

# 11. Injuries and Violence

This chapter deals with acute damaging events—motor vehicle crashes, falls, injuries from machinery, drownings, poisonings, gun shots, fires, smoke inhalation, lacerations, head trauma, suffocation, and other intentional or unintentional traumata. Injuries typically involve a transfer of energy to an organism in a quantity or form that the organism is not prepared to receive. The impact is usually sudden, but also may be subliminal and cumulative, as in repetitive movement injuries or radon exposure. **(Also see the section “Reducing Rates of Unintentional Injuries” in Chapter 3.)**

Worldwide, injuries and violence account for 19% of years of lost health (DALYs) in men and 11% in women of all ages. Hardest hit, however, are men and women 5 to 44 years old. Table 11.1 shows “externally caused” deaths as a percentage of total mortality by sex and age.

Men’s death rates from injuries are double to triple those in women for most specific trauma categories. The total estimated numbers of deaths due to intentional and unintentional injuries for all ages were 834,000 in developed regions, compared to 4,250,000 in developing areas. (These are estimated death counts and do not take population sizes into consideration.) These numbers lay to rest the long-held belief that injuries are primarily a problem of the industrialized world (Murray and Lopez, 1996). **(See also Chapters 12 and 13 for further discussion.)**

Two ways of thinking help the pandemic of injuries and violence continue at full throttle. These false assumptions are:

- that such events occur randomly, that they are “accidental”;
- that this is “just the way life is around here”—that it has always been this way and the community has learned to accept it.

Those false assumptions are easily replaced by the following two scientific axioms, which already have saved many thousands of lives in all regions of the world:

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- Trauma and injuries are not “accidents.” They have causes and risk factors. We may not be able to predict the exact time and persons to be involved in any one injury situation, but some useful truths are known about higher risk times, places, and persons. For example, intoxicated persons sustain more injuries than sober ones; the chance of a motorcycle injury becoming fatal is directly proportional to the bike’s speed and the rider’s lack of helmet; medicine bottles with child-proof closures are less likely to be involved in childhood poisonings than open medicine bottles—and the list goes on.

Furthermore, many injuries are intentionally caused (see Table 11.1), and, clearly, these are not accidents, either. In many instances, intentional injuries can be prevented by keeping the aggressor, the weapon, and the victim separated. **(Table 2.1 in Chapter 2 illustrates a broadly applicable epidemiologic strategy, using auto injuries as an example. Chapter 7 offers suggestions for reducing the intensity of intent which lies behind intentional injuries.)**

- “People who do not learn the lessons of the past are forced to re-live it.” But we have learned that the future need not be like the past, as attested by some of the success stories in the battle against diseases.

For example, yellow fever and neonatal tetanus have been eradicated from many places, but this only happened after people believed that they did not have to accept these diseases as part of their geography or culture. People learned that they could help eliminate troubles from their lives—and so they did.

**TABLE 11.1. Mortality due to injuries and violence, reported as a percentage of all deaths within each age and gender subgroup, worldwide, 1990.**

| Age                  | Males         |                      | Females       |                    |
|----------------------|---------------|----------------------|---------------|--------------------|
|                      | Unintentional | Intentional          | Unintentional | Intentional        |
| 0–4                  | 4.6%          | 1.1                  | 3.9%          | 1.3                |
| 5–14                 | 26.6          | 5.4                  | 17.9          | 3.7                |
| 15–29                | 31.9          | 26.9                 | 14.8          | 17.9               |
| 30–44                | 20.8          | 14.8                 | 8.9           | 9.3                |
| 45–59                | 7.8           | 4.4                  | 4.6           | 3.3                |
| 60–69                | 2.9           | 1.7                  | 2.3           | 1.5                |
| 70+                  | 2.0           | 0.9                  | 1.9           | 0.6                |
| Total (in thousands) | (2,137)       | (1,186) <sup>a</sup> | (1,096)       | (665) <sup>a</sup> |

**Source:** Calculated from data in Murray and Lopez, 1996.

<sup>a</sup> Among the intentional deaths, self-inflicted deaths (suicides) were estimated at 456,000 for men (38% of the “Intentional” total), and at 330,000 for women (50% of their “Intentional” total). About 502,000 deaths were attributed to war in 1990. This total includes 211,000 men, 141,000 women, and 150,000 children under age 15 years. Over half—58%—were women and children.

