Motor-Vehicle-Related Injuries

Motor-vehicle crashes are the leading cause of injury-related deaths in the United States. In 1997, nearly 42,000 people died on the nation's roads and highways, and another 3.5 million suffered nonfatal injuries. Such crashes are the leading cause of death for Americans ages 1 to 34. However, the number of deaths on our highways has been declining (see figure) because of the tremendous efforts of many groups over the last 30 years, advances in the design of vehicles and roads, laws requiring and regulating the use of life-saving devices such as safety belts, and changes in societal attitudes toward destructive behaviors like drinking and driving.

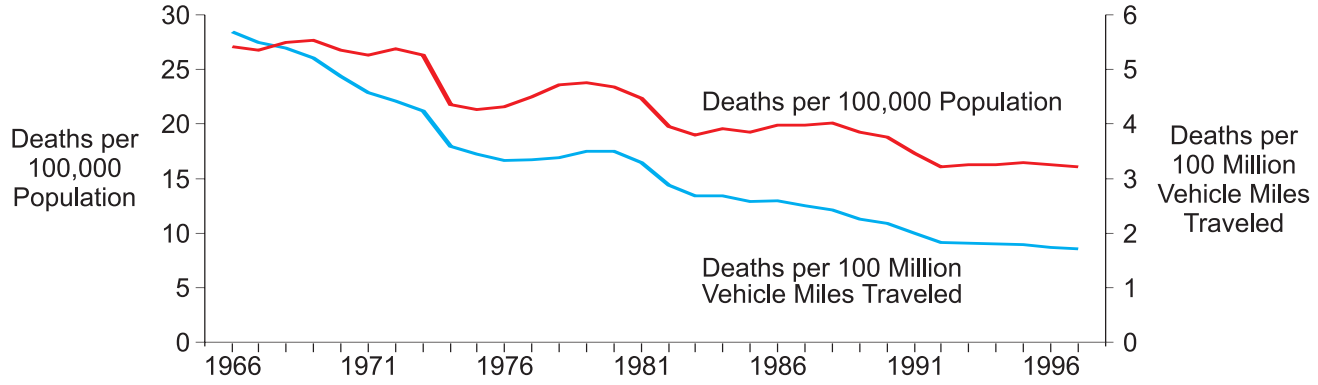
- Seat-belt use increased from 11% in 1981 to 68% in 1997.
- All states now have child car-seat laws, and all but one have adult seat-belt laws.
- In 1988, 60% of young drivers involved in fatal motor-vehicle crashes were not using restraints, but by 1995 the percentage had dropped to 46%. Alcohol was related to 32% of fatal motor-vehicle crashes among young drivers in 1988 and to 22% in 1997.

Alcohol-Impaired Drivers

Driving under the influence (DUI) of alcohol or other drugs is a major risk factor for motor-vehicle crashes. Prevention programs have helped significantly reduce the number of alcohol-related deaths: from 1987 to 1997, alcohol-related motor-vehicle-fatality rates fell 39%. This reduction is due partly to increased public awareness of the dangers of drinking and driving and partly to tougher laws.

Even so, impaired driving remains a major threat to public health and safety. The National Highway Traffic Safety Administration, which monitors traffic crashes nationwide and compiles statistics on impaired drivers, reported that 39% of traffic deaths in 1997 were alcohol-related. In regard to these deaths, the driver, the pedestrian, or the bicyclist had a measurable blood alcohol concentration (BAC).

Motor Vehicle Death Rates* 1966–1997, United States



* per 100,000 population and per 100 million vehicle miles traveled

Illegal drugs, usually marijuana or cocaine, were identified in 18% of drivers involved in fatal crashes. Other drugs (including prescription drugs) involved in traffic deaths were generally combined with alcohol.

The Scope of the Problem

- The number of DUI arrests is only the tip of the iceberg. About 1.4 million DUI arrests are made every year. But according to a 1994 CDC survey, there were over 126 million episodes of DUI that year. Since people younger than 18 were not included in the survey, this figure is probably an underestimate of the problem.
- Many impaired drivers are too young to purchase alcohol legally. It is illegal to sell alcohol to anyone under age 21 in all states. Yet in 1997, 21% of 15- to 20-year-old drivers killed in crashes had been drinking.
- DUI plus inexperience is especially lethal. Even at very low levels of BAC, young people are more likely than older people to be involved in a crash. One explanation is that young drivers are less skilled than older drivers and are more likely to take risks (e.g., driving too fast for road conditions).
- Children are often victims. In 1996, almost 3,000 children less than 15 years old died from motor-vehicle-related injuries; 21% of these deaths involved alcohol. Often the children were riding with a driver who was impaired.
- Most impaired drivers are male. Male drivers killed in crashes are almost twice as likely as female drivers to be legally drunk.
- A previous DUI arrest increases the likelihood of becoming a statistic. Drivers ages 21 to 34 who have been arrested for DUI are more than four times as likely to die in a crash as drivers who have never been arrested. And for drivers age 35 and older, the likelihood jumps to over 11 times that for drivers who have never been arrested.
- Most people convicted of DUI have serious drinking problems. Over 70% of drivers convicted of DUI are heavy frequent drinkers (alcohol abusers) or alcoholics (alcohol dependent).
- Alcohol-related crashes are expensive. In 1997, they cost American taxpayers $29 billion in direct costs and lost earnings.

Working toward a Solution

- NCIPC analyzed data collected from a national telephone survey (the Behavioral Risk Factor Surveillance System) and Mothers Against Drunk Driving (MADD) to see if residents of states with relatively low grades on the 1995 MADD *Rating the States* survey were more likely to report drinking and driving. MADD's grades were used as an indicator of each state's DUI prevention and enforcement climate. Men from states with relatively low MADD grades were more likely to report drinking and driving. However, there was no association between MADD grades and self-reported drinking and driving among women.
- NCIPC is working with the North Carolina Department of Environment, Health, and Natural Resources to evaluate whether mandatory substance-abuse assessment is effective in reducing repeat DUI arrests. The findings will provide North Carolina and other states with recommendations for improving substance-abuse-assessment programs for drivers convicted of DUI.

