

MMWR

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**Position Papers from the Third National Injury Control Conference: Setting the National Agenda for Injury Control**

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# MMWR

*Recommendations  
and  
Reports*

MORBIDITY AND MORTALITY WEEKLY REPORT

## Position Papers from the Third National Injury Control Conference: Setting the National Agenda for Injury Control in the 1990s

*Executive Summaries*



U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES

Public Health Service  
Centers for Disease Control  
Atlanta, Georgia 30333

**CDC**  
CENTERS FOR DISEASE CONTROL

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These position papers were solicited by the Division of Injury Control, National Center for Environmental Health and Injury Control, Centers for Disease Control (CDC), Public Health Service, U.S. Department of Health and Human Services, Atlanta, Georgia, for the Third National Injury Control Conference, held April 22-25, 1991, in Denver, Colorado. The views expressed are those of the contributors and **do not necessarily represent the policy of CDC or any other federal agency**. Furthermore, although all contributors agreed on the overall content of the paper, they did not agree on every recommendation. The major topic-specific recommendations in this document are from the Executive Summaries from the book, *Position Papers from the Third National Injury Control Conference: Setting the National Agenda for Injury Control in the 1990s*. Copies of the book can be obtained by contacting: Martha Highsmith, CDC, NCEHC, Mailstop F-36, 1600 Clifton Road, Atlanta, Ga 30333.

## Foreword

The concern and interest of the American public, policymakers, and public health professionals have increasingly focused on the problem of injury, including the high number of deaths and disabilities and the enormous costs—both human and financial. As part of this focus, the Committee on Trauma Research and the Institute of Medicine, in the *Injury in America* report, and the Secretary's Advisory Committee for Injury Prevention and Control called for a national plan to control injuries. As the first step in developing such a plan, the National Center for Environmental Health and Injury Control (NCEHIC) and the National Institute for Occupational Safety and Health (NIOSH) of the Centers for Disease Control (CDC) facilitated the development of seven, comprehensive position papers being published elsewhere (1). The plan will help shape the future of injury control research, programs, and policies for this decade.

The seven position papers were devoted to motor vehicle injury prevention, violence prevention, unintentional injury prevention (later retitled home and leisure injury prevention), occupational injury prevention, trauma care systems, acute care treatment, and rehabilitation of persons with injuries.

The objectives of the seven position papers are to a) define the field of injury control, b) assess the status of injury control research and programs, c) help CDC, other Federal agencies, and nongovernmental organizations define directions and priorities in a coordinated way, d) identify interventions to be evaluated and disseminated, e) assist the development of injury control program capacity in state and local health departments and other agencies, and f) identify organizations and opportunities for carrying out various research and program recommendations.

NCEHIC and NIOSH sought input from experts from many sectors—federal, state, and local government; academic institutions; industry and labor; and a wide range of national organizations. At the beginning of this process, 150 experts offered assistance. In particular, representatives of many agencies from seven federal departments participated, including:

- Department of Defense (Department of the Air Force)
- Department of Education (National Institute on Disability and Rehabilitation Research)
- Department of Health and Human Services (Maternal and Child Health Bureau, Alcohol Drug Abuse and Mental Health Administration, including the National Institute of Mental Health and National Institute on Alcohol Abuse and Alcoholism, National Institutes of Health, including the National Institute on Aging, and the National Institute of Child Health and Human Development)
- Department of Justice (National Institute of Justice)
- Department of Labor (Bureau of Labor Statistics and Occupational Safety and Health Administration)
- Department of Transportation (Federal Highway Administration and National Highway Traffic Safety Administration)
- Department of Veterans Affairs (Veterans Affairs Medical Center)
- Consumer Product Safety Commission

Additional participation came from professionals in motor vehicle safety advocacy, trauma surgery, neurosurgery, orthopedic surgery, pediatrics, emergency and rehabilitation medicine, trauma nursing, public health, biomechanics, emergency medical services (EMS) and trauma system management, survivors of injury, and national safety programs.

We asked these experts to address the objectives in their respective fields of interest by answering three key questions:

- Where are we?
- Where do we want to be at the end of the decade?
- How do we get there?

Seven draft position papers were developed for those who attended the Third National Injury Control Conference held April 22–25, 1991, in Denver, and for others interested in the field of injury. Many reviewers submitted written comments, and conferees debated and discussed the papers extensively. The conference theme, "Setting the National Agenda for Injury Control in the 1990s," was chosen to encourage conferees to focus on the development of a national plan.

The seven panels that produced the draft papers revised them based on written comments from almost 200 reviewers and the discussions at the conference. The recommendations in these *revised* papers represent an important step forward in the identification of injury control priorities. CDC will consider these position papers with input from reviewers, conference attendees, and other federal agencies in developing a national plan for injury control.

Each position paper contains topic-specific recommendations. The major topic-specific recommendations are contained in these Executive Summaries. In addition, each paper has independently addressed broader issues relating to the overall field of injury control. These crosscutting recommendations are important for all injury control efforts and include the need to:

- Increase public awareness of injuries and injury control.
- Increase attention and support from the Office of the Assistant Secretary for Health to coordinate multiagency and multidepartment efforts.
- Increase resources for injury surveillance, research, control programs (state capacity), intervention evaluation, training, and health services.
- Allow cooperative industry/government research and development projects.
- Require E-codes for all hospital discharges as part of a national surveillance system.
- Establish a Center for Injury Control at CDC to provide national leadership.
- With CDC playing a key role, develop a national applied injury control research laboratory to study both human and engineering factors.

Proponents of injury control face a unique challenge—coordinating diverse organizational and disciplinary areas to follow one course of leadership. This approach requires enormous effort and resources to overcome boundaries and implement a coordinated plan for injury control in the United States. In these times of economic restraint the best chance of attracting public attention and institutional support rests upon the ability of all concerned to produce a clear and compelling national plan.

The dedication and efforts of the chairpersons, panelists, reviewers, conference attendees, and CDC staff made these papers possible.

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## Position Papers from the Third National Injury Control Conference: Setting the National Agenda for Injury Control in the 1990s *Executive Summaries*

### MOTOR VEHICLE INJURY PREVENTION

Many injuries associated with motor vehicle crashes are preventable. In 1985, motor vehicle crashes cost the United States more than \$75 billion and 65% of this amount reflects only 15% percent of the crashes—those that caused death or injury (1). By 1991, this sum had increased considerably because of increases in the number of crash injuries and fatalities, increases in the cost of medical treatment and vehicle repair, and a rise in general price levels.

It is not the impact on our economy only that makes it necessary to reduce the mortality and morbidity associated with highway crashes. It is the human tragedy that these crashes represent. Forty-five thousand persons are killed on U.S. roads annually. More than 60% of these victims are not yet 35 years of age. In addition, millions are injured in crashes. Especially tragic is the fact that some survivors of motor vehicle crashes are seriously disabled. Crashes are the leading cause of traumatic brain injury and spinal cord injury.

The magnitude of injury's impact on society has made the control of crash injuries one of the goals of *Healthy People 2000*. The goal is to reduce crash fatalities from 19.1 per 100,000 people in 1987 to 17.0 per 100,000 people by the year 2000 (2). Many

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sectors of our society must cooperate to achieve this 11% reduction in crash mortality, and many of the recommendations of this panel must be implemented.

Unfortunately, even if this decreased crash fatality rate is achieved, more than 45,000 crash fatalities will occur annually. There will be no meaningful reduction in the actual number of persons injured in motor vehicle crashes. In terms of absolute numbers, projected increases in both population and travel will offset the efforts of the health and safety community. Motor vehicle crashes will remain the principal means by which young Americans die or are permanently disabled.

The multidisciplinary attack on injury that was the vision of *Injury in America* (3) must be employed. Investment in the prevention of injury and in the care and rehabilitation of injured persons must increase. Research must be directed toward solving this problem, which will require federal, state, and private resources. Collaboration must become the rule. But resources and collaboration will not be enough. The public must be convinced that motor vehicle injuries are not "accidents" and that the application of scientific principles to the prevention of injury has a real likelihood of succeeding.