The same can be done for many forms of child and adult injury. Health promoters can start working to reduce risks, increase protections, and lower disability step-by-step. And, like any journey, it will take time. Dramatic reductions in injuries and traumatic deaths can be achieved in the same ways as the conquests of many diseases: after the systematic population study of risk and protective factors, and field trials of the efficacy of intervention programs.

## MOTOR VEHICLE INJURIES

Road traffic collisions were estimated to have caused almost one million deaths worldwide in 1990. Counting both years lost to premature death and years lost from disabilities, the GBD Study estimates a burden of more than 34 million years of healthy life lost (DALYs). Worldwide, motor vehicle accidents are the single largest cause of death and disability due to external causes. Nearly half (45%) of these lost DALYs and 40% of these deaths occur among males 15–44 years old. Motor vehicle deaths are increasing most rapidly in developing nations.

### THE CULTURAL HISTORY OF VEHICLE INJURIES

Nations follow a natural history in the rate and nature of vehicular injuries. It goes something like this. First, motorbikes, trucks, and cars begin to enter the environment; then they increase in numbers; then roadways are improved, going from pathways, to roads, to superhighways; then average speeds and the disparity in speeds increase. The increase in numbers of vehicles per 1,000 km (or miles) of roadways is referred to as a nation's motorization.

Early in the process of motorization, the number of injuries relates more closely to the number of vehicles, rather than to the size of the population. At this stage, political decisions must be made and updated to protect the rights and safety of the unmotorized majority versus the motorized minority. One example is the paving of “speed bumps” on streets where many people live or walk and vehicles go too fast for safety. Speed bumps can be designed to allow different speeds depending on the location. Drivers hate speed bumps, but the lives of many pedestrians and bicyclers can be saved. Another example involves cutting parallel grooves a few centimeters apart across a concrete roadway. This creates a vibration in cars that warns drivers of excess speed or other reasons for caution. As the density of motorization rises, limitations on the nonmotorized population increase, as pedestrians are told to cross the street or road only at marked crosswalks, and bicycle

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and cart traffic is limited to the outside lane of the right-of-way, or even to special lanes separated by lines or barriers from lanes used for motor vehicles.

Roadway traumata are of two types: injuries to persons inside vehicles and injuries to persons outside vehicles (nonmotorized). The relative proportion of these in a given area depends on the number of moving vehicles . . . sometimes. Early in a nation's motorization, most injuries and fatalities occur to people who are walking or riding bicycles, to children and others who run out into streets and roadways, and to people in carts pulled by animals. As more motor vehicles take to the road the frequency of collision between them rises, and the balance of injury shifts more to vehicle occupants. There are well proven procedures which can safeguard each group (Trianca et al., 1988).

The traffic injury epidemic in every nation results from three interacting components: roadways, vehicles, and roadway users (drivers, bikers, walkers). In the past, traffic safety programs focused mainly on getting "bad drivers" off the roads, but actually, the majority of all crashes involve "average drivers." Hence, traffic safety needs to deal with all three factors.

To address each of the three interacting components of traffic injuries, communities should apply the three Es of intervention—Education, Engineering, and Enforcement. For the public, these interventions can be *active*, when a person must do something to be safe (e.g., keep from driving across the median into oncoming traffic or buckle a seat belt); or *passive*, when the safety measure is "built in" (e.g., concrete barriers separating two traffic directions or roll-over bars built into vehicles). Passive interventions usually are far more effective in preventing injuries.

## THE EDUCATIONAL CHALLENGE

It often takes a full generation of experience with "motorization" (widespread use of motor vehicles) for a cultural group to learn to live safely with motor vehicles. The route to safety can be analyzed in terms of four broad stages.

**First**, the community must overcome the fallacious thinking that injuries are "accidents," that they must be accepted rather than prevented (see earlier discussion).

**Second**, there must be intense education of everyone from young children through the elderly—but especially of males prior to ages 15–44—about the proper use of roadways and vehicles and their dangers. Such teaching can take place within families and at child-care centers and schools (elementary, secondary, and technical). Maternal and child health clinics, workplaces, agricultural agents, the police, and the media all can play important roles.

