Injury is the most underrecognized public health problem facing the nation today. Overall, injuries (unintentional injuries, homicides, and suicides combined) account for 7% of all deaths in the United States each year and were responsible for 167,184 deaths in 2004. Between ages 1 and 45 years, unintentional injury alone (without the contribution of homicide and suicide) is the leading cause of death and the fifth leading cause of death across all ages in the United States (Table 6-1). Among adolescents and young adults (ages 15 to 24 years), three of every four deaths in 2003 were injury related. Injury (unintentional injury, homicide, and suicide combined) is the leading cause of premature death for young people and thus is the leading cause of years of potential life lost before the age of 75 years. The societal cost of injury is enormous. Health care charges for the treatment of injury represent only a portion of the total financial burden. Other costs include those associated with loss of income, productivity, and property. Social costs are harder to measure but include pain, suffering, reduced quality of life, lost human potential, and disrupted families. For the year 2000 alone, the estimated total lifetime cost resulting from injury in the United States was estimated at $406 billion.

Injury is perceived to be a condition that affects young people disproportionately, yet trauma continues to be a major health problem throughout life. Despite the obvious importance of injury as a cause of premature death, the highest injury-related death rates are experienced by the elderly—a sector of the population that is expected to increase from 12.4% (in 2000) to 20.4% by the year 2040. Similarly, our oldest citizens (those older than 75 years) experience death rates nearly three times those of the general population; this group is expected to increase from 5% to 9% of the population in the next three decades. Nonfatal injuries in the elderly are also a major concern. For many older adults, a hip fracture may begin a downward spiral of immobility-related morbidity, an end to independent living in the community, and shortened life span. Indeed, half of all elders who are hospitalized for a hip fracture are unable to return home or live independently after the injury. Unless we are able to reduce death and injury rates among people older than 65 years, it is estimated that by the year 2030 this group will sustain more than one third of all injury-related deaths and hospitalizations. The social impact of this cannot be overstated.

Injury can be prevented or controlled at three levels. Primary prevention involves preventing the event, such as the car crash, that has the potential to cause injury. Secondary prevention involves preventing an injury or minimizing its severity during that crash. Tertiary prevention is optimization of outcome through medical treatment and rehabilitation. Trauma nurses will be most familiar with tertiary prevention and to a lesser extent with secondary prevention. Development of emergency medical services and systems and expert trauma management has improved—and will continue to improve—the outcomes of injured patients. However, these advances will never be enough to reduce the toll of injury-related death significantly. Why? The majority of deaths from traumatic injury occur early. It is estimated that, because of the severity of the injuries, half of all trauma deaths cannot be prevented with even the best medical management. For those who survive their injuries, the sequelae may be profound and, in some cases, increase that individual’s chance of reinjury. Achieving a significant reduction in trauma-related mortality and morbidity therefore must include attention to primary prevention. Indeed, the American Trauma Society website carries the message that when prevention succeeds, trauma is conquered.

At some time, all trauma nurses will ask, “Could this have been prevented?” Why then has injury prevention received so little attention in trauma training programs and trauma services? Trauma, it seems, is so endemic in our society that we fail to realize the enormity of its financial and social costs or our potential as a society to reduce its toll. In 1988, Dr. William Foege, former director of the Centers for Disease Control and Prevention, called injury “the principal public health problem in America today.” One year later, Surgeon General C. Everett Koop testified that “if some infectious disease came along that affected children [in the proportion that injuries do], there would be a huge public outcry and we would be told to spare no expense to find a cure and to be quick about it.” Much progress has been achieved in the ensuing years, but the commitment of the public, and of the health care profession, to injury prevention is still woefully inadequate—a symptom of society’s “general tendency to underinvest in programs designed to prevent social problems.” Why? Three answers come to mind: (1) injury is underrecognized and, as such, grossly underfunded and understudied relative to other health problems of similar magnitude; (2) injury prevention is relatively young as a field.
AN OVERVIEW OF INJURY PREVENTION

Although traumatic injury has been a problem throughout the ages, injury prevention is a relatively new field of scientific inquiry. Historically, injuries (often called accidents) have been viewed as the result of human error, fate, or bad luck. Injury prevention efforts reflected and inadvertently supported this belief by encouraging people to adopt safe and responsible behaviors or by blaming the victims for the events that led to their injuries or deaths. Most attempts at injury prevention focused on training individuals to be more responsible, a preoccupation with what Leon Robertson called “a basic cultural theme…that sufficient education will resolve almost any problem.”16 The concept that injury, like disease, is the product of the interaction of a human host and an agent within the environment, and can therefore be examined by epidemiologic methods, first appeared in the public health literature in 1949,17 more than a century after epidemiologists knew that explaining the development of epidemics as the consequence of individual behaviors was inaccurate.

of scientific inquiry and professional practice; and (3) training in injury prevention methods is lacking.

Trauma nurses know all too well how a few seconds can alter the course of a healthy young person’s life forever. They have witnessed the effects of alcohol and other substance abuse and access to lethal weapons as risk factors for injury; they recognize predictable trauma case histories; they know that certain days, times, and weather conditions are associated with increased caseload. Fortunately, many have also witnessed the protective effects of interventions such as seatbelts, helmets, and improved vehicle design. Clearly, trauma nurses possess the awareness and many of the attributes needed by injury preventionists and can make valuable contributions to injury prevention. The goal of this chapter, therefore, is to enable the trauma nurse to think about injury in a critical and systematic way. Traumatic injury is approached as a health problem to be solved. A public health problem-solving paradigm15 and two related conceptual frameworks for problem diagnosis and decision making are introduced.

### TABLE 6-1 The Ten Leading Causes of Death—United States, 2004

<table>
<thead>
<tr>
<th>Rank</th>
<th>&lt;1</th>
<th>1-4</th>
<th>5-9</th>
<th>10-14</th>
<th>15-24</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Unintentional injury</td>
<td>Unintentional injury</td>
<td>Unintentional injury</td>
<td>Unintentional injury</td>
</tr>
<tr>
<td>1</td>
<td>&lt;1</td>
<td>Congenital anomalies 5,622</td>
<td>Unintentional injury 1,641</td>
<td>Unintentional injury 1,126</td>
<td>Unintentional injury 1,540</td>
</tr>
<tr>
<td>2</td>
<td>Short gestation 4,642</td>
<td>Congenital anomalies 569</td>
<td>Malignant neoplasms 526</td>
<td>Malignant neoplasms 493</td>
<td>Homicide 5,085</td>
</tr>
<tr>
<td>3</td>
<td>Sudden infant death syndrome 2,246</td>
<td>Malignant neoplasms 399</td>
<td>Congenital anomalies 205</td>
<td>Suicide 283</td>
<td>Suicide 4,316</td>
</tr>
<tr>
<td>4</td>
<td>Maternal pregnancy complications 1,715</td>
<td>Homicide 377</td>
<td>Unintentional injury 1,052</td>
<td>Homicide 122</td>
<td>Homicide 207</td>
</tr>
<tr>
<td>5</td>
<td>Unintentional injury 1,052</td>
<td>Heart disease 187</td>
<td>Heart disease 83</td>
<td>Congenital anomalies 184</td>
<td>Heart disease 1,038</td>
</tr>
<tr>
<td>6</td>
<td>Placenta cord membranes 1,042</td>
<td>Influenza and pneumonia 119</td>
<td>Chronic low respiratory disease 46</td>
<td>Congenital anomalies 483</td>
<td>Congenital anomalies 188</td>
</tr>
<tr>
<td>7</td>
<td>Respiratory distress 875</td>
<td>Septicemia 84</td>
<td>Benign neoplasms 41</td>
<td>Chronic low respiratory disease 74</td>
<td>Cerebrovascular 211</td>
</tr>
<tr>
<td>8</td>
<td>Bacterial sepsis 827</td>
<td>Perinatal period 61</td>
<td>Septicemia 38</td>
<td>Influenza and pneumonia 49</td>
<td>HIV 191</td>
</tr>
<tr>
<td>9</td>
<td>Neonatal hemorrhage 616</td>
<td>Benign neoplasms 53</td>
<td>Cerebrovascular 34</td>
<td>Benign neoplasms 43</td>
<td>Influenza and pneumonia 185</td>
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<tr>
<td>10</td>
<td>Circulatory system disease 593</td>
<td>Chronic low respiratory disease 48</td>
<td>Influenza and pneumonia 33</td>
<td>Cerebrovascular 43</td>
<td>Chronic low respiratory disease 179</td>
</tr>
</tbody>
</table>


Trauma-related diagnoses in bold italic.

HIV, Human immunodeficiency virus.
and ineffective for the development of preventive strategies. This and later developments in injury control are discussed in a comprehensive article by Julian Waller. Dr. Waller, a pioneer of the injury field, is one of many who advocated for the removal of the term “accident” from discussions of injury. This was promoted to draw attention to the fact that injuries do not exhibit the randomness conveyed by the term “accident,” and that injuries can be explained by using scientific methods common to public health. The late Dr. William Haddon, considered by many to be the father of injury epidemiology, refined the understanding of the role of energy as the agent of injury. Haddon’s work formed the well-known definition of injury published by the World Health Organization adds ionizing radiation to the list and includes the important clarification that energy “interacts with the body in amounts or at rates that exceed the threshold of human tolerance.”

For an energy transfer (or energy deprivation) to occur, a human host and the agent of injury must interact within an environment. Interaction of host, agent, and environmental factors produces both the injury and the eventual outcome from that injury. This pivotal work of identifying the agent of injury and the vehicle (or carrier of the energy) and refining the relationships of host, agent, and environment in producing injury and its outcomes resulted in the development of the Haddon Phase-Factor Matrix. This tool is still in use today and is explained in detail later. Despite these contributions, and later efforts to reject “accident proneness” as an explanation for childhood injuries, the tendency to look at human behavior as the root of the injury problem and to focus prevention efforts on changing those behaviors is still pervasive. Individual knowledge, attitudes, beliefs, and behaviors are very important factors in injury prevention, as is the role of education and health behavior.