The report of this panel documents the record of success that health and safety professionals have achieved in this field. More importantly, the report describes the steps needed to do more than maintain the status quo. The panel's recommendations are designed to be illustrative, rather than exhaustive. Their implementation can launch an era of major reductions in the crash fatality and injury rates on U.S. roads.

The panel's recommendations, in their entirety, are listed in the position paper.

### **Leadership and Coordination**

The panel supports the recommendations of the Transportation Research Board (TRB) (4) with respect to the advancement of research in Department of Transportation programs. In addition, the recommendations of the Committee on Trauma Research on organizational structure should be fully implemented (3). These include the establishment of a National Center for Injury Control within CDC. This center should facilitate coordination of federal injury control efforts. Motor vehicle injuries, the single largest category of injuries, would be a key focus of the center's research and programs. The center would collaborate with established lead traffic safety agencies at the federal, state, and local levels. In particular, CDC would link the public health and traffic safety communities at the federal, state, and local levels to emphasize the importance of motor vehicle injuries within the broader field of injury control.

### **Public Recognition and Support**

Public awareness of the preventability of motor vehicle injuries must increase, because it will contribute to individual prevention efforts, public support for laws and enforcement efforts, and demands for legislative action in funding research and programs.

### **Proven Interventions**

Known technologies and behaviors to prevent or mitigate motor vehicle injuries should be adopted and implemented.

The following legislative and law enforcement interventions should be fully implemented:

- Adopt and enforce primary enforcement safety belt use laws and ordinances.
- Adopt and enforce administrative license suspension for drivers with a blood alcohol concentration  $\geq 0.08\%$  and  $> 0.00\%$  for youths  $< 21$  years of age.
- Adopt and enforce laws and ordinances requiring all motorcyclists and bicyclists to wear helmets.
- Enforce existing speed limits, oppose further increases in speed limits, and adopt legislation that discourages the use of radar detectors.
- Strictly enforce minimum drinking age laws as they apply both to sellers and purchasers.
- Strengthen and enforce existing laws and ordinances requiring child safety seat use and extend them to cover all passenger seating positions in all motorized vehicles.

Besides adopting, strengthening, and enforcing these laws, information on factors facilitating and impeding effective enforcement should be identified and disseminated.

The panel recommends that vehicles be equipped with both driver and passenger airbags and that vehicle designs protect both occupants and pedestrians. Vehicle designs that protect occupants include improved occupant-compartment integrity (including enhanced side-impact protection), energy-absorbing interior surfaces, improved door design, roof crush resistance, seats, and restraint systems. Designers of protective restraint systems should give attention to the comfort and convenience of persons of all sizes and ages. Vehicle designs that protect pedestrians include softer hood and fender designs and lower front bumpers. In addition, comprehensive community-based pedestrian and bicycle safety programs targeting defined problems and high-risk populations should be developed.

The panel recommends that roadway delineation be improved through increased use of effective reflective pavement markings and signs and providing safer, "forgiving" roadsides for errant vehicles.

Despite recent progress, alcohol and other drugs continue to play an important role in motor vehicle injuries and fatalities. This document specifically addresses impaired driving, and the panel concurs with the Surgeon General's Workshop on Drunk Driving (5)—that the extent of the alcohol problem must be addressed at a broader, more comprehensive level. It is unlikely that impaired driving can be substantially reduced until there is a reduction in problem drinking, drug use, and total per capita alcohol consumption. Additionally, commonly accepted practices related to the availability and promotion of alcoholic beverages should be changed.

### **Scientific Base**

Continued progress in reducing motor vehicle injury cannot be achieved without technological advances and a better understanding of human tolerance to injury. A scientific, rigorous understanding of human performance, behavior, capabilities, and motivation is also needed.

- Expand intramural and extramural research programs within the U.S. Department of Transportation and the U.S. Department of Health and Human Services; specifically, CDC should play a key role in developing an applied injury research laboratory to study both human and engineering factors.
- Enhance the training of professionals at all levels.
- Develop data systems; specifically, link traffic and medical records to improve our ability to develop and evaluate effective interventions.
- Support cooperative industry-government research and development projects with adequate protection of both the public's interests and manufacturers' proprietary concerns.
- Build the fields of engineering, biomechanics, human behavior research, and policy development in the areas related to injury prevention. Specifically, develop university-based centers of excellence in these areas.
- Enhance the knowledge and understanding of factors facilitating and impeding safe driving behaviors among various population subgroups, including youth, minorities, women, and the elderly and use these data to develop and target prevention and intervention efforts.
- Encourage collaborative interdisciplinary research among scientists working in fields that affect motor vehicle injury control, such as engineering, biomechanics, behavioral science, public policy, medicine, public health, and rehabilitation.

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2. Public Health Service. Healthy people 2000: national health promotion and disease prevention objectives: full report, with commentary. Washington DC: Government Printing Office, 1991. DHHS Publication No. (PHS) 91-50212.
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## PREVENTION OF VIOLENCE AND INJURIES DUE TO VIOLENCE

The health impact of self-directed and interpersonal violence in the United States is staggering. The need for action to address this problem has never been greater. This summary represents an agenda for reducing injuries and deaths due to interpersonal violence and suicidal behavior.

Interpersonal violence is a major public health problem in the United States. Homicide is the 12th leading cause of death, accounting for 22,032 deaths in 1988, and it is a leading cause of premature mortality. The U.S. homicide rate is substantially higher than that of other industrialized countries. Blacks and other minorities are at particularly high risk of injury and death due to interpersonal violence. Females are at high risk of nonfatal injuries from rape, child sexual abuse, and assaults by husbands, ex-husbands, and other intimate partners. Child abuse and neglect is a major cause of morbidity among infants and young children.

Suicide is the eighth leading cause of death in the United States. About 20% of all deaths due to injury are suicides. In 1988, 30,407 persons committed suicide. Since 1950, rates of suicide among young people (15-24 years of age) have tripled. Since 1979, after several decades of decline, rates of suicide among the elderly have been increasing.

In developing this agenda for violence prevention, the focus was on factors linked with the risk of injury and death from violence and that are amenable to preventive efforts or public health action in the future. A broad, diverse set of high-priority recommendations was developed with relevance to the *Healthy People 2000* goal for the prevention of self-directed and interpersonal violence (1). The recommendations are structured around a single major area of emphasis and four special areas of emphasis. The major area of emphasis is the need for a coordinated approach and coherent framework for planning and implementing a comprehensive violence prevention effort. The four special areas of emphasis are a) injuries from firearm violence, b) alcohol and other drug use, c) early childhood experiences that affect the

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risk of future violent behavior or victimization, and d) treatable mental disorders associated with an increased risk of suicide.

### Coordinated Approach

The recommendations for a broader, comprehensive infrastructure for violence prevention address the need to target resources for prevention toward high-risk groups, to improve surveillance, to empower communities to develop their own violence prevention programs, to broaden training for violence prevention, and to evaluate rigorously promising prevention programs. Priority recommendations include:

- Develop culturally appropriate violence prevention and intervention programs for communities with high rates of violent injury in order to address the specific needs, characteristics, and circumstances of these communities.
- Improve recognition, referral, and treatment of people at high risk for violence or violent injury (e.g., battered spouses, suicidal persons, and victims of child abuse or neglect).
- Set up a system for E-codes (codes to identify the external causes of injury—e.g., attempted suicide or child abuse) to be included with the usual nature-of-injury data in all hospital-discharge data.
- Develop and disseminate at the community level guidelines for preventing violent injuries.
- Develop new financial and other resources for the development and long-term support of community-based violence prevention programs.
- Establish fellowship training programs in violence prevention, with special efforts to recruit minorities and women.