Highlights of NCIPC-supported research include:

- Researchers reviewed studies on the impact of random alcohol screening on motor-vehicle-related injuries. Their findings indicated that screening reduces the incidence of deaths and nonfatal injuries in the U.S. and Australia. The studies they reviewed also raised questions about how long the effects of random alcohol screening last and the degree of enforcement necessary to achieve them.
- A systematic review was conducted of research on low-blood-alcohol laws targeting young and inexperienced drivers. Researchers concluded that such laws prevent many crashes, injuries, and deaths.
- In Washington State for the years 1989 to 1993, a study was conducted of drivers injured in motor-vehicle crashes reported by the police. Study results showed that alcohol was involved in 43% of such crashes and in 47% of crash-related hospitalizations. For drinking drivers, the average hospital bill per crash was higher than for nondrinking drivers ($18,258 versus $14,181).

- A study conducted by Harvard University found that, although most alcohol-impaired drivers who were fatally injured were not accompanied by adult passengers, about 5% to 10% of fatally injured drivers were accompanied in the vehicle by relatively unimpaired passengers who might have intervened to prevent alcohol-impaired driving.

Older Drivers

Per mile driven, adults age 65 and over have more fatal crashes than drivers in all other age groups except teens. However, compared with other age groups, older people are less likely to have a driver's license and those who are licensed drive fewer miles than other drivers.

Older Americans are concerned about highway safety, making them a promising group for motor-vehicle injury-prevention efforts. Of all age groups, they are the most likely to wear seat belts and the least likely to drink and drive or ride with a drunk driver. Furthermore, many older adults change their driving habits to allow for aging. For example, many stop driving at night because of vision problems or stop driving during rush hour. Some stop driving altogether. Finding acceptable alternative ways to travel for those who no longer drive may be a more important challenge than driving safety.

Little is known about how a driver's skills are affected by aging, chronic medical conditions, and certain prescription drugs. States, which regulate driver's licenses, have tried to address this issue. Several states require more frequent examinations after drivers reach a certain age or are diagnosed with certain medical conditions. But scientific data on the effectiveness of such prevention efforts is limited.

The Scope of the Problem

- Older drivers have a high crash rate per mile driven—3.0 per 100 million vehicle miles traveled. This rate is three times the rate for drivers 30 to 64 years old.
- In the last 10 years, the number of older drivers has increased 50%. This number will continue to rise as the U.S. population ages, which probably means the number of traffic deaths will rise. There are about 35 million people age 65 or over in the U.S. (about 13% of the population). This number will almost double by the year 2030.
- From 1987 to 1997, the number of traffic deaths occurring among people over the age of 70 increased 22%.
- In 1997, almost 6,000 people age 70 or older died of injuries sustained in motor-vehicle accidents.

Working toward a Solution

- NCIPC is participating in a collaborative effort, led by the National Highway Traffic Safety Administration, to update the 1988 report, *Transportation in an Aging Society*, and to host an international conference with a diverse group of experts to develop a national agenda and strategic plan for the safety and mobility of older adults. The anticipated outcome of the conference will be a plan of action to reduce motor-vehicle deaths and injuries among older people.
- A study is being conducted to determine the characteristics of older adults who die while driving a motor vehicle. Traits under study include demographic characteristics (e.g., age, education, medical condition), driving behaviors (e.g., miles driven, driving after dark), and physical functioning (e.g., activities of daily living).
- A study is underway to determine if older drivers pose an excess risk of death or injury to other people. Researchers are using a statewide data base containing 3 years' worth of hospital discharge data and police accident reports for Wisconsin.

Highlights of NCIPC-funded research include:

- A study of older drivers found that those with lower levels of cognitive and visual function drove less and avoided high-risk driving situations.

- Researchers analyzing age-related driver ability and performance problems used a computerized test as well as a road test. They found significant correlations between unsafe driving incidents and deficiencies in attention and in perceptual, cognitive, and psycho-motor abilities.

Children

In 1997 in the U.S., 383,000 children less than 16 years old were injured in traffic incidents, and more than 3,000 were killed. Of these deaths, 70% (2,216) occurred among children who were passengers in a vehicle. Between 1975 and 1996, death rates fell 11% for child passengers in crashes. This reduction could be even greater: 63% of children ages 0 to 14 who were killed in crashes during 1997 were not restrained. NCIPC and its partners are working to educate adults about the importance of properly securing child safety seats, placing children less than 1 year old in rear-facing seats, and placing children in the back seat away from airbags. All states now have child-restraint laws; however, these laws vary widely.

The Scope of the Problem

- Of the children ages 5 to 9 who died in crashes in 1997, 46% were unrestrained. A recent study found that 75% of children weighing 40 to 60 pounds were improperly restrained, and 19% were not restrained at all.
- A 1996 survey found that 85% of infants, 60% of children ages 1 to 4, and 65% of youths ages 5 to 15 were restrained. Whether a child is wearing restraints often depends on the driver. When riding with an unrestrained driver, only one in four young children is restrained.
- Airbags inflate at speeds up to 200 miles per hour and can severely injure or kill a child. For this reason, children age 12 and under should not ride in the front seat of a vehicle equipped with airbags.

- Researchers analyzed data on alcohol-related fatal crashes involving child passengers. They found that the higher the driver's measurable blood alcohol concentration (BAC), the less likely it was that a child in the car had been properly restrained.

Working toward a Solution

- A systematic review of the published literature was conducted to assess the effectiveness of clinical or community-based interventions designed to increase the use of child-restraint devices among children less than 5 years old. Such programs appear to be moderately effective in the short term, but their effects diminish substantially one or more months after the intervention.
- A project based at Harvard University will evaluate efforts to increase the proportion of properly restrained children age 12 and under seated in the rear of motor vehicles. Investigators will organize a community coalition, design risk communications, and provide incentives or rewards to motivate parents and children to adopt these safety behaviors.
- Researchers are developing and evaluating the prototype of a child booster safety system for children from 30 to 60 pounds that will provide head protection, will be easily positioned, and will incorporate a five-point restraint system. If perfected, it will provide the same level of protection as currently provided to children under 40 pounds in child safety seats.

