Meeting the

Challenge

The National Committee for Injury Prevention and Control:

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From The Preface by Surgeon General C. Everett Koop:

This is a book for people who are concerned about injuries and who want to act to do something about them. If you are not already concerned or motivated to act, I predict that you will be before you have finished Injury Prevention: Meeting the Challenge. The national committee that produced this book and the federal agencies that supported it hope that your concern will lead to action--community leadership, participation of your agency or organization, membership in an advocacy group, or informed citizen activities.

I urge each state and locality to examine current injury prevention efforts and to make every effort to strengthen the resources and the will of state government to reduce this most costly problem (in both human and dollar terms). But increased determination by government at every level is not enough. There must be significant changes in basic public attitudes and behaviors concerning injuries, as there have been in regard to tobacco, alcohol, exercise, and sexual behaviors, for example. We must accept that the injuries associated with motor vehicles are not "accidents" and that much can be done to reduce them. We must realize that violence in the forms of abuse, assault, or suicide is not only within the purview of the police and the criminal justice system but also of the health system.

Injury Prevention: Meeting the Challenge focuses on the knowledge and resources that can be mobilized and applied in a well designed, scientifically sound manner to ensure the effectiveness of community injury prevention and control efforts. It also focuses on the generation of new knowledge through such efforts, because it recognizes that research science is not the only source of useful knowledge. Careful monitoring by surveillance systems, for instance, can contribute valuable knowledge for internal use by the program itself and for the field, in general.

The product represents the successful collaboration of three federal agencies: the Office of Maternal and Child Health and Resources Development of the Health Resources and Services Administration, the Division of Injury Epidemiology and Control of the Centers for Disease Control, and the National Highway Traffic Safety Administration of the U.S. Department of Transportation. These three must be the core of a much broader coalition of federal agencies if the prevention and control of injuries is to be successfully addressed at that level.

The content for the book was provided by the ad hoc 31-member National Committee for Injury Prevention and Control. Members came from public and private organizations and national, state, and local levels of injury practice, research, and teaching, with recognized knowledge in all aspects of the problem. The task of converting their work into a useful and readable book was accomplished by the staff of Education Development Center, Inc.

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INJURY IS. . .

Unintentional or intentional 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. By focusing on the body-damaging exchange of energy, it is possible to understand the essential similarities in what might otherwise appear to be unrelated events. A motor vehicle crash and a gunshot each have the potential to produce injury through the excessive mechanical energy that they transfer. Similarly, both suicide by asphyxiation and an unintentional drowning are injuries involving the absence of an essential element (oxygen), even if one event is deliberate and the other is not. Thus, while the mechanisms of injury share common characteristics, the causes of injury in America are varied, indeed.

IN ONE AVERAGE YEAR, THERE WERE. . .

More than 140,000 injury-related deaths, including:
48,700 Traffic fatalities
20,500 Residential injury deaths
6,503 Drownings
11,100 Occupational injury deaths
and 53,000 Violence-related injury deaths, including
21,400 Homicides and 31,470 Suicides

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THE CHALLENGE WE FACE

On Wednesday, September 13, 1899, Mr. Henry H. Bliss of New York stepped off a street car at the corner of Seventy-Fourth Street and Central Park West. As he did, the 68-year-old real estate dealer was struck and killed by a passing motor car, thereby becoming the first recorded casualty in America's love affair with the automobile.[1] But if Mr. Bliss was unique on that September day, he would soon be one statistic among millions.

170,000 Injuries a Day

On an average day in the U.S., more than 170,000 men, women, and children are injured seriously enough to need medical care; nearly 400 die as a result of their injuries.[2] The annual cost of injury in 1987 has been estimated at $133.2 billion.[3] Injury is the single greatest killer of Americans from age 1 to age 44.[4] But injuries are not inevitable. Motor vehicle crashes, house fires, drownings, assaults, and all of the other ways in which injuries occur are not, as we used to think, "accidents"-- random, uncontrollable acts of fate. They are understandable, predictable, and preventable.

Prevention is the Key

That is the central theme of Injury Prevention: Meeting the Challenge. During the last decades, an increasingly sophisticated science of injury prevention and control has developed. Through detailed studies of patterns of injuries, we are learning how they occur and who is most at risk. Building on this new knowledge, injury specialists are developing and testing specific, targeted interventions and implementing them in communities around the country. Were we to apply the lessons of the science of injury prevention in a comprehensive way, we would see an enormous reduction in death, disability, and cost to individuals, government, and the private sector. In addition to the need for prevention, several key themes are considered.

■ Funding for injury prevention research and practice should be commensurate with the magnitude of the problem--the largest cause of death and disability of children and young adults in the U.S.

■ Data are an essential element in effective program design; they can be used to pinpoint major injury problems, to focus attention and resources, and to monitor and evaluate interventions.

■ We must increase the use of interventions that have proven effective and make the evaluation of promising interventions a priority.

■ Injury prevention is the responsibility of individuals and agencies representing many disciplines and perspectives. Multidisciplinary collaboration is critical. Leadership in injury prevention, whether individual or organizational, can arise in many places and must be fostered and encouraged wherever it develops.

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Injuries and the Young

Unlike cancer, cardiovascular disease, and other chronic diseases, injuries disproportionately strike the young. Table 1 summarizes the percent of injuries as the cause of death in each age group during 1985.

Table 1. Injury deaths by age group, 1985		
Age group (years)	Percent of population	Percent of deaths caused by injury
1-4	5.9	44
5-14	14.2	52
15-24	16.5	63
25-44	30.9	40
45-64	18.8	6
65+	11.9	2

Adapted from National Center for Health Statistics. Current estimates from the National Health Interview Survey, United States, 1985. Wasington, DC: U.S. Government Printing Office, 1986.