### Firearms

The panel believes the strategies most likely to produce immediate reductions in mortality from violence are those related to reducing firearm violence. Several recommendations in this regard were developed. All were designed to minimize ready access to handguns and other firearms. The strategies suggested include educational and behavioral change, technological and environmental efforts, enhanced enforcement of existing laws, and new legislative and regulatory efforts. Increased research is also needed to more precisely delineate the risks and benefits of ready access to handguns and other firearms.

### Alcohol and Other Drugs

Regarding alcohol and other drug (AOD) use, several of these recommendations target decreasing chronic use of AODs by persons at high risk of violent behavior by ensuring that such persons are properly identified and given adequate treatment. Also, these recommendations address decreasing initiation of AOD use, especially among people already at high risk of interpersonal or self-directed violence. Finally, to reduce the risk of violence associated with drug trafficking and addiction, the panel suggests research to explore alternatives to the current laws regulating illicit substances such as cocaine and heroin.

### Childhood Experiences

Some portion of violence prevention efforts should be designed to reduce the prevalence of childhood experiences (e.g., child abuse and neglect, witnessing violence in the home, and viewing media violence) that are associated with long-term risks of perpetrating violence or becoming a victim. Also, there should be strategies to intervene with children who are so exposed to mitigate the consequences of this exposure.

- Nurse-home visitation programs (or other home-visitor programs) for high-risk infants.
- Educational interventions for children, e.g., nonviolent interpersonal problem-solving skills, social skills, and appropriate norms of nonviolent behavior.
- Timely crisis intervention for families under stress and at risk for violence.
- Development of media programs that foster nonviolent behavior.

### Mental Disorders

There is a need to expand efforts to identify and treat people suffering from treatable mental disorders associated with suicide. Specifically, the panel endorses the National Institute for Mental Health Depression/Awareness, Recognition, and Treatment Program, which seeks to educate the public and potential gatekeepers to recognize and refer persons with depression. Also needed are expanded training and coordination among professionals who are potential gatekeepers for treatment services. The panel recommends increasing public health and insurance funding for outpatient treatment of persons with mental disorders.

While developing a broad, diverse agenda for intentional injury prevention, issues and opportunities for prevention of specific types of violence have necessarily been missed or underemphasized. Those persons who are interested in preventing certain types of violence or violent injuries can modify and expand upon these recommendations as appropriate.

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1. Public Health Service. Healthy people 2000: national health promotion and disease prevention objectives: full report, with commentary. Washington DC: Government Printing Office, 1991. DHHS Publication No. (PHS) 91-50212.



## HOME AND LEISURE INJURY PREVENTION

### Part I: Selected Injuries

Attention has been focused on injuries related to motor vehicle crashes; yet each year tens of thousands of lives are lost or irrevocably shattered because of unintentional injuries in other circumstances. In 1986, 48,410 Americans died from unintentional injuries not related to motor vehicles. These deaths accounted for 32% of all injury-related deaths. In 1985, the lifetime human capital costs in lost earnings and medical care (excluding consideration for pain and suffering) totalled about \$21 billion for fall-related injuries, \$2.1 billion for drownings or near-drownings, \$8.5 billion for poisonings (including intentional poisonings), \$2.8 billion for fire- and burn-related injuries (not including property damage), and \$14.4 billion for firearm injuries (intentional and unintentional) (1). The incidence and severity of these and other injuries can be reduced by applying the traditional tools of public health: surveillance to identify patterns and circumstances, research to understand causes and to develop and evaluate interventions, and implementation of programs that prevent or mitigate injuries.

The types of injuries addressed here are those resulting from falls, drownings, poisonings, fires, burns, and firearms. The Home and Leisure Injury Prevention Panel chose to emphasize these injuries because of their prominence in *Healthy People 2000*, their magnitude in terms of morbidity and fatalities, and because they can be prevented by effective interventions already available (2). These types of injuries affect different populations and vary in their causes and circumstances. The research and programs that address these types of injuries must encompass an array of academic disciplines, government and private organizations, and segments of society. No single intervention, agency, or approach can dramatically reduce the toll of unintentional injuries. A broad-based set of interventions that build on both research and examples of successful interventions are needed.

Programs that have succeeded in reducing definable injuries share common elements: adequate surveillance to define the circumstances of the injury, recognition of an action that probably would reduce the incidence or severity, and action by persons in positions to initiate it. Examples include the modification of aspirin

#### Home and Leisure Injury Prevention Contributors

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dosages and packaging to reduce poisonings among children, regulations requiring that children's sleepwear be made flame-retardant, and the installation of window guards in high-rise apartment buildings to prevent falls.

Recommendations for each topic addressed in this summary—falls, drownings, poisonings, fire- and burn-related injuries, and firearm injuries—are listed here. The designated agency for implementation for each priority recommendation is listed in parentheses: federal government (FG) or state and local government (SLG).

### Falls

Falls are the leading cause of all nonfatal injuries and are the second leading cause of death from unintentional injuries—after motor vehicles. Efforts waged by a variety of organizations can curb the number and severity of these preventable injuries.

#### Priority Recommendations

- Require helmet use during recreational activities with high head injury rates (e.g., bicycling, horseback riding, surfing, and snow skiing). (SLG)
- Encourage research on optimal living designs. Ensure that public and private building designs and codes take injury surveillance results into account, and enforce building code regulations that reduce major contributors to fall injury and its severity. (SLG)

#### Federal government

- Support epidemiologic surveillance of fall injuries to identify circumstances and specific locations of falls.
- Support analytic studies of major contributors to fall injuries, including biomedical, behavioral, and environmental risk factors for injuries and the interaction of these risk factors with age.
- Fund local injury-prevention workers to interpret and act on results of surveillance and analytic studies.
- Develop and disseminate prevention programs.
- Ban baby walkers, which apparently cannot be made safer.
- Develop standards for changing tables, high chairs, and playground equipment.
- Increase support of clinical trials to test strategies for injury reduction and rehabilitation in later life.

#### State and local governments

- Conduct surveillance of the circumstances and specific locations of fall injuries.
- Develop, revise, and/or enforce standards for residential facilities for the elderly, based on the best evidence of optimal designs for stairs, rails, and grips.

#### Private organizations

- Health-care providers and professional associations should encourage increased clinical counseling regarding fall risk from specific heights, cessation of use of baby walkers, and use of barriers for stairs.

- Insurance companies should provide financial incentives, such as lower premiums, to encourage compliance with safety standards.
- Health maintenance organizations (HMOs) and pharmacies should increase vigilance of prescribed drugs and polydrug use that is likely to impair vision, gait, coordination, and judgment. In addition, HMOs and pharmacies should consider putting warning labels on drugs that may increase the incidence of falls and injuries among the elderly.
- Businesses should not serve alcohol to intoxicated persons.

#### Academic and research institutions

- Conduct analytic studies (including risk factors for falls) listed under "Federal Government."
- Conduct clinical trials to test strategies for fall injury prevention and rehabilitation in later life.
- Develop and evaluate innovative interventions, such as barriers, warnings, alarms, hip pads, and residential facility standards and staffing.

### Drownings

In 1986, drownings were the third most common cause of death by unintentional injury in the United States. Agencies can establish regulations to prevent drownings. More research is needed on high-risk populations and the places and circumstances implicated in drownings.

#### Priority Recommendations

- Require complete four-sided isolation fencing at least 5 feet high with self-closing latches for all swimming pools. (SLG)
- Advance research on the circumstances and locations of drownings and near-drownings that result in hospitalization, with special attention to minority populations, to drownings associated with water other than in pools; and to potential means of prevention. (FG)

#### Federal government

- Advance analytic studies of combinations of boat and motor characteristics in drownings and near-drownings and studies of alcohol involvement in drownings.
- Develop, evaluate, and disseminate drowning intervention programs.

#### State and local governments

- Conduct surveillance of circumstances and specific locations of drownings and near-drownings.
- Promote cardiopulmonary resuscitation (CPR) training for all pool owners and teenagers and adults among populations with high drowning rates.
- Promote licensure and standard training for all boat operators.