<table>
<thead>
<tr>
<th>25-34</th>
<th>35-44</th>
<th>45-54</th>
<th>55-64</th>
<th>65+</th>
<th>All Ages</th>
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<td>Unintentional injury</td>
<td>Unintentional injury</td>
</tr>
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<td>Heart disease</td>
<td>13,032</td>
<td>Malignant neoplasms</td>
<td>16,471</td>
<td>Malignant neoplasms</td>
<td>16,942</td>
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<tr>
<td>Suicide</td>
<td>5,074</td>
<td>Heart disease</td>
<td>12,925</td>
<td>Heart disease</td>
<td>12,925</td>
</tr>
<tr>
<td>Malignant neoplasms</td>
<td>3,633</td>
<td>Unintentional injury</td>
<td>6,638</td>
<td>Unintentional injury</td>
<td>7,496</td>
</tr>
<tr>
<td>Heart disease</td>
<td>3,163</td>
<td>HIV</td>
<td>4,826</td>
<td>Suicide</td>
<td>6,906</td>
</tr>
<tr>
<td>HIV</td>
<td>1,468</td>
<td>Cerebrovascular</td>
<td>6,181</td>
<td>Cerebrovascular</td>
<td>6,181</td>
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<tr>
<td>Diabetes mellitus</td>
<td>599</td>
<td>Liver disease</td>
<td>2,799</td>
<td>Liver disease</td>
<td>2,799</td>
</tr>
<tr>
<td>Cerebrovascular</td>
<td>567</td>
<td>Cerebrovascular</td>
<td>2,361</td>
<td>HIV</td>
<td>4,422</td>
</tr>
<tr>
<td>Congenital anomalies</td>
<td>420</td>
<td>Diabetes mellitus</td>
<td>2,026</td>
<td>Chronic low respiratory disease</td>
<td>3,511</td>
</tr>
<tr>
<td>Septicemia</td>
<td>328</td>
<td>Influenza and pneumonia</td>
<td>891</td>
<td>Septicemia</td>
<td>2,251</td>
</tr>
</tbody>
</table>

Chapter 6 Injury Prevention

TRAUMA NURSING: FROM RESUSCITATION THROUGH REHABILITATION, 4TH EDITION
by Karen A. McQuillan, Mary Beth Flynn Makic & Eileen Whalen
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change; but to develop effective, sustainable injury prevention strategies, we must expand our field of vision beyond the individual. In short, we must subject injury problems to thorough scrutiny before we act.

**IDENTIFYING AND DEFINING THE INJURY PROBLEM**

The focus of trauma management is on the individual and his or her unique combination of injuries. The focus of injury prevention is much broader. Injury is a health problem of populations and, as such, must be identified on more than a case-by-case basis. Thereafter, it may be grouped and defined in several ways. Knowing how a problem was identified and how it has been defined is critical at all levels of injury prevention. For example, a trauma nurse interested in an area of tertiary prevention, such as optimizing functional outcome after severe head injury, may decide to review articles about management protocols and patient outcomes. The patients in Study I may seem to do much better than those in Study II. The nurse may decide to further investigate or even consider implementing the management protocols used by Study I. However, to implement these protocols would be unwise; essential preliminary information has been ignored. We cannot begin to compare differences in outcome unless we understand the differences in input. How are the hospitals and the patient populations in Studies I and II similar and different? What were the criteria used to determine the severity of injury in the study? Were penetrating head injuries included or excluded? Were all deaths reported, or only those that occurred after admission and within a defined time frame after injury? What was the average time to admission? If Study I included many cases that were transfers from other centers, early deaths in the transfer population are essentially excluded, thus reducing the total case fatality rate. What was the average age of the patients? What were the causes of the head injuries in the two studies? Were the patients comparable in terms of total injury severity? These considerations apply throughout all levels of prevention. For example, studying the protective effect of bicycle helmets or child passenger restraints in populations receiving trauma care fails to reveal those persons who are protected so effectively that they do not require any medical management. The issue of assessing exposure remains a great challenge to the injury prevention community. It is therefore important not only to gather information about the injury problem but also to be familiar with the source of that information and how the injury population of interest was defined.

Even more important to trauma professionals is the awareness that the quality of the trauma team’s documentation influences the quality and value of sources of injury data. Hospital records and death certificates are important sources of data. Health professionals must realize that the information they document in the trauma facility will find its way into aggregate data sets that are used for research and policy development. For example, our national injury fatality data are based on vital statistics data. These, of course, are derived from information reported on death certificates. Other important research data sets such as the Fatal Analysis Reporting System of the National Highway Traffic Safety Administration also use vital statistics data. Data errors or omissions originating in the hospital can therefore affect the ultimate quality of our national data. Even more important is the fact that injury coding and classification systems use data contained in patients’ records. Illegible, ambiguous, inaccurate, contradictory, or missing information compromises our ability to develop and maintain accurate data systems. An elderly patient who succumbs to pneumonia after sustaining a hip fracture will appear as a “natural death” in vital statistics data if the initiating event, the fall, is not clearly documented in medical records and on the death certificate. Information from emergency medical providers, such as the circumstances of a car crash or the use of restraints, will be lost if not documented. Careful and thorough reporting of information available on the etiology, clinical course, and outcome of the injury is in itself a contribution to injury prevention.

Definition of the injury problem of interest is a critical and often ignored step that must precede attempts to survey, measure, investigate, or prevent injuries. An injury problem can be defined in many different ways, and it is important that all stakeholders involved in the prevention initiative understand and agree on the working definition before action is taken. Although an injury problem definition may include clinical variables, such as severity, it may be a purely social or political definition such as **injuries occurring in the uninsured**. The following section presents examples of variables used in defining injury problems.

Most commonly, injuries are reported by severity: fatal, severe, moderate, minor. Surrogates for actual injury severity (e.g., hospital admissions, emergency department visits, ambulatory care visits, length of stay) are also common in the injury literature. Trauma nurses are familiar with identifying injuries by body region (head injury, spinal cord injury, maxillofacial injury, lower extremity injury) or by the nature of injury (burns, penetrating injuries, blunt force injury, etc.). Injury can also be defined using statements of the population at risk: the pediatric population, the elderly, adolescents, pregnant women, construction workers, urban populations, rural populations, minority groups, and gender groups. The setting or circumstances in which injury occurs may also be used to define the injuries of interest. Sport and recreational injuries, injuries in school or day care, occupational injuries, injuries occurring in nursing homes, injuries occurring between intimate partners, and injuries in the home are examples of such definitions.

An important way of classifying injury is by intent: unintentional or intentional. Unintentional injury, sometimes referred to in lay terms as “accidental” injury, includes motor vehicle and other transportation injury, drowning, fire and burn injury, falls, sport and recreational injury, and other unintentional injuries, such as a needlestick injury. Intentional injuries are the result of intended actions. This does not necessarily mean that the result was intended. For example, one person may strike another intentionally without intending to kill that person. Of course, there are many...
intentional injuries for which the outcome as well as the action was intended. Intentional injuries may be inflicted on another, or they may be self-inflicted, such as completed suicide, attempted suicide, and other self-destructive behaviors, such as self-mutilation. This latter category, assaults and homicides, receives much public attention. Although this is entirely appropriate and necessary, because firearm injuries have become the leading cause of death in some groups and areas of the nation, many health care providers may be surprised to realize that in the United States firearm suicides outnumber firearm homicides (16,750 and 11,624, respectively, in 2004)\(^\text{1}\) or that, overall, intentional injuries are far less common than unintentional injuries.\(^\text{2,3}\)

For some types of injuries, intent is hard to determine. Examples are carbon monoxide poisoning, drowning, and drug intoxication. When confronted with a person who has died as a result of a drug overdose, there is a possibility that this is an unintended overdose. It could also be a suicide or even homicide, if the supplier contaminated the supplied substance intentionally. Many factors are considered when determining the manner of death (“accidental,” suicide, homicide, or undetermined). For almost all injury deaths, whether early or late, determining manner of death is the responsibility of the medical examiner or coroner. The criteria used to do this vary slightly by jurisdiction and must therefore be understood by those wishing to identify categories of deaths, especially if deaths in several jurisdictions are to be compared.

One of the problems with identifying and defining deaths by intent is that it may break out, and therefore diminish, the apparent magnitude of deaths from the same mechanism. Reporting injuries and deaths by using a matrix approach that places primary emphasis on the cause (or mechanism) of injury and only secondary emphasis on intent is a recent development in the injury field, one with great value for injury prevention policy development.\(^\text{1}\) For example, in 2004 firearms accounted for 67% of homicides and 52% of suicides but fewer than 1% of unintentional injury deaths.\(^\text{1}\) The social burden of firearms is most apparent when the primary focus is on the proportion of all injury deaths that are the result of firearm injury. In 2004, firearms accounted for 17.7% of all injury deaths, second only to motor vehicles at 27.\(^\text{1}\)

The role of alcohol is an example of a problem that is magnified as one looks beyond individual mechanisms of injury. In 2001 there were 75,766 alcohol-attributable deaths in the United States.\(^\text{25}\) Of these deaths, 40,005 (or 53\%) could be considered injury related. The relationship between alcohol consumption and motor vehicle crashes is well described in the scientific literature and kept in the public eye by the tireless efforts of the country’s most successful grassroots advocacy organization, MADD (Mothers Against Drunk Driving).\(^\text{28}\) Less well known by the public is the association between alcohol consumption and numerous other types of injury such as boating and drowning deaths, violence, domestic violence, and recreational injury.\(^\text{27,28}\) Trauma has been called a “symptom of alcoholism,”\(^\text{28}\) an opinion supported by numerous investigators.\(^\text{27,30,31}\) Alcohol intoxication on initial admission is also associated with a 2.5-fold increase in the likelihood that the patient will be readmitted for trauma in the future.\(^\text{30}\) Although alcohol involvement in trauma has decreased by approximately 25\% in the past decade, conservative estimates still implicate alcohol and illicit drugs in 19\% of the estimated 2.2 million trauma patients hospitalized each year.\(^\text{28}\) A study of seriously injured patients in a trauma center found that a high percentage of patients were at risk for a current psychoactive substance use disorder and that this group’s prevalence of current alcohol dependence was nearly three times higher than estimates for U.S. residents aged 15 to 54 years.\(^\text{31}\) Detecting and managing alcohol-related problems in trauma patients poses an enormous challenge to the trauma care system.

Defining the injury problem is a difficult step in program development, but injury prevention programs developed without adequate definition will flounder. If we pursue a medical analogy, problem definition is the beginning of the diagnostic process. A 70-year-old woman has come to the emergency department with a hip fracture after a fall. Fall-related hip fractures in elderly women are a common and well-identified injury problem. But fall-related hip fractures occur in very different circumstances. A broad definition of the problem may be useful when the total burden of fall-related hip fractures in elderly women is measured, but it is inadequate as the basis for an intervention. Yes, we wish to prevent falls in the elderly, but in relation to what?

