

Injury Prevention and Control: Understanding the Issues and Making a Difference

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Injuries are a leading cause of death and disability worldwide. An injury is as defined intentional or unintentional damage to the body resulting from acute

exposure to thermal, mechanical, electrical, or chemical energy or from the absence of such essentials as heat or oxygen.¹ Persons are injured on roadways, in workplaces, in homes, and during leisure activities. No group within society is spared, although some are more at risk than others.

A significant injury can change the lives, often permanently, of victims, their families, their communities, and society at large. Injuries rank below cancer and heart disease as an overall cause of death among the general population. However, injuries are the leading cause of death for persons aged 1 to age 44 years.⁹ Injury alone accounts for the highest volume of potential years of life lost. The number of potential years of life lost is a calculation of premature mortality within a population, made by comparing the average age of death with an expected age of death such as 65 or 70 years.

Victims who survive their injuries often require hospitalization and physician care, and have a loss of productive years of working life. The cumulative cost of injuries is staggering, both in terms of human suffering and lost potential and in the direct and indirect financial toll. Direct costs include the immediate expenditures of hospitalization, medication, and rehabilitation. Indirect costs are a cal-

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ulation of lost productivity and lost contribution to the economic basis of the society.

Injuries are unique because unlike most disease processes, the damage to cells and organs occurs immediately as the result of a rapid transfer of energy. Because injuries are widespread among all sectors and age groups and their effects are so immediate, injury control and prevention are challenging. Many different sectors must work together to prevent and reduce injuries. Health care professionals can play a key role in this comprehensive effort.

DEVELOPMENT OF INJURY PREVENTION AND CONTROL

Unlike other diseases that have been subjected to a rigorous epidemiologic approach for many decades, the disease of injury has been a relative newcomer to scientific investigation. For a large part of the twentieth century, society considered injuries to be random, chance events, or "accidents" which could not be predicted or prevented. They were accepted as an inevitable part of daily life and any prevention activity was focused primarily on appealing to people to be more careful.

Groundwork for an expanded view of injury causation began in the late 1940s, and by 1980, Dr William Haddon had developed a 2-dimensional framework for studying the injury problem.³

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Table. Haddon's matrix applied to a car crash

	Host factors (human)	Agent factors (vehicle)	Physical	Sociocultural
Pre-event	Driver age and experience Alcohol	Speed of travel Condition of brakes, Condition of brakes, tires	Weather Type of roadway Type of signs, signals	Norms about drinking and driving Traffic laws such as graduated licensing
Event (crash)	Seatbelt use Seating position in vehicle	Vehicle size Airbags Type of bumpers	Guardrails Road medians, shoulders	Laws for occupant restraint use Level of law enforcement
Postevent	Age of victim General health status	Fuel system protection	EMS response-type and timing Rehabilitation programs	Funding for trauma care systems Standards for EMS and trauma

EMS, Emergency medical services. Adapted from "Injury prevention meeting the challenge."¹

Haddon's Matrix integrated the work of earlier researchers to explore concepts from engineering, biomechanics, physiology, medicine, and epidemiology in their application to the study of injuries. It was theorized that injuries, like infectious diseases, were the product of the interaction between the host (person), the agent, and the environment (physical and sociocultural). Haddon also added the dimension of time (pre-event, through event, and postevent) to create the matrix. By using a car crash as an example, the value of the matrix is demonstrated (Table).

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When factors of the host, agent-, and environment are examined across the various time dimensions in a cell-by-cell inquiry, possible actions, or what Haddon referred to as "countermeasures," can be identified. The countermeasures span all activities, from primary prevention of injury to rehabilitation after injury. In the car crash example, countermeasures could include broad public education and social marketing campaigns about the risks of drinking and driving, advocacy for better vehicle and road design, enhanced enforcement of seatbelt laws,

or improved coordination of prehospital care and transport.

Haddon's Matrix provides the infrastructure for the concept of injury control. *Injury control* is generally accepted as a broader and more inclusive term than *injury prevention* alone is. Prevention of all injuries would be the ideal situation. In reality, effective injury prevention strategies must also include interventions that limit the severity and the long-term impact of injuries. A comprehensive injury control program integrates a system that combines (1) prevention strategies; (2) emergency scene response; (3) acute treatment; and (4) rehabilitation of injury based on a solid foundation of injury surveillance, research, and program evaluation.

SUCCESS IN INJURY CONTROL

Worldwide efforts are needed to control the incidence and severity of injuries. During the past 25 years, traffic safety efforts in the United States have resulted in measurable reductions in injury mortality and morbidity.⁴ In some countries, national agendas for injury prevention and control have either been established or are under development. To date, there have been 5 world conferences focused on injury prevention and control; these conferences have brought together leading researchers, scientists, educators, and practitioners from a broad spectrum of disciplines. At the local level, communities are using partnerships and coalitions as a model for injury prevention and control programs.

The exciting part of injury prevention and control is that proven and effective strategies exist and new ones are being discovered. For example, it is well known that seatbelts save lives, that helmets significantly reduce the likelihood of brain injury, that consumer products can be engineered to minimize risk, and that neighborhoods and communities can be built in ways that promote safety. Progress is being made, but there is still much more to be done.

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