Because the burden of injury falls disproportionately on the young, it is important to consider how their deaths affect the future. This premature mortality is reflected in the measurement of Years of Potential Life Lost (YPLL) by each death occurring before age 65.[5] As can be seen from Table 2, injuries are responsible for more years of potential life lost than cancer and cardiovascular disease combined.[6]

Table 2. Causes of death and years of potential life lost (YPLL), 1985	
Cause	YPLL
Injury	3,476,752
Cancer	1,813,245
Heart Disease	1,600,265

Adapted from Centers for Disease Control. Premature mortality in the United States: public health issues in the use of years of potential life lost. Morbid Mortal Weekly Rep 1986;35(suppl):2S.

Alcohol and Injuries

The use and abuse of alcohol has a profound impact on the magnitude of the injury problem. "Almost half of fatally injured drivers and substantial proportions of adult passengers and pedestrians killed in motor-vehicle crashes--as well as in falls, drownings, fires, assaults, and suicides--have [higher than legal] blood alcohol concentrations."[7] Alcohol abuse has been associated with railroad and aviation crashes as well.[8] A 1987 report by the Transportation Research Board cited 750 fatal crashes, annually, in which a commercial vehicle driver had been drinking.[9] Table 3 estimates the number of injury deaths attributable to alcohol in 1980;

Table 3. Estimated number of injury deaths attributed to alcohol, 1980

Cause of death	Number of deaths	Alcohol-related	%
Railway crashes	632	63	10
Motor vehicle crashes	51,930	25,965	50
Other traffic deaths	232	46	20
Water transport deaths	1,429	286	20
Aviation deaths	1,494	149	10
Falls	13,294	3,324	25
Fires	5,822	1,455	25
Natural/environmental factors	3,194	799	25
Submersion, suffocation	10,216	3,576	35
Other unintentional	8,744	2,186	25
Suicide	26,896	8,061	30
Homicide	23,967	11,984	50

Adapted from Ravenholt RT. Addiction mortality in the United States, 1980: tobacco, alcohol, and other substances. Pop Dev Rev 1984;10:697-724.

Figure 1 demonstrates the role of alcohol in increasing the odds that a crash will occur. And recent research reveals that alcohol not only increases the chance of injury, but increases the severity of injury when it does occur.[10]
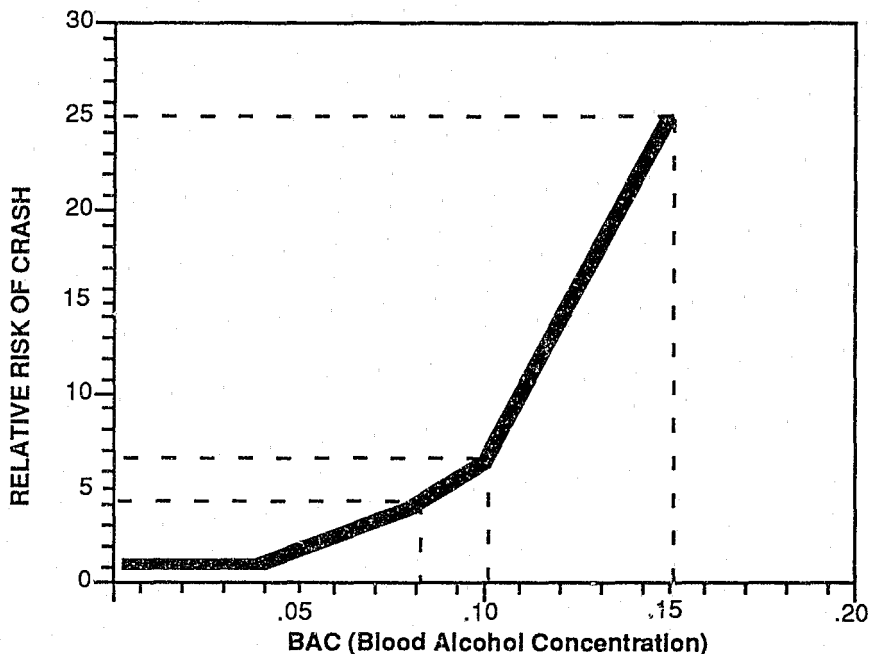

Figure 1. Odds of crashing. Adapted from Borkenstein RF, Crowther RF, Shumate RP, Ziel WB, Zylman R. The role of the drinking driver in traffic accidents (the Grand Rapids study). Alcohol Drugs Behav 1974;2(suppl 1):8-32.

PUBLIC HEALTH AND INDIVIDUAL CHOICE

The Cost of One Injury

Near Seattle, on an early January morning in 1985, "John" tried to jump his motorcycle over a hole in the road. He missed, fell, and struck his head on the pavement. He was not wearing a helmet. The 27-year-old was incoherent and combative when the paramedics found him and brought him to the hospital. He was operated on for a hemorrhage in the brain and spent 23 days in the intensive care unit. After another ten days, he was transferred to the rehabilitation unit. His attention was impaired, his memory and cognitive skills seriously affected, and he was now blind.

John's medical care cost $51,000; immediate rehabilitative services added another $14,000. The bills were paid by Medicaid. John was transferred to a rehabilitation facility in Michigan, near his parents' home. It is unlikely that he will ever again perform meaningful labor, and he will require continuing, costly rehabilitative care into the foreseeable future.

John's was one of 105 motorcycle injury cases included in a recent Seattle-based study. "Total direct costs for these 105 patients," concluded the researchers, "were more than $2.7 million, with an average of $25,764 per patient... The majority (63.4 percent) of care was paid for by public funds, with Medicaid accounting for more than half of all charges" (emphasis added).[11]

Some injury prevention strategies seek to help people alter their behaviors or adopt new, safer ones. Others rely upon more "coercive" methods of legislation and enforcement. This has been the source of controversy and heated political battles over such public health measures as alcohol excise taxes, fluoridation, safety belt laws, and the requirement that motorcycle riders wear helmets. Where is the balance between public health and individual choice?

