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Achievements in Public Health, 1900-1999 Motor-Vehicle Safety: A 20th Century Public Health Achievement

The reduction of the rate of death attributable to motor-vehicle crashes in the United States represents the successful public health response to a great technologic advance of the 20th century--the motorization of America. Six times as many people drive today as in 1925, and the number of motor vehicles in the country has increased 11-fold since then to approximately 215 million (1). The number of miles traveled in motor vehicles is 10 times higher than in the mid-1920s. Despite this steep increase in motor-vehicle travel, the annual death rate has declined from 18 per 100 million vehicle miles traveled (VMT) in 1925 to 1.7 per 100 million VMT in 1997--a 90% decrease (Figure 1) (1).

Systematic motor-vehicle safety efforts began during the 1960s. In 1960, unintentional injuries caused 93,803 deaths (1); 41% were associated with motor-vehicle crashes. In 1966, after 5 years of continuously increasing motor-vehicle-related fatality rates, the Highway Safety Act created the National Highway Safety Bureau (NHSB), which later became the National Highway Traffic Safety Administration (NHTSA). The systematic approach to motor-vehicle-related injury prevention began with NHSB's first director, Dr. William Haddon (2). Haddon, a public health physician, recognized that standard public health methods and epidemiology could be applied to preventing motor-vehicle-related and other injuries. He defined interactions between host (human), agent (motor vehicle), and environmental (highway) factors before, during, and after crashes resulting in injuries. Tackling problems identified with each factor during each phase of the crash, NHSB initiated a campaign to prevent motor-vehicle-related injuries.

In 1966, passage of the Highway Safety Act and the National Traffic and Motor Vehicle Safety Act authorized the federal government to set and regulate standards for motor vehicles and highways, a mechanism necessary for effective prevention (2,3). Many changes in both vehicle and highway design followed this mandate. Vehicles (agent of injury) were built with new safety features, including head rests, energy-absorbing steering wheels, shatter-resistant windshields, and safety belts (3,4). Roads (environment) were improved by better delineation of curves (edge and center line stripes and reflectors), use of breakaway sign and utility poles, improved illumination, addition of barriers

separating oncoming traffic lanes, and guardrails (4,5). The results were rapid. By 1970, motor-vehicle-related death rates were decreasing by both the public health measure (deaths per 100,000 population) and the traffic safety indicator (deaths per VMT) (Figure 2) (1).

Changes in driver and passenger (host) behavior also have reduced motor-vehicle crashes and injuries. Enactment and enforcement of traffic safety laws, reinforced by public education, have led to safer behavior choices. Examples include enforcement of laws against driving while intoxicated (DWI) and underage drinking, and enforcement of safety-belt, child-safety seat, and motorcycle helmet use laws (5,6).

Government and community recognition of the need for motor-vehicle safety prompted initiation of programs by federal and state governments, academic institutions, community-based organizations, and industry. NHTSA and the Federal Highway Administration within the U.S. Department of Transportation have provided national leadership for traffic and highway safety efforts since the 1960s (2). The National Center for Injury Prevention and Control, established at CDC in 1992, has contributed public health direction (7,8). State and local governments have enacted and enforced laws that affect motor-vehicle and highway safety, driver licensing and testing, vehicle inspections, and traffic regulations (2). Preventing motor-vehicle-related injuries has required collaboration among many professional disciplines (e.g., biomechanics has been essential to vehicle design and highway safety features). Citizen and community-based advocacy groups have played important prevention roles in areas such as drinking and driving and child-occupant protection (6). Consistent with the public/ private partnerships that characterize motor-vehicle safety efforts, NHTSA sponsors "Buckle Up America" week (this year during May 24-31), which focuses on the need to always properly secure children in child-safety seats (additional information is available by telephone, [202] 366-5399, or on the World-Wide Web at http://www.nhtsa.dot.gov).