- Enact and strictly enforce state laws that prohibit boat operation while intoxicated.
- Enforce requirements for having personal flotation devices for all persons on boats.

#### Private organizations

- The pool industry should sell safety equipment as part of the pool purchase and should develop new and more effective prevention technology, such as energy-absorbing pool bottoms to reduce diving injuries (e.g., head and spinal cord injuries).
- The insurance industry should review actuarial data and write homeowner insurance policies to reflect the presence of pools and spas, the presence of children <5 years of age where a pool or spa is present, and the presence of protective barriers to a pool or spa.
- The American Red Cross and other organizations should promote the use of poolside phones, isolation fencing for pools, and CPR training for all pool owners and teenagers and adults among populations with high drowning rates.

#### Academic and research institutions

- Conduct analytic studies of combinations of boat and motor characteristics in drownings and near-drownings and studies of alcohol involvement in drownings.

#### Poisonings

There has been a decline in fatal poisonings among young children over the last 2 decades. This has been attributed to poison control centers, which are cost-effective but which are now in jeopardy because of less funding.

#### Priority Recommendations

- Support continued funding for poison control centers, including funding from insurance and Medicare/Medicaid payments. (SLG)
- Review standards for drug packaging and tighten standards for child-resistant containers that are frequently involved in child poisonings, but continue to consider the needs of the elderly. (FG)

#### Federal government

- Support surveillance of the circumstances and locations of severe and fatal poisonings.
- Support analytic research on the distribution of and access to both legal and illegal drugs.

#### State and local governments

- Provide a poison information, toll-free telephone number for people who do not have access to a local poison control center.

#### Private organizations

- Conduct campaigns to increase the availability of ipecac syrup in all households.
- Collaborate with scientists in the evaluation of campaigns against drug use.
- Discourage advertisers from linking alcohol use to sports activities and from sponsoring television programs that glamorize drug use.

#### Academic and research institutions

- Conduct analytic studies on the extent to which persons at risk for poisoning can be identified.
- Evaluate the effectiveness of poison prevention and drug use treatment programs.

#### Fire- and Burn-Related Injuries

Despite the widespread adoption of smoke detectors, fires and their concomitant burn injuries remain a formidable cause of death. In 1986, they resulted in nearly 5,000 deaths. Groups at higher risk for fire- and burn-related deaths include the very young, the elderly, and minority populations. Coordinated efforts can affect community standards and individual practices so that deaths and disabilities are prevented.

#### Priority Recommendations

- Require cigarettes sold in the United States to have a low potential for igniting upholstered furniture. (FG)
- Develop, implement, and enforce codes to address the problem of burns in residences, including requirements for smoke detectors, sprinklers in new housing, and antiscald devices in hot water systems. (SLG)

#### Federal government

- Support surveillance of the circumstances and specific locations of fatal burns or burns that require hospitalization.
- Support analytic studies of kitchen scalds, gasoline burns, clothing ignition, and burns among the elderly, coupled with research by engineers and product designers to remedy correctable hazards.
- Fund the development and evaluation of community-based prevention programs in high-risk urban and minority communities.
- Conduct in-depth investigation of clothing ignition burns in children to determine if the flammable fabrics standard for children's sleepwear is being undermined by sleepwear as daywear.
- Apply the flammable fabrics standard to loose-fitting housecoats and bathrobes now commonly involved in burns associated with cooking and smoking.
- Regulate disposable cigarette lighters to make them child-resistant.

#### State and local governments

- Conduct surveillance of circumstances and locations of fatal and hospitalized fire- and burn-related injuries.

- Collaborate with the CDC and the U.S. Consumer Product Safety Commission in conducting in-depth investigations of clothing ignitions, kitchen scalds, and burns involving gasoline.
- Require antiscald devices in new showers and tubs.
- Develop and/or enforce maximum hot water temperature regulations for residential institutions.

#### Private organizations

- Safety organizations should form a coalition among themselves and with local fire departments to promote a campaign in the media that recommends changing batteries in smoke detectors when clocks are changed in the fall.
- Utility companies should check hot water temperatures when meters are read and recommend settings at 120 F or less if needed.
- The American Association of Retired Persons should push for flame retardant clothing for the elderly.
- Insurance companies should support the installation of sprinklers in multifamily homes by reducing insurance premiums.

#### Academic and research institutions

- Conduct analytic studies listed under "Federal Government."
- Evaluate fire department, community, and school-based fire- and burn-related injury prevention education.
- Conduct studies of characteristics of appliances and utensils that may affect the incidence and severity of burns.

#### Firearm Injuries

Many of the Violence Panel's recommendations apply to unintentional and intentional firearm injuries. This panel fully endorses all the Violence Panel's recommendations; particularly, the suggestions on the need to: a) minimize ready access to handguns and other firearms through a variety of strategies focused on three broad areas (educational or behavioral change interventions, technological or environmental interventions, and enhanced and new legislative or regulatory efforts); and b) continue rigorous scientific research to delineate with greater precision the risks and benefits of ready access to firearms. In addition, this panel makes the following recommendations.

#### Priority Recommendations

- Recognize firearm injuries as a public health problem and establish the regulatory authority for promulgating safety standards for firearms, addressing the problems of trigger locks, muzzle velocity, and visible indication as to whether the gun is loaded. (FG)

- Develop and disseminate prevention programs, including strategies to store guns in facilities outside homes. (FG)

#### Federal government

- Establish the regulatory authority for promulgating safety standards for ammunition, including application of the international law (Geneva Convention) and safety standards for military ammunition to all ammunition.
- Support surveillance of firearm injuries, including a history of the firearms involved, their make and model, the characteristics of the weapon and ammunition, the circumstances of the injury, weapon storage arrangements, and the means of access.
- Support analytic studies of characteristics of firearms and ammunition that are thought to increase the incidence and severity of injury.
- Evaluate the effects of firearm safety training on injuries.

#### State and local governments

- Collaborate with CDC in increased surveillance.
- Enact legislation requiring waiting periods and background checks for firearm purchases and building codes for buildings in which firearms are to be stored.
- Enforce extant regulations.

#### Academic and research institutions

- Conduct analytic studies of characteristics of firearms and ammunition involved in injury.
- Evaluate the effectiveness of firearm education and gun control laws and regulations.
- Conduct research on the psychological, social, and economic effects of firearm injuries on the injured, the shooters, the families of both, and communities.

#### Alcohol-Related Injuries

In addition to its specific recommendations, the panel notes that alcohol is implicated as a factor in many of these types of injuries. Policies that restrict the inappropriate consumption of alcohol affect home and leisure injuries as well as motor vehicle injuries. Therefore, the panel reiterates and endorses the following recommendations of the Surgeon General's Workshop on Drunk Driving.

#### Priority Recommendations

- Equalize federal excise tax rates by ethanol (pure alcohol) content across beverages by raising rates for beer and wine to that of distilled spirits. Adjust the resulting equalized excise tax rate to reflect the change in the Consumer Price Index since 1970, and in the future, annually adjust the resulting excise tax rate to reflect changes in the price index for the previous year. (FG)
- Strengthen enforcement of underage drinking laws with penalties for purchasers, sellers, and servers. (SLG)

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1. Rice DP, MacKenzie EJ, and Associates. Cost of injury in the United States: a report to Congress. San Francisco CA: Institute for Health & Aging, Univ. of California, and Injury Prevention Center, The Johns Hopkins Univ., 1989.
2. Public Health Service. Healthy people 2000: national health promotion and disease prevention objectives: full report, with commentary. Washington DC: Government Printing Office, 1991. DHHS Publication No. (PHS) 91-50212.