Certainly most persons would agree that compelling a motorcycle rider to wear a helmet is an infringement of his or her personal choice. The question is whether it is an appropriate one.

The right of government to protect the citizenry from harm by adopting, in the name of public health, measures that restrict individual liberty is well established. This "police power" (a termed coined by Chief Justice John Marshall in 1824)[12] has been defined as "the power vested in the legislature by the constitution, to make, ordain, and establish all manner of wholesome and reasonable laws . . . for the good and welfare of the commonwealth, and of the subjects of the same."[13]

Opponents of helmet laws (and other, similar measures such as minimum age laws

for purchase and public possession of alcohol or mandatory safety belt laws) have not, by and large, challenged the government's authority to protect the public from harm through the exercise of the police powers doctrine. They have, instead, asked where the public harm is if an individual's behavior affects only him or herself.

One answer to this fundamental question has come from the courts. Helmet laws have been challenged in many states and upheld 30 times in the states' highest courts; the U.S. Supreme Court has refused to overturn them.[14] In one court's celebrated comment:

> *From the moment of the injury, society picks the person up off the highway; delivers him to a municipal hospital and municipal doctors; provides him with unemployment compensation, if after recovery, he cannot replace his lost job and, if the injury causes permanent disability, may assume the responsibility for his and his family's continued subsistence. We do not understand the state of mind that permits the plaintiff to think that only he himself is concerned.*[15]

That is an essentially economic rationale, a resource allocation argument, for injury prevention. In yet another view, public health is one of the collective goods to which people aspire when they organize in societies with shared loyalties and obligations. In this vision, "public health is part of the basic glue that cements the democratic community together, a form of group solidarity in the face of man's most ancient foe."[16] For the message, "the life you save may be your own," the proponents of the public health-as-common-good view would substitute "the lives we save together might include your own."[17]

PUBLIC HEALTH RESPONDS TO THE CHALLENGE OF INJURY

Hugh De Haven, Dr. John E. Gordon, Dr. James J. Gibson, and Dr. William Haddon, Jr. were pioneers in the development of public health's understanding of and response to injury. Looking for ways to reduce the toll of death in airplane and auto crashes in the years between the two World Wars, De Haven (a World War I pilot and crash survivor, himself) studied cases in which individuals had plunged distances of 50 to 150 feet without sustaining serious injury. It was not the force, per se, that produced injury, he concluded, but the structural environment that controlled deceleration of the force and its distribution over the body.[18] This opened the door to efforts to design "crash-packaging" (e.g., safety belts, air bags, and structural changes to the vehicle).

Seven years after De Haven's seminal work, Dr. John E. Gordon suggested that injuries, like classic infectious diseases, were characterized by epidemic episodes, seasonal variation, long-term trends, and demographic distribution. Therefore they could be studied through the same techniques. Most important, each injury, like each disease outbreak, was the product of at least three sources: the host, the agent, and the environment.[19]

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Little more than a decade later, Cornell University psychologist James J. Gibson, investigating human and animal behavior in relation to the environment, wrote, "Man responds to the flux of energies which surround him--gravitational and mechanical, radiant, thermal, and chemical. . . Injuries to a living organism can be produced only by some energy interchange. Consequently, a most effective way of classifying sources of [injury] is according to the forms of physical energy involved."[20]

Having arrived at the same conclusion, Dr. William Haddon, Jr., of the New York State Health Department (he would later become the first administrator of the National Highway Traffic Safety Administration, NHTSA) modified the energy-transfer analysis by adding "negative agents" for injuries produced by the absence of such necessary elements as oxygen or heat[21] and extended Gordon's analysis to the development of preventive approaches by systematizing information through the use of the "Haddon Matrix." In the matrix, the host, agent (or vector), and environment are seen as factors that interact over time to cause injury. A Haddon matrix designed around traffic injuries appears in Figure 2.

	Host (Human)	Vector (Vehicle)	Physical Environment	Socioeconomic Environment
Precrash	Driver vision Alcohol intoxication Experience and judgment Amount of travel	Brakes, tires Center of gravity Jackknife tendency Speed of travel Ease of control Load characteristics	Visibility of hazards Road curvature and gradient Surface coeffient of friction Divided highways, one-way streets Intersections, access control Signalization	Attitudes about alcohol Laws related to impaired driving Speed limits Support for injury prevention efforts
Crash	Safety belt use Osteoporosis	Speed capability Vehicle size Automatic restraints Placement and hardness and sharpness of contact surfaces Load containment	Recovery areas Guard rails Characteristics of fixed objects Median barriers Roadside embankments -Speed limits	Attitudes about safety belt use Laws about safety belt use Enforcement of child safety seat laws Motorcycle helmet use laws
Postcrash	Age Physical condition	Fuel system integrity	Emergency communication systems Distance to and quality of emergency medical services Rehabilitation programs	Support for trauma care systems Training of EMS personnel

Figure 2. The Haddon Matrix. Adapted from Baker SP, O'Neill B, Karpf RS. The injury fact book. Lexington, Massachusetts: Lexington Books, 1984; and Haddon W. Options for the prevention of motor vehicle crash injury. Isr J Med 1980;16:45-68.

The contributions of De Haven, Gordon, Gibson, Haddon, and others helped to provide a sound, scientific basis for injury prevention. Their emphasis on modifying, through technology and legislation, the environments in which injuries occur would be supplemented, as we will see later, by efforts to educate the public and change specific injury-related behaviors. First, however, it is important to remember that, while injury is a public health problem, injury prevention cannot be solely a public health responsibility.

