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Injury in America

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One of the giants of trauma care in this country was Dr. Robert H. Kennedy, who, in the Oration on Trauma in 1954, outlined the spectrum of problems that confronted the care of the injured patient in the United States, and in so doing laid the framework for the development of systems for emergency medical services. Twelve years later, the National Research Council committees on shock, on trauma, and on anesthesia united to publish a white paper entitled "Accidental Death and Disability, the Neglected Disease of Modern Society."

The paper noted that "the general public is insensitive to the magnitude of the problem of accidental death and injury." The authors called for a series of actions, including a national conference on emergency medical services (EMS), the establishment of a national trauma association, the organization of community councils on EMS, the formation of a national council on accident prevention, and the creation of a national institute of trauma. Except for the last, all of these proposals have come to some degree of fruition.

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Some specific recommendations of the white paper included accident prevention, public training in first aid, trauma registries, committees on trauma, attention to rehabilitation, attention to medical-legal problems, universal systems of autopsies of victims of injury, a program for disaster care, and research on trauma.

Seven years later, in 1973, Dr. "Deke" Farrington gave the eleventh Scudder Oration on Trauma, and noted that although there had been some progress in terms of facilities and processes for care of the injured patient, there had been little benefit in terms of outcome. In 1974, I had the good fortune to become chairman of the committee on Emergency Medical Services of the National Research Council, National Academy of Sciences, which was the successor committee to the three that had issued the 1966 white paper. The Committee on EMS went to work on a review of the progress made since 1966, and published, in 1978, a pamphlet entitled "Emergency Medical Services at Midpassage."

The Committee on EMS found that "the attitude toward EMS has changed from a lack of awareness, which our predecessors appropriately called 'neglect,' to a lack of knowledge with which to deal with the complexities and pitfalls that have arisen. Thus, the committee finds EMS in the United States in mid-passage, urgently in need of mid-course corrections, but uncertain as to the direction and degree." The principal recommendation of the committee was for a major national investment for research into emergency medical care in general and trauma in particular. This call attracted even less attention than had the original white paper, and not much happened. Then in 1983, Congress mandated the establishment of still another committee within the National Academy of Sciences. This one, the Committee on Trauma Research, was formed within the Commission of Life Sciences and the Institute of Medicine, two divisions of the National Academy of Sciences (NAS). The committee was charged with investigating the status of trauma research in the United States at that time with particular attention to two questions: (1) Was more research needed? and (2) Was there a need for a national trauma institute? The committee issued its report in 1985, with the title *Injury in America*. A review of some of the facts about injury in the United States and some of the detailed recommendations of this committee follows.

Facts about trauma

From one point of view, little progress has been made in the last 20 years in the care of the injured. Trauma, which in 1966 had been the leading cause of death among people ranging in age from one to 37, was the leading cause of death among those ranging in age from one to 44 in 1984. The number

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of deaths and the number of individuals disabled had shrunk by only 10 percent in that time period, and the total cost of care of the injured had risen dramatically. Indeed, in 1985, the cost of trauma care broke the $100 billion mark and was estimated at approximately $104 billion. Motor vehicle accidents claimed nearly 50 percent of the total cost of trauma care.

Accidental injury accounted for more than three-fourths of the deaths of those in the 15- to 24-year age range and remained the principal cause of death up through age 44. Accidents accounted for more years of life lost than did cancer and heart disease combined. When one looks at total costs in dollars, motor vehicle injuries alone account for greater cost than any class of disease other than cancer. Since motor vehicle accidents account for little more than a third of all accidental injuries, the total cost of all accidental injuries must exceed that of any other class of disease.

