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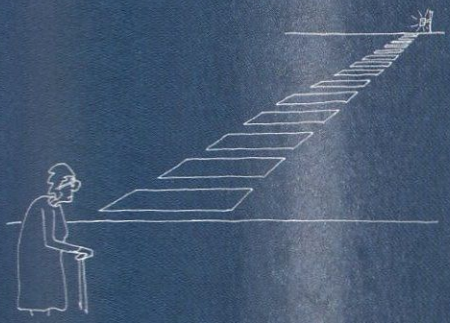

Chapter 17

Injuries Are Not Accidents

KEY TERMS

Consumer Product Safety Commission (CPSC)
Intentional injury
National Highway Traffic Safety Administration (NHTSA)
National Institute for Occupational Safety and Health (NIOSH)
Occupational Safety and Health Administration (OSHA)
Years of Potential life lost (YPLL)
Primary prevention
Secondary prevention
Tertiary prevention
Unintentional injury

Injuries are the fourth leading cause of death in the United States.[1(Table 20)] They are even more important than statistics suggest because injuries disproportionately affect young people and thus cause many **years of potential life lost (YPLL)**. Injuries are the number one cause of death among people ages 1 to 44.[1(Table 21)] In addition to the people killed by injuries, there are almost as many survivors left with permanent disabilities, a major economic and emotional drain on families and on society in general.

Traditionally, injuries have been thought of as "accidents," unavoidable random occurrences, or the results of antisocial or incautious behavior. It is only recently that public health practitioners have recognized that injuries can and should be treated as a public health problem, analyzable by epidemiologic methods and amenable to preventive interventions. While most injuries are caused to some extent by individual behavior, they are also influenced by the physical and social environment. Public health programs to prevent injury must find ways to change people's behavior by the classic methods of education and regulation, but for many types of injuries, prevention by changing the environment may be more effective.

Epidemiology of Injuries

Prevention of injury, like the prevention of most diseases, is based on epidemiology. Data are needed to answer the questions of who, where, when, and how, looking for patterns and connections that suggest where the greatest needs for prevention are as well as ways to intervene to prevent the injury. Fatal injuries are generally categorized as **unintentional** (sometimes referred to as "accidental") or **intentional** (homicide or suicide).

Injuries are an especially important cause of death in young people. In 2010, unintentional injuries caused 32 percent of deaths in children aged 1 to 4, 31 percent of deaths in children aged 5 to 14, and 42 percent of deaths in young people aged 15 to 24.[1(Table 23)] An additional 31 percent of deaths in the 15 to 24 age group were caused by suicide or homicide.

Race and gender affect injury rates. Males are more likely to sustain injuries than females, with a fatal injury rate 1.7 times higher than that of females for all age groups combined. Blacks have lower rates of injury mortality than whites, except for the high rates of homicide among young black males, which is more than nine times the rate for white youths.[1(Table 32)]

Injury rates, like other indicators of poor health, are higher in groups of lower socioeconomic status. The death rate from unintentional injury is twice as high in low-income areas as in high-income areas. House fires, pedestrian fatalities, and homicides are all more common among the poor.[2] The poor are more likely to have high-risk jobs, low-quality housing, older, defective cars, and such hazardous products as space heaters, all of which contribute to higher injury risks.

(**FIGURE 17-1**) shows the leading categories of injury deaths in the United States. Poisoning leads the list, followed by motor vehicle injuries, with firearms fatalities third. As a result of the high priority the federal government has placed on prevention of motor vehicle–related injuries, as described in a following section, highway fatalities have declined over most of the past four decades. Firearm fatalities increased between 1968 and 1994, and the Centers for Disease Control and Prevention (CDC) predicted that if trends continued, the number of firearm-related deaths would surpass those related to motor vehicles by the year 2003.[3] The trend in firearm injuries reversed in the early 1990s, however, while traffic fatalities remained steady, and then fell in the early 2000s so that the two causes are now about equal in the injury statistics, as shown in (**FIGURE 17-2**).[4]

Death rates from poisoning overtook traffic fatalities in 2009, however, becoming the leading cause of injury death in the United States. Deaths due to prescription drugs quadrupled between 1999 and 2010.[5] Other major causes of injury deaths that have drawn significant public health attention are falls and jumps, suffocation, drowning, and fires and hot objects.

Many injuries are not fatal, of course, but fatal injuries are the ones that are most reliably reported. While data on nonfatal injuries are less complete, these injuries can have serious and even devastating effects. In the years 2010–2013, for every fatal injury reported, more than 12 individuals were hospitalized for nonfatal injuries, and 223 were treated in the emergency department.[6] These numbers are illustrated in the "injury pyramid" shown