THE NEED FOR COLLABORATION

Injury is a public health problem because of its magnitude and because of its consequences for the health of Americans. No health problem responsible for so much death and disability could be defined as anything other than a public health problem. And injury is a public health problem because public health methods, practitioners, and agencies can contribute to its understanding and prevention.

Collection and analysis of data about health problems is one of the primary functions of public health agencies. By collecting and analyzing data about injuries, as is done for infectious diseases--where, when, and how they occur, and to whom--it is possible to understand patterns of occurrence, to identify risk groups for specific injuries, and to use the information as the basis for designing preventive measures. The data-based approach is critical to the foundation of the effective design, implementation, and evaluation of prevention programs.

In addition to their data collection and analysis capabilities, public health agencies can offer practical experience in the successful management of community-wide health problems through the design, implementation, and evaluation of community-based prevention programs. And, in its recognition that health problems have multiple causes and are therefore multidisciplinary by nature, public health understands the need to coordinate and participate in fashioning multidisciplinary solutions.

Public health is only one of a number of participants--and sometimes one of the most recent arrivals--when it comes to injury prevention. The effort to prevent the greatest source of injury-related deaths--traffic injuries--has long been led by engineering, criminal justice, and traffic safety agencies. Preventing injuries caused by interpersonal violence and suicide was the concern of criminal justice and, more recently of social service and mental health specialists, long before public health recognized that violence could be understood through the same techniques as other sources of injury (see the next section).

State and local health departments can play a central role in developing or implementing injury prevention programs. And state and local health practitioners can participate in injury prevention efforts that begin and are housed in other departments and agencies. Where programs begin is a function of leadership, and leadership in injury prevention arises because individuals care enough to lead.

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Dr. Robert Sanders and Child Safety Seats

Injuries are a major public health problem that will not be resolved without concerted leadership and action. Creative and steady leadership, many believe, is even more valuable than money.

The seeds of what is now nationwide enactment of child passenger safety seat laws were planted by one such leader. Tennessee pediatrician Robert S. Sanders describes himself as "a guy in the right place at the right time to push and shove a bit."[22] Push and shove he did, for three years, until he managed to secure passage of the world's first child safety seat law in 1978. When he started out, he knew little about how to influence the legislative process. Today, he is fondly called "Dr. Seatbelt" by legislators, lobbyists and the news media. Dr. Sanders' strategy, fine-tuned through the lessons of failure, was a mix of varied approach, persistence, and collaboration with many colleagues.

PUBLIC HEALTH AND VIOLENCE

That America has had a violent history has long been accepted, in fact and folklore. That violence is among our most pressing health problems is a much more recent realization. In 1986, nearly 53,000 deaths resulted from violence, including 21,400 homicides and 31,470 suicides.[23] Among Black men aged 15-34, homicide is **the** leading cause of death.[24]

Public health's first, critical contribution to the prevention of violence came with the very recognition that violence--by virtue of the enormous toll it takes in lives, health, and quality of life--is a health problem.[25] That identification opened the way for the application of epidemiologic techniques to violence; the use of surveillance and other data collection systems; the identification of high-risk groups; and the development and implementation of preventive strategies. Although public health is a newcomer to violence prevention, it can complement the longstanding efforts of criminal justice, the behavioral sciences, and others (Figure 3 illustrates the overlapping concerns of these fields).

The criminal justice system has, in general, been focused on the apprehension of individual offenders. Public health complements criminal justice's emphasis by looking at large numbers of cases and searching for the underlying patterns that emerge. By identifying these patterns, epidemiologists seek to understand who is at high risk and what risk factors are associated with particular types of violence.

One important pattern is that victims and perpetrators very often know each other. This runs counter to the common belief that most violence involves strangers. The public health approach to injury highlights the importance of victim-offender relationships and offers a way to understand and analyze these relationships. This is

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one of the most important contributions epidemiologic analysis has made to violence prevention.

As in other areas of injury, the new knowledge revealed by epidemiologic research and data collection can become the basis for fashioning preventive measures. Public health also addresses the social norms and attitudes that emphasize the acceptability of violence and that can be barriers to prevention. And, against a long-standing public perception that violence is inevitable, public health defines it instead as "a concern to be addressed and remedied, not an inalterable fact of life."[26]

"Identifying violence as a public health issue is a relatively new idea," wrote Surgeon General Koop in 1985. "Over the years we've tacitly and, I believe, mistakenly agreed that violence was the exclusive province of the police, the courts, and the penal system. To be sure, those agents of public safety and justice have served us well. But when we ask them to concentrate more on the prevention of violence and to provide additional services for victims, we may begin to burden the criminal justice system beyond reason."[27] Injury prevention practitioners have an important role to play in the understanding, control, and prevention of violence in their communities. But for violence prevention to succeed, it must involve the collaborative efforts of public health, criminal justice, health care, social work, mental health, and citizens in general.
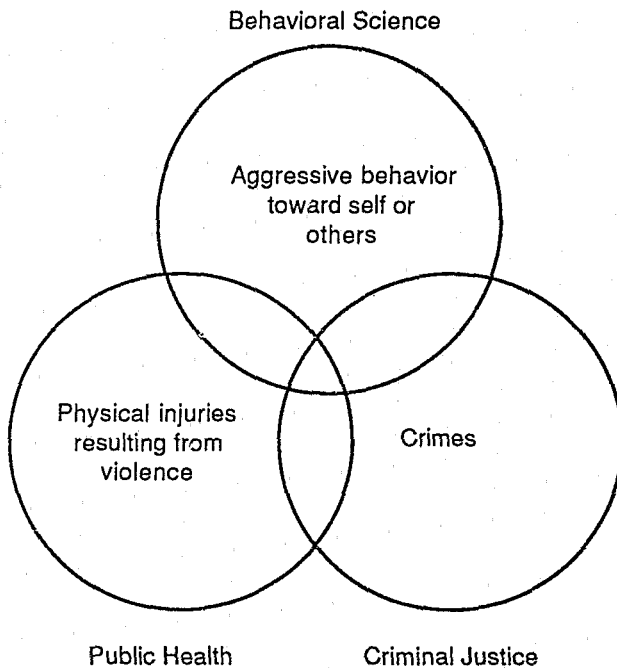

Figure 3. Overlapping perspectives of public health, criminal justice, and behavioral science.