- Group (age range, gender, community-dwelling, patients with existing disabilities such as visual impairment, frequent fallers)
- Region (the country, the state, a community, a residential facility)
- Environments (individual homes, nursing homes, recreational facilities, the street, the workplace, unfamiliar environments)
- Circumstances (ice, rain, on stairs, when getting up at night, in the shower, when taking certain medications, during dementia transitions)
- Severity (any fall, any injury, any fracture, hip fracture, traumatic brain injury)
- Consequences (injury requiring hospitalization, disabling injury, injury that requires that the person be placed in an elder care facility, falls that cause elders to restrict their activities from fear of subsequent falls)
- Other social considerations (falls in the uninsured, falls in patients of a certain health maintenance organization, falls in persons with a history of falls, falls that result in litigation)

Careful definition of the problem is the foundation for all future analyses. It may help to ask this question: “What is the specific problem I need to solve—and why?” If the answer is not clear, an intervention cannot be focused adequately. Definitions of injury problems may also evolve over time as our knowledge, awareness, and social practices change. The area of child passenger safety is one such example. At one time the problem definition for deaths and injuries to child motor vehicle occupants might have been that child passengers were
unrestrained in cars. An early study by another pioneer of the injury prevention field, Professor Susan Baker, defined a specific problem: disproportionately high injury and death rates in infant passengers. Her work laid the foundation for the development of rear-facing infant seats.32 Next came the realization that children needed special restraints, but the public’s awareness of this fact was low. Attention was given, appropriately, to building public awareness, passing child restraint laws, and making child safety seats available. As safety seat usage rates increased, so did awareness of a new problem: restraint misuse. It was not enough that people knew they should restrain the child in a safety seat, that they purchased a seat, or that they used it all the time. New problems were defined: car seat–vehicle incompatibility, high levels of incorrect use, the problem of rear-facing infant seats placed in front of an air bag. Most recently, there is growing realization that our almost exclusive attention to the youngest children (0 to 4 years of age) and our nonspecific “Buckle Up” message for older children has left the 4- to 8-year-olds inadequately protected in vehicles.33 National attention is now focused on increasing booster seat use in children in the 40- to 80-pound weight range (4- to 8-year-olds), who cannot be restrained adequately by adult seat belts.34

Evolving problem definitions require similar evolvement of injury prevention initiatives. For example, on July 1, 2002, 24 years after the first statewide child passenger safety law was passed in Tennessee, Washington State’s Antton Sken Law (HB 2675) took effect.35 This bill, signed into law during the 2000 legislative session, was the first state law in the United States to require booster seat use. By November 2006, 38 states and the District of Columbia had enacted some form of booster seat law.36 Members of first responder, trauma, and emergency medical communities played active advocacy roles to help ensure passage of the Antton Sken Law and are still, as noted by former U.S. Transportation Secretary Norman Mineta on February 14, 2006, “doing their part to address the consequences of this country’s failure to put children in booster seats.”37 There remains much work to be done to increase compliance with the laws, revise other child passenger safety laws and prevention initiatives of yesterday, and limit exemptions and close gaps to keep pace with the changing understanding of what is required to best protect this age group of children in motor vehicles. The critical lesson here is that problem definitions are not universally relevant. Time invested in this problem definition stage of the problem-solving process will reduce subsequent frustration and enhance the potential for success.

**Measuring the Injury Problem**

Once identified and defined, the injury problem should be measured. Measurement is important for several reasons, including resource procurement and allocation, intervention planning and delivery, and evaluation. The choice of measurement criteria is influenced by data availability, time, and needs. When an injury problem is presented, the nurse begins with some triage questions:

- **What is the magnitude of this injury?**
  - Incidence (the number of new cases of an injury that occur during a specified period of time in a population at risk for that injury)38
  - Prevalence (the number of affected persons with a particular injury present in the population at a specified time divided by the number of persons in the population at that time)38

- **What is the severity of the injury?**
  - High case fatality (such as firearm injuries or suicide attempts)
  - Low case fatality (such as playground injuries) in high numbers
  - High morbidity (such as traumatic brain injury, spinal cord injury, severe lower extremity injury, hip fracture in the elderly, and burn)

- **How preventable is the injury?**
  - Do we have proven interventions that can be used to prevent this injury (e.g., bicycle helmets, seat belts, product modification)?
  - Are there distinct clusters of injuries (clustering of injuries suggests that specific environmental risk factors are present)?

- **What are the costs of this injury?**
  - Direct costs such as financial costs of medical care (both acute and long term) and other nonmedical goods and services related to the injury (e.g., “costs for home modifications, vocational rehabilitation, administrative costs for health and indemnity insurance”)39
  - Indirect morbidity costs (i.e., “the value of foregone productivity due to injury-related illness and disability”) and mortality costs (i.e., “the value of foregone productivity due to death at an early age”)39
  - Additional costs such as those associated with property damage; police and fire services; legal fees related to compensation; and social costs such as pain, suffering, quality of life, lost human potential, and disrupted families39

- **Is some group disproportionately affected (e.g., young, urban African-American men; elderly women; children in custody; health care workers)?**

- **What is the public’s interest in this injury problem (e.g., will the public support stronger child passenger safety laws; are they aware that firearms are used more frequently in suicides than in homicides; do they care whether a child’s playground is safe and well maintained)?**

- **What are the consequences of not acting to prevent this problem (e.g., with a rapidly aging population, can we afford to ignore the problem of injuries in the elderly)?**

Answering these questions adequately often involves significant training and effort. A complete discussion of measurement methods is beyond the scope of this chapter. Nevertheless, much time, money, effort, and expertise is...
devoted to measuring the burden of injury, and there are many valuable data resources available to those interested in determining the magnitude of an injury problem. A list of such resources is included at the end of this chapter.

Even without extensive resources, it is possible to work through the checklist (above), as one might work through a triage situation, to guide decision making about optimal use of resources. When, for example, a high-profile injury death triggers public interest and demands that action be taken, should we respond with a prevention initiative? Is this one of many similar deaths and injuries? If so, we may use the heightened awareness to generate support for prevention initiatives. If this turns out to be a relatively rare but emerging injury problem, we would be wise to invest our resources in learning more about the injury through data collection and surveillance before we intervene. If, however, this is a truly rare event, can we justify allocating any resources to this problem at the expense of other more significant problems?

Measurement is important to determine the extent of the injury problem, but it is also critical to our ability to evaluate the effectiveness of interventions or any shifts in injury patterns that may be occurring as a result of interventions. Careful measurement of the injury problem is a wise investment.

IDENTIFYING KEY DETERMINANTS

Having identified, defined, and measured the injury problem, one must begin the diagnostic process required to determine the causal factors associated with the problem. Injuries do not occur in a vacuum. To prevent injuries or reduce their severity, one must understand the circumstances in which they happen. As with infectious and chronic diseases, the six basic questions of epidemiology apply: what is happening to whom, when, where, why, and how? These supposedly simple questions are problematic because what we see when we examine a situation is a function of where and how we look. If, for example, we are convinced that teenage drivers are fundamentally unsafe, we may assume on hearing of a single-vehicle crash in which a teenage boy died that the crash was the result of human error—another tragic example of teenage risk taking. But what if we were to visit the crash site and find that the road was narrow, winding, and lined with trees? What if we were to look at police crash records or newspaper reports and find that several other single-vehicle crashes involving drivers of different ages had occurred in this location? What if several other similar crashes had occurred, but drivers of small vehicles were the only ones to die? Most injuries occur within environments that humans have made; understanding the environment is therefore essential.

Typically, numerous factors interact to produce an injury and its outcome. In focusing prevention efforts on the most obvious factor, usually human behavior, we ignore other critical factors that may in fact be more modifiable than human behavior. The history of efforts to prevent child pedestrian injury is one such example. The road environment is complex; navigating it safely requires significant cognitive ability not present in children before age 9 years.40,41 Although this has been understood for nearly 40 years, when a 5-year-old child is killed or injured as a pedestrian, it is not uncommon to read the phrase “pedestrian error” on the police report. Even when an unsupervised child runs into a road at 10 pm, the incident is frequently called “accidental.”

Over the years, most pedestrian safety programs have focused on persuading or training children to be safer pedestrians and have shown little success. But, why should an exclusively child-focused approach work? If we pause to look beyond the victim, we will see numerous other factors that contribute to these injuries: design of the road, traffic speed, traffic density, signage, visibility, the size and design of the vehicle, driver training, driver awareness and behavior (including substance use), supervision of children, the presence of distractions (e.g., dogs, balls, other children), the child’s level of exposure to the traffic environment, the level of traffic enforcement, and the legal and social consequences of hitting a child pedestrian. Individually, each of these factors may influence the child’s risk of injury. Together, their interaction produces a set of circumstances that either supports or discourages the likelihood of pedestrian injury. Examining the presence and interactions of these factors in a systematic way is an important problem-solving step.

Factors that are important precursors of a public health problem, and therefore possible targets for prevention initiatives, may be referred to as key determinants.15 Key determinants may be numerous. It is important therefore to use an organizational framework to examine these multiple factors and their interactions in a logical manner. Usually organization of key determinants begins by grouping factors. The organizational framework used most commonly in injury problem solving is the Haddon Phase-Factor Matrix. As shown in Table 6-2, the Haddon Matrix is a $3 \times 4$ table. The four factors of the matrix are human (individual) factors, agent (and carrier) factors, physical environmental factors, and social environmental factors.42 Identifying these factors and assessing their relative importance is crucial to the development of effective prevention strategies. A second important concept is that, although the energy transfer occurs quickly, it is only one part of a dynamic process. Haddon described three phases representing stages in a time continuum that begins before the injury occurs and ends with the outcome. These phases are known as the pre-event, the event, and the postevent phase.42

The interaction of factors in the pre-event phase determines whether an event (such as a car crash) that has the potential to cause injury will occur. Factors interacting in the event phase influence whether an injury will result from this event and what the type and severity of that injury will be. Finally, the interactions in the postevent phase determine the consequences (short- and long-term outcomes) of the injury.