What is to be taught? Respect, even fear, of motor vehicles. How to cross roads safely. How to walk along roadways (at the edge, facing oncoming traffic). Bicycle safety.

What should be taught to drivers? Safe driving skills and attitudes. Obedience of the rules of the road. Limitations of speed. Hazards in roadways. Sharp attention to the road ahead (many crashes occur just after brief lapses in the driver's attention). Proper care of vehicle, especially brakes, steering, lights, tires. When children are passengers, they should sit in the rear seats of cars. When small, they should sit in properly attached safety seats; when larger, they should use seat belts. Children should not ride in the back of open trucks because of danger of falling into the roadway.

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Forjuoh and Li (1996) rate the efficacy, affordability, feasibility, and sustainability of 19 interventions aimed at reducing transport injuries. Educational interventions rank highly on the last three criteria, but do not rank well in terms of efficacy in reducing injuries and deaths. Historically, the introduction of new engineering and better enforcement has proven to be more effective.

Local media, such as town and district radio stations and newspapers, can render an important educational service by reporting traumatic deaths and severe injuries (due to motor vehicles, for example), including the place of crash and name of the victim. Studies of infectious diseases have shown that members of the public who know a person with a given disease (a "case") are more likely to take preventive action (a vaccine). The same principle should operate for trauma, and should increase safe behaviors. People one knows mean much, much more than statistics.

**Third**, communities must improve the quality of drivers of vehicles, be they mopeds, autos, farm trucks, or 18-wheel tractor trailers. Training in operating skills is the simple part, and often the only part formally taught. Riding as a passenger with a careful driver provides a model for how to perform these tasks safely. More important is training in judgment of speeds, distance, times and places for overtaking other vehicles, and the likelihood of having persons entering the roadway. Perhaps most important is learning and practicing rules of the road and driving ethics, as well as exercising emotional control when frustrated or angered. Even persons who are otherwise psychiatrically normal can so identify themselves with the power of a motor vehicle as its driver, that they claim for themselves a driver's "divine right," ignoring the rights of all others. Aggressive driving, in men or women, creates the same dangers. Psychologically speaking, being in a vehicle permits expression of aggression from within a cloak of anonymity (Professor B.J. Campbell, personal communication). Drivers must

accept that their rightful goal is not to subdue or defeat all other vehicles, only to pass through traffic safely. A culture tends to learn driver ethics through 20 to 30 years of painful experience. Can proper teaching and role modeling make this learning happen faster?

**Fourth**, pedestrians also need training, especially in localities where motor vehicle traffic has traditionally been light. Everyone needs to keep children from running out into roadways, and to make sure that children keep their wagons, tricycles, and other wheeled toys from carrying them into danger. **(Also see text on reducing rates of unintentional injuries in the section “From Birth Through Age 4 Years” and in “Screening Checklist from Ages 5 through 14 years in Chapter 3.)** Pedestrian mortality rates in the United States are relatively constant across age decades until age 70, when deaths increase greatly. In the United States 40% of adult pedestrians killed have high blood alcohol levels. People who have been drinking should not walk near traffic. A sober person should accompany them to a safe place to recover. Always, walk on sidewalks or on the side of the road facing oncoming traffic. When walking at dusk or in darkness, always wear light colored reflective clothing. When bicycling, wear light-colored clothing and equip the bike with reflective tape or reflectors. In the rain wear bright yellow (not dark) raincoats.

***A prescription for anyone walking in or near traffic: Remain alert, no daydreaming, no distractions like headphones. Walk defensively. You are responsible for your own safety and survival.***

#### THE ENGINEERING CHALLENGE

The greatest responsibility for containing—or “channeling—the threat of motor vehicles rests with the community. It is the community that builds, repairs (sometimes), and polices the roadways. Proper street and road engineering is the first step. This engineering has developed into an advanced science. Some of its newer techniques are low tech and inexpensive. It is better to build safely from the beginning, rather than to bequeath a blood-hungry infrastructure to future generations. When planning a new road, it is best to set aside a wide right-of-way, perhaps two to three times wider than the initial roadway. Most roads between busy cities need to be widened every 10 years because of increased traffic. This advance planning for space will save much money in the long run. Many expert consultative resources are available at little or no cost from ministries of transportation and international organizations such as WHO, PAHO, and the other Regional Offices.