STRATEGIES FOR INJURY PREVENTION

Moving a Mountain to Prevent Injuries

From June to October, tourists drive down the winding Newfound Gap Road across the Great Smoky Mountains, from Gatlinburg, Tennessee to Cherokee, North Carolina, the capital of the Cherokee Indian Reservation. And, with the visitors comes a discernable increase in motor vehicle collisions--particularly those involving pedestrians.

Jackie Moore was an Indian Health Service Community Injury Control Coordinator based in Cherokee. "My role was to document the problem by collecting data," she said. "Using a simple map, with pins to locate each crash, I built up a picture of the collisions that had occurred during the period of a year. When I looked at the data, the problem was clear. It was 'the gap.' " As the road winds into Cherokee, motorists and pedestrians passed though a cleft in the rocks so narrow that there was no shoulder space where they could safely walk.

"I turned the data over to the Cherokee Tribal Planning Board," said Moore. "With that evidence and the cooperation of a number of state and federal agencies, we obtained funds to make improvements. We blasted away the side of the cliff to widen the gap, and installed a mile of sidewalk and 22 street lights." "It's good to see that people finally have a safe place to walk," added Eddie Almond of the Cherokee Tribal Planning Office.

Not all injury interventions involve moving a mountain, of course. But in simple terms, Jackie Moore's experience demonstrates the progression from understanding an injury problem to developing and implementing an intervention.

Just as the occurrence of an injury requires the interaction of several factors, preventing one may require a mixture of countermeasures. One of the earliest attempts to systematize the process of considering injury prevention measures was Haddon's list of ten general strategies designed to interfere with the energy transfer/injury process.

Haddon's Ten Injury Prevention Strategies

1. Prevent the creation of the hazard (stop producing poisons).
2. Reduce the amount of the hazard (package toxic drugs in smaller, safe amounts).
3. Prevent the release of a hazard that already exists (make bathtubs less slippery).
4. Modify the rate or spatial distribution of the hazard (require automobile air bags).
5. Separate, in time or space, the hazard from that which is to be protected (use sidewalks to separate pedestrians from automobiles).
6. Separate the hazard from that which is to be protected by a material barrier (insulate electrical cords).
7. Modify relevant basic qualities of the hazard (make crib slat spacings too narrow to strangle a child).
8. Make what is to be protected more resistant to damage from the hazard (improve the host's physical condition through appropriate nutrition and exercise programs).
9. Begin to counter the damage already done by the hazard (provide emergency medical care).
10. Stabilize, repair, and rehabilitate the object of the damage (provide acute-care and rehabilitation facilities).[21]

Intervening successfully against injuries may involve the passage and enforcement of new laws or the increased enforcement of existing ones, the education of the population at large or of targeted groups, efforts to alter specific injury-related behaviors, or changes in the design of products or of the physical environment. These approaches are categorized as:

> legislation/enforcement interventions
> education/behavior change interventions
> engineering/technology interventions

Although these are distinct approaches, they are not mutually exclusive. Indeed, the most successful injury prevention programs, such as state efforts to require the use of child safety seats, combine the three strategies.

Since 1978, every state has passed a law requiring that children (generally under age four) riding in motor vehicles be restrained in federally approved child safety seats. The laws, themselves, are legislation/enforcement interventions. The child safety seats are an engineering/technology countermeasure known to be extremely effective when used properly.[28] But the seats frequently are used incorrectly.[29] Education was an important factor in passage of these laws and in encouraging parents to obtain and use the seats correctly. And clearly, education/behavior change interventions are critical in maintaining compliance with and thus maximizing protection afforded by child safety seat laws.

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Education/behavior change interventions are less common within the field of injury prevention. These are interventions that respond to the fact that injuries result from both environmental and behavioral causes. It is difficult to envision an environmental change that is without any behavioral component.

Behavioral science has much to offer the field of injury control in understanding the determinants of injury behavior and in developing effective strategies for behavior change.[30] Behavioral research suggests several promising techniques on which interventions can be based (e.g., incentives, behavioral feedback, and modeling) but because the use of these techniques is new, further research is necessary to determine their long-term impact.

Legislation/enforcement and engineering/technology interventions do have the potential to reach and protect the greatest number of persons and they should be employed whenever feasible. But education--both of policy makers and the general population--is often an antecedent to action and a necessary component in building public acceptance of new legislation. And both education and behavior change can increase compliance with injury prevention measures in the short-term, while helping eventually to alter injury producing attitudes and behaviors.

ATTITUDES AND INJURY

The experience of the helmet use law points to another critical element in understanding injuries in America: the extent to which their occurrence is affected by people's attitudes. One such attitude is the belief that injuries are "accidents." The problem is exacerbated by the way the media cover injuries. Injury is everywhere, but nowhere at the same time. Car crashes and house fires may be staples for newspapers and broadcast news reports, but each incident is reported as a separate, unique event--an "accident." Little attempt is made to look beyond that day's headline to patterns of injury or to prevention. The importance of working with the media to address this problem and strategies for doing so are highlighted in the book.