The Haddon Matrix can be used in several ways. Most commonly, it is used to think about the factors involved in an injury problem. Becoming familiar with the literature on the injury problem of interest, before filling out the matrix, will help identify possible risk factors that may otherwise be ignored. Not only does the Haddon Matrix help us to think out of the box (the blame the victim box), but it also helps us...
<table>
<thead>
<tr>
<th>Factors: Phases</th>
<th>Human (Individual Factors)</th>
<th>Agent and Vehicle</th>
<th>Environment-Physical</th>
<th>Environment-Social</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-event</td>
<td>Age,* gender,* visual acuity, alcohol or other substance use, fatigue, distraction, cell phone use, risk-taking behavior, driving skill and experience, reaction time, exposure (frequency of travel)</td>
<td>Vehicle design (road-holding ability, rollover risk, braking capacity) and maintenance</td>
<td>Design and maintenance of roadway, traffic density and flow, condition of road surface (wet, icy, oil slick, etc.), weather, visibility, traffic control (signals, lights, signage), animals and other obstacles in roadway</td>
<td>Speed limits, licensing laws and restrictions, impaired driving laws, motor vehicle occupant restraint laws (for all ages), regulations limiting driving hours for truck drivers, regulations limiting cell phone use, vehicle maintenance regulations, road rage.</td>
</tr>
<tr>
<td>Event</td>
<td>Restraint use, age-related health status, preexisting conditions such as osteoporosis</td>
<td>Speed, size, and crash tolerance of vehicle</td>
<td>Roadway design: median dividers, guardrails, break-away poles, roadside hazards (e.g., trees, parked vehicles)</td>
<td>Enforcement of speed limits and restraint laws</td>
</tr>
<tr>
<td>Post-event</td>
<td>Age* and preexisting comorbidities that may influence clinical course</td>
<td>Integrity of fuel system</td>
<td>Urban/rural location, distance from emergency medical services, barriers to extrication and emergency management</td>
<td>Policy/regulation mandating vehicle safety design standards</td>
</tr>
</tbody>
</table>

*Note: Age and gender are not modifiable variables and so appear in this matrix as surrogates for longer descriptive phrases such as “age-related developmental level” or to indicate the need to consider risk factors that may be associated with age or gender. Elderly drivers may have cognitive, visual, or other physical limitations; others will not. Elderly women may have osteoporosis and reduced bone density; others will not.
identify what we need to find out about the problem. For example, do we have reliable data on restraint use? Do we know how many of the children who do not wear bicycle helmets already own a helmet? The value of the Haddon Matrix is that it illustrates the multifactorial etiology of injury. A potential problem it creates, however, is that one may feel lost in a maze of causal factors. Faced with so much information, some preventionists complain that it is difficult to know what to target. To overcome this problem, it is necessary to take another step. Look at all the factors listed in the matrix and ask which of these factors is controllable? For example, we cannot change an elderly woman's age but we may be able to enhance her general health status, her muscle tone, or her balance. Next, look at the list of modifiable factors and consider which of these changes is the most likely to be accomplished. For example, which is the most likely to be accomplished: teaching 16-year-old drivers to drive safely or limiting their crash exposure through graduated licensing programs? Look at this final list to determine whether altering the variable would change the outcome significantly. For example, emergency medical services (EMS) response time is modifiable, but some injury mechanisms, such as firearm injury and drowning, result in such severe injuries that enhanced EMS alone does not have the potential to reduce the death toll significantly. This process forms the basis of causal thinking, which is critical to intervention and evaluation planning and is discussed in the next section.

**IDENTIFYING POTENTIAL INTERVENTION STRATEGIES**

Once the problem is diagnosed and the factor(s) to be targeted with intervention(s) identified (the change targets), the mechanism that will be used to achieve the desired change must be identified. The danger at this point is a "knee-jerk" response when selecting an intervention. The easiest, most obvious, most affordable, or most acceptable strategy is seldom the most effective. As is the case when treatment modalities for injured patients are selected, knowledge of the range of potential injury prevention strategies is critical when prevention options are chosen. Another legacy of Dr. William Haddon is his list of ten injury control strategies, presented in Table 6-3.

The Haddon strategies describe the countermeasures that must be put in place to prevent the occurrence of injury, reduce its severity, or achieve the best possible outcome from the injury. In essence, they describe an end we wish to achieve. The means we take to achieve that end may vary. For example, when faced with the problem of young children being poisoned when they ingest multivitamins containing iron, we may decide to implement Haddon strategy two: reduce the amount of the hazard. We eliminate strategy one: prevent creation of the hazard as an option because iron-containing vitamins exist for valid health reasons and we cannot justify not producing them. Because a major group of users of these products, pregnant and lactating women, are also likely to have children of ages at high risk for ingestions, we must accept that exposure to the hazard (iron-containing vitamins) is probable. The strongest possible (most upstream) intervention possible is therefore necessary. Strategy two is much more upstream than the now widely used strategy six: placing a barrier between the child and the hazard with childproof closures or use of safe storage such as locked cabinets. It also addresses the dose-response nature of iron-ingestion poisoning. Having selected reducing the amount of the hazard as our strategy, we must identify means to that end. An educational approach might be to educate mothers (and grandparents) of young children to buy small containers of the medication. A technologic solution might be to manufacture vitamins with lower unit doses so that a child would have to ingest greater quantities of the pills before reaching a toxic dose. A regulatory approach might be to mandate warning labels on containers or limited dose dispensing of the vitamins or to restrict their over-the-counter distribution. Often, we combine approaches for maximum effect. For example, we may limit over-the-counter availability of the vitamins, require that they be dispensed in a child-resistant container, and provide educational materials about the risk of iron-containing vitamins to those who purchase them.

In general, we aim to intervene as early in the causal chain as possible. An analogy used in the injury prevention community is finding multiple people drowning in a river. Do we focus our efforts downstream on pulling them out of the water one by one and attempting resuscitation, or do we walk upstream to find out why they are all falling (or being pushed) into the river? In the acute-care setting, the trauma nurse is the rescuer downstream. Nurses who embrace (directly or indirectly) a primary prevention role move upstream to deal with the factors that led to the trauma epidemic. Fortunately for injury prevention, some trauma professionals have found it possible to do both. Indeed, for accreditation purposes, some trauma services are required to demonstrate involvement in prevention. Comprehensive prevention requires work at all levels of the continuum. Investing all our efforts and resources downstream will never be enough to control the injury epidemic. Furthermore, if we fail to monitor activities and trends upstream, we cannot equip ourselves to deal with future consequences downstream.

Perhaps the greatest challenge to identifying effective primary prevention strategies is preoccupation with the individual: the blame the victim, train the victim paradigm. It has been said that "no mass disorder afflicting mankind was ever brought under control or eliminated by attempts at treating the individual." Injury is, indeed, a mass disorder requiring urgent preventive action. To control this problem we must move beyond talking to individuals about safety and embrace the wide range of intervention options available to us.
PART I  General Concepts in Trauma Nursing

Intervention strategies fall into four main categories—sometimes called the Four E’s:

1. Education (and behavior change)
2. Engineering (and technology)
3. Enforcement (and legislation)
4. Economic approaches (incentives and disincentives)

Each of these approaches is described below.

**Education** encompasses a wide range of strategies that range from one-on-one education to initiatives that educate society and eventually influence social norms. Health education and health promotion, although criticized by some in the past as ineffective, have much to offer the field if used strategically. We must, however, move beyond a preoccupation with reaching individuals with brochures, flyers, posters, and overcrowded informational displays. Effective prevention frequently requires modification of the nature of the hazard or of the physical or social environment, which is usually the purview of engineering or enforcement. This has led to suggestions that we should focus on engineering solutions rather than educational approaches. In reality, there is no place for either/or; we need both. Little is accomplished in our society without the commitment and involvement of groups of people. Mobilization of this valuable resource—be it parents, health care providers, legislators, law enforcement agencies, the media, product manufacturers, or funding agencies—requires the ability to influence knowledge, attitudes, beliefs, and behaviors. The behavioral sciences can also help us identify barriers to change and those factors that predispose, enable, or reinforce change, whether at the individual or national level. Trauma nurses who wish to present educational programs are encouraged to identify, and consider as a resource, professional health educators and behavioral scientists in their organizations and communities. They may also choose to review a recent textbook by Gielen et al. on behavioral approaches to injury and violence prevention.

**Engineering** involves engineering out the hazard (such as designing safer products and safer roads) or using engineering and technology to protect the person in an energy-transfer situation (helmets, restraint systems, crumple zones in cars, automatic sprinkler systems). After injury has occurred, engineering approaches include the development of technology to enhance early warning and emergency response and, of course, the technology associated with management, rehabilitation, and reintegration of the

<table>
<thead>
<tr>
<th>Haddon Strategy</th>
<th>Example Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Prevent creation of the hazard</td>
<td>Do not manufacture three-wheeled all-terrain vehicles, certain types of ammunition, and certain poisons</td>
</tr>
<tr>
<td>2 Reduce amount of the hazard</td>
<td>Ban human pyramids</td>
</tr>
<tr>
<td>3 Prevent release of the hazard</td>
<td>Limit pills per container</td>
</tr>
<tr>
<td>4 Alter release of the hazard</td>
<td>Decrease water temperature in homes</td>
</tr>
<tr>
<td>5 Separate person and hazard in time and space</td>
<td>Limit contact drills in football</td>
</tr>
<tr>
<td>6 Place barrier between the person and the hazard</td>
<td>Provide handrails for the elderly</td>
</tr>
<tr>
<td>7 Modify basic qualities of the hazard</td>
<td>Improve braking capability of vehicles</td>
</tr>
<tr>
<td>8 Strengthen resistance to the hazard</td>
<td>Reduce alcohol use by drivers</td>
</tr>
<tr>
<td>9 Begin to counter damage done</td>
<td>Blisters-package pills</td>
</tr>
<tr>
<td>10 Stabilize, repair damage, and rehabilitate</td>
<td>Use child safety seats and seat belts to control deceleration forces</td>
</tr>
</tbody>
</table>

TABLE 6-3  The Haddon Strategies Applied

injured person into society. Many of the injury hazards in today’s world are the result of products or environments that we have created with technology. It is not surprising therefore that technology is an important part of the solution. Engineering interventions to prevent injury are so pervasive in our society, however, that we may not notice them, take them for granted, and forget how relatively recent these achievements are. The fact that safety sells, so evident in current motor vehicle advertising campaigns, is a very recent development in our society and the result of years of injury prevention and consumer advocacy. Indeed, each step forward in road design, product modification, product labeling, policy and legislation, and changed social norms about injury has been hard won.