Road features that limit speed are valuable—speed bumps, turns in the road, an unrepaired surface, all do quite well. Deep holes or ridges in the road surface are harmful, however, because they damage steering mechanisms and may cause cars to swerve and cycles to overturn. Another warning device called speed strips

or rumble strips consists of strips or bands of rough or serrated pavement which create noise and vibration when crossed at too rapid a speed. This can be a warning that a stop sign is ahead or that the vehicle is going off the driving lanes, either to the left or right. Proper installation of warning signs and stop signs, painting lane lines on pavements, and creating turn lanes where traffic patterns require them cost little; their savings in human and property damage are comparatively greater. Head-on collisions—the impact of vehicles moving toward each other—are particularly lethal. Such crashes can be largely prevented by separating opposite traffic directions with barriers, fences, or wide spatial separation (e.g., dual-lane highways). In cities where speeds are less, similar benefits may result from one-way streets.

Other proven safety measures in roadway construction include:

- Make road curves of large radius, rather than small, and bank curves to reduce frequency of vehicles leaving the road.
- Make road shoulders hardened or paved.
- Use surfacing materials that provide good adhesion to vehicle tires to reduce skidding, especially in wet weather.
- Shield bridge abutments and immovable barriers with collapsible “bumpers” that reduce crash impact. A variety of bendable rails and plasticized barrels are produced for this purpose.
- Move poles for power and light well off the shoulders, and remove trees which might make an impact fatal.

A systematic life-saving program for towns and cities is to maintain records of locations of vehicular collisions causing deaths or disability. This includes injuries to people who are on foot or riding bicycles. Keeping track of minor collisions (“fender benders”) may require much work, but they tend to correlate highly with places and times where major losses occur. One or two impacts or collisions might occur anywhere, but when a “spot map” shows larger clusters of incidents, helpful interventions can be made, often cheaply.

Vehicle engineering plays a major role in transport safety. The typical incident involves two crashes: first, the vehicle either hits an “outside” object (such as another vehicle, a post, barrier, wall, or a pedestrian) or it runs off the road; and second, the initial impact throws persons inside the vehicle against the dashboard, steering column, window glass, inner roof, or doors. Doors may swing open, and riders may be ejected outside onto unforgiving surfaces, depending on the speed of the vehicle on impact.

The exterior of the auto or truck can be designed and built to absorb as much shock as possible, thus reducing the crash acceleration of passengers inside. Similarly, the interior design can contribute to safety by cushioning the dashboard, steering wheel, and backs of front seats; constructing the steering column so that it slowly collapses on impact; installing crash-resistant door locks; and, most important of all, installing three-point safety seat belts that restrain both the shoulder and the waist. Such safety belts protect front-seat riders from crashing their heads on the windshield, and also prevent ejection out of the car, which too often has fatal consequences. Properly installed air-bags for riders in the front seats also add to safety, but only when the three-point seat belt is also worn at the same time. Seat belts are much cheaper than air-bags and far more effective as well.

In addition, new engineering changes are seeking to make vehicle exteriors less damaging to cyclists and walkers, by reducing protrusions on the front and sides of the vehicles and shaping the front to deflect the object struck to reduce frontal impact and move the object (or person) away from the wheels (Trinca et al., 1988).

## THE ENFORCEMENT CHALLENGE

Early in a nation's transition to motorization, it is essential for that country to develop, publicize, and teach its population a comprehensive, clearly defined system of laws relating to traffic behaviors of drivers, passengers, bicyclists, and pedestrians.

Enforcing such traffic regulations is an essential community function, which will have substantial effects in terms of lives saved. Consistent enforcement with locally appropriate penalties works on the principle of behavior modification by penalizing violations. Even though perhaps only a small percentage of such violations are initially punished, the effect on the total numbers of such behaviors will be substantial. Social learning principles will spread the effect to non-penalized persons, tending to change their behavior.