SPECIFIC PUBLIC HEALTH CONCERNS

High-Risk Populations

Alcohol-impaired drivers. Annual motor-vehicle crash-related fatalities involving alcohol has decreased 39% since 1982, to approximately 16,000; these deaths account for 38.6% of all traffic deaths (9,10). Factors that may have contributed to this decline include increased public awareness of the dangers of drinking and driving; new and tougher state laws; stricter law enforcement; an increase in the minimum legal drinking age; prevention programs that offer alternatives such as safe rides (e.g., taxicabs and public transportation), designated drivers, and responsible alcohol-serving practices; and a decrease in per capita alcohol consumption (5,6).

Young drivers and passengers. Since 1975, motor-vehicle-related fatality rates have decreased 27% for young motor-vehicle occupants (ages 16-20 years). However, in 1997 the death rate was 28.3 per 100,000 population--more than twice that of the U.S. population (13.3 per 100,000 population) (9). Teenaged drivers are more likely than older drivers to speed, run red lights, make illegal turns, ride with an intoxicated driver, and drive after drinking alcohol or using drugs (11). Strategies that have contributed to improved motor-vehicle safety among young drivers include laws restricting purchase of alcohol among underaged youths (6) and some aspects of graduated licensing systems (e.g., nighttime driving restrictions) (12).

Pedestrians. From 1975 to 1997, pedestrian fatality rates decreased 41%, from 4 per 100,000

population in 1975 to 2.3 in 1997 but still account for 13% of motor-vehicle-related deaths (9). Factors that may have reduced pedestrian fatalities include more and better sidewalks, pedestrian paths, playgrounds away from streets, one-way traffic flow, and restricted on-street parking (6).

Occupant-Protection Systems

Safety belts. In response to legislation, highly visible law enforcement, and public education, rates of safety belt use nationwide have increased from approximately 11% in 1981 to 68% in 1997 (8). Safety belt use began to increase following enactment of the first state mandatory-use laws in 1984 (6). All states except New Hampshire now have safety-belt use laws. Primary laws (which allow police to stop vehicles simply because occupants are not wearing safety belts) are more effective than secondary laws (which require that a vehicle be stopped for some other traffic violation) (6,13). The prevalence of safety belt use after enactment of primary laws increases 1.5-4.3 times, and motor-vehicle-related fatality rates decrease 13%-46% (13).

Child-safety and booster seats. All states have passed child passenger protection laws, but these vary widely in age and size requirements and the penalties imposed for noncompliance. Child-restraint use in 1996 was 85% for children aged less than 1 year and 60% for children aged 1-4 years (14). Since 1975, deaths among children aged less than 5 years have decreased 30% to 3.1 per 100,000 population, but rates for age groups 5-15 years have declined by only 11%-13% (9). Child seats are misused by as many as 80% of users (15-17). In addition, parents fail to recognize the need for booster seats for children who are too large for child seats but not large enough to be safely restrained in an adult lap-shoulder belt (18).

21ST CENTURY CHALLENGES

Despite the great success in reducing motor-vehicle-related death rates, motor-vehicle crashes remain the leading cause of injury-related deaths in the United States, accounting for 31% of all such deaths in 1996 (CDC, unpublished data, 1999). Furthermore, motor-vehicle-related injuries led all causes for deaths among persons aged 1-24 years. In 1997, motor-vehicle crashes resulted in 41,967 deaths (16 per 100,000 population), 3.4 million nonfatal injuries (1270 per 100,000 population) (9), and 23.9 million vehicles in crashes; cost estimates are $200 billion (1).