**Enforcement** is an oversimplified term for a wide-ranging area that involves the development and enforcement of law, regulation, and policy. Federal, state, and local laws and regulation have been used to advance injury prevention in numerous and varied ways.\(^\text{49}\) For example, laws and regulations have been used to establish and fund federal safety programs; create a mandate for EMS systems development; mandate hospital reporting of external cause of injury codes in 26 states; require the use of seat belts, child safety seats, booster seats, bicycle helmets, and other safety equipment; establish graduated driver’s licensing, speed limits, and traffic control regulations; regulate the manufacture and distribution of consumer products; set safety standards for schools, school buses, child care facilities, health care settings, and the workplace; control high-risk behaviors such as drunk driving; establish building codes; set standards for vehicle design and performance; and create trauma registries and other data systems. Tort law or private litigation has been used successfully to protect the public from unsafe products.\(^\text{49}\) This has been achieved in several ways, including seeking compensation for victims of negligence and deterring, through liability, negligent practices by companies.\(^\text{46,51}\)

Despite numerous successes, gaps in some existing laws compromise both coverage and effectiveness.\(^\text{49}\) Additionally, the effect of any law, regulation, or policy is closely linked to its enforcement. Challenges to enforcement are not limited to inadequate law enforcement resources. Those responsible for enforcing a law or policy must believe in the law, their ability to enforce it, and the utility of that enforcement. Building support for enforcement may be as important as creating public support for the law, if it is to be implemented. Many injury prevention laws encounter powerful opponents and are challenged or overturned. Achieving passage of and defending injury prevention legislation usually requires compelling data and extensive and prolonged advocacy efforts. In 1981, Lawrence Berger suggested that six conditions be met when the implementation of injury legislation is contemplated. These are that one “be thoroughly convinced that the bill addresses a strikingly important issue. One should have evidence that the bill’s action can be effective; support from judges and police officers that the law can be enforced expeditiously; economic estimates that excessive costs will not be involved; legal counsel confirming the constitutionality and compatibility of the proposed law with existing legislation and ordinances; and broad-based support from constituents.”\(^\text{50,52}\) Clearly, writing, passing, and implementing injury prevention laws is not the sole responsibility of lawyers, legislators, and the law enforcement community.\(^\text{53}\) Elizabeth McLoughlin, a tireless injury prevention activist, has documented many of the lessons learned in California’s prolonged efforts to achieve legislation requiring the use of helmets by motorcyclists.\(^\text{54}\) One valuable advocacy lesson, which she continues to develop and apply in other areas of injury prevention, is the power of using “the authentic voice of survivors and family members who have been affected” in support of legislation.\(^\text{54,55}\) Because of their expertise and personal experience of caring for trauma victims, trauma nurses can make valuable contributions when they join efforts to develop and advocate the passage and implementation of injury prevention laws.

**Economic incentives**—or, in many cases, disincentives—are used to persuade people or organizations to adopt safe practices or behaviors. Examples include fines for traffic offenses, increased insurance premiums, withholding of federal funds, and financial penalties imposed by courts on the manufacturers of unsafe products. Positive incentives include lowered insurance premiums for safe drivers or those buying safer vehicles and incentives to corporations that provide safe working environments.

To be effective, interventions must target the risk factors. The relationship between the chosen intervention and the risk factor we hope to change must be stated explicitly. For example, if an identified risk factor for adolescent bicycle crash–related head injury in your community is that teens do not own helmets, helmet distribution would be a logical intervention choice. Helmet distribution would not be a logical choice if the identified risk factor is teenagers’ refusal to wear helmets, even if they have them.

The Haddon Matrix (described previously) can be used in a second way to assist in the identification of possible interventions. This is accomplished by thinking about what interventions might be used to address risk factors present in different cells of the matrix. Pre-event phase interventions attempt to reduce the number of events with the potential to cause injury: prevent car and bike crashes, falls, house fires, ingestion of poisons, assaults, and so on. Examples of such interventions would be graduated licensing programs for teenage drivers, limiting the number of hours driven without rest by truck drivers, enforcing speed limits, legislation that penalizes people caught driving while intoxicated, putting traffic-calming measures in place in areas with many pedestrians, mandating use of safety harnesses for construction workers, enforcing building standards in nursing homes, and closing beaches when there are strong currents. Event phase interventions attempt to reduce the number and severity of injuries that occur in these events. Examples include seat belts and air bags, enhanced vehicle crashworthiness, bicycle helmets and handlebar design, bulletproof vests for police officers, smoke detectors and automatic sprinkler systems, controlling access to lethal weapons, prevention of osteoporosis,
and physical conditioning of athletes. Postevent phase interventions attempt to prevent complications and optimize outcome. Those most familiar to the trauma nurse include emergency medical management, medical care, and rehabilitation. Others include improving the integrity of vehicle gas tanks to reduce the chances of postcrash fires, early detection and notification of injury, preventing entrapment, improving health insurance status and social support structures (to optimize rehabilitation), and job retraining.

Injury prevention also uses active and passive strategies. An active strategy is one that requires a person to act each time he or she, or the person he or she hopes to protect, is to be protected. A passive strategy will afford protection without action on the part of the person to be protected. All intervention strategies lie on a continuum from entirely active to entirely passive. Seat belts, for example, are not entirely active. They require that a person fasten the seat belt each time he or she gets into the vehicle but, once fastened, the belt will protect the person for the duration of the trip. Figure 6-1 illustrates the relationship between the type of strategy and the likelihood of prevention effectiveness.

An inverse relationship is observed: prevention effectiveness increases as the need for action decreases. For this reason, whenever possible, injury prevention specialists will try to implement an intervention that is passive. In most cases, achieving passive strategies—such as modification of an unsafe product or environment—requires that some infrastructure be established. This infrastructure might be public support for a law or policy, designated funds for road improvement, legal or financial penalties for the manufacture of products that lead to injury, or an energetic advocacy effort.

Trauma nurses who feel uncomfortable with the idea of engineering or law and policy approaches may find it helpful to realize that they can contribute to these efforts in other ways. Increasingly, injury prevention efforts include comprehensive or multicomponent approaches and interdisciplinary collaborations. The spectrum of prevention (Table 6-4) is a tool that has been used to encourage comprehensive programs that move beyond a purely educational approach. The six levels of the spectrum represent areas in which prevention initiatives can be implemented. The critical concept, however, is that the levels are synergistic; prevention effectiveness may be enhanced by creating strong linkages between the components. Level 3, educating providers, is of particular relevance to trauma nurses. Cohen and Swift emphasize that “providers have influence within their fields of expertise and opportunities to transmit information, skills and motivation to clients, and colleagues. It is essential, therefore, that they receive education to improve their own understanding of prevention.” They go on to comment that certain professionals (such as trauma nurses) “can be highly effective advocates for policy changes related to their job experience.” When used with the Haddon Matrix, the spectrum can suggest systematic approaches to an injury problem.

Possible intervention strategies can be identified in many ways. The injury prevention literature is a rich source of information. Several injury prevention texts devote chapters to different types of approaches. The excellent website of the Injury Control Resource Information Network at the University of Pittsburgh (www.injurycontrol.com/icrin), which can be searched by topic area, provides extensive links to other sites. Through it, the trauma nurse can access the Center for Injury Prevention and Control of the Centers for Disease Control and Prevention (CDC), CDC-funded injury control research centers, federal agencies, and a wealth of injury prevention resources. A valuable source of information on best practices for child and adolescent injury prevention can be accessed on the website of the Harborview Injury Prevention and Research Center (http://depts.washington.edu/hiprc/practices/index.html). Readers are encouraged to browse the websites listed in Box 6-1 for further information about injury and injury prevention.

The range of possible interventions and access to information about them expand constantly. The main challenge to identifying intervention options is not a lack of information; it is failure to consider this information-gathering step an important part of the problem-solving process.

![Figure 6-1](https://example.com/image.png)

**Figure 6-1**  The relationship between the amount of action required and the likelihood that protection will result. (Modified from Baker SP: Childhood injuries: the community approach to prevention, J Public Health Policy 2:235-246, 1981.)
TABLE 6-4 The Spectrum of Prevention

<table>
<thead>
<tr>
<th>Influencing Policy and Legislation</th>
<th>Developing strategies to change laws and policies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Changing Organizational Practices</td>
<td>Adopting regulations and shaping norms</td>
</tr>
<tr>
<td>Fostering Coalitions and Networks</td>
<td>Convening groups and individuals for greater impact</td>
</tr>
<tr>
<td>Educating Providers</td>
<td>Informing providers who influence others</td>
</tr>
<tr>
<td>Promoting Community Education</td>
<td>Reaching groups with information and resources</td>
</tr>
<tr>
<td>Strengthening Individual Knowledge and Skills</td>
<td>Enhancing individual capacity</td>
</tr>
</tbody>
</table>


SELECTING A STRATEGY TO IMPLEMENT

At first, the range of potential strategies may be intimidating. Recognizing the importance of technologic or regulatory strategies may cause a nurse comfortable with one-on-one patient encounters to feel inadequate. Even injury prevention specialists feel at times that the obstacles to achieving such interventions are insurmountable, causing some to retreat to easier, more familiar, or more immediate interventions. The Revised Intervention Decision Matrix62 is a simple tool designed to identify intervention options and choose among them (Table 6-5). It can also identify long-term goals and intervention options that support each other.

Eight elements of the Intervention Decision Matrix are used as decision criteria for selecting an intervention:

- **Effectiveness**
- **Feasibility**
- **Cost feasibility**
- **Sustainability**
- **Political will**
- **Social will**
- **Potential for unintended risks**
- **Potential for unintended benefits**

**Effectiveness** refers to the likelihood that the intervention will do what it is intended to do. Specifically, will the intervention reduce the number and/or severity of injuries? As discussed previously, a passive injury prevention strategy is more likely to be effective than an active strategy.

**Feasibility** refers to the likelihood that an intervention will happen. Is it technically possible, practical, achievable, and viable? Are safer products and technical solutions possible and available? Do they work? This is not a recommendation to choose low-risk and easily achieved interventions, for these are seldom effective. Rather, it cautions the enthusiastic preventionist to avoid trying to change the essentially unchangeable, such as the road-crossing abilities of 4-year-old pedestrians.

Some of our most effective interventions have taken numerous years to achieve. Through the efforts of others, what was not feasible 10 years ago is feasible today.