## HOME AND LEISURE INJURY PREVENTION

### Part II: An Infrastructure for Injury Control

Injury is the leading cause of death and disability among this country's children and young adults. Injuries kill more Americans between the ages of 1-34 years than all diseases combined. Injuries rob Americans of more years of working life than all forms of cancer and heart disease and cost the United States between \$150 and \$200 billion annually (1). Yet injury research receives only 2 cents out of every federal dollar devoted to research on health problems. Despite experiencing the loss of a loved one or witnessing the irrevocable changes that disabilities cause, people too often continue to perceive injuries as random encounters with fate. The tragic consequences of injuries are compounded because, in many cases, they are preventable.

During the next decade, to achieve lasting progress, an infrastructure for injury control is needed to coordinate efforts, avoid unnecessary duplication, ensure and sustain the continuity of resources, train a cadre of injury control researchers and practitioners, and develop and maintain standardized surveillance systems. The surveillance systems will identify problems, target interventions, and evaluate progress in preventing injuries and reducing their severity.

### Organizational Structure and Coordination

A variety of public and private organizations are involved in injury control. These organizations need a national lead agency for injury control that will provide leadership, guidance, and funding, as reported in *Injury in America* (2).

### Recommendations

- Establish a federal Center for Injury Control to serve as the national lead agency for injury control.
- Appropriate adequate funding for the Center to carry out a national injury control initiative.
- CDC should establish a national strategic plan to direct the activities of the new Center so that national injury control priorities can be set consistent with the Year 2000 Objectives. The plan should include the establishment of state and local capacity to carry out injury control programs as well as injury control research.
- Revise public health laws to include state and local health departments' surveillance and program implementation directed toward preventing injuries.

### Training and Research

Injury control encompasses many disciplines; health care, epidemiology, engineering, ergonomics, architecture, public policy, law, and health communications. In these fields, however, graduate curricula rarely incorporate injury control principles. Lack of faculty expertise, funding, and training materials has thwarted scientific training in injury control and its incorporation into many relevant academic areas. These barriers must be addressed.

Once a cadre of injury control researchers and professionals is created through training, it can be sustained through consistent funding for research and the development and evaluation of intervention and prevention strategies. Without sustained funding, the needed scientific base for injury control will erode.

#### Recommendations

- To increase the pool of injury control professionals, CDC should develop and implement a strategic plan for national training based on the national injury control strategy and on sound education technology. The plan should call for identifying target audiences and learning objectives, developing model curricula, integrating injury control training into ongoing professional education, and evaluating the success of these efforts.
- The Federal government should expand funding of the CDC extramural research program to support approved, but unfunded injury prevention research centers and research projects.

#### Surveillance

Surveillance has been defined as "the ongoing and systematic collection, analysis, and interpretation of health data in the process of describing and monitoring a health event." In the case of injury control, surveillance data are potentially useful to a wider audience (e.g., product manufacturers, builders, farmers, industries, small businesses, insurance companies, regulatory agencies, state and local governments, hospitals, advocacy groups, and researchers).

Various injury control surveillance systems have been developed in response to the differing needs of those using the information. One approach is to gather data on severe injuries—to whom, how, and where they occur—and match appropriate prevention strategies to the circumstances leading to the injuries. Another approach is to gather minimal data, e.g., external causes of injury (E-codes), in mortality and hospital data sets and then to use these data to identify high-frequency causes that need further study.

#### Recommendations

- E-codes should be routinely obtained for hospitalized patients whenever an injury is the principal diagnosis or is directly related to such. E-codes should be required for reimbursement by federal and private health insurance systems, and they should include two separate fields—one for cause of injury and another for place of occurrence—when appropriate.
- Congress should fund CDC (perhaps through its National Center for Health Statistics) to contract with states to collect data on fatal nonmotor-vehicle injuries. This effort would be equivalent to the Fatal Accident Reporting System used for on-road motor vehicles.
- The CDC should assess the cost-effectiveness of alternative surveillance systems. This could be done by comparing different approaches used by health departments and other agencies.

#### References

1. Rice DP, MacKenzie EJ, and Associates. Cost of injury in the United States: a report to Congress. San Francisco, CA: Institute for Health & Aging, Univ. of California, and Injury Prevention Center, The Johns Hopkins Univ., 1989.
2. Committee on Trauma Research, Commission on Life Sciences, National Research Council, and the Institute of Medicine. Injury in America: a continuing public health problem. Washington DC: National Academy Press, 1985.

## OCCUPATIONAL INJURY PREVENTION

Acute injury that occurs in association with work is a tragedy of enormous proportions. Every year in the United States 7,000–11,000 workers die of job-related injuries. Most of these workers are in the prime of their lives, and 88,000 workers are hospitalized. Almost 2 million injuries result in disability and 75 million days of work are lost. Premature death results in about 250,000 potential productive years of life lost.

The cost of work-related injuries incurred in 1989 has been estimated by the National Safety Council at more than \$48 billion. This figure is less than the true cost, because not all workers are included and intentional injuries are not counted. Even these statistics cannot convey the personal hardships that workers and their families undergo because of occupational injury.

Most occupational incidents that result in injury are avoidable and preventable. Strategies to reduce the number of injuries must be aggressively directed and supported by all with a responsibility or interest in protecting workers—including workers themselves. Interdisciplinary action is crucial. Government, industry, labor, universities, workers, and the public must focus attention on this problem and coordinate efforts to solve it.

Costs often play an important role in decisions affecting occupational safety, both in public policy and at the company level. The costs of injury prevention are often given greater weight than the money that would be saved through reduced medical costs and increased productivity. In "selling" the prevention of occupational injuries, there is a need to stress both the economic and human benefits.

There is currently no standard definition of a work-related injury. Some countries count injuries sustained by bystanders and/or injuries sustained by workers commut-

### Occupational Injury Prevention Contributors

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ing to or from work. In the United States such injuries are not included in any definition of occupational injury. A work-related injury in the United States is one attributable to work activity. Work activities are defined as those duties or tasks that produce a product or result or are done in exchange for money, goods, services, profit, or advantage.

Lack of commitment to injury prevention could be at the heart of the occupational injury problem in the United States. At present, there is no infrastructure approach to preventing occupational injury. Funds for research and training programs are scarce, and the lack of well-trained people in injury epidemiology and safety engineering is a real problem. When employers and employees are united in their commitment to workplace safety, the number of work-related injuries decreases. Organizations must be convinced of the benefits of this commitment.

The Year 2000 Health Objectives call for: a) reducing the number of deaths resulting from work-related injury; b) reducing the incidence of injuries that result in medical treatment, time lost from work, or restricted work activity; and c) implementing plans for state-based identification and prevention programs, increased worksite programs, consultation and assistance to small business, and increased awareness and attention by health-care providers. However, the Year 2000 Health Objectives reflect the limitations of the data upon which they are based (e.g., the data on injuries to members of some high-risk occupational groups, such as the self-employed and most farm workers, are excluded). Improvements in surveillance will affect the reported numbers and rates of injuries and will, therefore, make it difficult to evaluate true change. Success of these objectives should take into account improvements in baseline data.

Efforts to reach the Year 2000 Health Objectives must be augmented with complementary strategies and incorporated into a national plan. This plan must include education, research, surveillance, and prevention. The catalyst for the success will be public consensus that injuries in the workplace are unacceptable. This change in awareness and attitude can be accomplished by developing a grass-roots initiative to broaden public appreciation and understanding. Educating the nation's youth beginning in elementary school and training researchers and practitioners will have a positive impact on injury control. Above all, workers must be informed about risks and prevention measures and given the power and knowledge to report specific hazards and aid in their mitigation.

Surveillance of occupational injuries should be enhanced to improve the timeliness, accuracy, and completeness of reporting at all levels—from company level to the national level, where trends are monitored and research priorities established.

Research must be conducted to describe the extent of the occupational injury problem in the United States. This research could be used to improve and standardize occupational injury surveillance systems, and to develop and test hypotheses aimed at identifying risk factors for specific injury problems in special populations. The most compelling problem areas warrant examination of workplace components to identify the circumstances under which injuries occur, the causes, opportunities for intervention and prevention strategies. Research efforts should emphasize "passive" or automatic protection in which hazards are designed out in preference to "active" prevention measures requiring frequent action by the worker. Evaluation research should be used to test the effectiveness of preventive strategies under variable workplace conditions.