The challenge for the 21st century is to sustain and improve motor-vehicle safety. Future success will require augmentation of the public health approach to 1) expand surveillance to better monitor nonfatal injuries, detect new problems, and set priorities; 2) direct research to emerging and priority problems; 3) implement the most effective programs and policies; and 4) strengthen interagency, multidisciplinary partnerships. Key public health activities will be to

- continue efforts shown to reduce alcohol-impaired driving and related fatalities and injuries.
- promote strategies such as graduated licensing that discourage teenage drinking and other risky driving behaviors such as speeding and encourage safety belt use.
- enhance pedestrian safety, especially for children and the elderly, through engineering solutions that reduce exposure to traffic and permit crossing streets safely and by encouraging safer pedestrian behaviors, such as crossing streets at intersections, and increasing visibility to drivers and driver awareness of pedestrians.
- accommodate the mobility needs of persons aged greater than 65 years--a population that will almost double to 65 million by 2030--through a combination of alternative modes of

transportation (e.g., walking and better public transportation) and development of strategies to reduce driving hazards (6,19).
- encourage the 30% of the population who do not wear safety belts to use them routinely.
- encourage proper use of age-appropriate child-safety seats and booster seats, especially for older children who have outgrown their child seats but are too small for adult lap-shoulder belts.
- conduct biomechanics research to better understand the causes of nonfatal disabling injuries, in particular brain and spinal cord injuries, as a foundation for prevention strategies.
- develop a comprehensive public health surveillance system at the federal, state, and local levels that track fatal and nonfatal motor-vehicle-related injuries and other injuries and diseases (i.e., outpatient and emergency department visits, hospitalizations, disabilities, and deaths) as a basis for setting prevention and research priorities.

Reported by: Div of Unintentional Injury Prevention, National Center for Injury Prevention and Control, CDC.

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Figure 1

FIGURE 1. Motor-vehicle–related deaths per million vehicle miles traveled (VMT) and annual VMT, by year — United States, 1925–1997