**Cost feasibility** refers to the affordability of an intervention. At a time of limited resources, cost considerations are an important factor in intervention selection. The danger is that cost becomes the only consideration, to the detriment of effectiveness. Selecting an intervention with low effectiveness because it is the least expensive alternative squanders all resources. No matter how “affordable” an intervention appears to be, if it yields very low injury prevention returns, the cost per protected person will be enormous.

**Sustainability** refers to the potential for continued effect. It can be thought of in two ways:

1. Will the effect persist after the intervention is completed? For example, will driving in excess of the speed limit return to pre-enforcement levels when the police leave the site?
2. Will the intervention become institutionalized? For example, will it become the social norm that people wear seat belts? Will a community assume responsibility for the maintenance of a newly renovated playground?

**Political will** can also be viewed in two ways:

1. Is the intervention ethical? Is it equitable? Does it violate human rights? Is it unreasonably intrusive? These, of course, are critical issues that must be weighed carefully when any intervention is considered.
2. What is the prevailing political mood about this intervention? For example, it is often easier to pass legislation that requires protection of children than that protecting adults. Many areas of injury control are impeded by the fact that the political process creates barriers to interventions that compelling scientific evidence and, in many cases, public opinion support. An intervention that has low political acceptability faces a major obstacle and alerts us to the need for awareness building. But, and this is important to remember, political obstacles of this type are not insurmountable.

**Social will** is the key to building constituent support and challenging political barriers. Low social will indicates the need to generate support for the initiative. This may be achieved in various ways but requires that the factors contributing to the low social will be assessed. People may be unaware of the problem, unconcerned about it, resistant to change, afraid of the cost or inconvenience of interventions, or too busy to care. Each reason requires a different remedial approach. The key issue is that with time social will, and ultimately political will, may be changed. If, however, low social will is a barrier to prevention, understanding and addressing the causes of this should be a priority. Attempting to implement interventions in settings where social will is low is like swimming against the current. Coalitions and informal networks that bring together diverse sectors of the community may help build social support for prevention initiatives.33 As often-quoted social anthropologist Dr. Margaret Mead once
BOX 6-1 Sources of Injury and Injury-Prevention Information

The following resources are included so that readers can find additional information about injury and injury prevention. This list is by no means exhaustive. Many of these resources have good search engines and extensive links to other sites.

General
Agency for Healthcare Research and Quality: www.ahrq.gov
American Association for the Surgery of Trauma: www.aast.org
American Public Health Association Injury Control and Emergency Health Services Section: www.icehs.org
American Society of Safety Engineers: www.asse.org
Association for the Advancement of Automotive Medicine: www.carcrash.org
Association of American Medical Colleges: www.aamc.org
Core Competencies for Injury and Violence Prevention: www.injuryed.org (developed by the SAVIR-STIPDA Joint Committee on Infrastructure Development: http://www.injuryed.org/docs/Core%20Competencies.doc)
Department of Veterans’ Affairs: www.va.gov
National Training Initiative for Injury and Violence Prevention: http://www.injuryed.org/
North Carolina Institute for Public Health: http://www.sph.unc.edu/nciph/
The Prevention Institute: www.preventioninstitute.org
State and Territorial Injury Prevention Directors: http://www.stipda.org/
The Trauma Foundation at San Francisco General Hospital: www.traumaf.org

Data Sources
These sites link to numerous other data sites.
Administration for Children and Families, federal and state reporting systems: http://www.acf.hhs.gov/programs/ch/systems/index.htm
Bureau of Justice Statistics: http://www.ojp.usdoj.gov/bjs/
Bureau of Transportation Statistics: www.bts.gov
Census Bureau database and extracts: www.census.gov
Fedworld: www.fedworld.gov
Injury Control Resource Information Network: www.injurycontrol.com/icrin/
Injury Databases and Published Statistics: www.injurycontrol.com/icrin/stats.htm
National Center for Health Statistics: http://www.cdc.gov/nchs/
National Center for Injury Prevention and Control, scientific data and injury statistics (WISQARS™): www.cdc.gov/ncipc/osp/data.htm
National Data Archive on Child Abuse and Neglect: www.ndacan.cornell.edu

Children
ABC’s of Raising Healthy Kids: Steps to Staying Safe and Healthy: http://www.cdc.gov/women/owh/kids/abc.htm
American Academy of Pediatrics: www.aap.org
Archives of Pediatrics and Adolescent Medicine: http://archpedi.ama-assn.org/
Bicycle Helmet Safety Institute: www.bhsi.org
Bicycle Related Injury: www.cdc.gov/ncipc/bike/
Booster Seat Coalition (Washington state): http://depts.washington.edu/booster
Children’s Hospital of Philadelphia Trauma Link: http://www.chop.edu/consumer/jsp/division-generic.jsp?id=71016
Children's Safety Network: http://www.childrenssafetynetwork.org/
Injury Free Coalition for Kids: www.injuryfree.org
International Society for Child and Adolescent Injury Prevention: http://www.iscaip.net/
The Journal of Injury Prevention: http://ip.bmj.com/
Juvenile Products Manufacturers’ Association: www.jpma.org
KidsandCars.org: http://www.kidsandcars.org/
National Coalition for School Bus Safety: www.ncsbs.org
National Network for Child Care: http://www.nncc.org/
National Safe Kids Campaign: www.safekids.org
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BOX 6-1  Sources of Injury and Injury-Prevention Information—cont’d

National Transportation Safety Board’s Child Passenger Safety: www.ntsb.gov/Surface/Highway/childseat.htm
National Trauma Data Bank: http://www.facs.org/trauma/ntdb.html
Prevent Child Abuse America: http://www.preventchildabuse.org/index.shtml
Safety Belt Safe USA: www.carseat.org

Domestic Violence/Family Violence/Relationship Violence
Center for the Study and Prevention of Violence: www.colorado.edu/cspv/index.html
Center for Violence Prevention and Control, University of Minnesota: http://www1.umn.edu/cvpc/
Family Violence Prevention Fund: http://endabuse.org/
National Domestic Violence Hotline: www.ndvh.org
Relationship Violence Warning Signs and Resources: http://ub-counseling.buffalo.edu/warnings

Elderly
The American Association for Retired Persons: www.aarp.org
Fall Prevention Center of Excellence: http://www.stopfalls.org/index.shtml
  http://www.cpsc.gov/cpscpub/pubs/701.html

Firearms
Johns Hopkins Center for Gun Policy and Research: http://www.jhsph.edu/gunpolicy/
The Million Mom March Foundation: www.millionmommarch.com

Fires
US Fire Administration: http://www.usfa.dhs.gov/

Government Agencies
CDC Injury Topics and Fact Sheets: www.cdc.gov/ncipc/cmprfact.htm
CDC National Center for Injury Prevention and Control: www.cdc.gov/ncipc/ncipchm.htm
CDC WISQARS™: http://www.cdc.gov/ncipc/wisqars/default.htm
CDC Wonder Compressed Mortality: http://wonder.cdc.gov/mortSql.html
Department of Justice, Office of Justice Programs: www.ojp.usdoj.gov
Department of Veterans’ Affairs: www.va.gov/
Food and Drug Administration: www.fda.gov
Indian Health Services: http://www.ihs.gov/
Insurance Institute for Highway Safety: www.ihs.org
National Center for Injury Prevention and Control: www.cdc.gov/ncipc
National Institutes of Health: www.nih.gov
National Institute on Alcohol Abuse and Alcoholism: www.niaaa.nih.gov
National Institute on Drug Abuse: www.nida.nih.gov
National Institute of Mental Health: www.nimh.nih.gov
National Institute for Occupational Safety and Health: http://www.cdc.gov/niosh/homepage.html
Occupational Safety and Health Administration: www.osha.gov

Injury Centers (Selected)
Alberta Centre for Injury Control and Research: http://www.acicr.ualberta.ca/
California Department of Health Services, Epidemiology and Prevention for Injury Control Branch: http://www.dhs.ca.gov/epic/
The Center for Injury Research and Prevention: http://stokes.chop.edu/programs/injury/
Center for Rural Emergency Medicine at West Virginia University: http://www.hsc.wvu.edu/crem/
Emory Center for Injury Control: http://www.sph.emory.edu/center_cic.php
Harborview Injury Prevention and Research Center: http://depts.washington.edu/hiprc/

Continued
said, “Never doubt that a small group of thoughtful, committed citizens can change the world. Indeed, it is the only thing that ever has.”

Potential for unintended risks must be considered because an important principle in injury control is—as in medicine—first, do no harm. Some interventions with the potential to protect may also have the potential to cause harm. One well-publicized example was the airbag-related deaths of approximately 70 children that led, in part, to the development of second-generation or “smart” airbags. 63

High school driver education courses that increased the driving exposure of 16-year-olds led to increases in motor vehicle crash involvement and death rates in this group. When courses were discontinued 64 or driving curfews imposed, 65,66 crashes were reduced substantially. In April 2000, the American Academy of Pediatrics issued a policy statement (RE9940) discouraging swimming programs for children under the age of 4 years. Many potentially harmful
unintended consequences of early training were noted in the discussion, such as the fact that early lessons did not translate into higher levels of swimming proficiency, removal of a child's fear of water may inadvertently encourage an unsupervised child to enter the water, parents of trained children may develop a false sense of confidence in their child's ability, the lack of an established relationship between safety training and observed safety skills, and the potentially tragic consequences of even a brief lapse in supervision.67

PLANNING THE IMPLEMENTATION

A familiar saying, *those who fail to plan, plan to fail*, is wise counsel to anyone implementing injury prevention programs. Time invested in implementation planning will save time, resources, and frustration. Ideally, implementation and evaluation (discussed below) should be planned together. A prudent first step is to review factors that are key to successful implementation of education, engineering, and enforcement strategies. These factors are summarized in Table 6-6, compiled from a comprehensive discussion of injury prevention by Sleet and Gielen.68

Next it is time to plan the implementation. Before taking any intervention actions, one should consider and document the following:

1. The project goal
2. Project objectives
3. Action steps (sometimes called process objectives)
4. The intended audience for each step
5. The methods/strategies to be used for each step
6. The indicators of success for each step
7. Evaluation methods for each step (discussed below)
8. A project time line
9. A person (or group) responsible for each action step
10. The resources (financial or other) necessary to achieve the objectives

The *project goal* is a statement of your project’s destination. Ideally, it should be specific and measurable within a reasonable time frame. It is not always practical to define outcomes as reductions in deaths and injuries. Although reducing the burden of injury is our ultimate goal, it may be wiser to define a more attainable goal such as “to reduce within the next 12 months the number of vehicles that run red lights in Hazard City by 25%.”