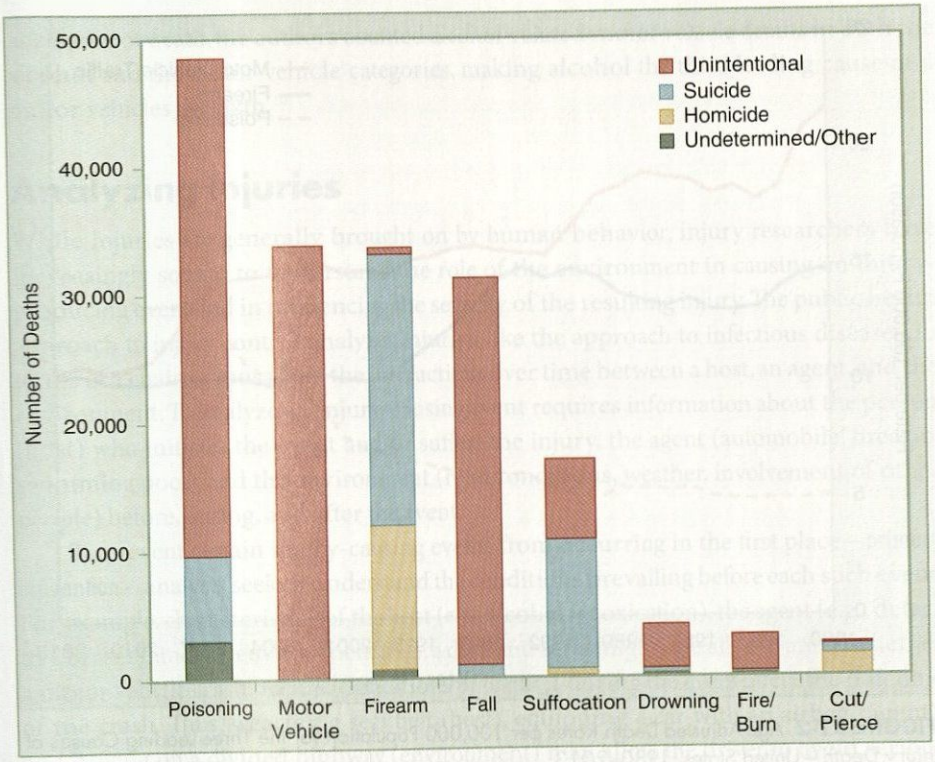

FIGURE 17-1 Leading Causes of Injury Death, 2013

Data from U.S. Centers for Disease Control and Prevention, "National Vital Statistics Report: Deaths: Final Data for 2013." http://www.cdc.gov/nchs/data/nvsr64 /nvsr64_02 .pdf, accessed September 16, 2015.

in (**FIGURE 17-3**), from which it is possible to estimate the impact of nonfatal injuries when data on fatal injuries are known.

Injuries that result in long-term disability, especially head and spinal cord injuries, are particularly costly to society. In 2010, for example, 1.5 million Americans sustained a traumatic brain injury (TBI).[7] Of these, about 50,000 died, and 280,000 were hospitalized and survived, often with lifelong disabling conditions. Many of these victims are young. Caring for these patients costs billions of dollars, much of it paid for with public funds.

Alcohol is a significant factor in a very high percentage of injuries. Sixty-five percent of traffic fatalities in 2013 involved alcohol.[8] High alcohol levels are found in the blood of more than one-third of adult pedestrians killed by motor vehicles.[9] Many of those fatally injured in falls, drownings, fires, and suicides are under the influence of alcohol, as are many of the perpetrators and victims of homicides. Other drugs may play a role in injury, but because blood alcohol tests are much more commonly done than tests for other drugs, the role of alcohol in injury is better documented.

The importance of alcohol's contribution to injury accounts for its high placement on the list of "actual causes of death." To stress the importance of driving while intoxicated

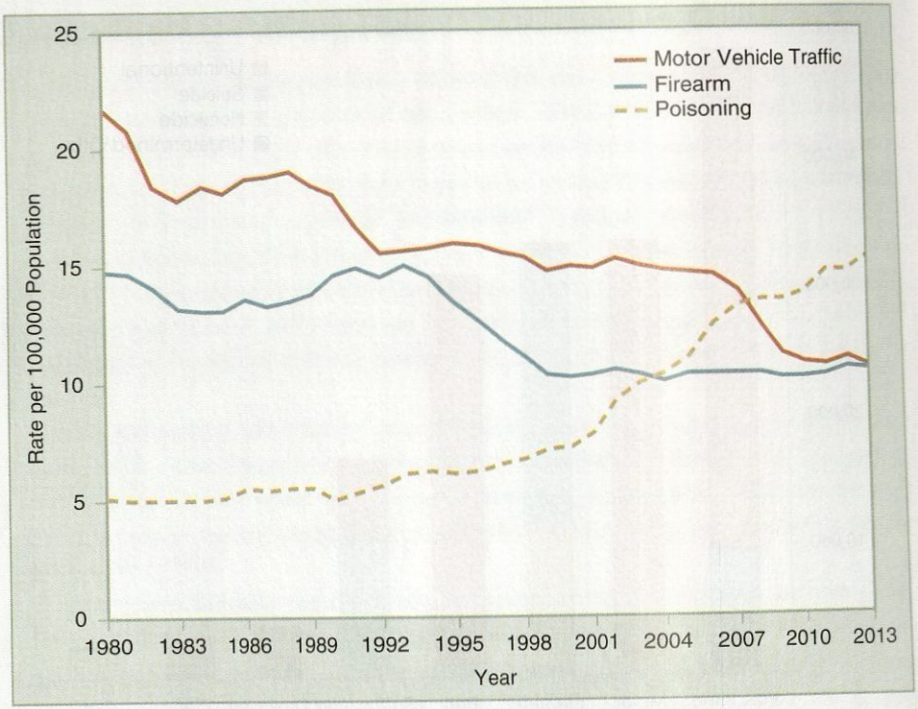

FIGURE 17-2 Age-Adjusted Death Rates per 100,000 Population for the Three Leading Causes of Injury Death—United States, 1980–2013

Data from U.S. Centers for Disease Control and Prevention, CDC Wonder, wonder.cdc.gov/cmf-icd9.html and wonder.cdc.gov/ucd-icd10.html, accessed September 16, 2015.

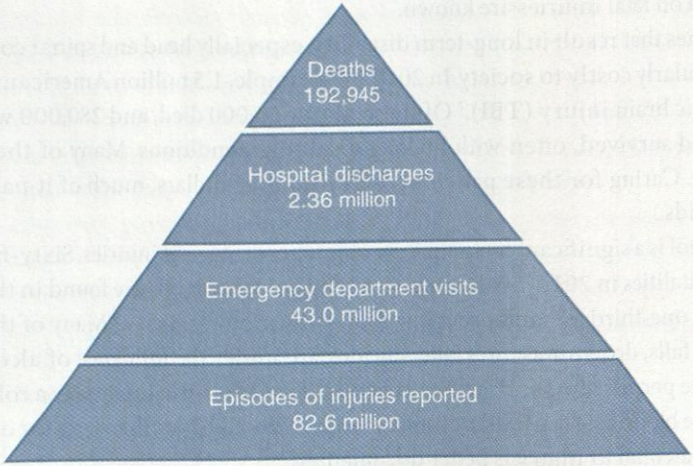

FIGURE 17-3 Centers for Disease Control and Prevention, "Burden of Injury, United States, 2009–2013"

Data from U.S. Centers for Disease Control and Prevention, http://www.cdc.gov/nchs/fastats/injury.htm, accessed September 16, 2015.

as a cause of death, the authors counted alcohol-related motor vehicle deaths in both the alcohol and the motor vehicle categories, making alcohol the third leading cause and motor vehicles the sixth.[10]

Analyzing Injuries

While injuries are generally brought on by human behavior, injury researchers have increasingly sought to understand the role of the environment in causing an injury-producing event and in influencing the severity of the resulting injury. The public health approach to injury control analyzes injuries, like the approach to infectious diseases, in terms of a chain of causation: the interactions over time between a host, an agent, and the environment. To analyze an injury-causing event requires information about the person (host) who initiates the event and/or suffers the injury, the agent (automobile, firearm, swimming pool), and the environment (road conditions, weather, involvement of other people) before, during, and after the event.