- Researchers at the University of North Carolina at Chapel Hill examined data related to childhood deaths and injuries in motor vehicle crashes following the implementation of a 1985 law mandating that child passengers in the front seat ages 4 to 15 years use a safety belt. They found that children in this age range experienced a 42% decline in deaths and serious injuries after the law was implemented.
- A project at the University of California at Irvine will study factors associated with use or non-use of child safety seats and will evaluate the effectiveness of programs that provide education in addition to fining parents who do not use safety seats compared with programs that only issue fines to parents.

Pedestrians

Pedestrians account for about 13% of motor-vehicle-related deaths in the United States. Most pedestrians injured or killed are young children, older adults, or intoxicated individuals. In 1997, over 5,000 pedestrians were killed and another 77,000 were injured. On average, a pedestrian is killed in a traffic crash every 97 minutes.

The situation is improving. Pedestrian deaths per 100,000 people in the U.S. declined 41% from 1975 to 1997. However, this decline is probably due, at least in part, to a decrease in walking.

The Scope of the Problem

- In 1996, 31% of all children 5 to 9 years old killed in traffic crashes were pedestrians. About 25% of all pedestrians killed in traffic were less than 16 years old. At least 30,000 children are non-fatally injured on U.S. streets each year.
- People age 70 or older accounted for 18% of all pedestrian deaths. The death rate for this age group was 3.9 per 100,000 people—higher than that for any other age group.
- Of all pedestrians age 16 or older killed in nighttime crashes, 55% had BACs of 0.10% or higher. In many states, a person with a BAC this high is considered legally drunk.
- Most pedestrian deaths occurred in urban areas—70% in 1996. However, pedestrian injuries that occur in rural areas are more likely to be fatal because of higher driving speeds and thus greater impact.
- Among people age 65 or older, 37% of pedestrian deaths occurred at intersections; among children less than 5 years old, only 13% of such deaths occurred at intersections.
- Most pedestrian deaths occur at night: in 1996, 25% occurred between 6 p.m. and 9 p.m., 22% between 9 p.m. and midnight, and 11% between midnight and 3 a.m. The highest percentage of daytime pedestrian deaths (13%) occurred between 3 p.m. and 6 p.m.
- Because the problem is complex, single interventions cannot protect all age groups. For example, infants are usually injured in a stroller; toddlers are commonly injured in driveway backovers. Preschoolers and elementary-school-age children in the lower grades are often injured when they dart out between two cars parked on a residential street, particularly when they are playing. Elementary-school-age children in the upper grades and teens are more commonly injured on busy streets. Risk factors for childhood pedestrian injuries include particularly high traffic volume, low income, and younger age.

Working toward a Solution

- A review of the scientific literature was conducted to determine the developmental risk factors for childhood pedestrian injuries and interventions that addressed these risk factors. According to the review, education and training of young children (preschool and lower elementary school age) was of limited value when compared with environmental changes, because it is hard for young children to recognize and respond to traffic hazards.

- A review of data on pedestrian traffic deaths for the United States from 1975 to 1996 showed that the number of childhood pedestrian deaths increased fourfold on Halloween evenings as compared with all other evenings. This finding has direct implications for Halloween safety training and perhaps for Daylight Savings Time.
- Researchers from NCIPC and the Georgia Division of Public Health linked medical examiner and police crash-report data to assess trends in pedestrian death rates for the four core counties of metropolitan Atlanta. They found that while the U.S. pedestrian fatality rate has been steadily falling, the rate for metropolitan Atlanta increased 13% from 1994 to 1998. This report has spurred significant local response.

NCIPC has funded four pedestrian-oriented grants since 1987:

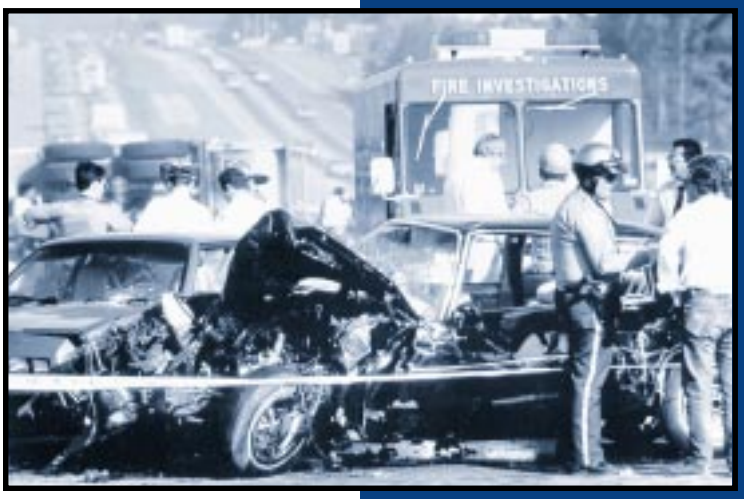
- Expansion of an emergency-department surveillance system to determine to what degree police underreport pedestrian injuries;
- Analysis of risk factors for pedestrian injury among Hispanic children;
- Analysis of the magnitude and nature of pedestrian injuries among children that occur off public roadways (e.g., private driveways, parking lots);
- A project at Johns Hopkins University and the University of Maryland to develop and evaluate a community-based pedestrian safety intervention for urban communities. This project will compare environmental characteristics of neighborhoods in the study area, such as traffic, roadways, and play areas, as well as the social, cognitive, and behavior characteristics of families in these neighborhoods.

General Transportation Safety

Highlights of NCIPC-funded research include:

- Researchers are studying the effectiveness of parents' influence, either through persuasive communication or driving restrictions, in reducing motor-vehicle crashes among teenagers.
- A biomechanics project at the University of Pittsburgh will evaluate wheelchair seating systems in motor vehicles in order to improve occupant protection for people who use wheelchairs while riding in motor vehicles.
- The University of Pittsburgh will determine from fetal death certificates what external events and associated factors accompany fetal deaths caused directly or indirectly by an injury suffered while in the womb. This project is co-funded with the National Highway Traffic Safety Administration.
- The University of California, Berkeley, has designed and is testing a method of gathering reliable information about the costs of head injury (helmeted and not helmeted) related to motorcycle crashes. This system is being developed to provide states with a tool to assess costs of motorcycle-related head injuries when considering policy concerning helmet use.
- Researchers at Harvard are analyzing crash data to determine whether the thresholds at which air bags deploy should be modified to ensure maximum protection at higher speed impacts while not deploying at lower speeds, which can have an injurious effect on drivers, especially women. Raising the deployment threshold of airbags should be considered to increase safety.
- Researchers at the University of Iowa are developing a battery of behavioral tests that will indicate driving capabilities of people with head injuries. These tests, conducted both on- and off-road, will measure attention, memory, and driving function.