Surveillance and research provide future directions for occupational injury control, but these activities cannot override the importance of immediate action. Known prevention strategies can and must be implemented at all U.S. worksites. Compliance with standards should be strictly enforced. The mandates of the Occupational Safety and Health Administration (OSHA) should be broadened to include workers not now covered. Information about model programs should be shared and assistance provided for companies or organizations with few resources.

## Recommendations

### Federal government

- Extend Department of Labor responsibility and authority to cover all public sector and agricultural workers.
- Expand worker empowerment and involvement under the Occupational Safety and Health (OSH) Act.
- Make injury prevention a factor in awarding contracts, loans, and grants.
- Set an example by protecting all federal employees.
- Expand criminal prosecution for willful acts that endanger workers' lives.
- Increase resources for occupational injury prevention programs and research.

### National Institute for Occupational Safety and Health (NIOSH)

- Design a model injury surveillance system, including sample forms for recording injuries.
- Evaluate the effectiveness of intervention strategies.
- Work with the Bureau of Labor Statistics and the Bureau of Census to improve worker population estimates, including those of minority, self-employed, migrant, and other neglected workers.
- Study injuries in high-risk or poorly understood worker populations (e.g., agricultural workers, the self-employed, adolescents, migrants, public sector employees, and employees in small companies).
- Develop the laboratory capacity to develop worker protection systems.
- Communicate to employers and workers information on hazards and hazard reduction strategies.
- Work to improve fatality reporting and to establish data on work-related injuries requiring hospitalization.
- Assist states in developing occupational injury control programs.

### OSHA and the Mine Safety and Health Administration (MSHA) with NIOSH

- Evaluate the effectiveness of standards.
- Determine which inspection strategies work best in what circumstances.
- Promulgate new and improved standards.



- Develop the capacity to acquire and use injury data to set rulemaking priorities.
- Expand enforcement capability through the states.

#### **Bureau of Labor Statistics**

- Continue to develop its Census of Fatal Occupational Injuries program and establish its revised Occupational Safety and Health Survey.

#### **National Center for Health Statistics**

- Expand efforts to encourage and develop guidelines for work-related injuries to be reported on death certificates and for occupation and industry coding.

#### **Department of Agriculture**

- Coordinate with NIOSH in its outreach effort to improve safety and health in agriculture and rural small businesses.

#### **State and local governments**

- Designate a lead agency to coordinate occupational injury prevention and control activities involving all relevant state agencies, including health, labor, workers' compensation, transportation, emergency medical service, vital statistics, law enforcement, and agriculture.
- Coordinate occupational injury control activities with other injury control activities at the state and local level.
- Investigate deaths due to on-site work injuries (especially those not investigated by OSHA, MSHA, or the National Transportation Safety Board) through appropriate, designated state agencies, including the health department.
- Encourage local prosecuting attorneys and law enforcement officials to investigate serious work-related injuries and deaths and pursue criminal prosecution of employers where appropriate.
- Include worker injury-prevention considerations in requirements for state and local permits and licenses.
- Encourage the collaboration of workers' compensation programs and insurance companies to develop injury surveillance data.
- Require that injuries at work be reported on death certificates.
- Develop injury prevention programs for public workers with cities and counties.
- Adopt requirements for including an injury-at-work code on hospital discharge data.

#### **Private organizations**

##### **Advocacy groups**

- Promote legislation, regulations, and initiatives that protect workers.
- Educate the public regarding occupational injury.
- Advocate injury control as a high priority.

#### **News and entertainment media**

- Improve reporting of the circumstances, costs, and preventability of occupational injury.
- Run public service announcements on injury hazards and controls.
- Reduce the portrayal of unsafe practices and portray behaviors that enhance injury prevention.

#### **Foundations**

- Give priority to funding research and evaluation regarding occupational injury.
- Increase communication with governmental agencies regarding occupational injury prevention.

#### **Academic and research institutions**

- Conduct research on occupational hazards, injury occurrence, and injury prevention.
- Develop and evaluate injury prevention and control strategies in collaboration with federal and state agencies and representatives of the private sector, including employers, workers, and advocacy groups.
- Work with NIOSH, NCHS, the Bureau of Labor Statistics, and other relevant agencies to develop model forms and surveillance systems.
- Help to develop a standard definition of work injury.
- Work with management and labor to develop surveillance systems for specific companies.
- Stimulate the incorporation of injury prevention principles in all curricula and related educational materials for professionals in business, architecture, engineering, public health, nursing, medicine, and agriculture.
- Develop injury prevention curricula for elementary and high school students.
- Develop and evaluate rehabilitation programs.

#### **Professional societies**

- Provide their members with continuing education in injury prevention.

#### **Unions and employees**

- Identify and report potential hazards.
- Work with employers to establish injury surveillance systems.
- Include safety demands in collective bargaining.
- Ensure that employers implement and evaluate injury prevention programs for workers.
- Participate with government agencies in developing injury prevention programs for workers.
- Use workers' rights fully to promote safe workplaces.
- Comply with established procedures for occupational safety.

### Employers

- Implement injury prevention programs for workers, with an emphasis on engineering controls and other passive countermeasures.
- Apply effective, state-of-the-art injury prevention measures.
- Encourage workers to identify and report hazards.
- Make safety and health a "bottom line" component of all company activities.
- Communicate information on injury experience and injury control programs in annual reports and other external communications.
- Incorporate safe workplace design and practices in procurement, contracts, and acquisitions.
- Build training programs around job hazard analyses.
- Identify, record, and report all injuries resulting in death, hospitalization, other medical attention, or lost time from usual job separately, and use this information for injury prevention strategies.
- Incorporate injury surveillance and prevention in business organization or practice.
- Determine safety consequences of new technologies.
- Implement rehabilitation programs that help injured workers regain full-life function and that comply with the Americans with Disabilities Act.
- Share their prevention experience with other employers, especially employers in small companies with limited resources.

### Insurance companies

- Provide policyholders with information on economic incentives for developing injury control programs.
- Provide technical assistance in injury prevention to client employers.
- Cooperate with other organizations in developing injury surveillance data.
- Require, as appropriate, injury prevention programs for workers.

Occupational injury is a public health crisis that demands immediate attention. It is important that improved surveillance establishes an accurate count of injuries and deaths and that research and timely reporting result in new prevention strategies. Also, it is essential to use prevention strategies that are now available to protect workers.

## TRAUMA CARE SYSTEMS

The impact of trauma, or injury, on society is profound. Trauma is the leading cause of years of potential life lost and the fourth leading cause of death in the United States. Trauma causes more than 150,000 deaths annually. Each year, 57 million Americans are injured—1 in 4 seriously enough to require medical treatment. Nonfatal injuries account for 1 in 6 hospital days and for 1 in 10 hospital discharges (1). Trauma and its adverse outcomes occur disproportionately among young and elderly persons, who have special trauma care needs. Among children and adolescents 1–19 years of age, trauma causes more deaths than all diseases combined (2).

Trauma, including intentional and unintentional injuries, takes a large toll on our society in terms of death, morbidity, and disability. Trauma creates huge problems in lost productivity and medical care costs. In 1985, the overall cost of trauma was estimated at \$158 billion (1). That same year, trauma cost the federal government \$21.7 billion. This figure includes \$8.9 billion in direct medical payments and \$12.8 billion in disability and death payments (1).

Trauma care systems can play a vital role in reducing mortality, morbidity, and disability due to injuries. The optimal trauma care system is designed to care for all injured patients and provides a continuum of services including: prevention programs, prehospital care, acute care, and rehabilitation. In this summary, this type of system is called an inclusive trauma care system. A small subset of patients are major trauma patients with life-threatening injuries. Optimal care for these patients will require the resources of highly specialized institutions called trauma centers.