To prevent certain injury-causing events from occurring in the first place—**primary prevention**—analysts seek to understand the conditions prevailing before each such event. For example, characteristics of the host (e.g., alcohol intoxication), the agent (e.g., defective brakes), and the environment (e.g., a dark and rainy night) are all relevant to whether a motor vehicle crash occurs. Conditions prevailing during the event affect the outcome of the crash. Thus, wearing a seat belt (host), equipping a car with an airbag (agent), and driving on a divided highway (environment) may allow the driver to avoid serious injury during a crash—**secondary prevention. Tertiary prevention** depends on conditions after the crash that determine whether the victim survives the injury and the extent of any resulting disability. The availability and quality of emergency care are major factors in tertiary prevention.

Because motor vehicle injuries cause so many deaths, they were the first category of injuries to be analyzed and subjected to systematic prevention efforts. Much data are available on conditions surrounding motor vehicle crashes, and methods for preventing motor vehicle injuries are highly developed. National highway safety programs were launched two decades before Congress identified injury as a general public health problem and established the National Center for Injury Prevention and Control at the CDC.

Injury-control efforts developed for motor vehicle injuries have served as a model for more embryonic efforts to control other categories of injury. Early prevention strategies focused on changing people's behavior by the classic public health methods of education and regulation. As with many public health issues related to behavior, regulation is usually more effective than education in getting people to change their behavior. In the earliest days of traffic safety efforts, for example, society learned that laws regarding speed limits and traffic lights were necessary to control the chaos on the roadways.

Modern injury control began, however, with the recognition that engineering plays an important role in the causation of injuries and their severity. Sharp objects cause more damage to the human body than blunt ones; an impact distributed over a broad surface results in a less severe injury than that to a smaller surface; if deceleration can

be controlled and made less sudden, the body can better withstand the force. In general, automatic protections are more effective than measures that require effort, and the more effort a measure requires, the less likely it is to be employed. Thus the "three Es" of injury prevention are education, enforcement, and engineering.

These insights, first applied in the auto industry, have also been applied to prevention of many other kinds of injury—especially childhood injuries—with considerable success. For example, when the New York City Health Department noted that a large number of children died from falls out of windows, it instituted the "Children Can't Fly" program, requiring landlords to install window guards, and the number of fatal falls was reduced by half.[11] The number of children that drown in swimming pools has been reduced by laws requiring pools to be fenced. Poisonings in children can be prevented by childproof caps on medicine containers and some household chemicals. The use of smoke detectors has reduced the number of deaths from fires. State and federal regulation of the flammability of fabrics has also saved lives, especially those of children—due to laws on children's sleepwear. As a result of these measures and others, fatal injury rates among small children have declined markedly in recent years.[1(Table 21),12]

Motor Vehicle Injuries

Attention was focused on the problem of motor vehicle injuries by Ralph Nader's indictment of the automobile industry in his book, *Unsafe at Any Speed: The Designed-In Dangers of the American Automobile*, published in 1966. Congress responded by passing the National Traffic and Motor Vehicle Safety Act of 1966, which established the **National Highway Traffic Safety Administration (NHTSA)** and empowered it to set safety standards for new cars, such as installation of seat belts, laminated windshields, collapsible steering assemblies, and dashboard padding. Hundreds of thousands of drivers had died from being impaled on unyielding steering columns. Heads and faces of front-seat passengers had been cut by sharp dashboard edges and by glass from broken windshields. The safer designs mandated by the 1966 legislation led to an enormous reduction in both injury and mortality.[11]

NHTSA was also required to collect data on motor vehicle–related deaths and to conduct research aimed at prevention of motor vehicle collisions and amelioration of their effects. Among other activities, NHTSA has an ongoing program of crash-testing various vehicle models, seeking to understand how further improvements in engineering could protect occupants during a crash. These studies have led to further improvements in automobile design—including headrests that protect their occupants during rear-end collisions, strengthened side bars to protect occupants during side crashes, and airbags—now required by federal law.[13]

While requirements that vehicles more effectively protect their occupants during a crash are an important part of injury control (secondary prevention), preventing crashes from occurring in the first place (primary prevention) is the highest priority. Characteristics of the vehicle such as turn signals and brake lights help prevent crashes. State laws

that require annual inspections of these devices, as well as of brakes and tires, are aimed at ensuring that defects in vehicles do not lead to injuries. Beginning with 2011 models, the NHTSA rates cars with a 5-star safety ratings system that includes crash avoidance technology such as electronic stability control, lane departure warnings, and forward collision warnings.[14] Environmental features, especially improvements in highway design, have been shown to prevent crashes. Divided highways, raised lane dividers embedded in road surfaces, rumble strips at road edges, and "wrong-way" signs at off ramps can help to prevent mistakes by drivers.

Injury control methods that target the driver depend on both education and enforcement, and they exemplify the typical difficulties in getting people to practice healthier behaviors. Because alcohol plays such a major role in fatal crashes, laws against drinking and driving are virtually universal. Their effectiveness depends on how well they are enforced, however. The activism of volunteer groups such as Mothers Against Drunk Driving (MADD) has helped to raise public consciousness about the extent of the problem, and tolerance for drinking and driving has declined in recent years. In addition to imposing severe penalties for being caught driving drunk, many states have expanded legislation to make establishments that serve alcohol liable for serving minors or persons already obviously intoxicated.

