Injury Mortality and Prevention Strategies for Elderly American Indians in the Phoenix Area Indian Health Service

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Introduction

Elder health and injury prevention are major initiatives of the Indian Health Service (IHS). Given the greater absolute number of injuries in younger age groups, there has been less emphasis on injury prevention in the older population. However, injuries are a significant cause of death among elderly American Indians and Alaska Natives — the fourth leading cause of death for persons 55-64 years old, and the seventh leading cause for those ages 65 and older.[1]

Injuries among elderly American Indians pose unique patient management and prevention challenges. Severe injury is often the first step in the decline and deterioration of health in many elders. A severe injury may also limit the mobility, freedom, and autonomy of elders and begin their dependence upon others for their care. This article examines the causes of American Indian elder deaths over a 15 year period in the Phoenix Area of the IHS, and offers guidance for elder American Indian injury prevention.

Methods

Mortality data were obtained from IHS mortality tapes. Each year, the Centers for Disease Control and Prevention's (CDC) National Center for Health Statistics (NCHS) provides IHS with a mortality tape based on death certificate data for all U.S. decedents. IHS then categorizes these data by IHS Area. The data set for this study includes all deaths of American Indians residing in the service area of the Phoenix Area IHS during 1979-1993. Phoenix Area IHS is comprised of a geographical area that includes Nevada, Utah, and portions of Arizona and California. Service population figures for Phoenix Area IHS were obtained from 1980 and 1990 revised census data. In this study, elders were defined as persons age 55 years and older. The U.S. All Races crude mortality rates for 1979-1993 for the grouped ages 55 and over were calculated from statistics obtained from CDC's National Center for Injury Prevention and Control.

International Classification of Diseases, 9th Revision (ICD9) external cause of injury (E-codes) in the data set were used to identify causes of injury-related death (E800-999). Average annual injury-related mortality rates are expressed as the number of deaths per 100,000. Data were analyzed using Epi Info, Version 6.02 statistical software.

Results

There were 282 elder deaths due to injury during the 15-year time interval. The leading causes of injury death for Phoenix Area elders are shown in Table 1 and Figure 1. Motor vehicles accounted for more than one-third (36.8 percent) of all deaths. Phoenix Area elder injury mortality rates exceeded the U.S. All Races rates for every cause except self-inflicted. The total injury mortality rate for Phoenix Area elders was more than double the U.S. All Races elderly rate. Motor vehicle pedestrian and environmental factors mortality rates were exceedingly high for Phoenix Area elders, exceeding the U.S. All Races elder rates by 7.8 and 12.3 times, respectively. The all-injury mortality rate for Phoenix Area male elders was more than 3.5 times higher than that for females. Motor vehicle-related deaths in Phoenix Area elders exceeded the U.S. All Races elder rate by almost four times. Males had a motor vehicle mortality rate that was five times higher than that for females. Motor vehicle-related pedestrian deaths were exceedingly high for Phoenix Area elders, especially males. In contrast to the U.S. All Races rates in which 23.1% of motor vehicle-related deaths were pedestrian, almost half (49.5 percent) of all Phoenix Area elders killed in motor vehicle crashes were pedestrians. In male elders, motor vehicle pedestrian fatalities accounted for an astonishing 59.5% of all motor vehicle-related deaths. In contrast, 15.7% of female motor vehicle-related deaths were pedestrian in nature.

