

Serious and Fatal Fall Injuries in Alaska, 1991-2000  
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**Abstract**

During the years 1991 through 2000, there were 13,705 fall injuries recorded in the Alaska Trauma Registry, 166 of which were fatal. The Alaska Bureau of Vital Statistics reported 18 additional fall deaths without hospital involvement during the study period; the total number of hospitalized and fatal fall injuries in Alaska from 1991-2000 was 13,723. Rates were about the same for males (230 per 100,000) as for females (224 per 100,000) overall, but varied between the sexes when age was considered. Alaska Natives/American Indians were over 2 times more likely to injure themselves by falling (396 per 100,000) than non-Natives (182 per 100,000); but at the same time, rural Alaskans were at greater risk for fall injuries than urban Alaskans. The estimated cost of hospitalization alone due to falls in Alaska during the study period was \$157,619,000 or \$15,761,900 per year.

**Methods**

Data from the Alaska Trauma Registry (ATR) and the Alaska Bureau of Vital Statistics (ABVS) were reviewed for a 10-year period (1991-2000). Trauma Registry data were obtained from all 24 acute care hospitals in Alaska and were abstracted from hospital medical records during hospitalization and after patient discharge. There are up to 220 data elements, which include information on patient demographics, circumstances of injury, pre-hospital and in-hospital response times and treatment, severity of injury, diagnosis, length of hospital stay, hospital charges, and discharge condition. Every record also includes a narrative describing the injury event. Data are entered into computers and a subset of the data is transferred to the System Trauma Registry for injury prevention and trauma care research. All hospital injury admissions are included in the ATR. The ATR is maintained within the Alaska Department of Health and Social Services, Section of Community Health and Emergency Medical Services (CHEMS).

For this study ATR data included all fall injury patients who were admitted to a hospital, transferred to another acute care hospital, or declared dead in the Emergency Department. Data elements included in this study were: demographics (age, sex, ethnicity, geographic region of residence); month and year injury occurred; Abbreviated Injury Scale (AIS); type of injury; body part injured; mechanism of injury; injury place; cost; length of hospital stay; and type of payer.

Data on trauma victims who died without any hospital involvement were obtained from the Alaska Bureau of Vital Statistics. As required by law, the ABVS maintains records of all Alaskan deaths and obtains information via the death certificate.

ICD-9 and ICD-9-CM Codes used to identify fall cases were E833.0-835.9, E843.0-843.9, and E880-888. ICD-10 Codes W00-W08 and W10-W19 were used to identify the out of hospital fall deaths recorded in Vital Statistics for 1999 and 2000.

The term 'urban' in this study refers to Alaskan residents of Anchorage, Fairbanks North Star Borough, and the City and Borough of Juneau; the term 'rural' refers to Alaskans residing in all other parts of Alaska, including: the Aleutian/Pribilof region, Bristol Bay, Copper River, Kenai Peninsula, Kodiak, Matanuska-Susitna Valley, North Slope Borough, Northwest Arctic Borough, Norton Sound Borough, Prince William Sound, Rural Interior, Southeast Alaska (excluding the City and Borough of Juneau), and the Yukon-Kuskokwim Delta.

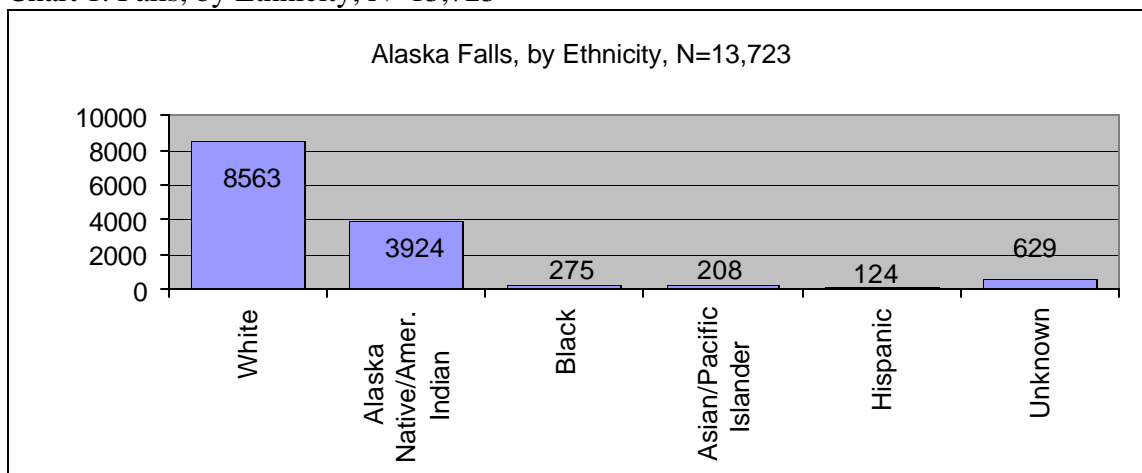
## **Results**

Over the 10-year study period, there were 13,723 fatal and serious non-fatal fall injuries, averaging 1,372 per year. Fall rates rose during the study period from 212 per 100,000 in 1991 to 261 per 100,000 in 2000.