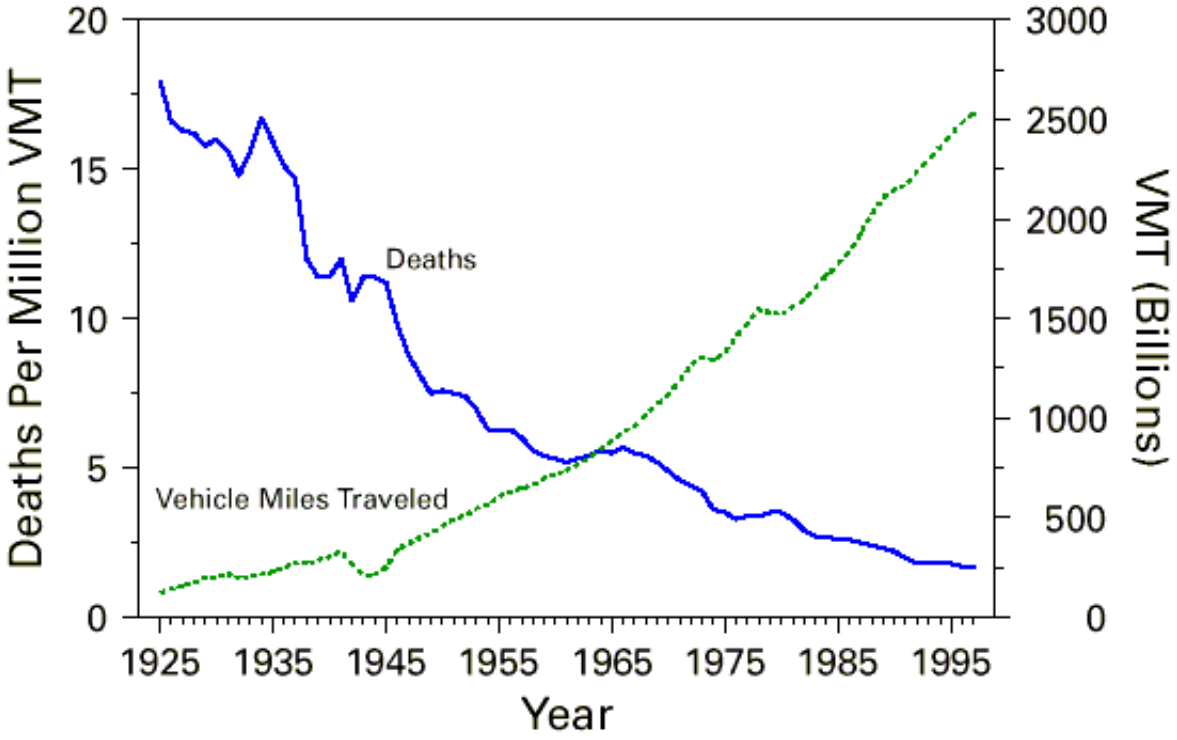

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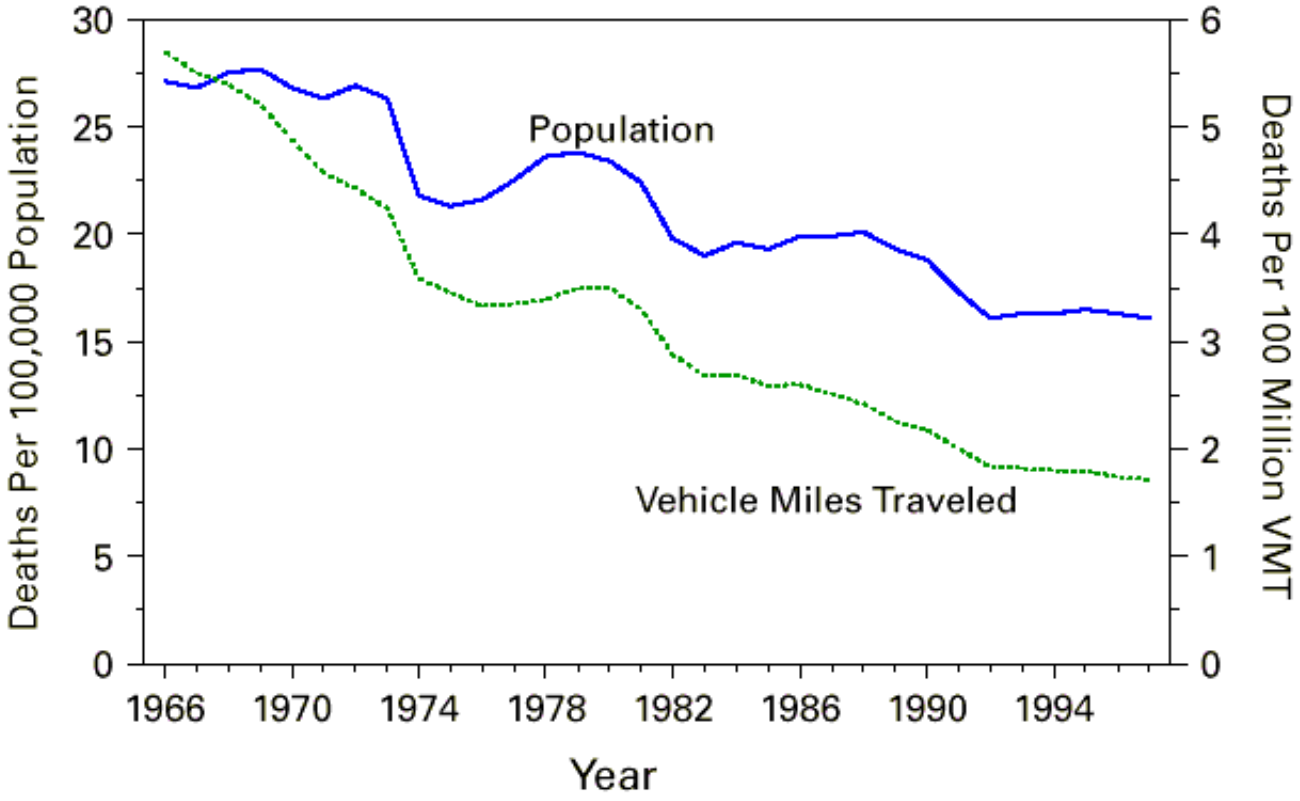
Figure 2

FIGURE 2. Motor-vehicle–related death rates per 100,000 population and per 100 million vehicle miles traveled (VMT), by year — United States, 1966–1997



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