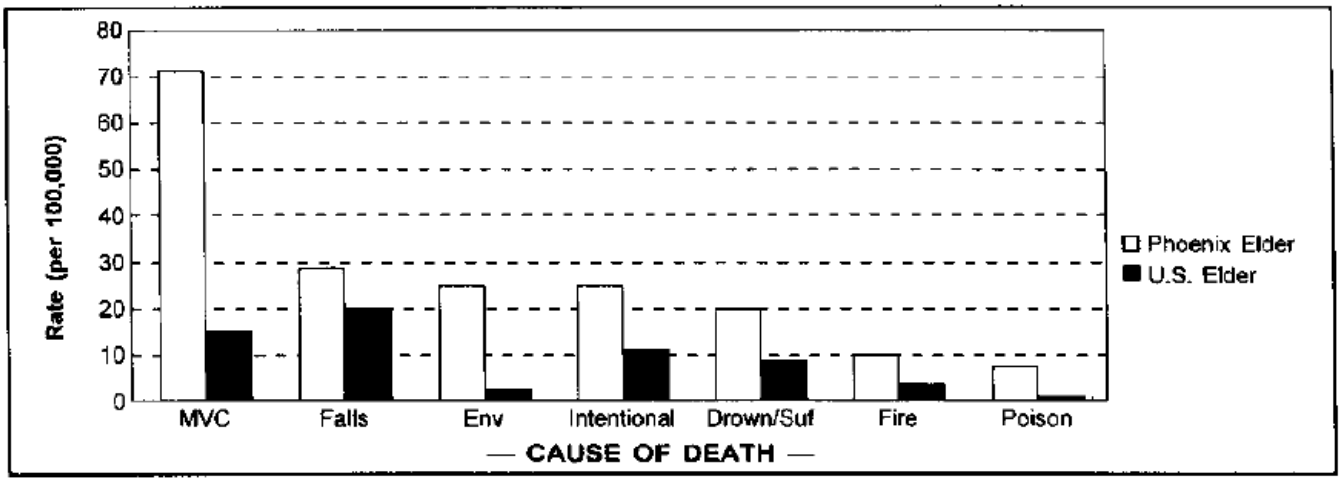
The rate of deaths by fall for Phoenix Area elders was slightly higher than the U.S. All Races Rate (ratio: 1.4:1). Elderly Phoenix Area males had more than twice (2.4 times) the rate of fall-related death as elderly females. In contrast, the U.S. All Races male rate is only 1.1 times higher than the female rate. It was not possible to determine leading causes of falls because most (60 percent)

Table 1. Numbers and crude rates (per 100,000 population) of injury-related death for elder* American Indians by gender in the Phoenix Area IHS, 1979-1993; and Phoenix Area to U.S. All Races crude rate ratios.

	Male		Female		Total		U.S. All Races	
Cause of Injury	No.	Rate	No.	Rate	No.	Rate	Elder Rate	Ratio
Motor Vehicle	82	124.6	19	24.9	101	71.1	19.5	3.6
MV Pedestrian	47	74.1	3	3.9	50	35.2	4.5	7.8
Falls	27	41.0	13	17.1	40	28.2	20.0	1.4
Environmental	32	48.6	3	3.9	35	24.6	2.0	12.3
Intentional	25	38.0	10	13.1	35	24.6	23.2	1.1
Assault	16	24.3	8	10.5	24	16.9	4.9	3.4
Self-Inflicted	9	13.7	2	2.6	11	7.7	18.1	0.4
Drown/Suff.	24	36.5	3	3.9	27	19.0	6.5	2.9
Fire	6	9.1	6	7.9	12	8.5	3.8	2.2
Poisoning	5	7.6	3	3.9	8	5.6	1.4	4.0
All Injuries†	**216**	**328.2**	**66**	**86.6**	**282**	**198.6**	**90.1**	**2.2**

* Elder: persons age 55 years and older
Phoenix Area Rate ÷ U.S. All Races Elder Rate
† Includes listed injury causes as well as other minor injury categories

Figure 1. Causes of injury-related death, Phoenix Area IHS and U.S. All Races elders, 1979-1993.



were coded as E887 "fracture, unspecified cause" and E888 "other and unspecified fall." In order to ascertain this information, improved documentation is needed on vital statistics documents (e.g., death certificates and death registers).

Incredibly, the mortality rate from environmental factors was 12.3 times greater for Phoenix Area elders than U.S. All Races. The majority (91.4 percent) of these deaths were in males. Heat-related deaths occurred in Phoenix, Sacaton, Fort Yuma, and Colorado River Indian Tribes (CRIT) Service Units, which typically have very high summer temperatures. The majority (42.9 percent) of hypothermia deaths occurred in the Whiteriver Service Unit, which typically has cold winters. The remainder occurred in Uintah-Ouray, Schurz, San Carlos, Owyhee, Keams Canyon, and CRIT Service Units, most of which also have cold winters.