## **Demographics**

In the study population there were 7,253 males (52.9%) and 6,466 females (47.1%), plus 4 with sex unrecorded. The fall rate for females was 224 per 100,000, and the rate for males was 230 per 100,000. Chart 1 shows that there were more fall injuries among the non-Native population of Alaska, however, the injury rate was over twice as high among Alaska Natives/American Indians at 396 per 100,000 than was the injury rate among the non-Native population of Alaska (182 per 100,000). Race was listed as 'unknown' in 629 cases (4.6%) in the ATR data.

Chart 1. Falls, by Ethnicity, N=13,723



There were more falls among urban Alaska residents than Alaskans living in rural areas (Table 1), however the highest rates occurred in the rural regions such as Rural Interior (707 per 100,000) and Northwest Arctic (691 per 100,000).

Table 1. Falls, By Region, N=13,723

<b>Injury Region</b>	<b>Rural Urban</b>	<b>Number</b>	<b>Rate per 100,000</b>
Rural Interior	Rural	515	707
Northwest Arctic	Rural	236	691
Bristol Bay	Rural	261	675
Yukon-Kuskokwim	Rural	698	614
Prince William Sound/Copper River	Rural	293	568
Norton Sound	Rural	257	558
North Slope Borough	Rural	182	500
Aleutian/Pribilof	Rural	165	428
Kenai Peninsula	Rural	977	405
Municipality of Anchorage	Urban	4,998	389
Southeast Alaska (excluding City & Borough of Juneau)	Rural	1,686	384
Matanuska-Susitna Borough	Rural	1,038	382
Kodiak	Rural	261	376
Fairbanks North Star Borough	Urban	1,460	353
City & Borough of Juneau	Urban	678	233
Unknown (ATR)		18	N/A

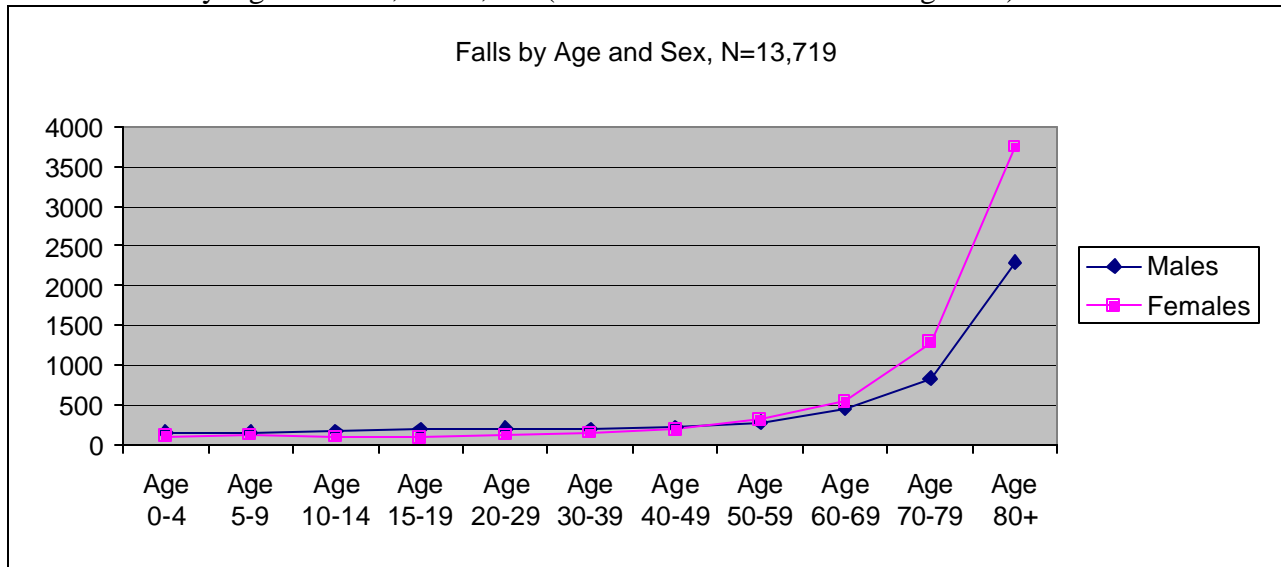
Rural residency and the Alaska Native population are closely correlated in Alaska. The percent of the population that is Alaska Native can vary from between under 10% in Anchorage to over 80% in the Northwest Arctic Borough. Consequently, it is difficult to separate out the influence of each.