- Researchers at Colorado State University are evaluating interventions to lessen anger among young people while driving. Interventions focus on reducing anger and its expression while driving, minimizing risky and aggressive driving, and reducing the number of crashes.



- Researchers at the University of California at Los Angeles are investigating the effects of legislation in California that restricts the time of day when teens can drive and the age of passengers allowed in a minor driver's vehicle. By comparing the incidence of and circumstances associated with crashes of 16- and 17-year-old drivers before and after the law was put into place, researchers will estimate the effects of the law in reducing crashes and injuries.
- A project at the University of Washington will study the association between passenger airbags and passenger death in a vehicle crash and whether the risk of death varies by age of the passenger.
- Researchers at the University of Washington will develop and test a device that can be retrofitted in a standard motor vehicle seat for reducing the whiplash motions of the cervical spine in an occupant involved in a rear-end collision.
- A project at the Johns Hopkins School of Public Health will examine the feasibility of evaluating the protective effects of devices that automatically take up slack in a seatbelt prior to crash forces being transmitted to the occupant of the vehicle.
- One NCIPC-supported project will result in an interactive driving simulator for driver education and training for teenagers. The simulator will be designed for both the novice driver and advanced driver training for new automotive technology, adverse weather conditions, and emergency maneuvering. Using high school students, the program will compare advanced simulator training with conventional driver training.

Robert H. was a Navy Seal before he was badly injured in a car crash. "At the time, I was involved in an aggressive form of military service (scuba diving, jumping from airplanes). We were hit from behind at a stoplight. My back was broken, and my pelvis, femur, scapula, and collarbone. The accident ended a lot of things in my military career; I had to give up being a Seal and rethink what I was going to do. Because of that accident, I was in the hospital 4 or 5 weeks and underwent therapy and rehabilitation for 6 or 7 months. I've had three back operations, including spinal fusion. In the years since the accident, I've suffered recurring injuries and hospitalizations."

Bicycle-Related Injuries

In 1996, more than half a million people were treated in emergency departments for bicycle-related injuries. Seventy-three percent were children and teens under age 21. In 1997, 813 bicyclists—31% of them under age 16—were killed in crashes with motor vehicles, an increase of 7% over the previous year. Only 3% of those killed were wearing helmets.

The Scope of the Problem

- About 67 million Americans ride bicycles; half of them are children or teenagers.
- Children account for one-third of the nation's hours spent riding, one-third of bicycle-related deaths, and two-thirds of bicycle-related injuries. Bicycles are associated with more childhood injuries than any other consumer product except motor vehicles.
- A review of hospital discharge data in Washington State found that nonfatal bicycle injuries among children age 14 and under cost more than $113 million each year.
- Among children age 14 and under, more than 80% of bicycle-related deaths are associated with the bicyclist's behavior—for example, riding into a street without stopping, swerving into traffic that is coming from behind, running a stop sign, or riding against the flow of traffic.
- An estimated 127,000 children and teens (under age 21) and 29,200 adults are treated each year in emergency departments for injuries to the brain, face, eye, or ear sustained while bicycling. Of these, about 33,000 are traumatic brain injuries such as concussions and hemorrhages—almost 80% are sustained by children.
- Head injuries are the leading cause of death in crashes with motor vehicles and the most important determinant of permanent disability. A helmet is the single most effective safety device available to reduce injury to the brain and upper face from bicycle crashes, but relatively few riders wear them.

Scott Terrell/Skagit Valley Herald

- Only 25% of children ages 5 to 14 wear a helmet when riding. The most common complaints from young riders are that helmets are not fashionable or "cool," that their friends don't wear them, and that helmets are uncomfortable (usually too hot).

- The Healthy People 2010 goal is to have 50% of ninth- through twelfth-graders wear bicycle helmets when they ride. The current percentage is close to zero.

Working toward a Solution

- CDC-funded extramural research has demonstrated that wearing a bicycle helmet reduces the risk of head injury by 85% and the risk of traumatic brain injury by 88%.
- Researchers found that if every rider wore a helmet, 500 deaths and 151,000 nonfatal head injuries could be prevented each year. That's more than one death per day and one nonfatal head injury every 4 minutes.
- Some evidence suggests that legislative efforts related to helmet use are more effective than school or community programs alone. By early 1999, 15 states and more than 65 local governments had enacted some form of bicycle-helmet legislation; most pertain to children and adolescents. These laws help increase helmet use among all income groups, but especially among high-income families.
- Measures should be developed to prevent crashes between bicycles and motor vehicles. Strategies include traffic and road engineering (e.g., building speed bumps and creating bike lanes or paths) and educating drivers and riders on the rules of sharing the road safely.
- NCIPC funds bicycle safety programs in 15 communities throughout California, Colorado, Florida, Oklahoma, and Rhode Island. The multifaceted programs coordinate education, helmet giveaways, and other efforts to promote bicycle safety and increased helmet use, especially among children ages 5 to 12. Evaluation conducted halfway through the three-year projects has shown promising results.
  - In some communities, helmet use doubled.
  - Helmet use among all communities was 51%, double the national average and exceeding the Healthy People 2010 objective.
  - Collectively, these programs have provided helmets to more than 36,000 children, supported helmet legislation and ordinances, educated more than 30,000 children at school or in the community, and mounted bicycle safety awareness campaigns that have reached more than 200,000 households.
  - In Florida, where a statewide helmet-use law is in effect, some school policies mandate helmet use. Preliminary data from a 1999 survey by the Florida Bicycle Safety Program found that children in that state are 8 times more likely to wear a helmet while riding to or from school if they live in a county that mandates helmet use.