### Important Infractions from a Safety Viewpoint

- **Excessive speed for the section of roadway involved.** Higher speeds reduce the chance to avoid collision. They increase the distance it takes to stop. They make accurate steering more difficult. They increase the chance that an impact will be fatal both to those outside and inside the vehicle. Consider that two vehicles approaching one another, each at a speed of only 80 km/h (50 mph), collide with an impact equal to one car crashing into a concrete wall at 160 km/h (100 mph). Head-on collisions at such speed assure the destruction of both vehicles—and usually of the persons within.

- **Carelessness, risk taking, distraction, and attention lapses.** Stop and change drivers when the current driver feels inattentive, road weary, or emotionally upset. Where possible, it is wise to rotate drivers every few hours before fatigue sets in.
- **Impairment of drivers by alcohol or drugs.** This creates the highest risk of impact, crippling injury, and death. Severe penalties such as revocation of driving privileges or time spent in jail are appropriate. The legal definition of intoxication (and penalties) is a blood alcohol level of only 0.08% to 0.10% in most English-speaking nations. While other countries may have different standards, most places have definitions based on observable behavior, such as slurred speech, unsteady gait, odor of breath, slowed reflexes, or impaired thinking. Intoxicated driving is not that frequent in total populations, but because of its virulence, must be eliminated. Scandinavian nations have taken the lead in building zero-tolerance of impaired driving into their laws and culture (Evans, 1991, especially Chapters 7 and 8).

Social pressure and peer group helpfulness are far more effective than the law in keeping people who have been drinking alcohol from driving a vehicle. Media campaigns with the slogan “Friends don’t let friends drive drunk” appear to be effective. Even persons not obviously intoxicated often have their senses, coordination, and judgment impaired just enough for a crash to happen. A group going to a party or event where alcohol will be served often appoints a “designated driver,” who on that occasion will abstain from all alcohol and drive the group home safely. Using a taxicab or obtaining a ride from a fully sober person are other ways to avoid “drinking and driving” a motor vehicle. Even partly intoxicated persons walking along a roadway are at great danger because of their inattention and erratic walking pattern.

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In places where traffic laws are new, largely ignored, or scoffed at, enforcement has a trauma-strewn road ahead of it. There are three specific antidotes to this problem:

- Establish the laws early in the area’s movement into motorization and create a recognition of their practical value in the population.
- Teach schoolchildren and youth the rules of the road.
- Phase in enforcement by punishing the more serious infractions first, such as driving while under the influence of alcohol, reckless driving, speeding more than 30 km/h (or 20 mph) over the posted speed limit, and failure to stop at designated sign posts.

This kind of phase-in of enforcement has not been adequately evaluated in the field, but has the theoretic advantage of “making real” the fact of enforcement. First, it requires only a few arrests to spread the news widely. Second, it does not overwhelm traffic police and magistrates with large numbers of prosecutions. Third, a few arrests for obviously dangerous behaviors are less likely to create a community “backlash” of anger against authorities than many arrests suddenly.

After this level of enforcement becomes accepted as routine, traffic officials can begin enforcing less extreme violations, particularly if they result in a crash. Throughout each stage of the process, *consistency* of enforcement is essential. Later, officers also can begin issuing warning citations to persons with other infractions, such as making illegal turns and driving a vehicle lacking required safety equipment, such as burned out lights, ineffective brakes, or cracked windshields.

In some nations with a long history of motorization, new laws requiring seat belt use by everyone riding in the front seats of cars or trucks were phased in first by passing the law and providing public education, then by a month or two of “warning tickets” (citations), followed by comprehensive enforcement with monetary fines. For defective equipment violations, after the “learning period,” enforcement consisted of issuing an arrest citation that the car owner could eliminate by coming to the police station within five days and showing a traffic officer that the equipment problem had been repaired.

### **CROSS-CUTTING INITIATIVES**

Other strategies for reducing vehicle injuries involve decreasing the number of individual vehicles on the road. Improving public transport systems in cities—bus or rail—and giving residents incentives for using them can be a valuable strategy. Bus and rail travel is not only safer per million passenger miles, it also reduces air pollution and traffic congestion in cities. Singapore, home to far more vehicles than city streets and boulevards could hold safely, pioneered restricting the use of private autos to alternate days, based on the last digit of the license number. Other cities provide remote parking and low cost commuter rail to the city. France has used a different tactic: taxing vehicles according to engine size. Since high speeds require large, high-powered engines, faster cars get taxed more. The result: fewer high-speed cars on the road.

