

Addressing the Growing Burden of Trauma and Injury
in the Developing World

Abstract

Developing countries suffer disproportionately from reduced life expectancy and quality of life. Trauma and injury are often overlooked as contributors to global inequities in health; yet long-term disabilities from injury represent a significant burden. The Fogarty International Center at the National Institutes of Health (NIH) convened a panel of 40 experts in trauma and injury from both the United States and developing nations to build a research agenda to create new knowledge and support the development of new investigators in the field. The participants identified epidemiology and surveillance, basic science, prevention research and policy research as priorities for the investment of NIH funding to improve global health by reducing the impact of trauma and injury in low and middle-income nations.

Global Inequities Due to Trauma and Injury

Significant disparities in life expectancy and quality of life exist between high-income nations and low- and middle-income countries. Low- and middle-income nations, constituting three-quarters of the world's population, suffer over ninety percent of the burden of premature mortality as measured in lost years of life. Because infectious diseases and malnutrition are responsible for 16 million deaths per year, the impact of trauma and injury on premature mortality and long-term disability is often overlooked. Yet there are more than five million deaths from injuries each year, accounting for nearly one in ten deaths globally.¹ Road traffic injuries are responsible for roughly one-quarter of the total, while intentional injuries—both suicide and interpersonal violence—account for another quarter.² There is also a preponderance of long-term disability from extremity injuries in many less developed countries; such disability should be eminently preventable with low-cost improvements in hospital-based care.^{3,4,5,6} Despite the fact that a tremendous amount of resources are consumed caring for injured patients at hospitals throughout the developing world, minimal attention has been directed toward better understanding of injury, prevention efforts, or organized efforts to improve trauma treatment systems. The amount of funding devoted to such efforts is a small percentage of that devoted to other health problems in developing countries.⁷

According to World Health Organization (WHO) estimates, almost 90% of deaths due to injuries take place in poorer countries and injuries will be among the leading global health problem in this millennium.^{8,9} The Newly Independent States in Europe have the highest overall injury mortality rates while North America, Western Europe, and

Australia/New Zealand have the lowest overall injury mortality rates.^{1, 10} Each year about one million people die and about 10 million are seriously injured on the world's roads.⁹ The World Health Organization has indicated that, for people aged 3-35 years, road traffic crashes are now the leading cause of death and disablement. The global economic burden of road traffic crashes is estimated at \$500bn.¹¹ Most of the casualties are in low and middle income countries, and most are vulnerable road users: pedestrians, cyclists, and riders of two wheeled motor vehicles. Children as pedestrians are particularly vulnerable, and pedestrian injuries account for most of the 280,000 childhood road deaths each year.^{1, 9, 12, 13} Elderly pedestrians constitute another particularly vulnerable group.¹ In addition to the unequal distribution of death rates, there are differences in the etiology of injuries. For example, in developing countries, more than 70% of traffic deaths are among those who will never be able to afford to purchase an automobile.

Among the reasons why trauma and injury are so devastating in the developing world are inadequate systems of emergency care at both the community and hospital levels,^{14, 15, 16} inadequate infrastructure, such as paved roads, for transporting trauma victims to hospital or for providing for road safety;^{15, 17, 18, 19, 20} inequities in access to emergency response systems, as well as inequities in access to pre-hospital and hospital emergency services between cities and rural areas,^{8, 16, 21, 22, 23, 24, 25, 26, 27, 28} or due to inequitable income or racial differences;¹⁵ constrained resources;^{14, 16} lack of administrative leadership in ministries of health due to poor recognition of the impact of trauma on national health,¹⁶ inadequate public education and public communication around injury prevention issues;^{3,}

^{16, 29, 30, 31} an untrained healthcare workforce due to a paucity of specialty training in trauma care;^{3, 16, 33, 34} and inadequate communication, information and interfacility transfer systems.¹⁶ Compounding the problem is the fact that responsibility for injury prevention cuts across many administrative domains including public health, criminal justice, and road safety, among others.

Addressing the Challenges

To consider the challenges posed by trauma and injury in developing countries, and to determine appropriate actions, the Fogarty International Center at the National Institutes of Health (NIH) convened a meeting on the NIH campus on July 22-23, 2003. This consultation brought together approximately 40 researchers in the field of trauma and injury from both developing countries and the United States to advise on needs and priorities for research, training and the development of new technologies to reduce the burden of trauma and injuries in developing countries. Approximately one-third of the group currently work in or have ongoing research collaborations in the developing world. The major topics addressed included: Research gaps and training needs related to intentional and unintentional injuries in the developing world; basic science and options related to diagnosis and treatment of injury, wound care, wound healing, spinal injury, brain injury, and orthopedics; ethical challenges to performing trauma research; capacity building; and mental health issues related to trauma and injury.

The consultation was jointly sponsored by the Fogarty International Center, National Institute of General Medical Sciences, National Institute of Child Health and Human

Development, National Institute of Mental Health, National Institute of Biomedical Imaging and Bioengineering, National Institute of Neurological Disorders and Stroke, the National Heart, Lung, and Blood Institute at the NIH and the National Institute on Disability and Rehabilitation Research of the Department of Education. The involvement and commitment of several of the National Institutes demonstrates the increasing recognition of the disease burden caused by trauma and injuries.

FIC and its partners were interested in obtaining focused recommendations to guide the development of a research and research training agenda to pursue related to trauma and injury in the developing world.