The drowning/suffocation rate was almost three times higher for Phoenix Area elders than the U.S. All Races elder rate. Six of the thirteen elder drowning deaths were attributed to swimming pools/quenching tanks; these victims were all males who were residents of the Colorado River, Phoenix, and Sacaton Service Units. The majority (92.9 percent) of suffocations were caused by aspiration of food or other objects; almost three-fourths (72.7 percent) were males.

The poisoning rate for Phoenix Area elders was four times higher than the U.S. All Races Rate. Twice as many males died from poisoning as females. Half of the deaths were attributed to drugs and medicinals, half to other solids and liquids, and one death was due to denatured ethanol.

The primary cause of fire-related death was from residential house fires (83.3 percent). Two deaths (16.7 percent) were attributed to clothing ignition. The Phoenix Area elder fire death rate was more than twice the U.S. All Races elder rate. Male and female elders had similar rates of fire-related death.

Phoenix Area elders had an assault rate that was over

three times higher than the U.S. All Races Rate. However, the mortality rate due to self-inflicted injury was less than half the U.S. All Races Rate. Males had higher rates of both self-inflicted and assault-related death.

Discussion

Mortality rates of Phoenix Area elders exceeded the U.S. All Races Rates in all classes of unintentional injuries. The following discussion highlights successful injury prevention strategies and those that show promise of preventing injuries in the elderly. Emphasis is placed on the injuries for which Phoenix Area elderly are at most risk: motor vehicle-related injuries, falls, and exposure.

Motor Vehicle Occupants. Elderly persons are at greater risk of motor vehicle-related death because of the physiology of aging (e.g., impaired vision, hearing, and mobility to respond to emergent situations) and their poorer survivability following a crash.[2,3,4] Nationally, elders are least likely to drink and drive, more likely to wear seat belts, and drive fewer miles than younger age groups.[2] However, American Indian elders may be at higher risk of motor vehicle occupant death because of low seat belt use, community conditions such as poor roads, inadequate or nonexistent street lighting, and lacking or distant emergency medical services.[5]

Working in partnership with such agencies as the IHS, the National Highway Traffic Safety Administration (NHTSA), and the Bureau of Indian Affairs (BIA), many tribes have implemented successful and promising strategies for reducing motor vehicle-related occupant injuries. Seat belts are a proven strategy estimated to reduce motor vehicle fatalities by 45%-60%.[6] Restraint use is increased by mandated usage coupled with strict enforcement. One example of a successful occupant protection effort is the Navajo Nation, which passed a primary enforcement law in 1988.[7] Within two years, motor vehicle-related hospitalizations declined 28.5%, and within three years, seat belt use rates increased from 14% to 60%.

Motor Vehicle Pedestrians. Elderly persons, especially those over 70 years old, have the highest pedestrian death rates of any age group.[8] Elderly American Indians may be at higher risk of pedestrian death because their communities typically have more rural roads and may lack adequate sidewalks, street lighting, and public transportation. Elders may be more prone to walk because they cannot afford a vehicle, or may have an older or poorly maintained vehicle.

A variety of environmental modifications have proven effective in reducing pedestrian injuries and deaths. For example, in response to a cluster of nighttime pedestrian fatalities on the Fort Apache Indian Reservation in Arizona, the Whiteriver Service Unit implemented a highway lighting project.[9] Although an evaluation of this project is currently in progress, a dramatic decrease in pedestrian injuries has been observed in the project area.[10] Other roadway lighting projects in American Indian communities include those on the Blackfeet Reservation in Montana, the Eastern Band of Cherokee Indians in North Carolina, and the Jicarilla Apache Reservation in Gallup, New Mexico.