Restrictions on drivers also have proven valuable. Young drivers everywhere are involved in more crashes than older drivers. If persons must be licensed before being allowed to drive (and violations are firmly penalized), delaying the eligible age for receiving a driver’s license will cut crash frequency. Some states in the U.S.A. now have a stepped licensing program: 16-year-olds are eligible to receive a license after passing tests, but they can only drive an automobile if ac-

accompanied by an older licensed driver and can only drive during the day. Driving privileges are then incrementally expanded each six to twelve months. Other states only permit teenage drivers to carry one other teenager as passenger, because having several teenagers in one car has been found to create an especially high risk.

National, state, and provincial governments can help communities to reduce traffic deaths by introducing the vehicle equipment standards detailed below. After a run-in period sufficient for the early majority to obtain the recommended equipment, these standards can be required by law. **(Also see the section “Diffusion of Innovation” in Chapter 12.)**

- Motorcycles and their riders incur far more crashes per 100,000 km than do passengers in four-wheeled vehicles. Therefore, governments should encourage, and later require, drivers and passengers of any two-wheeled motor vehicle capable of going more than 50 km/h (30 mph) to wear safety helmets while riding. Helmets should be able to withstand impacts at the above speed without cracking open. The most frequent cause of death and most costly form of injury while riding motorcycles is head trauma with permanent brain damage. Helmets reduce the risk of fatality by about 28% in serious crashes. The most effective way to increase helmet use is to require wearing helmets by law, and enforcing it (Evans, 1991).
- Require all locally produced or imported cars or trucks to have safety belts installed, especially in front seats. In the United States, all but one state requires front-seat occupants to use seat belts. Three-point, harness type seat belts that restrain both shoulder and waist protect against the “second collision”—when the body hits the car interior after the car has hit an outside barrier or moving car. Shoulder belts protect the face and head. Restraints also keep the person inside the car. Ejections from the vehicle during severe impacts are very often fatal. Combined lap/shoulder belts reduce risk of fatalities to front-seat riders by about 40%, with half of this effect (based on United States national statistics) coming from preventing driver or passengers from being ejected from the vehicle (Evans, 1991, p. 247).
- Smaller children require safety seats having their own restraints and being latched to seat belt anchors, preferably in rear seats. In the United States, all 50 states require that children be restrained in child safety seats or safety belts, depending on their size, or they must ride in the back seats. In a collision, an unrestrained child becomes a missile launched against vehicle windows, struts,

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and metal—often fatally. Areas mandating child safety measures quickly learn their value in lives saved.

- In developing areas many people ride in the backs of open trucks or cling to the sides of buses. Open trucks require protective railings, so standing passengers do not fall out at bumps or turns. Trucks and buses also should have sturdily mounted grab bars to assist people entering and leaving vehicles.

The problems associated with establishing and advancing traffic safety programs in developing nations are complex. Strategies that have worked in highly motorized nations may not be transplanted successfully without major modifications. It should be kept in mind that proven principles work, but not necessarily the details. More recently motorized areas need not reinvent the wheel, however. That would take unnecessary time and unnecessarily lose lives. The ideal is for the developing nation to face its problem early by constituting a panel of advisors combining international and national traffic safety experts, and work out cooperatively a year-by-year plan. The process is thoughtfully and critically described in the 1998 volume edited by the Global Traffic Safety Trust.

### **CARBON MONOXIDE IN VEHICLES**

Carbon monoxide (CO), an odorless, colorless gas, is the leading cause of fatal poisoning in the United States and is similarly serious elsewhere. Carbon monoxide occurs wherever fuels burn. CO poisoning of drivers, passengers, and auto repairmen is always a threat wherever motors are running in an enclosed space without sufficient free flow of outside air. Exhaust systems must be regularly checked for leaks, especially in buses or trucks where people ride in the rear. Of course, children are damaged by lower concentrations of CO than adults.