After alcohol, the second most important factor in fatal crashes is youth: 9 percent of drivers in fatal crashes are between 15 and 20 years old, even though those in this age group make up only 6 percent of all drivers.[15] According to NHTSA, this is believed to be due in part to inexperience: Driving is a complex task, and new drivers are more likely to make mistakes. These crashes are also due to risk-taking behavior and poor judgment.

Most states have now addressed the issue by implementing graduated driver-licensing systems by which young drivers must pass through one or two preliminary stages over a period of time before they are allowed a full license.[16] NHTSA has developed a model law that includes the following provisions: With a learner's permit, a licensed adult must be in the vehicle at all times; the young person must remain crash-free and conviction-free before being allowed to take a road test for a provisional license. Nighttime driving is restricted for those with a provisional license. Young drivers must remain crash-free and conviction-free for a year before moving to a full license. As of 2008, all states have adopted some form of the graduated system, although there is significant variation among states in the restrictions imposed at different stages.[17] Graduated licensing has been successful in preventing traffic fatalities among young people: States that have adopted the system have experienced significant reductions in crashes by drivers less than 20 years old.

In addition to being inexperienced, young drivers may also be just starting to drink, and doing both together can be fatal. In 2012, 28 percent of drivers 15 to 20 years old who were killed in crashes had alcohol in their blood.[15] The federal government and many states have made concerted efforts to reduce drinking and driving among young people. One attempt to deal with the problem was a federal law requiring states to increase

the drinking age to 21 to receive highway funds (the law became effective in 1988).[11] In 1995, a similar federal law required states to pass zero tolerance laws for drivers under 21 years old. Since 1998, all states and the District of Columbia have laws setting a limit of 0.02 percent blood-alcohol concentration or below, suspending driver's licenses for those found in violation. The evidence indicates that this is an effective approach to saving lives.[18]

Speed limits are an important factor in highway injuries. In 1974, Congress imposed a national speed limit of 55 miles per hour to conserve fuel at the time of the Arab oil embargo. That law, which contributed to a 16 percent decline in traffic fatalities between 1973 and 1974, was revoked in 1995 as part of the deregulation trend.[11] Many states have raised their speed limits as a result, including 40 states that have limits of 70 miles per hour or above on rural interstates.[19]

The use of seat belts has been shown to reduce fatalities by 40 to 50 percent. Child-safety seats can reduce the risk of a child's being killed during a collision or sudden stop by 71 percent.[11] These engineering measures require people to use them correctly, however, and even state laws requiring the use of seat belts and child safety seats are widely ignored. In states that have primary seat belt laws—laws allowing police officers to pull over drivers and ticket them merely for not wearing a seat belt—the rate of seat belt use is higher than it is in states that have secondary laws—laws that permit police to issue tickets for seat belt violations only after stopping a driver for another reason. As of July 1, 2015, 34 states and the District of Columbia have primary laws, and 15 have secondary laws. New Hampshire has no seat belt law for adults. All states and the District of Columbia have child restraint laws, though the types of restraints for various age children varies among the states.[20]

An issue that has recently come to the attention of traffic safety advocates is cell phone use while driving. The NHTSA collects data on distracted driving, which includes using a cell phone, eating, reading, and using a navigational system, all of which degrade the driver's performance. According to NHTSA, in 2013 3154 people were killed in motor vehicle crashes involving distracted drivers..[21] As of July 1, 2015, 14 states and the District of Columbia had laws banning the use of handheld cell phones while driving, and an additional 23 states ban their use by novice drivers.[22] No state has banned use altogether, although the evidence indicates that even hands-free phones can cause significant distraction to the driver. Even more risky than talking on a cell phone is text messaging, which has become increasingly common, especially among younger drivers. A study that used video cameras installed in the cabs of long-haul trucks found that when drivers texted, their risk of a collision increased 23-fold.[23] Other studies suggest that the risk among drivers of passenger cars is similar. Forty-six states and the District of Columbia ban text messaging while driving, and an additional two states ban the practice for novice drivers.[22]

In 1968, when implementation of federal traffic safety legislation began, almost 55,000 Americans died each year from motor vehicle–related injuries. The national effort to reduce this toll has had significant success. By 1993, the number had declined to just over 40,000 fatalities per year despite the fact that many more cars were on the roads and that the

number of miles driven has more than doubled.[3] Since then, the downward trend halted for over a decade and then dropped dramatically to 32,367 in 2011. The fatality rate per 100 million vehicle miles of travel was at an all-time low in 2011.[24] Future progress in traffic safety could depend on factors such as the price of gasoline. High gas prices tend to lead people to drive less. They also encourage people to buy smaller cars. When gas prices are low, heavier vehicles such as minivans, pickup trucks, and sport utility vehicles are popular, contributing to increases in traffic fatalities because crashes between vehicles of widely disparate size and weight cause high risk to the occupants of the smaller vehicle. Sport utility vehicles, vans, and pickup trucks, with their higher center of gravity, are more likely to roll over in crashes than sedans, however, offsetting the advantage occupants get from their size.

Pedestrians, Motorcyclists, and Bicyclists

About 14 percent of people killed in motor vehicle crashes are pedestrians, and public health efforts are also directed at preventing these injuries.[25] Elderly people have the highest risk for being killed by a motor vehicle while walking. Nineteen percent of pedestrians killed by motor vehicles are 65 or older.[25] Most of these injuries occur in urban areas. A 1985 study investigated reasons for a high fatality rate among older pedestrians along Queens Boulevard in a part of New York City inhabited by large numbers of senior citizens. It was found that elderly persons took an average of 50 seconds to cross the 150-foot wide boulevard, while the "walk" sign allowed only 35 seconds. Moreover, because of the boulevard's width and because vision loss is common among the elderly, many pedestrians could not read the "walk/don't walk" signs, which were located on the far side of the boulevard. The traffic safety unit installed additional signs on the median strips so that they could be more easily seen, and they reset the signs to allow more time for crossing. After implementation of these and other measures, such as stricter enforcement of speed limits, the rate of death and severe injuries among pedestrians fell by 60 percent.[11]

Public health professionals viewed the Queens Boulevard story as a success, but residents of the neighborhood still call that stretch of roadway the "Boulevard of Death." The city's Department of Transportation has continued to make safety improvements, including more fences to curtail jaywalking, restricting vehicle U-turns and left turns, and posting safety signs to remind pedestrians about the danger.[26]

In 2013, 4668 motorcyclists and 743 bicyclists were killed in crashes.[27,28] Children younger than 15 years of age account for 7 percent of the bicycle-related fatalities, making this one of the leading causes of injury-related death in children.[28] Over the decade from 2004 to 2013 there was a steady increase in the average age of bicyclists killed or injured in crashes with motor vehicles, from 39 to 44.[28] The most important protective measure for bicycle and motorcycle riders is to wear a helmet. At least 83 percent of bicyclists killed and 41 percent of fatally injured motorcyclists were not wearing helmets.[29,28] Head injuries also cause profound, permanent disability in many survivors.

