the acute care setting additional health measures, including health care costs, lost work days, and quality indicators related to pain management, palliative care, and stress experienced by individuals and families. Also, it is likely that different treatments received in the prehospital and hospital acute care setting can lead to different long-term outcomes for the acutely injured. Thus, there is the need to evaluate and validate both new and existing methods of reporting acute injury care and trauma system outcomes that extend beyond mortality to include long-term functional outcome, familial and social outcomes, and economic impact and outcome. New methods of measuring morbidity, quality of life, functional status, and cost will help define the benefits and costs of trauma care systems.

Building Research Capacity

CDC's Injury Center, together with the Steering Committee and the ACIPC, recognizes that the successful implementation of the Acute Injury Care Research Agenda relies heavily on the simultaneous development of a research infrastructure that can support investigations in the proposed research priorities. To this end, the Injury Center recommends infrastructure development in four primary areas. First, the Injury Center recommends research efforts in injury prevention and control across the spectrum of acute injury care, including the development of an acute injury care research network or use of an existing network that would allow coordinated research. Second, the Injury Center recommends the examination of existing databases to see how they may best be used to assess and improve systems of acute injury care, including initial steps to strengthen the information infrastructure and maximize the use of current data sources. Third, the Injury Center recommends the expansion and restructuring of existing training and education programs in injury care and prevention targeting health care professionals. Education in acute injury care for health care professionals remains crucial to successful injury prevention and control efforts, is necessary for infrastructure development, and is necessary to create the cadre of acute injury care research professionals to ensure long-term success. Finally, the Injury Center recommends that efforts be undertaken to determine, evaluate, and address barriers and obstacles to conducting acute injury care research, including those presented by institutional, jurisdictional, clinical, legislative (including the Emergency Medical Treatment and Active Labor Act), and administrative issues.

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