Through state highway construction projects, IHS, and/or tribal funding, pedestrian walkways/bike paths have been completed in Sells, Arizona; Fort Belknap, Montana; Fort Totten, North Dakota; and other locations. These improvements provide an alternate to walking on the roadway for pedestrians to travel between housing areas and schools, stores, offices, etc. Other approaches to preventing pedestrian injuries include painting edge lines on roads, and construction of barriers and walkways to provide physical separation of pedestrians from vehicles.[5]

Falls. Phoenix Area elders, especially males, are at high risk for fall-related death. Most falls are due to a combination of physiological and environmental factors.[11] Gait and balance disorders, visual and cognitive impairment, osteoporosis, use of sedatives and hypnotics, and use of multiple medications increase the risk of falls.[12,13] Environmental factors such as dangerous stairs, clutter, loose rugs, slippery floors, and poor lighting are implicated in 18-50 percent of elderly falls in the home.[5,12]

There are many examples of tribal, IHS, and Housing and Urban Development (HUD) initiatives to improve the indoor home environment. These projects typically include installation of grab bars in bathrooms, handrails on steps, use of non-skid mats and rugs, and improvement in room and hall lighting. The majority of these interventions have not been formally evaluated or published.

The IHS Whiteriver Service Unit conducted a case-controlled study of physiological and environmental factors associated with porch step falls on the Fort Apache Reservation in Arizona.[13] Environmental hazards that were associated with falls included steps with shorter tread and width, absence of hand rails, and absence of outdoor lighting and indoor plumbing. Physiological factors were not associated with these falls. Most victims of falls lived in Housing Improvement Program (HIP) or private homes which were not subject to uniform porch step construction. This Service Unit is currently pursuing porch step improvement as an intervention strategy.

Fatalities and complications from injury increase in persons rescued more than one hour after being injured.[15] Elderly people who fall often have difficulty getting up and getting help.[5] Floor-level emergency alarms or personal emergency "beepers" provided to high-risk elderly people allow them to call for help. A high fall death rate on the Cherokee Reservation in North Carolina resulted in distribution of personal emergency notification "beepers" to high-risk elderly.[14] When "beepers" are activated, the local IHS hospital is notified. However, consideration should be given to the cost of starting such a system, monthly fees, and whether local service is readily available.

A comprehensive fall intervention strategy would combine primary prevention, clinical assessment to identify high-risk individuals, and targeting of appropriate physiological and environmental interventions. This approach requires

collaboration and case referral between primary care providers and environmental health professionals, community health representatives, and health educators for home visits. This strategy was used in a non-reservation community to target interventions appropriate to elderly with given risk factors.[15] Interventions included medication adjustment, behavioral (health) education, and exercise programs. In homes, safety equipment was installed and environmental hazards were removed. Within one year, the case group fall rate had decreased significantly ($p < .04$).

Environmental Factors. Surprisingly, the third leading cause of injury death in Phoenix Area elders was exposure. The typical victim was a male who died of hypothermia. Elderly are more susceptible to cold because of impaired thermoregulation.[16] The association of alcohol consumption with hypothermia was not available in the database. However, one study observed that American Indians living in New Mexico had a hypothermia rate 30 times greater than non-Indian residents.[17] Of these deaths, most (86 percent) were male, most of those tested for blood alcohol levels (BACs) were intoxicated (BAC > 0.10 mg/dL), and the highest death rates were in persons 55-64 years old. The authors concluded that victims had died while traveling off of dry reservations to obtain alcohol. In response to a large numbers of pedestrians killed, and persons dying from hypothermia in McKinley County, New Mexico, intoxicated pedestrians are picked up and taken to an alcohol detoxification center in Gallup for 48 hours.[18] This reduces the risk of pedestrian as well as hypothermia death.