Public health advocates have devoted considerable efforts to promote the use of bicycle and motorcycle helmets. Congress (as part of the 1966 National Highway Safety Act) mandated that states pass laws requiring motorcyclists to wear helmets, leading to a

dramatic decline in motorcycle fatalities. Because of vigorous objections on grounds of personal liberty, the federal law was changed in 1976.[30] In response, 27 states repealed or weakened their laws, and by 1980 motorcycle fatalities increased dramatically. As of July 2015, 19 states and the District of Columbia required helmet use for all motorcycle operators and their passengers. In another 28 states, only those under a certain age, usually 18, are required to wear helmets.[31] In states where only minors are required to wear helmets, laws are difficult to enforce. Data on crashes in these states show that, despite the law, fewer than 40 percent of fatally injured riders wore helmets, while in states with universal laws, 91 percent were wearing helmets.[32] Only 21 states and the District of Columbia have laws requiring bicycle helmets, and these laws apply only to children, although some local governments have laws that apply to riders of all ages.[33] The bulk of the public health effort regarding bicycle helmets focuses on community education programs.

Poisoning

Poisoning surpassed firearms as a cause of injury death in 2004, as shown in (Figure 17-3). In fact, the number of deaths from poisoning more than doubled between 1999 and 2010.[34] In trying to understand the dramatic increase in poisoning fatalities, scientists at the CDC analyzed death certificates recorded at the National Center for Health Statistics and found that the vast majority of them listed drugs, legal and illegal, as the cause of death.[35] Opioid pain medications were most commonly involved in the unintentional deaths, followed by cocaine and heroin. Suicide by poisoning most commonly involved psychoactive drugs, such as sedatives and antidepressants, followed by opiates and other prescription pain medications.

The CDC scientists noted that during the 1990s, pain specialists were arguing that opioid pain medications were being underprescribed because of fear of addiction, leading to suffering by patients who were being denied relief from chronic pain. In response, between 1990 and 2002 there was a dramatic increase in prescriptions written for these drugs, including hydrocodone, oxycodone, and methadone. The increase in sales of methadone was explained by prescriptions filled at pharmacies for pain management rather than distribution of the drug through narcotics treatment programs. The scientists' conclusion was that the increase in unintentional poisoning deaths was largely a result of nonmedical, recreational use of prescription pain relievers. Further evidence for this explanation is the age and sex distribution of the individuals who died, primarily middle-aged and male, rather than older females who typically suffer from chronic pain, and many of them had a history of drug abuse.[35]

The CDC analysis leads to the conclusion that the medical prescription of opioid painkillers is being diverted for illegitimate and dangerous uses. The authors note that corrective actions may be necessary to reduce deaths without diminishing the quality of care for patients who need the drugs for pain relief. This may include better communication and education of healthcare providers to warn them of the risks and inform them how to recognize patients who may be prone to abuse. There may be a need for stricter regulation of opiates by the Drug Enforcement Agency, which registers physicians and pharmacies that handle opiates and tracks the buying and selling of these drugs.

The New York State Attorney General, Eric Schneiderman, has proposed an online drug tracking system for the state that would reduce the risk of patients' obtaining multiple prescriptions for opiate drugs. The system would require physicians to check a patient's prescription history before writing a new prescription and require pharmacists to confirm prescriptions before filling them.[36]

The age group with the lowest poisoning mortality rates is children under 15 years old, in part thanks to public health measures designed to protect curious youngsters from ingesting toxic substances. Childproof caps on pharmaceuticals and cleaning products have helped to keep poisons out of the hands and mouths of toddlers, and poison control centers staff emergency phone lines 24 hours per day. Nevertheless, parents are advised to be alert to the risks of childhood poisonings.

Poisoning deaths from other substances of public health concern include alcohol poisoning, a result of binge drinking, which amount to over 2000 deaths per year.[37] Carbon monoxide poisoning, which causes over 2000 suicides and nearly 500 unintentional deaths annually, may result from breathing air containing motor vehicle exhaust or from malfunctioning stoves, furnaces, or other appliances.[38]

Firearms Injuries

In 1994, firearms injuries had surpassed motor vehicle injuries as the leading cause of injury death in eight states and the District of Columbia. It appeared that firearms would soon become number one nationwide, as seen in (Figure 17-2). However, the number of homicides dropped dramatically in 1994 and 1995, and suicides and unintentional gun deaths fell slightly. The number of deaths caused by firearms continued to decline, falling from almost 40,000 in 1993 to below 30,000 in 2004. A number of reasons have been proposed for the decline, including tougher gun control laws, community policing, and demographic changes.[39] Since 2004, the number of firearms deaths increased slightly, reaching 33,636 in 2013.[40]

Violence is traditionally thought of as a criminal justice issue rather than a public health issue. Certainly no one is arguing that the criminal justice system should abandon its mission. But public health has a different mission: It focuses on prevention as opposed to punishment. The relative success of the public health approach against motor vehicle injuries has inspired calls for it to be applied against violence, especially against firearm violence, the behavior that has the most severe consequences for health.