Status of Trauma and Injury Research in the Developing World

Participants at the consultation reported that data about trauma and injuries in developing countries are sparse. There are an insufficient number of epidemiologists and other trained researchers in developing nations to conduct such research, and little funding to support their work. As poor as the data are on road traffic accidents, for political and social reasons data on trauma and injury due to suicide, interpersonal violence, civil wars, landmines, and crime are even less available. In the absence of data, public officials do not recognize trauma and injuries as serious public health problems.

Further compounding the challenges facing trauma and injury research in developing countries, clinicians in many nations who might otherwise participate in research efforts

are overwhelmed by the burden of infectious diseases and struggle to provide high-quality care in facilities that often lack basic equipment and supplies. They lack both time and training that would enable them to participate fully in a research study.

Finally, participants emphasized that conditions in developing countries that result in injury are different from those in the developed world. For example, road traffic injuries (RTI) are the leading cause of injuries across the globe. In developing nations, most RTI occur among pedestrians, rather than among drivers or passengers. Therefore, interventions such as road safety education may be important strategies to reduce RTI; these need to be validated, however. Similarly, developing nations face hazards--such as landmines—that are rarely seen in developed nations. These hazards create unique needs for low-cost technologies for trauma patients, e.g., prosthetics devices that can be made quickly and developed from local materials.

Other differences noted by participants include the absence of trained emergency medical services in most developing countries. This lack lengthens the critical time period before trauma victims are seen by clinicians and contributes to increased morbidity and mortality. Even in the largest hospitals, internationally-accepted guidelines for the treatment of trauma and injuries may not be followed, diagnostic equipment may not be up-to-date, resources are strained, and treatment practices that are widely used in developed countries are not being implemented. For example, advances in resuscitation, wound closing, and infection control have greatly reduced the survival of children who

experience massive burns in the United States; these practices are far less common in the developing world.

In addition to issues of pre-hospital and hospital care, consultation participants considered other critical components of trauma and injury care. These include the mental health impact of exposure to physical violence, trauma and injury, most commonly post-traumatic stress disorder and depression, affecting not only the victim but his/her family as well. Furthermore, trauma and injury create a need for immediate rehabilitation and often result in long-term disability that affect patients' productivity and often the well-being of the entire family.

Participants emphasized that each developing country is unique and that a deep understanding of the infrastructure and cultural characteristics of each nation needs to be factored into any research that is conducted.

A Research Agenda

To improve outcomes for trauma and injury victims in developing countries, research is needed that will inform policy-makers and improve clinical practice. Participants recommended the following kinds of research studies as the most critically needed:

a) Epidemiology: A broad spectrum of epidemiological and surveillance research is needed to enhance the knowledge of trauma and injury problems and risks relevant to

low- and middle-income nations. Such research is needed to document the causes and extent and nature of trauma and injuries in order to focus the attention of policy-makers and planners. Because of the challenges facing providers and researchers in developing countries, innovative surveillance data collection strategies that improve upon existing systems—such as improved clinician reporting mechanisms, development of common definitions for mechanism and nature of injuries, identification of minimum data sets required, and/or distributed data collection and analysis procedures—could help advance the field significantly.

b) **Basic Science** to improve the diagnosis and treatment of trauma and injuries through innovative and low-cost diagnostic strategies, including new low cost imaging techniques and effective inexpensive blood substitutes needs to be strengthened. Both new interventions and research on how to effectively modify existing ones based on local needs is a priority. Research is needed to adapt existing clinical guidelines to the needs of people in developing countries and to evaluate the efficacy of surrogate methods for diagnosis and localization of injuries.

c) **Prevention Research**: Studies are needed to better understand the context in which trauma and injury occurs in low- and middle-income countries, as well as human risk-taking factors that increase the likelihood of trauma and injury. This includes qualitative research about how trauma and injury-related technology transfer from high-income to low- and middle-income countries may be enhanced, development and evaluation of public education strategies about road safety for pedestrians to reduce road traffic

injuries, and outcome studies that document the effectiveness of primary prevention practices.

d) **Health Services Research** that documents the outcomes and cost of current trauma care systems, as well as research that explores innovative and cost-effective ways to provide low-cost diagnosis and treatment to trauma and injury victims, is also critical. For example, research on the impact of major elements of trauma care—pre-hospital care, use of internationally-accepted treatment guidelines, hospital treatment policies, among others—on patient outcomes is needed. Work is also needed to develop and evaluate innovative strategies to provide trauma care and/or mental health care through informal systems in remote areas not served by medical providers, as well as to identify the most cost-effective baseline equipment, training and infrastructure to provide trauma and injury care, given resource constraints. Diffusion research could help identify the most effective ways to increase the use of practices e.g., how to stop bleeding, accepted in high-income countries by providers in developing nations.

e) **Policy research** may examine obstacles to government commitment to injury prevention and recommend the most effective policy process for increasing the visibility of trauma and injuries on the national policy agenda.

As new research on trauma and injury in developing countries is pursued, it is critically important to address the many ethical questions that arise both in treating victims of

trauma and injury who may not be able to give informed consent at the time of entry into a study and more generally in conducting research in developing countries.

Building Research Capacity

Participants urged additional support for training of scientists and clinicians in this field. Researchers in developing nations also need the support of trained personnel such as trauma registrars, data quality assurance staff and field supervisors. For this reason and to develop the skill base of a broad array of research roles, short courses and distance learning may be appropriate strategies to explore. The participants were particularly supportive of training in close linkage to research, potentially employing existing FIC/NIH models, to meet the critical needs in this field today and to prepare for the growing burden tomorrow.

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