  These bicycle safety programs have demonstrated the following: a multifaceted approach is more effective than a single intervention; state or local laws increase helmet use; helmet giveaways are most effective when accompanied by safety education and instruction on proper helmet fit; and helmet use is increased by such programs across a wide range of socioeconomic groups, although the programs require several years to reach their maximum potential.

- NCIPC and the National Highway Traffic Safety Administration, U.S. Department of Transportation, co-chair the National Bicycle Safety Network (NBSN), a group of about 20 federal, nonprofit, and advocacy agencies and organizations that support efforts to promote bicycle safety and increase the number of riders to promote physical activity. To share information more effectively among member organizations and the people they serve, NBSN created a web site called the Bike Hub (www.cdc.gov/ncipc/bike). The site provides information on safety programs, legislation, research, and technical aspects of bicycle helmets. In May 1999, NBSN sponsored a national, grassroots youth safety campaign during Bicycle Safety Month. The program culminated in a bike rodeo in front of the U.S. Capitol, with several members of Congress in attendance.

- A project at the University of Washington will develop and evaluate a bicycle helmet promotion intervention in King County, Washington, targeting young adolescents ages 12 to 14. The program will use community-based coalitions to increase bicycle helmet use and reduce bicycle-related head injuries among this group.
- To find clues to the nature and severity of head impacts, small business researchers are using computerized tomography scanning to image the internal structure of a damaged helmet. The outcome of this research will be the development of a common method for assessing helmet damage, which should greatly enhance the ability to define head protection standards for head gear.
- A study at the University of Alabama to determine perceptions of caregivers of children that relate to bicycle safety and their provision of proper safety gear for their children found that caregivers perceive the dangers associated with bicycling but are not aware of available programs and methods that prevent risk. This study resulted in recommendations to improve comprehensive education on bicycle safety for caregivers and also urged health professionals to educate caregivers of children about bicycle safety in routine health care visits.
- Researchers from the University of North Carolina will evaluate a law in British Columbia that requires all cyclists regardless of age to wear helmets. Data from an observational survey of helmet use before the law will be compared with survey data after the law was implemented to determine changes in correct and incorrect helmet use as well as changes in the amount of bicycling.

Three years ago, 42-year-old Bert C. was riding his bicycle one afternoon when he was hit by a drunk driver. Bert was thrown into a telephone pole and was in a coma for months. He is now a quadriplegic and can get around only in a wheelchair. Although his mind is clear, he can speak just a few words that are understandable. His aunt, Sarah D., says, "Bert was the most physically fit person you'd ever want to meet. He was really muscular and biked 100 miles most weeks. He was very independent. Now he can't work anymore and has to depend on a health-care worker and his parents, who have moved in with him. Bert's life is totally ruined because somebody drank too much and got behind the wheel of a car."

Falls Among Older Adults

Falls are the leading cause of injury deaths among persons age 65 and older. Falls are also a major cause of severe nonfatal injuries and a common cause of hospital admissions for traumatic injuries among older adults. In 1994, fall-related injuries cost an estimated $20.2 billion.

Falls account for 87% of all fractures in older adults, with hip fractures being the most serious. Hip fractures result in more hospital admissions than any other injury, and the impact of this type of injury on an individual's quality of life can be devastating. Half of all older persons hospitalized for hip fractures cannot return home or live independently after the injury.

The Scope of the Problem

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- Falls are the leading cause of injury-related deaths among people age 65 and older, and the death rate rises sharply with age. In 1997, nearly 9,000 people age 65 and older died as a result of falls.
- Persons age 75 and older account for 82% of fall-related deaths among older adults.
- The number of fall-related deaths is higher among men than among women, and more whites than blacks die from falls.
- Among older adults, 60% of fatal falls occur in the home, 30% in public places, and 10% in institutions.
- Hip fractures are the most serious fall-related injury. Because the U.S. population is aging, the problem of hip fractures will likely increase substantially over the next four decades. In 2000, the number of hip fractures is expected to reach 300,000, and by 2040, this number should exceed 500,000.
- Women sustain 75% to 80% of all hip fractures. By age 90, one in three women will have sustained a hip fracture.
- White women are at highest risk for falls and hip fractures. Other factors that can increase the risk of falls and related injuries include physical conditions that limit one's ability to perform routine daily activities; weak muscles or problems with balance; taking several medications or using psychoactive medications; environmental hazards such as clutter on floors and stairs, slippery surfaces, and poor lighting; wearing soft, thick-soled shoes; and vision problems.

Working toward a Solution

- Several strategies have been shown to reduce the risk of fall-related injuries and deaths. These include regular exercise to improve strength and balance; review and adjustment of medications by a health care professional to avoid side effects such as dizziness, drowsiness, or disorientation; and home modifications such as installing grab bars, removing tripping hazards, increasing lighting, and installing rails on both sides of stairs.
- Simple clinical screening tests can accurately identify seniors who are most likely to fall.
- In 1998, NCIPC began funding the Center on Aging at San Diego State University to establish the National Resource Center on Aging and Injury. The Center is a joint effort between the University Center on Aging, San Diego State University, and the American Society on Aging, San Francisco. The Resource Center is using cutting edge technology to collect, evaluate, and disseminate information about preventing unintentional injuries among older adults. Fact sheets, formal publications, and the web site (www.olderadultinjury.org) will educate health care professionals, caregivers, and other individuals concerned about reducing injuries among older adults.
- Since 1996, NCIPC has been collaborating with the National Fire Protection Association (NFPA), U.S. Consumer Product Safety Commission (CPSC), and other organizations to develop an educational program to reduce the incidence of fire- and fall-related injuries among older adults. In 1999, *Remembering When: A Fire & Falls Prevention Program for Older Adults* was completed and pilot-tested in Mississippi, Arkansas, and Alaska and in Atlanta and Cleveland. The revised program can be accessed through NFPA's web site (www.nfpa.org).
- Since 1996, NCIPC has funded a project of the University of California at Los Angeles and the Roybal Institute of Gerontology that is developing and testing an intervention to prevent falls and fall-related injuries among older Hispanics living in East Los Angeles.
- NCIPC developed a fall-risk assessment checklist, *Falls at Home*, that uses reliable questions to identify home hazards for falls and produce a fall-risk score. This tool can help public health organizations identify older persons who are most likely to fall and better target interventions. This instrument was field tested by the Allegheny County (Pennsylvania) Health Department as part of their fire and fall prevention program. The validity of the fall-risk score is currently being assessed, based on the field-test data.
- NCIPC developed *A Tool Kit to Prevent Senior Falls*, a comprehensive packet of materials that provides health professionals with current technical information and resources about falls and fall-related injuries. Materials can be incorporated into new or existing programs to reduce falls among older adults. The tool kit contains fact sheets, graphs and charts, current statistics, research findings, and a science-based fall-prevention brochure and home safety checklist. Approximately 4,000 tool kits were distributed in late 1999 to state and local health departments and agencies on aging, health maintenance organizations, and advocacy groups such as the American Association of Retired Persons (AARP).