Trauma care systems that treat the most severely injured patients improve patient outcome (3–10). Because nonfatal, traumatic injury has a major impact on the young, effective trauma care systems can play a key role in rapid recoveries for these people. To address the needs of all injured patients, inclusive trauma care systems that involve all acute care facilities are needed to have a truly comprehensive and cost-effective system. More importantly, the constant surveillance of injuries by trauma systems would allow identification of high-risk groups and injury problems. In

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turn, the information gathered would help in the design and implementation of effective changes in the environment to prevent injuries and ultimately lower the cost of injuries within a region (11). Recommendations in this summary were made because of the key role of trauma care systems in mitigating injuries and because of their support for the Year 2000 Objectives in *Healthy People 2000* (12).

## Major Challenges

### Public education

Establishing trauma care as a major public health priority and educating the public about the benefits of an inclusive trauma care system are essential. An informed public will demand optimal care and effective injury prevention efforts, including training for health professionals in trauma care and research, education, and prevention programs. Support from the public, business, government, and a strong coalition of health professionals can provide the necessary impetus and funds to establish a national trauma care system.

### Financing

Current financing for trauma care is grossly inadequate. Recently, the proportion of uncompensated or undercompensated care has been so large that many metropolitan hospitals with trauma centers have closed their doors to severely injured persons. Treating large numbers of uninsured, severely injured patients, especially those associated with violent crime and drug abuse, has had a negative economic impact on hospitals and trauma care. There is a shortage of professionals, e.g., prehospital care providers, trauma physicians, nurses, and technicians. Constantly increasing medical costs, combined with the decreased proportion of third-party reimbursement and decreased federal subsidies, continues to financially overburden hospitals that maintain trauma centers. Without notable changes in this financial situation, development of trauma systems will cease, and more trauma centers will close (13-16).

### Rural care

Several challenges face rural trauma care. Limited access to care and prolonged response and transport times are detrimental to the outcome of the trauma patient. In addition, many health-care providers in rural communities lack the experience necessary to provide optimal care because of their infrequent exposure to major trauma patients. Continuous training for rural health-care providers is essential. Rural health-care institutions depend on an inclusive and integrated trauma care system for support, referrals, and training. Without coordination and cooperation between rural care systems and urban hospitals in the same region, the rural trauma patient remains at higher risk for long-term disability and mortality (17-20).

### System evaluation

To be effective, efficient, and proficient, trauma care systems require continuous monitoring and evaluation. The current competitive environment in health-care delivery mandates routine evaluation of resources, facilities, and patient outcomes to illustrate cost-effectiveness. A national uniform data set is essential for conducting

this evaluation. This data set should be appropriate for use by all acute care institutions. It will be vital for demonstrating improved patient outcome, assessing quality of care, and directing resource allocation.

## Recommendations

- Establish trauma care as a national public health priority.
- Develop, implement, and evaluate an inclusive trauma care system in the United States.
- Develop, implement, and evaluate a national uniform data set for trauma care. National standards for case criteria and collecting, analyzing, and reporting trauma care data should be appropriate for use by all acute care institutions.
- Increase the availability of funding for research on injury control.
- Identify, implement, and evaluate cost-effective measures for trauma care systems.
- Conduct a comprehensive evaluation of reimbursement problems and provide financial support for trauma care systems.

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## ACUTE CARE TREATMENT

Traumatic injury is epidemic in the United States, and it is the largest killer of people 1-44 years of age. Traumatic injury continues to be a major threat among older people and is among the four leading causes of death. Traumatic injury takes an economic toll greater than heart disease and cancer combined. Even when it does not result in death, it is the cause of an extraordinary amount of disability.

Trauma, which has been called the number-one public health problem in the United States today (1), particularly affects people in industrialized societies, where occupational and household injuries cause even heavier tolls, along with motor vehicle trauma. The United States, however, has an additional cause of trauma—interpersonal violence—that causes a toll of death and disability not seen in other industrialized countries.

Annually, 150,000 people in the United States die of trauma. More than 2 million people are hospitalized because of injuries (2). The yearly economic losses, including direct medical costs, disability costs, and lost wages and taxes, amount to over \$100 billion.

Despite this toll in human and economic costs, little has been done to address this problem. Since 1967, it has been highlighted periodically in national white papers, but the public and legislative response has been lacking. Annual federal research expenditures related to trauma care are approximately 5 percent of those for cancer, heart disease, or AIDS. The legislative response in mandating the development of trauma systems and centers has occurred entirely at the state level and has varied, with fewer than five states having a complete system in place.

The treatment phase of acute care begins before the patient reaches the hospital and extends through the hospital phase, including treatment in the emergency department, operating room, intensive care unit, and hospital ward. Rehabilitation should begin while the patient is in the hospital phase of treatment.

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Although the medical care of traumatized patients is generally well defined, improved care is needed in many areas to reduce deaths and disabilities. In the broadest sense, the goal of the treatment phase is to minimize the effects of the injury.

### Major Challenges

The principal goal of treatment is to give patients the care that will lead to their maximal functional recovery. Starting in the prehospital environment and continuing through all phases of hospital care, the aim of those providing acute care treatment is to minimize the effects of injury. In many situations, the correct treatment method is not apparent, since many standard care procedures have not been objectively studied, particularly those in the prehospital environment.

Early mortality among traumatized patients is due principally to head and high spinal cord injury (50%), blood loss (30%–40%), and airway and pulmonary compromise (5%–15%) (3). The time between injury and treatment becomes a critical variable that must be factored into the decision process. Severe airway and pulmonary compromise generally must be relieved within minutes if the patient is to survive. Major bleeding must be addressed within minutes for the most effective results, while persons with head injuries should be treated within 2–3 hours. Timeliness is far more important in trauma treatment than in most other areas of medical care. Thus, a major challenge of treatment is not only to determine and carry out the optimal treatment but to do so within an appropriate time frame. To better understand what "an appropriate time frame" is, there is a need to investigate the relationship between the time from trauma to treatment and the patient's outcome. Study also is needed to determine the effectiveness of particular treatments conducted under particular time constraints.

In the hospital, the major challenge to health-care providers is to determine rapidly the nature and extent of a patient's injuries and to provide the proper, timely treatment. There is a need to improve diagnostic modalities in several areas, particularly in those related to perfusion and oxygenation at the tissue level.

Among those patients whose bleeding has been controlled and who survive the acute phase of injury, the major cause of death during the first few days is irreversible cerebral damage or uncontrollable cerebral swelling. Research is urgently needed to develop improved methods of reducing secondary cerebral injury and of controlling brain swelling. Methods now in use have changed little over 3 decades and are inadequate in many cases.

Deaths among trauma patients who survive the first few days are most often due to infection and organ failure, with the lung being the most commonly affected organ. The body's response to traumatic tissue damage and major blood loss appears to result in an activation of multiple processes (collectively known as the inflammatory response) that are themselves destructive to body tissues. As the result of advances in molecular biology, knowledge of these processes has expanded dramatically, and understanding of the inflammatory processes is similarly increasing. The nature of the inflammatory response, however, needs to be investigated further. The goal should be to develop agents that can attenuate the inflammatory response or modify it in beneficial ways while not causing further damage.

Finally, the overall impact of trauma care systems needs greater study and validation to build broader support among third-party payers, nontrauma system providers, and other interested parties. The lack of development of trauma systems is partly because no large-scale studies of the cost-effectiveness of trauma care have been conducted. Such studies are needed to demonstrate the value of trauma care, to define the potential benefits from widespread implementation of trauma care systems, and to support the Year 2000 Objectives in *Healthy People 2000* (4).