In addition, there is a general acceptance in American society that risk taking is essentially good.[31] Indeed, these physical (rather than emotional or intellectual) risks are glorified in the media. Further, because many injuries occur as a result of involvement in activities that are pleasurable, many Americans will resist any attempts at control if they perceive the risks as acceptable.

Many risks are beneficial to society, and not all risks result in injury.[32] How much of the social value of risk taking is worth preserving and at what cost? If we were to tolerate no risks at all, few sports, whether professional or amateur, would be permitted. Clearly, there are competing values at play.[33]

Automobiles, alcohol, and handguns are the three commodities connected with an overwhelming majority of fatal and serious injuries. Confronting and altering attitudes about each of them, and the ways in which they are to be used, are important concerns for health professionals.

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Other attitudes condition the violent behavior that leads to so many injuries. Violence is portrayed as an acceptable and often successful instrument of conflict resolution. Murder and suicide are endemic on motion picture and television screens. The ideologies of racism and male dominance are deeply ingrained. Many social norms and public models encourage, rather than inhibit, interpersonal or self-directed violence.

GROWING SUPPORT FOR INJURY PREVENTION

Clearly, there is much work to be done in injury prevention and control. Fortunately, for a number of important reasons, this is a most favorable time in which to proceed.

- A national agency infrastructure exists to stimulate and support activities.

- Funding for injury research and prevention programs (although still far from commensurate with the problem) has increased dramatically.

- Many effective or promising countermeasures, through this support and encouragement, have been or are being tried.

- These countermeasures and the information about their effectiveness are contributing to the scientific basis for action.

Finally, and most important, many state and local health departments, traffic and public safety agencies, and communities themselves are poised to take action against injuries.

THE NATIONAL COMMITTEE FOR INJURY PREVENTION AND CONTROL

In late 1986, the Bureau of Maternal and Child Health and Resources Development of the U.S. Department of Health and Human Services, with assistance from the Centers for Disease Control, and the National Highway Traffic Safety Administration, established the National Committee for Injury Prevention and Control.

The committee's charge was to investigate and report on the state of the art in injury prevention and to make recommendations for continued progress. The project was managed and staffed by Education Development Center, Inc., (EDC), of Newton, Massachusetts. Injury Prevention: Meeting the Challenge, by the National Committee and EDC, is the result of that collaboration.

The committee was comprised of 31 experts drawn from many areas of injury prevention (e.g., state health department practitioners, injury prevention researchers,

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engineers, physicians, nurses, highway safety officials, and representatives of the sponsoring federal agencies, among others).

Injury Prevention: Meeting the Challenge is a response to the need for a reference to help individuals "do" injury prevention and control work. But it is a resource, not a prescription. It presents options and alternatives in reducing injuries. It tells readers what they need to know to make choices, and surveys what some of the relevant choices are.

The state of the art in injury prevention and control is promising, if uneven. Too few interventions have been thoroughly evaluated, but many show great promise. Their continued use is important, but so too, is their further evaluation to determine what works. One conclusion of this review is inescapable: We know enough to act and we know that doing so can dramatically reduce the burden of injury. One estimate for childhood injury, for example, is that the implementation of only 12 currently available interventions (including air bags, child safety seats, motorcycle and bicycle helmets, smoke detectors, and the elimination of handguns) could reduce deaths by 29 percent.[34]

Progress has been made, not sufficient but progress nonetheless. The question is whether we can do better. Can agencies and communities use the process and interventions outlined in this book to improve the lives of Americans? One indication that this is possible is contained in a survey of state health departments published by the Childhood Injury Prevention Resource Center at the Harvard School of Public Health.[35]

The authors conclude that in the period from 1981 to 1987 injury programming at the state level tripled, injury activities were integrated into a wider variety of state health departmental divisions, injuries of interpersonal and self-directed violence became part of the domain of some state health departments, the development of systems to report injuries has increased, and staffing levels appear to have expanded. However, despite this progress, which the authors characterize as piecemeal and lacking coordination, "few state health departments had established comprehensive injury prevention programs with long- and short-term action plans, and staff need additional training to ensure the development of effective programs."[35] It is the committee's hope that Injury Prevention: Meeting the Challenge will help to fill the need to educate individuals, in health departments and elsewhere, how to plan, implement, and evaluate programs that will prove to be effective in reducing injuries.

Injury is among the oldest health problems faced by humanity. Never before, however, has there been so much interest in preventing injury, whether among university researchers, government officials, health professionals, business, labor, or concerned community members. How leaders in injury prevention emerge, and how they and their agencies and communities harness the energy and growing expertise and resources that exist will determine whether "preventing injuries" remains an expression of hope or becomes a reality.

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THE PROCESS OF INJURY PREVENTION: CHAPTERS 1-5

Chapters 1 through 5 describe the "process" of injury prevention--a structure for moving from the early stages of getting started, to learning from and working with data, to program design, implementation, and evaluation.

Chapter 1. Getting Started

Chapter 1 introduces the reader to the most important elements of an injury prevention effort:

- Leadership, both at the individual and agency level, including communicating the extent of the injury problem to agency colleagues and superiors, policymakers, and the public,

- Problem identification, including assessment of community awareness of a problem, existing community resources, the political environment, and readiness to take action,

- The systems approach to the development of injury prevention programs, and

- Challenges facing injury prevention programs.

Chapters 2 and 3. Learning from Data; Working with Data

These chapters explain the essential role of injury data in confirming, disproving, or refining an analysis of an injury problem and as an aid to the design, implementation, and evaluation of an effective injury prevention and control program. They review, in detail, the strengths and limitations of national, state, and local data sources, including vital statistics files, medical examiners' reports, hospital discharge data, state motor vehicle records, and others. The need for each state to establish an injury surveillance system is highlighted as well as the critical importance of including E codes (a system for classifying the causes of injuries) in hospital records. The collection and analysis of new data are also described.