Highlights from NCIPC-supported research include:

- An article on fall-related deaths and hip fractures was prepared for *Surveillance of Selected Public Health Indicators Affecting Older Adults—United States*, a publication of the *Morbidity and Mortality Weekly Report*.
- Biomechanics researchers developed a dual-stiffness floor to prevent hip fractures among the elderly. Previous CDC-sponsored research found that hip fractures occurred when the person fell directly on the hip, suggesting that the energy absorbed during a fall, and not bone strength, was the main cause of hip fracture. Researchers used this information, along with computer and plastic models of hips and floors, to identify an optimal new flooring material that provides a firm walking surface but yields to sudden impact.

- Researchers analyzed data from the *Study to Assess Falls among the Elderly* (*SAFE*) in South Miami Beach, Florida, to determine whether certain kinds of medications or drug combinations increased the risk of a hip fracture. They found no association between hip fractures and the use of antihypertensives, beta blockers, and vasodilators. A retrospective cohort study of Tennessee nursing-home residents found that residents were more likely to fall if they used tricyclic and other heterocyclic antidepressants and selective serotonin-reuptake inhibitors.
- Analysis of the *SAFE* data found that for healthy older persons, vigorous exercise decreases the risk of fall-related fractures.
- Analysis of the *SAFE* data also showed that older adults' current calcium intake (from their diet or supplements) does *not* appear to be associated with their risk of sustaining a hip fracture.
- CDC funded a randomized clinical trial of seven pairs of nursing homes to evaluate an intervention that used structured, individual assessments of nursing-home residents. These comprehensive assessments were paired with recommendations on environmental and personal safety, wheelchair use, psychotropic drug use, and walking safety. Residents who took part in the intervention were less likely to fall and be injured than other nursing-home residents. These results were particularly significant for those who had three or more falls in the previous year.

Current NCIPC-funded extramural research includes:

- Researchers at Vanderbilt University are conducting a controlled trial to evaluate the effectiveness of the Tennessee Fall Prevention Program (TFPP). An estimated 9,000 residents in 112 Tennessee nursing homes will be included in the study. The study will compare rates of falls that result in serious injuries in facilities that took part in the intervention with those that did not (control facilities). If the TFPP is found to be effective, it would provide a model for feasible, cost-effective injury-prevention programs in long-term care facilities.

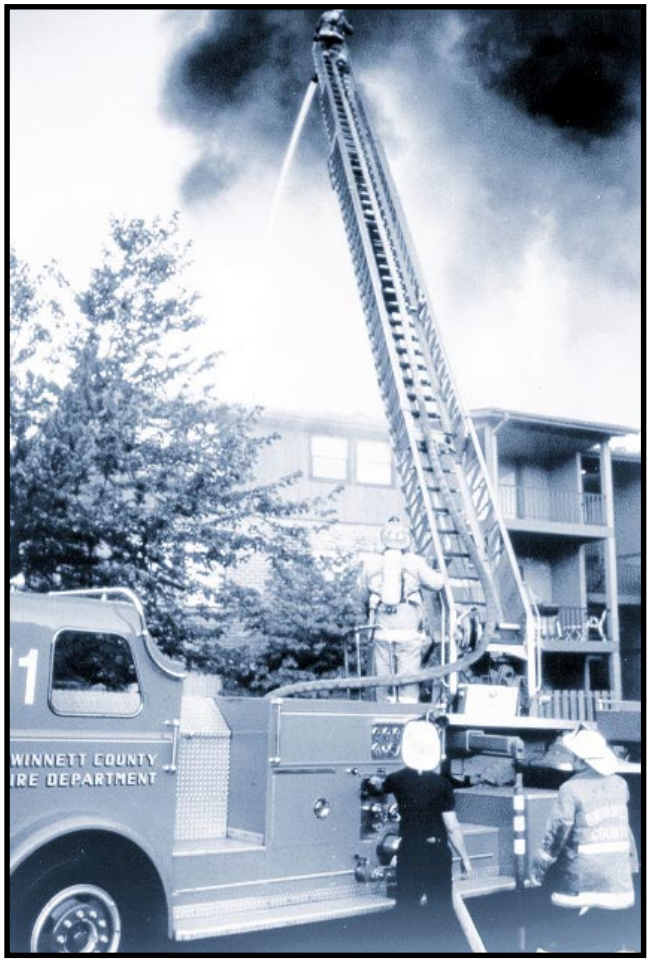
A year ago, 86-year-old Louisa C. fell and broke her left hip. A month later, she broke her other hip. She no longer lives independently or drives. A professional caregiver is on duty in her home around the clock, every day of the year. Her daughter, Bobbi S., says, "Her life has completely changed. She has just lost so much, and she is deeply depressed and unhappy. It's also been extremely costly. Besides the two surgeries she's had and the hospital care, it costs her about $100,000 a year to have a caregiver with her all the time."

Fire-Related Injuries

The United States has the highest death rate from fires of any industrialized country. Fires and burns are the fourth leading cause of unintentional injury death in this country. House fires account for 66% of fire-related injuries and 72% of fire-related deaths. A working smoke alarm can reduce the risk of death in a house fire by about 50%.