### Recommendations

- Evaluate (with a multidisciplinary group of professionals from fields such as marketing, public relations, and psychology) why the public does not provide greater support for efforts to reduce the toll of injuries, despite their significance as a cause of morbidity and mortality in all age groups.
- Develop improved methods to score injury severity and to evaluate and predict clinical outcomes in the general trauma population as well as among specific populations in the areas of pediatrics, neurotrauma, burns, and orthopedics.
- Develop population-based studies of trauma outcomes and of the cost-effectiveness of trauma system care versus traditional health care.
- Define the optimal treatments to be given before patients reach the hospital, the relationship between the time it takes them to reach the hospital and their outcome, and the optimal resuscitative fluid to use on patients before they reach the hospital.
- Formulate objective trauma treatment guidelines for use in the emergency department phase of care, including guidelines for improved diagnosis of abdominal injuries.
- Develop techniques for real-time monitoring of tissue perfusion and oxygenation.
- Support basic scientific investigations of the inflammatory process, including the immunologic, metabolic, hormonal, and cytokine responses to traumatic injury.
- Develop better methods for assessing perfusion and metabolism in all tissues and for evaluating agents used to modulate the inflammatory and growth processes that can lead to tissue damage after injury.
- Develop and conduct clinical trials of pharmacologic agents used to treat acute sequelae of traumatic injury, particularly those that reduce edema of the brain and spinal cord, attenuate the inflammatory response, and enhance healing.
- Evaluate new treatment modalities of nutritional support, including the early institution of nutritional support, the use of nutritional regimens with enhanced concentrations of specific nutrients, and the use of enteral alimentation to enhance immunologic responsiveness.
- Develop and test new orthopedic therapies to enhance healing, reduce immobility and disability periods, and improve functional outcomes.
- Develop interventions that address the psychosocial impact of traumatic injury on patients and their families.

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## REHABILITATION OF PERSONS WITH INJURIES

Improvements in emergency medical systems, trauma centers, injury prevention, and medical and surgical management have resulted in increased survival rates for people with serious injuries. Mere survival, however, is not enough. Children and adults with injuries need rehabilitation and educational services to help them regain biologic, psychologic, and social functions. These services must be comprehensive, longitudinal, and coordinated. Rehabilitation needs to be viewed as part of a continuum of care provided by an interdisciplinary team and by the injured person's family—from the early acute stage to the end of the person's life, if necessary. Injuries in the following six categories require intensive rehabilitation services, and exact a huge toll.

### Spinal Cord Injury

Estimates of people with spinal cord injury (SCI) in the United States range from 177,000–200,000. Annually, 10,000–20,000 more people receive an SCI. Most people with SCIs are permanently impaired, and most have major disabilities. In the United States, the cost of SCI is estimated at \$6.2 billion annually.

### Traumatic Brain Injury

No surveillance data with exact numbers of traumatic brain injuries exist. An estimated 70,000 people annually incur moderate-to-severe head injuries and require long-term rehabilitation services to help cope with cognitive, behavioral, and emotional deficits. Children and young adults are disproportionately affected by traumatic brain injuries and often require lifelong rehabilitation services.

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## Burns

About half of all people who receive burn injuries require medical care. Each year, 70,000–100,000 hospital admissions are for burns. About a third of these admissions are to facilities with specialized burn units. Data are limited on long-term sequelae to burn injuries, rehabilitation outcomes, and the costs of rehabilitation care for burns.

## Limb Injuries

About half of all hospital trauma admissions are due to injuries to the upper and lower limbs. The result is a total of \$5.4 billion in hospital charges.

## Back Injuries

Of the estimated 5.2 million Americans with low back pain, about half are chronically disabled. Low back pain is the most common cause of work disability among adults <45 years of age. The cost of compensable low back pain has been estimated at \$11 billion.

## Polytrauma and Other Injuries

Polytrauma (injuries to more than one body system) occurs frequently. For example, about half of all people injured in motor vehicle crashes have multiple injuries (head, spinal, facial, or extremity). Each year, an estimated 2.4 million Americans suffer from an eye injury, and nearly 1 million Americans now have permanent visual loss because of ocular trauma.

## Rehabilitation Services

Rehabilitation can improve functional outcomes by maintaining function of body systems and reducing residual disabilities. Unfortunately, rehabilitation services are not available to all who need them. The capacity of the health-care system to provide rehabilitative services is not uniform throughout the country. Services are sometimes fragmented and poorly distributed. Moreover, the cost of rehabilitation is a barrier for people who lack medical insurance or for third party payers for medical expenses.

Although great progress has been made in the development and delivery of rehabilitation services, many improvements are still needed. Two recent developments are encouraging. First, the passage of the Americans with Disabilities Act reflects a recognition of the rights of persons with disabilities to have access to employment and to an independent, noninstitutional lifestyle. This legislation will have an impact on our nation. Similarly, the recently published Institute of Medicine Study, *Disability in America*, will have an impact on policymakers and researchers by providing them with a framework for prevention strategies (1).

Vital to this position paper is the belief that all injured children, adults, and their families should receive the benefits of rehabilitation that are currently available and that research, both basic and applied, should receive adequate funding. The goal is to establish, by the year 2000, a cost-effective system of rehabilitative care that will permit an injured person to achieve optimal health, personal autonomy, and an independent, noninstitutional lifestyle. A cost-effective system of rehabilitative care will help achieve an important objective of *Healthy People 2000*, namely the reduction of secondary disabilities subsequent to head and spinal cord injuries (2).

This is an ambitious goal, and it requires substantial financial commitment, new systems of health-care delivery, and new research and evaluation. The achievement of this goal depends on cooperation and collaboration among researchers, clinicians, consumers, families, communities, and public and private agencies. We believe that obtaining the finances and the cooperation needed to attain this goal is possible.

## Basic Science Research

The National Institutes of Health (NIH) recently convened a group of experts in rehabilitation medicine, behavioral and social sciences, allied health, nursing, and related fields to help determine what research is needed to build a strong foundation for rehabilitation services. This task force recommended a solid program of basic science research and outcome research. In addition, NIH recently established the National Center for Medical Rehabilitation Research to address the need for basic rehabilitation research. This panel strongly endorses the recommendations of the NIH task force report and the establishment of the National Center for Medical Rehabilitation Research. The panel further recommends establishing a cohesive program of research that would include projects ranging from basic science to ways injured persons can function in the community.

## Surveillance

The field of rehabilitation is hampered by lack of data on etiology, risk factors, treatment, and outcomes related to rehabilitating persons with injuries. Evaluating preventive strategies and clinical care approaches is important. However, without objective measurement tools, measuring evaluation outcomes is difficult. Development of a clinical care data base that would include epidemiologic information on etiology, risk factors, treatment, outcome, and cost on all persons with injuries is needed.

## Information Dissemination and Technology Transfer

Information from researchers must reach clinical and public health programs and the public. Information about gaps in care, the relative effectiveness of various clinical care strategies, and emerging problems must reach researchers. A high priority should be given to funding proposals for information dissemination and technology transfer among researchers, clinicians, all health-care providers, injured persons and their families, and community members.

## Rehabilitation Services Capacity

Comprehensive rehabilitation services are not uniformly available. Successful clinical service systems such as the Model Spinal Cord Injury Care Systems, provide integrated care by using existing clinical and prevention knowledge. Such innovative systems, however, are not available in all regions of the country, and not everyone who needs such services can afford them. Systems of care need to be developed for all people with debilitating injuries and the effectiveness of these systems needs to be evaluated.

## Clinical and Health Services Research

Many types of interventions and other factors influence the medical outcomes and quality of life of a person with disabilities. Health systems research, incorporating a

variety of innovative and traditional approaches, is needed to address issues such as access to and payment for services, cost-benefit analysis of rehabilitation services, reemployment training and back-to-work incentives, and combinations of traditional and nontraditional rehabilitation services and therapeutic methods.

### **Training**

The field of rehabilitation faces shortages of trained medical, allied health, and nonmedical care givers. Various professional and nonprofessional groups need many levels of training. Formal methods must be developed to train, support, and certify personal care attendants who are critically important in helping people with disabling injuries achieve independence. Trained personnel are needed in all areas of rehabilitation, including research, clinical care, and personnel services, to ensure the development of model systems of rehabilitative care.

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