Chapter 4. Program Design and Evaluation

After presenting a framework and defining key terms ("program," "goal," "objective," "strategy," and "intervention"), the chapter focuses on the importance of establishing injury program goals and outcome objectives based on a prior assessment of community needs and resources, as well as a thorough analysis of relevant injury data. Many examples are provided.

The importance of including an evaluation component in the initial design of the program, as well as of collaborating with experts in evaluation design, is highlighted. Basic information on the evaluation of process and outcome objectives is presented. Theoretical models to aid the practitioner in selecting interventions are explained.

Chapter 5. Program Implementation

Chapter 5 returns to themes introduced in Chapter 1. It discusses the operation of an injury prevention program. Special attention is given to overcoming common barriers, working with a community coalition or advisory board, and conducting public relations activities, including working with the media. It focuses also on institutionalization of injury prevention programs: the comprehensive, long-term responses to the injury problem without which we will never significantly reduce injury death and disability.

THE STATE OF THE ART IN INJURY PREVENTION AND CONTROL: Chapters 6–17

These chapters are intended as a resource for injury prevention and control practitioners, for the directors of new injury prevention programs, for decision makers trying to respond to this major health problem, and for concerned citizens seeking to reduce the injury burdens of their communities. From traffic injury to residential, recreational, and occupational injuries, to the injuries that result from interpersonal violence and suicide, these chapters document what is known about the injuries themselves and about who is at greatest risk, and explore the state of the art in interventions.

Interventions are assigned to one of four categories based upon what is known about their efficacy. The categories are Proven Effective, Promising, Ineffective, and Unknown or Insufficiently Studied. The committee's recommendations include both the statement of efficacy and suggestions for further use of the intervention.

The state of the art in injury prevention is: There are too few interventions that have been proven effective, and there are many promising interventions about which too little is known. There are a smaller number of ineffective or counterproductive interventions that should be abandoned and a great many ideas for new programs and future research. That description, while accurate in general, requires some modification as it applies to each of the three main intervention areas.

Traffic injury, which has the longest history of public and governmental interest and well-organized, multidisciplinary research, also has the greatest number of proven effective interventions. However, even here there are a great many promising countermeasures for which sufficient evaluation data are not yet available. In residential, recreational, and occupational injuries, there are fewer proven effective measures and more that fall into the promising category. Finally, in interpersonal violence and suicide, the paucity of effective interventions highlights the need to make these injuries a national priority.

The practical development and successful implementation of the interventions discussed in these chapters require the collaboration of state and local health officials, traffic safety and public safety experts, public health specialists, physicians, emergency medical services personnel and other health care workers, behavioral science and health education specialists, injury researchers, and others. Public officials, policy makers, and the media have key roles to play, as well. And, as

injury prevention practitioners have discovered countless times, the understanding and support of the local community can make an enormous difference in the success or failure of injury prevention efforts.

TRAUMA CARE SYSTEMS: Chapter 18

A comprehensive injury prevention system includes all of the following elements: primary prevention to forestall events (e.g., auto crashes) that might result in injuries; secondary prevention to modify the consequences of such events to either prevent or reduce the severity of an injury (e.g., the air bag that inflates after a crash); and tertiary prevention, acute medical care and rehabilitation directed at "the return of a functioning patient to society" after an injury.[36] Injury Prevention: Meeting the Challenge is primarily about primary and secondary prevention. However, the book's final chapter summarizes important information about tertiary prevention.

Battlefield Medicine and Civilian Injuries

The recognition that time is a critical factor in determining whether an individual can survive major trauma is an old one. Attempts to decrease the time from wound to treatment on the battlefield have marked military medicine since Baron Larrey's lightweight, 18th century *ambulances volantes* ("flying" ambulances) evacuated Napoleon's wounded soldiers to the rear for care.[37]

During the first World War, it took 12-18 hours before an injured soldier received surgical care. By Vietnam, however, "a combat casualty characteristically (underwent) definitive surgical care within one and one-half to two hours following injury."[38] As the delay decreased, death rates dropped. Eight percent of soldiers evacuated to aid facilities during the first World War died. During World War II, the percentage dropped to 4.5 percent. It was 2.5 percent in Korea and less than 2 percent in Vietnam.[39]

Yet, the application to civilian medicine of these principles of systematic trauma care--the rapid evacuation of the severely injured to well-staffed and equipped facilities--lagged. "Wounded in the remote jungle or rice paddy of Vietnam," wrote one specialist in 1967, "an American citizen has a better chance for quick definitive surgical care by board certified specialists than were he hit on the highway near his hometown in the continental United States."[38]

Great progress has been made in improving the delivery of emergency medical services, through the efforts of the federal government, especially the National Highway Traffic Safety Administration (NHTSA), and the states.[40] Nevertheless, there is still much to be done to apply fully the lessons of military medicine to saving the lives of the severely injured.

Although the terms "emergency medical services systems (EMS)" and "trauma care systems" are sometimes confused, they define related, but different entities. The Emergency Medical Services Systems Act of 1973, the basic federal legislation in the field, defines EMS as "a system which provides for the arrangement of personnel, facilities, and equipment for the effective and coordinated delivery in an appropriate geographical area of health care services under emergency conditions."

A trauma care system is defined as "a system of health care delivery which integrates and coordinates prehospital EMS resources and hospital resources to optimize the care, and, therefore, the outcome of traumatically injured patients."[41] Trauma care systems are, therefore, one of several elements included within EMS systems.