Motor vehicle accidents account for the lion's share of unintentional injuries, whereas suicide and homicide just about equally account for intentional injuries. Most injuries are the result of some form of transfer of mechanical energy, including injuries attributed to motor vehicle accidents, firearms, and falls. Only about one-fourth of all injuries result from the transfer of nonmechanical energy. In addition, motor vehicle accidents affect predominantly the young. In the 20-year age group, motor vehicle deaths account for nearly half of all deaths among both sexes. Another factor is that alcohol figures prominantly in fatal motor vehicle accidents. Indeed, alcohol has been implicated in more than half of all motor vehicle accidents. Some relatively simple preventive measures have been introduced, such as the wearing of seat belts and tougher drunk driving laws, but they have met with limited degrees of acceptance.

The detection of injury and notification of emergency medical services have been major problems for many years. Injuries are three times as likely to be fatal if they take place in remote, rural areas than if they occur in major cities. The problem is in part one of having the system detect the occurrence and in part a problem of response time, transportation, and perhaps limited intervention in the field.

Speed also is a factor in injuries associated with motor vehicles. The number of pedestrian deaths rises as the posted speed limit rises. It takes no great insight to observe that it is dangerous to walk on interstate highways, but our emergency departments continue to receive a steady stream of individuals who insist upon doing so. Furthermore, more than 50 percent of pedestrians injured fatally at night are legally intoxicated. The message is clear: Don't drink and walk.

Head injury is clearly the most common cause of mortality among motorcyclists. There was a dramatic fall in deaths per motorcycle driver as 40 states enacted helmet laws. Conversely, there was a dramatic rise in such deaths when these laws were repealed in 27 states since 1976. Motorcyclists argue that the helmet limits their freedom, and they seem to be unconcerned with the tremendous burden that every major motorcycle injury places upon society. Seventy percent of motorcyclists killed at night are legally intoxicated, as are the majority of those fatally injured at all times of the day and in most age groups. Thus, alcohol must be viewed as the single major contributing factor in all motor deaths. Homicide accounts for approximately half of fatal intentional injuries. Firearms are, increasingly, the principal means of homicide, and handguns alone account for nearly 80 percent of homicides by firearms. Firearms are also the major cause of successful suicide in males of all ages and in females up to age 65. Further, there has been a dramatic increase in suicidal deaths by firearms since the 1950s. Thus, the handgun must be viewed as the single major contributing factor in fatal intentional injuries.

Peaks of death

In 1983, in a classic article in *Scientific American*, entitled "Trauma," Dr. Donald Trunkey, until recently Chairman of the College's Committee on Trauma, pointed out that there are three major peaks of incidences of death in relation to the time of injury. Immediate deaths account for nearly 50 percent of the total. Such deaths are not preventable unless detection and therapy are immediate. It

would appear that many of the events that lead to injury could be prevented by appropriate programs to control the use of alcohol among drivers, to lower speed limits, and to control the use of handguns. Accidental injury could be limited in large measure by the use of such devices as seat belts and helmets.

The second phase of deaths related to injury occurs within a matter of a few hours and can be attributed primarily to the effects of hemorrhage and shock. In part, these deaths could be prevented by improving treatment during transportation to trauma centers, but there are at least some aspects of death from shock that continue to elude our understanding.

Finally, about 20 percent of trauma deaths occur a longer time after injury, largely as a result of sepsis and the attendant multiple organ failure. Here, our knowledge is even more limited; and it is tempting to believe that if we could understand the mechanisms that render the injured individual susceptible to infection, we might prevent a large segment of these fatalities. Thus, one can argue that we have a fair knowledge of the epidemiology of injury and could at least begin to see our way clear to a program of prevention. However, we need a greater understanding concerning the mechanics of injury, its treatment, and the rehabilitation of the injured patient if we are to develop the optimal system in the care of trauma patients.

The National Academy of Sciences' Committee on Trauma Research noted that the two great causes of premature death throughout history have been infection and injury. Infection has been conquered in the developed countries, except in immunosupressed individuals, but injury continues to take its toll. The committee recommended that a healthier view concerning the prevention of injury might result if the term "accident" were no longer used to describe an event that almost always has a clearly indentifiable cause.