The elderly may live in homes that are too cold or too hot because they cannot afford to pay utility bills for heating or cooling.[16,19] General guidelines for preventing elderly hypothermia include improving room heating, increasing clothing worn during the day and at night (e.g., hat, long underwear, and mittens), and using additional dry, warm blankets at night.[16,19]

Fire and Flame. Efforts in preventing elder fire/flame-related deaths should focus on the home environment. Smoke detectors are "potentially the most cost-effective tool we have for reducing deaths from fires."[20] A smoke detector can reduce the risk of residential fire death by 40% or more.[21] However, a majority of homes on the Spirit Lake Sioux Reservation in North Dakota (formerly Devils Lake Sioux) lacked adequate numbers of smoke detectors to meet minimum National Fire Protection Association (NFPA) standards.[22] On that reservation, as well the Fort McDowell Reservation in Arizona, in those homes that had smoke detectors, a majority (primarily ionization-type) were disconnected due to nuisance alarms, usually from cooking and bathroom steam.[22,23] To overcome the nuisance alarm problem, ionization detectors should be installed at least 20 feet from the stove and 10 feet from the bathroom door.[22] If this separation is not possible, photoelectric alarms, which are less sensitive to cooking vapors, are recommended.

A coalition on the Cherokee Indian Reservation in North Carolina used a combination of environmental modifications to address home fire-related injuries.[24] Smoke detectors were installed, rapid-burning stair paneling was replaced with sheet rock, and fire extinguishers were provided. Because homes were typically two-story with only one exit door, temporary fire escape ladders were provided until permanent secondary fire exits could be constructed. Within five years, fire-related injuries had decreased by 26%.

Study Limitations

The IHS mortality tapes provide only general information about injury events, and, for injuries such as falls and environment-related, lack detail needed for developing specific local interventions. Underestimation of census figures, by as much as 12.5%,[25] might increase the magnitude of injury rates calculated. However, the rates presented in this article are probably underestimated because of 1) miscoding of American Indians as other races, which in the Phoenix Area is estimated at 4.4 percent[26] (in some Areas, miscoding is as high as 30 percent), and 2) failure to code a large percentage of injuries as the cause of death in elderly persons.[27] For example, elderly deaths actually due to injury may be coded in vital statistics as deaths from pneumonia or heart failure.

Recommendations

Phoenix Area elderly suffer high rates of injury death. Given limited resources, effort should be concentrated on those causes of injury for which elders are at the highest risk of death. In the Phoenix Area, these are motor vehicle-related, falls, and environmental factors. Because elderly injuries have an important physiological as well as environmental component, successful prevention requires the collaboration of environmental health professionals as well as primary care providers, social services, health educators, and other community health professionals.

This study emphasizes the need for:

- Improvement of provider coding of causative information related to injuries, especially falls;
- Local severe injury surveillance, which is routinely completed by environmental health staff at some service units. Local data collection reveals details about the nature of injury that are lacking in vital statistics data;
- Further study to determine whether exposure deaths are due to lack of transportation or lack of adequate shelter (heating or cooling).

Conclusions

As public health officials, we have developed appropriate anticipatory guidelines for newborns, infants, teens, and young adults. Based upon sound epidemiological data, as well as proven intervention strategies, we can also produce guidance to assist our elders in living full and complete lives without premature death or disability due to a predictable and consequently preventable injury.

We know enough to act. Readers of this article should determine the best way to impart this information to your patients or clients. Table 2 identifies simple strategies to reduce this burden of trauma on our most senior citizens. Second, reach out beyond your patient or client to the community. Can your voice as a public health advocate assist a community coalition in ensuring that every elder's home is protected by a functioning smoke detector, for example?

Our elders have given a lot to us. This is a cause worth our investment in time and energy.

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Table 2. Simple strategies to reduce elderly injury deaths.

Motor vehicle
- Use of seat belts
- Safe pedestrian walkways and roadway lighting
- Protective custody/safe (sober) rides

Falls
- Home modifications for elders with reduced mobility
- Medication review and modification
- Exercise programs
- Hormone therapy to prevent osteoporosis

Environmental factors
- Home visitation in extreme temperature periods
- Community shelter and transportation service
- Adequate heating and cooling of homes

Fire
- Working smoke detector in home

Poisoning
- Medication review during clinical visits
- Prescription counseling with relatives
- Proper labeling of medications, use of original containers
- Removal and safe disposal of old medication

Assault
- Effective tracking and referral of victims and high-risk individuals
- Home visitation, 911 emergency service
- Community safe house

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