Early symptoms of carbon monoxide poisoning are drowsiness, dizziness, headache, or nausea. Anyone experiencing any of these common symptoms, should be questioned to eliminate CO exposure. Children arriving at school with these symptoms should have their buses checked. If repairs cannot be done the same day, bus windows should be kept open until the problem is fixed. Truck drivers with these symptoms should keep windows open.

### **LOOKING AHEAD**

Although the overall numbers of injuries may rise in a province or state as the numbers of vehicles increase, the future still looks more encouraging over time. The cultural changes of a motorizing society tend to reduce the burden of

motor vehicle trauma in terms of hundreds of millions of vehicle miles driven. That means that nations become safer over time per unit of travel completed. In the United States between the 1920s and the 1990s, the motor vehicle death rate decreased from about 15 deaths per 100 million vehicle miles to about 2. This suggests that any nation committing itself to highway safety can achieve similar proportional reductions. This can be accomplished in fewer decades, now that research has identified which are the most successful initiatives.

## SUICIDE AND VIOLENCE

Worldwide, there were 786,000 deaths recorded as due to suicide and 563,000 due to violence (homicide) in 1990. According to the Global Burden of Disease Study, an additional 502,000 deaths were attributed to wars (see Table 11.1 for a breakdown of intentional and unintentional deaths). These worldwide figures mask the vast differences that exist in these rates across countries. Given such differences, each country must develop programs tailored to its own circumstances. (The sources consulted for this section were Bennets, 1993; and Murray and Lopez, 1996.)

Why anger emerges, how intense it is, and how it is expressed are tied to a person's cultural and ideological background. Interestingly, countries that have the highest suicide rates tend to have low homicide rates, and the reverse is true elsewhere. The same distinction between suicide-predominant versus homicide-predominant areas is observed among the 50 states of the United States. The social acceptability or degree of disdain toward suicide or homicide not only influences those persons who consider perpetrating the act, but also the validity of reporting. In most nations an unknown fraction of suicides and homicides are recorded as accidental deaths.

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The highest suicide rates among men occur in the former socialist economies, particularly among men aged 30–59 years old. Countries with the highest suicide rates in men are Hungary, Finland, China, and Japan. Established market economies, China, India, and other parts of Asia and the Pacific Islands follow. In most regions, the suicide rate increases with age, with China experiencing an annual rate of 104 per 100,000 for men over age 60.

The picture is very different for women, with suicide being infrequent, except for China, which has the highest rates, especially among young women 15–29 years old (44 per 100,000 in this age group). This compares to 23 per 100,000 in India, and 4 in the established market economies for women in the same

ages. The highest suicide rate for women is 92 per 100,000 for women older than 60 years old in China. Suicide is extremely rare among women in Sub-Saharan Africa, Latin America, and the former socialist nations.

The cost of suicide goes far beyond years of life lost. While worldwide data are unavailable, many industrialized nations find that only about 5% to 15% of suicide attempts are fatal. The remaining 90% or so attempts incur many millions of dollars in medical expenses, and about 5% suffer permanent disabilities. Suicide rates have risen sharply the world over in the last 30 years, even affecting adolescents. However, suicide is still most frequent in the oldest ages. According to the GBD Study, suicide rates will continue to rise until at least 2020.

The ecology of homicide differs greatly from that of suicide. Highest worldwide risks are among men in Sub-Saharan Africa (176,000 deaths in 1990), where homicides outnumber suicides by 13 to 1. Latin American and Caribbean men have the second highest risk of violent death, at 89,000 such deaths in 1990 and a 5.6 to 1 ratio of homicide to suicide. In Africa, women die of assaultive violence 10 times as often as by suicide. These ratios are high because the number of suicides is extremely low. Men aged 15–44 years old are at highest risk for violent death worldwide, while women of all ages are relatively spared from homicide.

The challenge of reducing intentional deaths should consider primary and secondary prevention of aggressive conduct disorders. **(Also see discussion in Chapter 7.)** At the population level—the foundation on which cultural and health changes are built—the “culture of violence” must be systematically dismantled and replaced with tolerance.