Injury research

The NAS committee then looked at the investment in research directed toward control of this major cause of premature death and concluded that a dramatic increase in expenditures for research in trauma was necessary and that this research required an appropriate focus. The committee identified five principal areas for research on injury: epidemiology, prevention, biomechanics, treatment, and rehabilitation. The recommended research priorities related to epidemiology included a professional surveillance system, a national capacity to identify and control outbreaks of specific injuries, a consistent and accurate system for coding and measuring injury severity, and research into the long- and short-term costs of injuries.

Acts of prevention should include persuasion as part of an educational program, a system of legal interventions, and automatic protection by such means as seat belts and airbags. Clearly, effectiveness increases as means of prevention are made mandatory.

Research related to prevention should include evaluation of educational programs, applicable laws, automatic protection, barriers to implementation, prevention of injuries, and training of professionals in injury research and control.

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The embryonic area of biomechanics could provide the basis of an extensive research program. Relatively little is understood about the mechanisms of injury. We need to know more about the body's responses to mechanical loads and about the tolerance of the whole body and of body regions to injury. The technology for assessing injury needs to be improved.

Treatment of trauma

The area of treatment has traditionally been the domain of the trauma surgeon. Attention should be given to identifying and evaluating the factors in trauma therapy that produce optimal or less than optimal results. More research is needed into

causes of shock, infection, tissue-healing, and the development of swelling. Research programs should be instituted for the development of biocompatible materials, prostheses, and artificial organs. Major clinical studies are needed to evaluate pharmacological, surgical, and other approaches to patient care. Finally, more training programs are needed for research and care of the injured patient.

As long as people are injured and as long as their treatment is successful, rehabilitation will pose a major challenge. Research centers devoted to clinical neurophysiology are needed to explore the recovery of neural function. Research should be done on the identification and preservation of residual functions, on minimizing the effects of skeletal trauma, and on mechanisms related to memory and learning.

Center for injury control

The NAS committee stressed the need for an organization to focus attention on trauma research. The committee felt that an institute within National Institutes of Health would not address the need to influence public policy, foster demonstration programs and centers, and emphasize development and application as opposed to basic research. It is important to note that the committee felt unanimously that, given the present state of knowledge, a pluralistic approach is needed and that an independent agency would be too costly and could not gain public acceptance. So the committee recommended that a center for injury control be established within the Centers for Disease Control (CDC).

To our astonishment, Congress has responded to the committee's proposal. In 1986, $10 million was appropriated to begin a grants program in injury control. However, the program was established within the existing Center for Environmental Health in the CDC rather than in a separate Center for Injury Control. Consequently, the major focus of the program to date has been in the areas of epidemiology and prevention, which are traditionally the province of the Center for Environmental Health. More than 400 grant proposals have been submitted and the review process is under way. Only time will tell the degree to which the relatively hard science areas of biomechanics and treatment will receive the attention due them.

The CDC has indicated that it will consider establishing an independent Center for Injury Control if it is assured of greatly increased and continuing funding. Thus, what needs to be done at present is to increase and continue the appropriation of dollars for injury control. Furthermore, a Center for Injury Control must be set up as an independent center within the CDC in order to establish a balance of priorities among the areas in which research is needed.

The goal of establishing a national trauma institute, which was first requested in 1966, is getting closer to reality. However, it will take a concerted effort by all concerned with the care of the injured patient to move the system the remaining distance to that goal. We need a program of intense lobbying of the members of Congress, and we need a major program to raise public consciousness.

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It goes without saying that trauma surgery is hard work. We all know that the hours are bad and that we are frequently confronted with situations that are difficult to control. Meanwhile, the trauma surgeon must maintain a more certain source of surgical practice and frequently is faced with the need to teach, to do research, to train those providing emergency medical services, and to assist in organizing those services.

We need to extend the list of the duties of the trauma surgeon to include political action and public education. I have no doubt that we have the capacity to rise to the occasion, given the fact that we have chosen to be involved in the surgery of the injured in the first place. Let me echo Aldous Huxley, who said in his poem *Orion*, "The choice is always ours. Then let me choose the longest art, the hard Promethean way."