There are plenty of grim statistics showing that America's permissive attitude toward guns is harmful to people's health. In 2013, firearms killed 33,636 Americans.[40] Of these, almost 63 percent were suicides, 33 percent were homicides, and the rest were caused by unintentional shootings, legal intervention, or unknown causes. Teenagers and young adults are especially at risk. Thirty-eight percent of people who die from firearms are between the ages of 15 and 34. Forty percent of these deaths among young people were suicides, and 56 percent were homicides. The death rate from firearms is six times higher for males than that for females. Young African American males are especially at risk, especially for homicide.[40]

Homicide rates in the United States are two to five times higher than those in other developed countries.[41] Although suicide rates among Americans are comparable to those in other developed countries, a high percentage of them are committed with firearms. The easy availability of guns in the United States is believed responsible for many of these deaths. Homicide and suicide are more likely to succeed if guns are used rather than less lethal weapons. In 2013, 51 percent of suicides and 79 percent of homicides were committed with guns.[40] Suicide among young people is especially tragic. While rates of suicide among people 15 to 24 years old have declined since 1990, suicide is still the second leading cause of death in this age group.[1(Table 21)] Almost half of these suicides are committed with firearms.[40]

A telephone survey of U.S. households conducted in 2004 found that 38 percent of them possessed at least one firearm.[42] While many people own a handgun because they believe it will protect them, a number of case-control studies have shown that the opposite is true. One study found that the relative risk of death by an unintentional gunshot injury is 3.7 for people living in a home with at least one gun, compared to a home without guns.[43] Another study found that residents of a household with a gun present in the home are three times more likely to die in a homicide[44] and five times more likely to commit suicide[45] than when no gun is available. In another study, a gun kept at home was found to be 43 times more likely to kill its owner, a family member, or a friend than an intruder.[46] There is some controversy about these findings. An analysis by the National Academy of Sciences cast doubt on whether the relationship between gun ownership and homicide or suicide represents cause and effect. The report stated that the data were too unreliable to draw firm conclusions and noted that information such as that collected on guns traced to crimes by the Bureau of Alcohol, Tobacco, Firearms and Explosives is inaccessible to researchers.[47] On the other hand, a number of published literature reviews have supported the findings that having a gun in the home increases risks to members of the household.[48]

The CDC had been collecting data on patterns of violence for almost two decades, and in the early 1990s the agency stepped up its efforts to identify and evaluate interventions to prevent and reduce the impact of violence. Politically, however, guns have been a much more difficult issue to deal with than motor vehicles. Many conservative politicians, with the support of the National Rifle Association (NRA), regard any attempt to control access to firearms as an attack on the Second Amendment to the Constitution. Limits on the depiction of violence in the media are also vigorously opposed in the name of protecting freedoms, although there is some evidence that viewing violent episodes on television or in the movies increases the cultural acceptance of violence and makes children and youths more likely to behave in aggressive ways.

Opponents of gun control have even gone so far as to try to prevent the CDC from conducting research on violence as a public health problem. In 1995 and 1996, conservative members of the House of Representatives, backed by the NRA, tried first to eliminate the CDC's National Center for Injury Prevention and Control and then to cut from the center's budget the exact amount—about $2.4 million—that it had proposed for research on firearms injury.[49] President Clinton supported the CDC's work, and attempts to cut

the center's budget failed. However, the political opposition had an impact. Legislation passed in 1996 explicitly forbade the CDC from using any of its funding "to advocate or promote gun control."[50(p.190)]

Efforts to reduce firearms injuries are continuing nonetheless. The Harvard Injury Control Research Center, with funding from private foundations, developed a National Violent Injury Statistics System in 1999, modeled after the NHTSA's reporting system for motor vehicle injuries. This became a pilot for what is now the National Violent Death Reporting System (NVDRS), established in 2002 by the CDC with support from a new Congress. The NVDRS is a state-based system that collects detailed data on homicides and suicides in order to better inform policy on violence and suicide.[51,52] As of 2015, the program operated in 32 states.

The successful passage of the Brady Handgun Violence Prevention Act and the federal assault weapons ban in 1994 showed that there could be political support for limiting access to firearms even in an antiregulatory climate. However, the assault weapons ban expired in 2004 and the fact that it has not been renewed by Congress shows that the NRA still has clout in Washington. Some states and communities have similar bans, as well as violence prevention and youth development programs, including education to promote nonviolent resolution of arguments. The economic cost of gun violence in medical care—calculated at about $2.3 billion per year—has helped to persuade some states to pass stricter gun control regulations. About half the medical costs of firearms injuries are borne by taxpayers.[53]

Public health advocates note that guns need not be banned in order to make them safer. The third "E" of injury prevention—engineering—has not been widely applied in the prevention of firearms injuries. Safety catches can be used to make guns childproof, for example, and there are even ways to personalize guns so that they can be used only by the owner. Safety features are required by law for many consumer products that are much less dangerous than guns. When the political climate is ready to support major efforts to prevent firearms-related injuries, the public health approach has much to offer.[54,55]

Occupational Injuries

Workplace injuries have been a significant public health problem since the Industrial Revolution, if not before. In 1907, over 15,000 American workers were reported to have died on the job. Many states implemented occupational safety laws in the late 19th and early 20th centuries. In 1970, the Congress passed a federal law creating the **Occupational Safety and Health Administration (OSHA)**, empowered to set standards, inspect workplaces, and impose penalties for workplace hazards. The law also created the **National Institute for Occupational Safety and Health (NIOSH)** to conduct research, recommend standards, and conduct hazard evaluations.[11]

The workplace is safer now, with 4585 fatal injuries reported by the Bureau of Labor Statistics in 2013, despite a large increase in the number of workers.[56] In part, this improvement reflects mandated safety measures and educational programs; in part, it reflects an economy less dependent on heavy industry. However, in addition to the deaths, almost one million Americans suffer an injury each year that leads to lost work days.[57]

As in the pattern of injuries overall, motor vehicles are the leading occupational cause of death, with highway crashes accounting for 24 percent of all worker deaths.[56] The second leading cause of injury mortality in 2013 was falls, at about 16 percent of deaths. Close behind falls was "contact with object or equipment," which includes being struck by falling objects and being caught in running equipment or machinery. Workplace homicides, which ranks fourth, have declined to 9 percent of deaths, following the general trend of decreasing firearms deaths. Not surprisingly, workers in some types of jobs have higher risks of occupational fatality than others. Logging and fishing are the most dangerous occupations, with the highest rate of deaths per 100,000 workers. Aircraft pilots and flight engineers had the third highest fatality rate in 2013.[58]

Roofers and construction workers have a high risk of falls. Agricultural workers are at risk for amputations by machinery, electrocutions, and pesticide poisoning. Police officers have a high risk of homicide. A major cause of fatalities in firefighters is collapsing buildings.