The Scope of the Problem

- In 1997, there were about 400,000 house fires in the United States. These fires claimed the lives of 3,360 people. There was a house fire every 78 seconds, and a fire-related death every 2 hours. Property damage caused by fires exceeded $4.6 billion.
- House-fire death rates are highest for children less than 5 years old and for adults older than 65. Older adults are at increased risk of fire death because they are more vulnerable to smoke inhalation and burns and are less likely to recover. Sense impairment (e.g., blindness or hearing loss) may prevent them from noticing a fire or hearing a smoke alarm, and mobility impairment may keep them from escaping a fire.
- Death rates for blacks and Native Americans are more than twice the rate for whites. Black children ages 0 to 14 are three times as likely to die in a house fire as white children.
- The rate of death from house fires is high among the poor, the less educated, and those living in manufactured homes (trailers) built before 1976.
- House-fire deaths occur disproportionately in the Southeast. They also occur disproportionately during December through February, when more than one-third of home fires occur.
- The most common causes of house fires are cooking and heating equipment.
- The most common cause of house-fire deaths is cigarette smoking.
- According to one study, alcohol contributed to 40% of deaths in residential fires.
- Most fire-related deaths occur during fires that start at night while residents are asleep, a time when effective detection and alerting systems are especially important. Working smoke alarms on every habitable floor and outside every sleeping area give residents of a burning home enough warning to escape nearly all types of fires. If a fire occurs in a home, a working smoke alarm can reduce the risk of death by about 50%.



Working toward a Solution

- In 1998, NCIPC funded 14 states (Alabama, Alaska, Georgia, Kansas, Kentucky, Michigan, Minnesota, Mississippi, New York, Oklahoma, Pennsylvania, South Carolina, Virginia, and Washington) to establish smoke-alarm installation and education projects in over 30 high-risk communities. High-risk homes are identified, and target populations include children age 5 and under and adults over 65. Each year, at least two communities with a fire-mortality rate higher than the national and state average are selected. Local health departments work with fire departments and community-based organizations.
- In 1997, NCIPC funded five state health departments (Arkansas, Maine, Maryland, Massachusetts, and North Carolina) to compare different approaches to promoting use of smoke alarms in high-risk households.
- Since 1996, NCIPC has collaborated with the National Fire Protection Association (NFPA), the U.S. Consumer Product Safety Commission, and other organizations to develop an educational program to reduce the incidence of fire- and fall-related injuries among older adults. In 1999, *Remembering When: A Fire & Falls Prevention Program for Older Adults* was completed and pilot-tested in Mississippi, Arkansas, and Alaska, as well as in Atlanta and Cleveland. The revised program has been released and can be accessed through the NFPA (www.nfpa.org/).

Highlights from NCIPC-supported research include:

- A study was conducted to evaluate the long-term working status of smoke alarms distributed to high-risk households in Cherokee County (North Carolina), Oklahoma City, and in eight areas of Minnesota. Researchers found that about 58% of the study homes in Oklahoma and 73% in North Carolina still had at least one working alarm 3 to 4 years after installation. In 76% of households with alarms that did not work, the batteries were missing or disconnected.
- In North Carolina, a study was conducted to compare characteristics of people who die in house fires with characteristics of survivors of similar fires. Those who died were likely to be male (65%), home alone at the time of the blaze (41%), and intoxicated (53%). Those at high risk were children less than 5 years old, adults 65 years old or older, individuals who had a physical or cognitive disability, and individuals impaired by alcohol or drugs. The presence of a working smoke alarm lowered the risk of death for both low- and high-vulnerability groups. The presence of an adult with no physical or cognitive disabilities and unimpaired by alcohol or drugs (i.e., a potential rescuer) reduced the risk of death in the high-vulnerability group, but not in the low-vulnerability group.
- This study also found that 79% of households reported having a smoke alarm, and 52% had more than one. About one-third of respondents with smoke alarms had not checked them in the last 3 months. Homeowners were more likely to have a smoke alarm (83%) than renters (67%) were. Fire extinguishers were present in 52% of households.
- An estimated 94% of U.S. households have at least one smoke alarm. However, about 25% of these do not work because of battery removal (often because of nuisance alarms from cooking, etc.) or because the 9-volt battery was not replaced each year. Through a small-business innovative-research project, NCIPC-funded research led to the development of a smoke alarm with a 10-year lithium battery. These alarms are equipped with a hush button to discourage disassembly or removal because of nuisance alarms. Some of the alarms, now available nationally, are in a case that cannot be opened, in order to deter battery removal or tampering.
- A study was conducted to estimate the proportion of U.S. homes with installed smoke alarms, smoke alarms on the same floor as bedrooms, and fire escape plans. Researchers found that 91% of surveyed households reported at least one installed smoke alarm, and 94% of these respondents reported they had an alarm on the same floor of the home as the sleeping area. Sixty percent of all households had designed or discussed a fire-escape plan at least once; only 17% had actually practiced carrying out such a plan.

- A project at Harvard University evaluated the cost-effectiveness of alternative ways of providing power to smoke alarms (i.e., the one-year battery, ten-year battery, and hard-wired alarms). Smoke alarms, no matter which specific powering system, are an extremely cost-efficient intervention.
- To determine which type of smoke detector (ionization or photoelectric) is more likely to be disabled because of nuisance alarms, a project at the University of Washington will distribute both types of detectors in 600 homes and follow up at 9- and 18-month intervals to see if the smoke detectors are still working or if they have been disabled.

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A home fire starts every 78 seconds in the United States.

John M. lives in a historic section of Oklahoma City, where the homes are old and, in most cases, so are their heating systems. One morning, John answered his door to find a woman accompanied by two firefighters. They asked if he had a smoke alarm. "An ornamental one," John laughingly answered, "that's probably as old as I am." After the group installed a brand new smoke alarm for free, John thanked them and promptly forgot all about it. A few months later, he was awakened very early by a noise he did not recognize. When he opened his bedroom door, John found the house full of smoke and the new smoke alarm in the hallway blaring away. He extinguished the fire in the living room and got his invalid grandmother out of the house safely. If it had not been for the smoke alarm, "We would surely have lost our lives," John said. "The fire chief told me that in 2 more minutes the entire house would have gone up in flames." The smoke alarm in the hallway had done its job.