Project objectives are the map to your destination. They provide a set of outcomes that will need to be reached if the project goal is to be achieved. Remember two words—DOTS and SMART—as you write objectives. The DOTS criteria (Discreet, Outcome-focused, Time-framed, and Specific) are described below:

- “Discreet” means that each desired outcome should have its own objective. Writing “increase overtime funding and levels of enforcement at high-risk intersections” combines two objectives. This is a problem because the two desired outcomes pose different intervention challenges.
- “Outcome-focused” implies that something will change and that the change will be measurable. For example, “funds will be obtained to cover the cost of 100 hours of overtime enforcement activity.”
- “Time-framed” means that the stated objective should include a date by which the outcome will be achieved. By October 1, 2008, funds will be obtained to cover the cost of 100 hours of overtime enforcement activity. Typically, program objectives are short-term objectives (see below).
The SMART criteria (Short-term, Measurable, Achievable, Relevant/realistic, and Time-framed) are described below:

- “Specific” refers to how, and to what extent, the outcome will be achieved. By October 1, 2008, X dollars will be obtained through a grant from the Magnanimous Foundation to cover the cost of 100 hours of overtime enforcement activity.

The SMART criteria are the key to selecting effective evaluation methods/strategies to be used for each step.

**TABLE 6-6 Key Factors for Successful Implementation of Injury Prevention Strategies**

<table>
<thead>
<tr>
<th>For successful implementation of education and behavior strategies, the target group must:</th>
<th>Be exposed to the appropriate information</th>
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<tbody>
<tr>
<td>For successful implementation of engineering and technology solutions, the technology must:</td>
<td>Have the resources and skills to make the proposed change(s)</td>
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<tr>
<td>For successful implementation of legislation and law enforcement strategies:</td>
<td>Derive benefit (or perceive a benefit) from the change</td>
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<td></td>
<td>Be reinforced to maintain the change over time</td>
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<td></td>
<td>Be effective and reliable</td>
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<td></td>
<td>Be acceptable to the public and compatible with the environment</td>
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<tr>
<td></td>
<td>Result in products that dominate in the marketplace</td>
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<td></td>
<td>Be easily understood and properly used by the public</td>
</tr>
<tr>
<td></td>
<td>The legislation must be widely known and understood</td>
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<tr>
<td></td>
<td>The public must accept the legislation and its enforcement provisions</td>
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<td></td>
<td>The probability, or perceived probability, of being caught if one breaks the law must be high</td>
</tr>
<tr>
<td></td>
<td>The punishment must be perceived to be swift and severe</td>
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</table>


- “Specific” refers to how, and to what extent, the outcome will be achieved. By October 1, 2008, X dollars will be obtained through a grant from the Magnanimous Foundation to cover the cost of 100 hours of overtime enforcement activity.

The SMART criteria (Short-term, Measurable, Achievable, Relevant/realistic, and Time-framed) are described below:

- “Short-term”: ideally, objectives should be able to be accomplished in weeks rather than months or years. Many planners prefer to split large long-term objectives into several smaller and shorter-term objectives.
- “Measurable”: specific enough that a change can be measured.
- “Achievable”: select objectives that can be accomplished. Large, overly ambitious objectives increase the likelihood of program failure.
- “Relevant/realistic”: to the program’s goal. If one hopes to encourage an adolescent to adopt a lasting behavior change, a simple public service announcement is not a relevant or realistic intervention choice.
- “Time-framed”: described above.

**Action steps** (sometimes called process objectives) are the actions one takes to achieve the program objectives. These may include securing letters of support for a grant application, ordering incentive items, convening an advisory group that includes members of partner agencies, developing educational materials, organizing media events, gathering data to identify hazardous intersections, and conducting training of field workers.

The intended audience for individual action steps (sometimes called the target group) is not necessarily the same as that stated in the program goals and objectives. Organizing a media event will involve one group of people, planning enforcement schedules another, targeting repeat offenders yet another. Being specific about the group involved in each step conserves resources and helps identify the partners you will need to involve in program implementation.

The methods/strategies to be used for each step represent the bottom line: how will this happen? Writing down each step may seem unnecessary but it protects from errors of omission. Additionally, it provides the basis for a realistic estimate of time and resources needed to complete the project.

The indicators of success for each step determine how you will know the program objective (action step) has been achieved. This is what you hope to find when you evaluate this part of the process. For example, what will indicate to you that the activity has increased law enforcement’s willingness to do enforcement?

Evaluation methods identified for each step are the key to good program management and evaluation throughout the life of the program. Evaluation methods are used to determine/measure to what extent an indicator has been achieved. For example, if our desired indicator is that we will increase bicycle helmet use rates by 25%, our evaluation methods could include observational surveys or self-report. The choice of evaluation method influences the strength of evidence produced, but many methods are quick and affordable. The benefits of evaluation are discussed later.

A project time line is most useful if it is written down using real dates instead of week markers, such as Weeks 12 to 16. This alerts project staff to potential conflicts, such as meetings scheduled for public holidays, a training session planned for the week of Thanksgiving, and so on.

A lead person (or group) should be designated as responsible for each step. This enhances resource management, project monitoring, and staff accountability.

The resources (financial or other) necessary to achieve the objectives. It is important to consider the resources required to implement a program. Money is a valuable resource but fortunately, given that injury prevention is a significantly underfunded area, not the only important resource. Strategic partnerships for prevention can prove significant.
important resource mobilizers, both in terms of financial resources and nonfinancial resources, such as time, space, in-kind contributions, volunteer expertise, and so forth. Partnerships, however, require investment of resources (notably time and leadership) to be productive. In summary, implementation planning will help to do the following:

1. Eliminate planning gaps
2. Keep you focused and on track
3. Manage resources wisely
4. Make objectives attainable

**Program Evaluation**

Evaluation is a valuable part of any injury prevention program. Contrary to popular opinion, evaluation is not a personal judgment of the program staff, nor is it used to trick unsuspecting programs into revealing their flaws, nor is it to be undertaken only if funding absolutely depends on it. Evaluation is a tool that, if used well, can build better programs. Evaluations may be simple or complex depending on one's needs, resources, training, and professional perspective. Real-world program evaluations need not be exhaustive or complex to provide valuable information about the program and should be considered prevention partners rather than adversaries. There are only four categories of information that evaluation can reveal about the program: good things that you have already identified, good things that you had not identified (a bonus), bad things that you have identified, and bad things that you had not yet identified. Fear of discovery in this latter category deters many from doing evaluation, yet most of us would like to know as early as possible if we had a malignant tumor. In the same way that early detection and management of a malignancy may enhance the chances for a good outcome, early detection and management of program problems enhances the chance of a good outcome. Evaluation is therefore an excellent management tool if it is integrated into the program from the very beginning.

There are many practical reasons to do evaluation, and to do it throughout the life of the program:

1. **To determine whether the planned program objectives are adequately defined and measurable**

   When planning an evaluation, it is essential to clearly define the program goals and objectives to be measured (discussed later). Early evaluation planning will identify overly broad or vague intervention objectives that put programs at risk of failure.

2. **To identify the program preferences of your intended audience and program partners**

   Once the desired intervention has been identified (e.g., building community support to modify an unsafe playground near the hospital), evaluation can help you determine which approaches are most likely to be acceptable and productive.

3. **To ensure that program materials and program messengers are suitable for and acceptable to the recipients**

   This is one of the most important reasons to evaluate programs. So many programs produce materials that are entirely unsuitable for the people who will receive them. Common problems include a reading level that is too high; too much information; vague information (e.g., all children should buckle up); culturally inappropriate language, pictures, or messages; cluttered or overcrowded materials; and incorrect idiom for the age group. This extends beyond written materials. For example, program presenters must have credibility with the target audience, and a program venue in a community where few people own cars must be easily accessible by public transportation during the hours the program will be offered.

4. **To determine whether what you plan to do is feasible**

   Many programs flounder because they are too ambitious. Others fail because planning occurred in a vacuum. Many factors can affect your ability to deliver the program. Potential barriers to implementation should be assessed carefully and the program plans modified accordingly. Successful programs tend to be focused and well defined. Start with small, achievable programs and build your experience, credibility, and support base.

5. **To monitor whether program activities are happening as planned**

   No matter how well conceived a program is, it cannot be effective if it does not happen. For example, are the activities happening, are people attending events, are coalition members delivering the information necessary for drafting the proposed legislation? These important questions must be answered: Is it happening? If not, why? How can it be improved? Did that work?

6. **To have an early warning system for unintended consequences of your intervention**

   As discussed previously, interventions to prevent injuries may have side effects. These unintended consequences may be positive or negative. It is important to identify both. Negative consequences are critical because they may increase risk of injury to certain members of the population or create a new risk entirely. Positive effects may help support the current intervention or similar initiatives in the future.

7. **To determine whether program objectives are being met and you are progressing toward the stated goal**

   If, for example, your program objective is to achieve passage of legislation, there are several interim objectives that will need to be accomplished during the process. Each should be considered an outcome to be measured. In your journey toward legislation, these outcomes are the mileposts that will let you know whether you are moving in the right
direction and whether you are covering enough miles each day to get to your destination on time. For example, did the bill get to the house committee on time? Missed preliminary deadlines may mean a year’s delay, lost social support momentum, or an end to funding.

8. To provide baseline data for future projects

Injury prevention gains are often achieved incrementally; seat belt or bicycle helmet use rates that were successes 5 years ago are only starting points for new initiatives. Information we gather about our target community for a current project may help identify future priorities or approaches. If planned and conducted carefully, evaluation and needs assessment form part of the same information cycle, thus conserving valuable resources.

9. To determine whether the intervention is effective

This is the most well known reason to do evaluation, and one frequently tied to program funding. Did the program work? Did it make a difference? Can we demonstrate an association between our program and the observed changes?

10. To identify factors that may limit the effectiveness of such interventions

Many factors may limit the effectiveness of apparently successful interventions. Failure to sustain the intervention effect is an important factor. Programs that demonstrate short-term successes such as increased bicycle helmet use or the presence of a working smoke detector may find that, over time, these gains are lost. Educational and enforcement campaigns that are intensive but of short duration should, if at all possible, include a long-term evaluation component. Other factors that may limit effectiveness may include decreased funding for overtime needed to enforce a law, the emergence of cheaper and unsafe alternatives to safe products, or challenges to policy and law.