***It is at the population level—the foundation on which cultural and health changes are built—where the “culture of violence” must be systematically dismantled and replaced with tolerance.***

War is a health plague built on violence. In 1990 alone, wars were estimated to have caused 502,000 deaths (see footnote in Table 11.1). Although there were no world wars or major international conflagrations during that year, there were local conflicts in Africa and the Middle East. And yet, those 502,000 deaths in 1990 were more than deaths from site-specific cancers (except for lung and stomach), all the inflammatory heart diseases, or HIV/AIDS. Moreover, once permanent disabilities were added to the deaths, wars in 1990 accounted for 20 million lost years of health. And that continues year after year—a horrific epidemic, indeed.

War has been defined as, “Old men seeking power or revenge sending their young men out to kill, and be killed by, other young men.” The GBD Study’s accounting of war deaths belies this view. The 1990 tally was 211,000 men,

141,000 women, and 150,000 children under age 15 years. Clearly, women and children together die far more frequently than men by a ratio of 58% to 42%.

### **Risk Factors**

Data show that suicides outnumber other intentionally inflicted deaths by a 40% margin worldwide. Countries and areas within countries where suicide is a health and social problem, will find the discussion of depressive disorder useful, because that is the prime risk factor for self-inflicted injury. **(Also see the section “Neuropsychiatric Disability” in Chapter 7.)** Other factors that may precipitate suicide are (1) experiencing humiliation or defeat, (2) feeling trapped in a situation the person can neither overcome nor escape, and (3) believing that no close caring person is available who is able and willing to really help. **(Also see relevant text in “Major Problems at Ages 15–24” in Chapter 4.)**

The worldwide annual tally of suicides and homicides is huge—1.8 million in 1990. Nevertheless, small average cities of 100,000 residents might experience only about 15 suicides and 11 homicides in a given year. When incidents are so rare, it is difficult to predict them without labeling too many false positives—citizens who are categorized as “high risk,” but who have no bad outcomes. With this caution held aloft, here are some of the “signs of risk” for suicide:

1. The strongest single predictor is a prior suicide attempt. Anyone who attempts suicide needs serious help, which should continue until the crisis is resolved.
2. Major depression confers an 18-fold lifetime risk over that of the population without any mental disorder.
3. Bipolar disorder confers 24-fold risk.
4. Chronic dysthymia—feeling sad and troubled for years—confers a 17-fold risk.
5. Persons who are currently depressed (suffering from any of the above three conditions), may have a 30-fold increased risk, according to one study (Guze and Robins, 1970).
6. Having overpowering feelings of being alone in the world, such as may occur after an acute life crisis.
7. A history of impulsive, damaging behavior.
8. A family history of suicide (gives patient a role-model).

9. A terminal illness or a disfigurement.
10. Belonging to a socially-alienated, stigmatized group.
11. Being hospitalized for alcoholism (70-fold risk), AIDS (36-fold risk), or renal dialysis (10- to 50-fold risk).
12. Availability of a lethal means of death: guns, poison, large quantities of a potentially lethal prescribed medication. Each culture has its own methods.

Family members, teachers, and health workers dealing with individuals or groups in which suicide risk factors are elevated should take into account the “natural life history” of this cause of death. The stages are as follows:

1. Thinking about death, dying, or reuniting with close persons who are dead.
2. Talking with others about hurting him- or herself and feelings of uselessness, failure, badness, abandonment, hopelessness, helplessness.
3. Making veiled or open threats of suicide.
4. Preparing for death: giving away favorite possessions, giving “final” advice, finishing up unfinished tasks (in the context of other signs). Using various indirect means of saying goodbye.
5. Making suicide plans: this is usually discovered only by asking, perhaps using several different approaches.
6. Attempting suicide; this is always a drastic step that needs treatment.
7. Completing the effort by another attempt.

Knowing the above sequence enables teachers, social workers, or health care providers to observe and inquire—and to help families look for and ask—for these signs and to intervene as early in the sequence as possible. Positive findings are a signal to obtain immediate help to halt and reverse the psycho-behavioral process. **(For further discussion, see the section “Major Health Problems at Ages 15–24” in Chapter 4, the section “Special Issues for Men” in Chapter 5, and Chapter 7.)**