Since the late 1950s, nearly two-dozen studies have demonstrated that 20 percent of trauma deaths are preventable and that "the most common causes of preventable deaths are a delay to definitive surgical intervention and the lack of performance of indicated surgery."[42] It is these causes of preventable death that trauma care systems were designed to address. The essence of a trauma care system is the understanding that seriously injured patients will survive in greater numbers if they are taken rapidly to specialized facilities, rather than to the nearest available hospital. The designated trauma center is distinguished by the immediate availability on a 24-hour basis of specialized surgeons, physician specialists, anesthesiologists, nurses, and resuscitation and life support equipment.

Rehabilitation services seek to return the trauma victim to the fullest physical, psychological, social, vocational, avocational, and educational level of functioning of which he or she is capable, consistent with physiological or anatomical impairments and environmental limitations. Rehabilitation services have assumed even greater importance within trauma care systems because of the increasing survival rate for seriously injured patients and because of patients' ages, which average in the mid-20s.

Unfortunately, far too few communities are served by comprehensive trauma care systems.[43] This final chapter of Injury Prevention: Meeting the Challenge discusses the requirements for, and impediments to, extending effective trauma care systems and rehabilitation services across the nation.

THE COMMITTEE'S GENERAL RECOMMENDATIONS

In addition to the many recommendations contained in the book's discussion of the state of the art in injury prevention, the National Committee for Injury Prevention and Control put forward a series of general recommendations to advance injury prevention at the national, state, and local levels.

Recommendations

▪ Decision makers in the private and public sectors must recognize the

magnitude of the injury problem and declare injury control a priority. They must strengthen interventions that work and increase enforcement of safety legislation and regulation and further the use of engineering approaches to reduce hazards in the environment.

- Funding for injury prevention and control research and practice programs should be commensurate with the importance of injury as the largest cause of death and disability of children and young adults in the United States. Responsibility for providing these resources must be shared by public and private sources, including federal and state governments, foundations, and corporations. To effect this goal, federal agencies must include injury control within their mandate and strengthen their regulatory and programmatic responsibilities. As a guideline, we suggest that the minimum federal share for injury prevention research and practice approach $125 million by 1992.

- Government, private foundations, industry, and community organizations should vigorously support training for injury prevention and control. Training is needed for health care workers, including physicians and nurses; public safety officials, including police and firefighters; teachers and early childhood educators; engineers, architects, and city planners; and state and local practitioners. In addition, journalists and other media professionals need to be educated about the opportunities for promoting prevention when reporting injury events.

- National leadership is needed to forge partnerships across the many disciplines involved in injury control and among state and local public health leaders. Often these disciplines are separated by theory, training, and vocabulary. To achieve lasting results, funders should require representatives of these disciplines to work together in a concerted and coordinated fashion. Injury prevention should be integrated into routine agency activities and the staff roles of many disciplines.

- Injury surveillance activities that build upon and improve existing data collection systems should be established at the national, state, and local levels. Improving the availability and quality of morbidity data should be given priority. Recognizing the enormity of this task, we suggest initial action be taken through two avenues by requiring inclusion of E codes as a separate data element in hospital discharge data, and by requiring reporting of selected injuries, starting with spinal cord injuries, as part of the National Notifiable Disease System.

- Each state and large metropolitan area should designate a lead agency devoted to injury prevention and control and an organizational unit within the agency with full-time staff to address injuries. To ensure a permanent base and adequate funding, the lead agency should include injury prevention and control

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programming as a line item in its budget. The lead agency should foster coordination and collaboration with other agencies and organizations leading to a comprehensive injury prevention and control program. A task force may facilitate the development and implementation of a plan to address the injury problem in a comprehensive and coordinated manner.

■ National leadership is essential to affect social attitudes about and media portrayal of alcohol and other drugs. Public and private organizations should collaborate to affect legislation, regulatory change, and public education to prevent substance abuse and coordinate programs to combat it.

■ Researchers and program developers should develop and test new interventions to address interpersonal violence and suicide. Decision makers and practitioners must recognize that these injuries are more than a criminal justice or mental health problem. They constitute major public health problems that can be understood and prevented through the same strategies and techniques as other injuries.

■ Decision makers and funders must recognize that the evaluation of injury programs is an integral part of the management of community injury problems and require such components in programs. When funding is limited, programs can select interventions that are known to be effective with a similar population and then limit their evaluation. Programs that implement untried interventions, or ones that have yielded conflicting evaluation findings, however, should include extensive evaluation measures.

■ Program developers should design interventions that apply the best information available regarding engineering, biomechanics, behavior change, and enforcement strategies. Currently, there are few models and much uncertainty about the effectiveness of many available countermeasures. Therefore, the greatest need is to design interventions with specific, measurable objectives, evaluate the interventions, and disseminate the results widely.

■ Research on injury prevention must address the identification and modification of behavioral factors that contribute to injuries. Interventions based on the same theories that have been successfully applied to the prevention or cessation of smoking, alcohol and drug use, and to encourage exercise and medication compliance should be applied to injury control and the results evaluated.

■ Firearms are involved in 30,000 deaths and 900,000 nonfatal injuries each year. Because of this tremendous toll, the following measures related to firearms should be considered: restrictive licensing, reinforcement of existing restrictions on gun purchases with waiting periods to permit effective

background checks, strict enforcement of existing laws, and changes in the design of firearms to make them safer. With respect to handguns, we also support federal, state, and local initiatives to restrict the manufacture, sale, possession, and carrying of handguns.

■ Support for the development of comprehensive trauma care systems by all levels of government and by the health care and public health professions must be a priority. Trauma care systems have been proven effective in reducing injury-related mortality and morbidity. They are an essential component of a systematic approach to injury prevention from primary prevention through rehabilitation.

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