Injury from Domestic Violence

All too often, family conflict leads to violence against children or spouses. In 2012, an estimated 1640 children under age 18 died from child maltreatment; 70 percent of the deaths occurred in children younger than age 3. Child protective services agencies estimated that 686,000 children were victims of maltreatment in 2012. More than 3 million reports of child abuse and neglect are received by state and local agencies annually.[59] Most often the perpetrator is a parent.

Intimate partner violence, including rape, physical violence, or stalking, is another serious problem in the United States, affecting more than 12 million women and men each year. In 2007, intimate partner violence resulted in more than 2300 deaths. A number of surveys provide data on the extent of domestic violence in the United States. For example, in 1996 the CDC collaborated with the National Institute of Justice to sponsor the Violence Against Women Survey. In 2010 the two agencies, together with the Department of Defense, began conducting an ongoing National Intimate Partner and Sexual Violence Survey. The CDC's Behavioral Risk Factor Surveillance System includes questions about intimate partner violence, and the Pregnancy Risk Assessment Monitoring System collects data about physical abuse during and after pregnancy.[61]

The risk factors for domestic violence victimization and perpetration are often the same. For example, childhood physical or sexual victimization is a risk factor for future victimization and perpetration. Other factors include low self-esteem, low income, young age, and heavy alcohol and drug use. The CDC puts a high priority on preventing domestic violence, but little is known on how to accomplish this goal. The agency conducts and supports research on how to reduce or eliminate risk factors and increase protective factors.

Nonfatal Traumatic Brain Injuries

In addition to the over 52,000 deaths each year, an estimated 2.2 million Americans are treated in hospital emergency departments for nonfatal traumatic brain injuries (TBIs), and uncounted others sustain the injury but are treated elsewhere or do not seek care.[62]

These data come from CDC surveys of general hospitals and children's hospitals and do not include data from people treated in military hospitals or Veterans Administration hospitals. Since members of the military are at high risk of TBIs, the CDC's data is a significant underestimate.[63]

TBIs may be mild, moderate, or severe. A mild TBI, called a concussion, may cause only a brief change in consciousness or mental state. More severe TBIs can lead to changes in thinking, sensation, or language, and may cause permanent disability. They may increase the risk later in life for Alzheimer's and other dementias and for Parkinson's disease. A well-known example of the latter is the boxer Mohammed Ali, who was diagnosed with Parkinson's syndrome at the age of 43 after years of enduring blows to the head.[64]

The age group at highest risk for hospitalization and death from TBIs is individuals 75 years and older, while the greatest number of emergency department visits are by children aged 4 and under.[7] The leading causes of these injuries are falls, followed by being hit by an object and motor vehicle crashes, the latter including drivers, passengers, pedestrians, motorcyclists, and bicyclists.

The **Consumer Product Safety Commission (CPSC)** administers another surveillance system that collects data from a nationally representative sample of 66 hospital emergency rooms. This system focuses on injuries associated with consumer products and identifies TBIs associated with products such as bicycles, swing sets, or inline skating equipment. Accordingly, the injuries identified through this system have different causes and affect younger individuals than those included in the CDC system. The group found at highest risk by the CPSC are aged 10 through 14 years, and the leading causes of the injury involve bicycles, football, playground activities, basketball, and riding all-terrain vehicles. Like the CDC system, the CPSC found that boys are much more likely than girls to suffer a TBI.[65] The CDC recommends primary and secondary prevention to minimize TBI. Primary prevention calls for participants in such activities to wear protective equipment such as helmets. Secondary prevention provides that anyone suspected of having a TBI should be removed from play and allowed to return only after being evaluated by a healthcare provider experienced in diagnosing and managing TBI.[65]

In recent years, attention has been drawn to the TBI risks from playing football, both professionally and as students. In October 2008, a 16-year-old high school football player in New Jersey died after suffering a brain hemorrhage during a game, the fourth high school player to die of a head injury in the United States that year.[66] The New Jersey student had had a concussion during a practice three weeks earlier, but had been cleared by a doctor to return to play. Young brains are especially vulnerable to repeat mild TBIs within a short period of time, and the question of how long young athletes need to recover is controversial. Sports physicians note that athletes of all ages, eager to return to the game, tend to deny symptoms, and it is difficult for doctors to determine when it is safe for them to return.[67]

Similar issues have troubled the National Football League (NFL) in trying to develop a policy on when players may return to the game after a head injury. Several observations have suggested that professional football players may suffer a high rate of brain damage due to repeated head trauma. A study of retired players found a statistical link between multiple concussions and later-life depression. After evidence accumulated that retired

football players had a higher than average risk of dementia, an NFL program to assist these retirees was launched, and dozens more candidates than expected signed up. Another red flag was that when autopsies were done on five retired NFL players who had died before age 51, degenerative brain damage was found similar to that found in boxers with dementia. At a meeting of NFL officials, Troy Vincent, veteran player who is currently executive vice president of football operations for the NFL, was quoted in 2007 as saying that most players don't worry about concussions. He himself had had six documented concussions, he said, but possibly dozens more. "Outside of me being knocked out, asleep, I went back in the game on all the other occasions. And 50 or 60 times, I'm in the huddle, I don't know where I'm at, don't know the call, and I've got a player holding me up. I'm not sure if athletes really know what a concussion is—get some smelling salts and back in the game."[68]

The issue of TBI in athletes is now being taken very seriously. The Boston University School of Medicine's Center for the Study of Traumatic Encephalopathy in 2008 established a Brain Bank to study the brains of deceased individuals who had suffered repeated blows to the head. The majority of the donated brains have come from the families of retired athletes who were exhibiting symptoms. A study of 85 of these brains found that 68 of them showed evidence of chronic traumatic encephalopathy. Fifty of them were former football players, of whom 33 played with the NFL, nine were college football players, and six played football in high school.[69] Notable among the four hockey players was Derek Boogaard, who was known as an "enforcer " for the Minnesota Wild and the New York Rangers. His record after playing 255 games was three goals, 13 assists, and 589 minutes in the penalty box. He died at age 28 from an accidental overdose of alcohol and painkillers.[70]