11. To justify resource allocation and qualify for funding in the future

Increasingly, prevention programs are required to demonstrate the benefits that result from investment of resources. Assessments of the cost-effectiveness and cost-benefit of programs may be used to determine whether a program is fiscally responsible and whether it should be funded or continued. It can also be used to determine, in times of multiple priorities and resource limitation, where and how prevention dollars should be invested. Cost-effectiveness analysis examines the relationship between program costs and program outcomes when those outcomes (e.g., lives saved) are not measured in dollars. Cost-benefit analysis expresses the relationship between program costs and program benefits in dollars (e.g., X dollars invested in prevention results in Y dollars saved). Although the nurse may never be asked to conduct such an analysis, one practical step toward such an evaluation should always be taken. This is the monitoring and documentation of resources obtained and expended during the program. Monitoring the budget is only part of this task. As mentioned previously, resources invested may be more than money: volunteer time, in-kind services, discounted prices on safety equipment, use of personal vehicles, and so forth. All should be considered when program cost is calculated.

12. To develop your own experience and self-efficacy in conducting evaluations

When asked why they do evaluations, many people answer “because we must to get funded.” This illustrates the lack of confidence people have in their ability to conduct evaluations and, more important, their failure to realize what evaluation can do for them. Even a simple evaluation can provide valuable information about the program. The hardest evaluation is the first.

13. To promote the viability and commitment of your program team

At some time, every trauma nurse will experience the frustration that results when, having invested considerable time and energy in an activity, she or he receives no feedback about the outcome. Unlike the immediate reward that may be apparent when a trauma nurse helps save a life in the clinical setting, it has been said that the rewards for prevention are more “ethereal.” Stephen Teret, a prominent injury preventionist, notes that “if the preventionist is highly successful, the individual who was spared injury…may never even know that he or she was at risk.” Given the absence of immediate feedback, evaluation can help prevent burnout by demonstrating to those involved in the project the early, tangible outcomes that result from their actions. In its role as a management tool, evaluation also enhances the likelihood that a program will be focused, well organized, and implemented. This in itself promotes the viability of the team.

14. To prevent—through dissemination of negative findings—replication of ineffective programs

The worst program outcome is not a program that fails but a program that fails in silence. News of successful interventions are published and reported in many ways; not so negative findings. If an intervention fails, the program team should have access to enough information from the evaluation to determine, at least in part, why. This information can help the team—and others considering implementation of similar programs—to overcome these problems in the future.

15. To contribute to the body of knowledge about the effectiveness of interventions to prevent injury

Trauma nurses will be familiar with the term evidence-based medicine. Although growing, the body of knowledge about the effectiveness of interventions to prevent injury is limited. Evaluations of intervention effectiveness therefore enhance our ability to practice evidence-based prevention.
16. To increase community support

This may seem to be a peripheral reason to evaluate, but it has several program benefits. Evidence of early program successes may decrease resistance to the initiative; releasing information to stakeholders may increase their awareness of, support of, and trust in the project; and coalitions that are kept involved and informed are more likely to function effectively. A well-integrated program evaluation can enhance the overall health of the program.

Evaluation can be divided into four distinct stages:

1. Formative
2. Process
3. Impact (short-term outcomes)
4. Outcome (longer-term outcomes)

Formative evaluation is pilot testing (of intervention components) or troubleshooting (when something changes or goes wrong). It is done for quality assurance and to ensure that program materials are suitable for the target audience. Examples of formative evaluation questions might include the following:

- When is the best time to offer training sessions?
- Do teenage mothers understand the educational materials that are available for new mothers?
- How is our community different from community X?
- Do kids prefer yellow or green helmets?
- Is this instructor suitable for this audience?
- How difficult is it to install a rear-facing infant seat correctly?

Formative evaluation is very affordable and should be done during program planning and when any situation (e.g., the trainer) changes.

Process evaluation is used to determine whether the intervention activities are happening as planned. Ideally, it should be done throughout the life of the program. Examples of process evaluation questions include the following:

- How many people attended the health fair?
- What percentage of coalition members attend all meetings?
- How many bicycle helmets were distributed?
- Have we identified a sponsor for the proposed legislation?

Process evaluation is an early warning system for things that may go wrong. Use the information to enhance the implementation.

Impact (or short-term outcomes) evaluation measures the short-term impact the program has on the participants. It is determining whether the intervention had any effect on the audience. Where possible, it should be done after each encounter with the target group. Examples of short-term outcomes evaluation questions are listed below:

- How many people left the car seat check with correctly installed seats for each child?

Outcome evaluation or longer-term outcomes evaluation assesses whether the program made a measurable difference: did it work? Examples of outcome evaluation questions include those listed below:

- [After the presentation] did parents’ awareness of their child’s need to ride in a booster seat increase?
- Did the audience’s knowledge of risk factors for falls increase?
- Did vehicle speed decrease during the enforcement period?

Outcome evaluation or longer-term outcomes evaluation assesses whether the program made a measurable difference: did it work? Examples of outcome evaluation questions include those listed below:

- To what extent have injuries to 4- to 8-year-old motor vehicle occupants decreased?
- By what percentage have bicycle helmet use rates increased?
- Have resources for youth programs increased as a result of this advocacy effort?
- Have we reduced the number of crashes associated with running red lights?

Repeat evaluations may be necessary to demonstrate that the intervention effect is real, sustained, and generalizable. Unfortunately, because of the cost involved, few interventions are evaluated this rigorously.

The choice of evaluation design will influence the strength of the conclusions and the value of information available to the program team and others. Poor quality data, the wrong data, or the wrong conclusions will undermine the evaluation. Pick the strongest design you can afford and, when in doubt, discuss your plans with an expert. Ideally, the program should be evaluated by an outside investigator, but few projects have funds available to hire an evaluation consultant for more than a few hours. These suggestions are offered to make evaluation more affordable:

- If you are able to contract an evaluation expert, do so during the design phase of the intervention. No matter how skilled a statistician the evaluator is, she or he will be unable to produce good answers from bad data.
- Try to establish relationships with local universities, colleges, or research organizations. These may provide lower-cost or in-kind technical assistance.
- Decide what your evaluation objectives are. What do you need to know and why? The evaluation should meet the needs of your project.
- Establish a database for formative and process evaluation data at the beginning of the project. In this way, resources are conserved as program management and evaluation activities merge.
- Never underestimate the power of information. Look at the data regularly. They are collected to inform and improve program implementation. Discuss any concerns with someone you trust who is experienced in your area.
- Recognize that needs assessment and evaluation form part of the same cycle. Time invested in careful
planning will conserve valuable resources now and in the future.

It is beyond the scope of this chapter to describe evaluation methods in more detail. Readers are encouraged to read the referenced resources for additional information. Evaluation is much more than an inconvenient requirement imposed by funding agencies. It is a critical component of successful injury prevention programs and a valuable prevention partner.

**CHALLENGES TO IMPLEMENTATION**

As many injury researchers search for new and innovative solutions to complex injury problems, we should not forget that, for some problems, we have effective solutions. Bicycle helmets work, occupant restraints work, regulating water heater temperature works, modification of household and infant products works, child-resistant packaging works, and many other interventions and approaches work. Why then are there so many injuries from causes for which we have solutions? The answer is warehousing—not delivering the interventions to the population at risk. In some cases, we plan to deliver the intervention—the product leaves the warehouse—but it is not delivered intact or in time.

Implementation of effective injury prevention strategies may be our greatest challenge. No matter how well conceived and planned a program is, it will not be effective if it does not happen, if it is implemented inadequately, or if the intervention time frame is too short. Prevention program planners with limited resources are advised to look at the literature (and Web sites listed in this chapter) and select proven interventions whose implementation is well documented. So many resources are wasted as the same mistakes are made again and again. When considering an intervention, the nurse who reads or hears about a similar program should not hesitate to contact the people running the program. A phone call or e-mail correspondence can yield valuable, practical information not readily available elsewhere.

Fractionation of effort is a major impediment to program implementation. Essentially it is as if we were to hire a team of people to build a house, each with responsibility for a different piece of the project but without any team planning or communication before, during, or after the project. If, in fact, this house were ever built, it is likely that it would be flawed, over budget, and behind schedule. It is not uncommon to find several groups or organizations within a community working on aspects of the same injury problem in isolation from each other. Institutional and organizational mandates, real or imagined traditional roles, and interagency politics may reinforce this fractionation. To optimize resource utilization and the chances for success, fractionation of effort must be challenged. Coalitions and collaborative initiatives are energizing prevention efforts in many areas of injury control. If well managed, coalitions can increase the visibility of the issue, funding opportunities, and the skill base of the participants. Readers interested in coalitions are encouraged to visit the Web site of the Prevention Institute, www.preventioninstitute.org, for more information on coalition building for injury control.

It is important that the trauma nurse be aware of several modifiable barriers to implementation of effective programs. These include the following:

1. Inadequate or absent evaluation
2. Overly broad problem definition
3. Incomplete problem diagnosis
4. Unrealistic goals
5. Poorly defined program objectives
6. Working in a vacuum
7. Turf wars
8. Planning and implementation gaps
9. Cruise control and tunnel vision
10. Burnout

Reference has been made to each of these previously. Of all 10 problem areas, the first one, *inadequate or absent evaluation*, is the most important. To understand why, the reader is encouraged to re-read problems 2 through 10 and ask whether *evaluation throughout the life of the program could have prevented, or reduced the severity of, this problem*. The answer to all nine is *yes*. Investing limited resources, energy, and expectations in poorly designed and implemented programs will lead to failure, frustration, and burnout. Even well-planned prevention efforts may take years to bear fruit, and they face numerous challenges along the way. Persistence and patience, combined with a continued sense of urgency, are notable attributes of successful preventionists. Get to know your opponents as well as your supporters. Start small and build your prevention skills; nothing breeds success like success.

Battling obstacles to effective prevention programs may be demoralizing at times but not nearly as demoralizing as watching again and again as young lives are lost to injuries that could have been prevented. Adopting a problem-solving approach to injury control does not guarantee program success, but it will assist readers to think about injury problems—and the trauma nurse’s role in injury prevention—critically, systematically, and creatively.

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