Playground Injuries

Every year, about 200,000 preschool and elementary-school children are treated in emergency departments after being injured on a playground. That's about one injury every 2½ minutes. Severe injuries—fractures, internal injuries, concussions, dislocations, amputations, and crushes—account for about 35% of all playground injuries. Just under 3% of these injuries require hospitalization.

The Scope of the Problem

- The U.S. Consumer Product Safety Commission has reported a dramatic increase over the past two decades in playground-related injuries to preschool and elementary-school children who are treated in emergency departments. In 1977, there were 93,000 injuries; in 1994, there were 200,000.
- Each year, 17 children die from incidents related to playground equipment. More than half of these deaths are from strangulation; one-quarter to one-third are from falls.
- Playground injuries occur in a variety of settings: schools, public parks, day care centers, and residences. However, 70% are associated with public playground equipment.
- Falls from swings, monkey bars, climbers, and slides are the leading cause of playground injuries.
- Most injuries that children sustain at school occur on the playground.
- In 1995, the cost of playground-related injuries to children under 15 was $1.2 billion.

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Working toward a Solution

NCIPC has funded the University of Northern Iowa's National Program for Playground Safety (NPPS) since the program was established in 1995. NPPS bases its action plan to promote playground safety awareness on a **"SAFE"** framework:

- proper **S**upervision of children on playgrounds
- **A**ge appropriateness of equipment
- proper surfacing to protect from **F**alls
- proper **E**quipment maintenance

NPPS maintains an information clearinghouse accessible by hotline (1-800-544-PLAY) and web site (www.uni.edu/playground). They have developed a safety survey to evaluate playgrounds, and they sponsor a Playground Safety School to promote playground safety and advocacy at the community level. Their research on common surfacing materials has provided valuable information to the U.S. Consumer Product Safety Commission and to the playground industry.

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Andrew K. was 5 years old when he was badly injured while climbing on monkey bars. His mother was at the playground when it happened: "He fell through the bars, which were held together by protruding bolts. He tore a third of his lip off and sliced his chin open; 90 stitches were required to sew it up. One side of his jaw was shoved back to his ear, and he broke two teeth." In the 5 years since his fall, Andrew has had plastic surgery 15 times and has undergone repeated dental work. He will probably need more jaw surgery.

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Water-Related Injuries

The popularity of swimming, boating, and other water sports makes water safety a major public health concern. In 1997, over 4,000 people died from water-related injuries; nearly 25% of these deaths occurred among children less than 15 years old. Among Americans ages 1 to 24, drowning is the second leading cause of death from unintentional injury, and many drownings occur in home swimming pools. In 1992, the U.S. Coast Guard reported about 6,000 recreational boat crashes that resulted in 3,700 injuries and 816 deaths.

The Scope of the Problem

- Drowning is the second leading cause of injury-related death for children ages 1 to 14 and claimed 905 lives in 1997.
- For every child who drowns, another 4 are hospitalized and 16 receive emergency-department care for near-drowning.
- Near-drownings can be costly and severe, resulting in lifelong disability. Emergency-department costs for near-drowning vary from $75,000 for initial treatment to $180,000 a year for long-term care. The lifetime cost of care for a brain-damaged individual can exceed $4.5 million.

Photo courtesy of Protect-A-Child Pool Fence System, Inc. Reprinted with permission.

- In 1997, drowning rates were almost four times greater for males than females in almost every age group.
- The overall drowning rate for blacks is about twice that for whites.
- Many drownings occur in home swimming pools. About 60% of drownings among children less than 5 years old occur in pools; over half the time, the pool is in the child's own backyard.
- Most children who drown in pools were last seen in the home, had been out of sight less than 5 minutes, and were in the care of one or both parents at the time.
- Drownings are 60% more likely to occur in in-ground swimming pools without four-sided fencing than in pools with four-sided fencing.
- For Americans ages 15 to 39, diving-related injuries and deaths are the most common water-related injury. Many such injuries result in spinal-cord damage. Nearly 15% of diving-related deaths occur among people in their 30s.
- Alcohol is involved in about 50% of all deaths associated with water recreation and in 40% to 50% of drownings among teenage boys.

Working toward a Solution

- NCIPC conducted a study to determine the prevalence of proper fencing around outdoor swimming pools among U.S. households. Researchers found that 76% of the households that owned or had access to an outdoor pool apparently had adequate fencing around the pool. If all home pools in the U.S. were properly fenced, an estimated 19% of pool-related drownings among children less than 5 years old might be prevented.
- In *Drowning: New perspectives on intervention and prevention*, NCIPC analyzed data on drowning rates in the U.S. by personal risk factors (age, gender, and race) and by setting (region of the country, recreational boating sites, swimming pools, and water parks). Discussion of preventive measures included supervision of young children, four-sided pool fencing, use of personal flotation devices, knowledge of cardiopulmonary resuscitation (CPR), and legislation regarding alcohol use at water-recreation facilities.
- NCIPC analyzed survey data on alcohol use during recreational boating. Of respondents who operated a motorboat, 31% reported doing so at least once while alcohol-impaired. This was more commonly reported by males, people 25 to 34 years old, people who drove motor vehicles while alcohol-impaired, and those who drove motor vehicles without using safety belts.

Dr. Deborah Mulligan-Smith of Fort Lauderdale, Florida, says, "In my 16 years of pediatric emergency medicine, I've dealt with far too many devastated parents of drowning victims." In one 3-month period, three of her friends lost their toddlers in separate drowning incidents. Supported by an alliance of health and safety groups, Dr. Mulligan-Smith formed a coalition that works to prevent drowning and related injuries, particularly among children. The coalition supports legislation on children's health and safety issues and promotes life-saving training such as CPR, first aid, and swimming lessons. According to Dr. Mulligan-Smith, drowning is "totally preventable—if parents take the time to learn how to prevent these tragedies."