In 2011, more than 4500 former football players filed a lawsuit against the NFL, claiming that the league had fraudulently concealed the dangers of repeated head trauma. The first evidence of a link between football and brain disease had appeared in the late 1990s. As the evidence grew, the NFL denied any connection. However, in 2013 the league agreed to settle the lawsuit for $765 million without admitting wrongdoing. Negotiations are ongoing: The number of retired players suing the NFL has increased, the number of ailments attributed to repeated TBI has grown, and concern has intensified about the risks to children of playing tackle football.[71,72]

Tertiary Prevention

For any kind of serious injury, the promptness and quality of emergency medical aid play a significant role in whether a victim survives as well as in the extent of permanent disability. Lack of prompt emergency care accounts for the fact that death rates from motor vehicle crashes are higher in rural areas than in more populated ones. The establishment of special trauma centers and the use of helicopters to transport injured patients over long distances have improved the prospects in some locations, but many parts of the country still lack integrated trauma-care programs. Well-trained emergency medical technicians and well-equipped ambulances can make the difference between life and death. There is still a need for research to better understand the biomedical aspects of injury and to devise better treatments.

Conclusion

Injuries are a major cause of death and disability in the United States. They are of particular concern to public health because they disproportionately affect young people, and many injuries are preventable. Fatal injuries are categorized as unintentional—commonly called "accidents"—and intentional, a category that includes homicide and suicide. Poisoning has recently surpassed motor vehicle crashes as the leading cause of injury deaths. Injuries caused by firearms are third. Alcohol is a significant factor in a very high percentage of injuries. The number of deaths caused by injuries is just the tip of the injury pyramid, which shows that for every death there are many injuries resulting in hospitalizations, many more injuries requiring treatment in emergency rooms and physicians' offices, and even more injuries treated at home.

Analysis of injuries provides guidelines for prevention. The analysis involves considerations of the host, agent, and environment and how they may be altered to prevent an injury from occurring (primary prevention), to minimize the damage (secondary prevention), or to prevent resulting disability by providing prompt treatment (tertiary prevention). This kind of analysis was pioneered in the analysis of motor vehicle injuries, which focused not only on the driver (host) but on making the vehicle (agent) safer and on developing safer highways (environment). Tertiary prevention included the provision of ambulances and trauma centers.

Prevention of motor vehicle injuries also includes campaigns to change people's behavior by persuading them, or requiring them by law, to wear seat belts when riding in motor vehicles and to wear helmets when riding on motorcycles. Bicycle helmets, which are underutilized, are also an important safety measure.

The number of poisoning fatalities has increased dramatically over the last decade. Much of the increase is due to misuse of prescription drugs, especially painkillers. Regulatory approaches to reducing poisoning risks must be balanced against evidence that patients suffering from chronic disease have sometimes been denied the relief of appropriate medications.

Due to large numbers of firearms injuries, the United States has higher rates of homicides and childhood suicides than other industrialized nations. The easy availability of guns in the United States contributes to the high death rate from firearms injuries. Some studies have suggested that the presence of a gun in the home increases the risk that a resident will be a victim of homicide or suicide. However, data to support such studies is unreliable because of opposition by the gun lobby to the collection of such data.

Public health has made progress in preventing childhood injuries from falls, drowning, poisoning, and fires and burns. Much of this progress comes from laws requiring safety features such as window guards in apartment buildings, fencing around swimming pools, childproof caps on medicine containers, and fireproofing of children's sleepwear.

Workplace injuries have decreased since the late 19th and early 20th century. In part this is due to the creation of the OSHA, which sets standards, inspects workplaces, and imposes penalties for workplace hazards, and NIOSH, which conducts research on the subject.

Domestic violence, including child abuse and domestic partner violence, is a significant problem in the United States. Surveys sponsored by the CDC and other organizations provide evidence on the prevalence of these problems. The CDC has placed a high priority on prevention and sponsors and conducts research on how to reduce risk factors and enhance protective factors.

Because TBI, in addition to causing deaths, can have serious consequences, including lifelong disability, the federal government has surveillance systems in place to identify such injuries and their risk factors. Young people are especially vulnerable to TBI, because their brains are more easily damaged and take longer to heal than adult brains. Recently football injuries have drawn public health attention. There is evidence that professional football players may suffer degenerative changes to the brain because of repeated blows to the head, putting them at risk of depression and dementia. High school football players are even more vulnerable to serious consequences if they return to the playing field too soon after suffering a concussion.

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Chapter 18

Maternal and Child Health as a Social Problem

KEY TERMS

Congenital anomalies
Contraception
Developmental disabilities
Family planning
Infant mortality rate (IMR)
Immunization
Maternal mortality rates
Prenatal care
Preterm birth
Prematurity
Special Supplemental Nutrition Program for Women, Infants, and Children (WIC)
Sudden infant death syndrome (SIDS)
Supplemental Nutrition Assistance Program (SNAP)

The health of pregnant women and children is traditionally one of the highest priorities of public health. In a society concerned with the welfare of its population, everyone should be guaranteed adequate conditions for the best possible start in life. The fetal and infant stages of development provide the foundations of good health throughout life. There is increasing evidence that conditions in utero and during early life play a powerful role in increasing individuals' susceptibility to the chronic diseases that plague American adults, including high blood pressure, obesity, cardiovascular disease, and diabetes.[1] Moreover, because children are the most vulnerable segment of the population, like canaries in the coal mine, they are the first to suffer from any adverse conditions that affect human health in general.

Children's health first became a public concern in the United States at the end of the 19th century, prompted by alarm at the high infant and child death rates in the summer from diarrheal diseases.[2] Heat, poor sanitation, and lack of refrigeration contributed to heavy microbial contamination of milk, which was sickening poor children. In 1893, New York City established milk stations that provided safe milk. Similar programs soon followed in other cities. The success of the milk programs in improving children's health inspired the formation of voluntary infant welfare societies with the mission of teaching