The trend toward increased fall injuries in older Alaskans is seen in the higher rates for the 60 and older age groups (Table 2). Rates ranged from 124 per 100,000 in the 0-4 age group to 3,179 per 100,000 in the 80+ age group. The rate of fall injuries steadily increased with age, with the most pronounced increases between the 60-69 age group and the 70-79 age group - a 129% increase. Males had higher rates than females in the teen and young adult years; however, from ages 50-59 on, female rates surpassed male rates (Chart 2).

Table 2. Falls by Age, N=13,723

Age	Total Falls	Rate per 100,000	Male Total Falls	Male Rate per 100,000	Female Total Falls	Female Rate per 100,000
0-4	668	124	403	146	264	100
5-9	740	133	419	147	320	118
10-14	673	128	443	163	230	90
15-19	600	138	440	194	160	77
20-29	1,269	156	851	196	418	111
30-39	1,930	168	1,155	192	775	141
40-49	2,075	201	1,191	218	884	183
50-59	1,550	288	786	270	764	310
60-69	1,288	490	614	451	674	532
70-79	1,459	1,070	532	826	926	1,287
80+	1,471	3,179	419	2,294	1,051	3,752

Chart 2. Falls by Age and Sex, N+13,719 (There were four unrecorded gender)



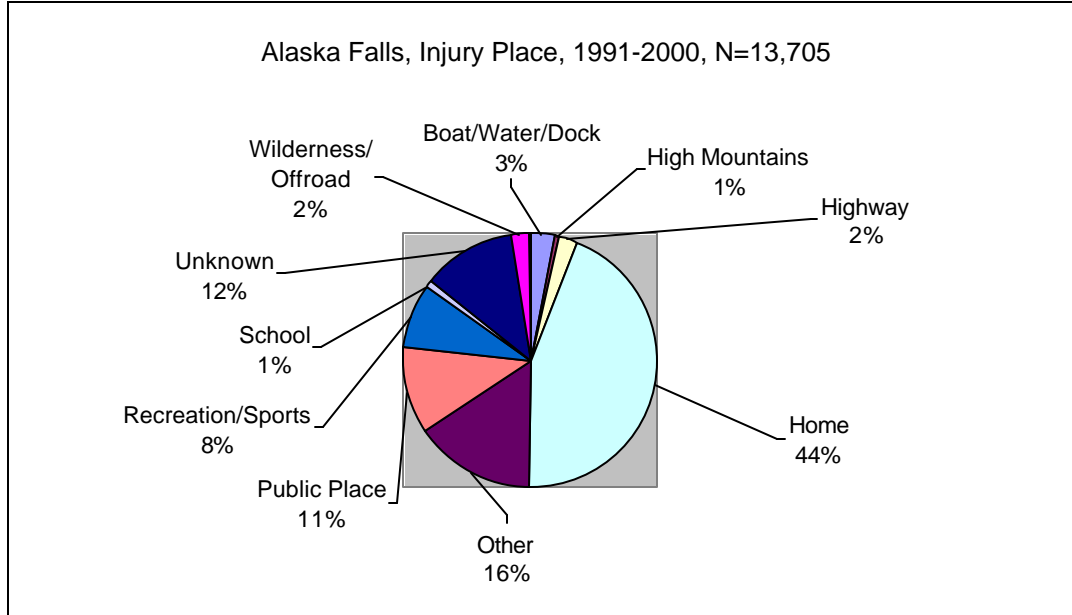
### Month of Injury

Alaska's fall injuries and deaths peaked slightly in March, but remained fairly consistent throughout the year. The fact that falls did not increase in the winter months (November-February) as might have been expected to occur given Alaska's often icy and snowy winter climate conditions, is consistent with the finding that falls were more common in the home.

### Place of Injury

The place where falls occurred is recorded only for the Trauma Registry records (i.e. excludes the 18 out-of-hospital injury deaths). Most of the falls occurred in or around the home (6,017) or in a public place (1,512), (Chart 3). Alaskans rely on a variety of transportation methods to travel throughout the state; two of the most common methods are air and water transport. There were 222 falls either in or around watercraft and 66 falls in or around aircraft.

Chart 3. Falls, Place of Injury, N=13,705 (“Other” includes Mine/Quarry, Oil/Field/Rig, Airplane/Airport)



**Types of Falls, Types of Injury, Injury Severity, Body Part Injured, Traumatic Brain Injury, Days Hospitalized, Alcohol Involvement**

Among the 13,705 fall injuries recorded in the Alaska Trauma Registry, slipping/tripping/stumbling caused 36.7% of the falls resulting in admission to the hospital (Table 3). The majority of hospitalized falls (75%) resulted in fractures (Table 4), and most of the fractures were to lower extremities (6,270; Table 5). Most hospitalized fall injuries (88%) were rated either moderate in severity (7,947; AIS 2) or serious (4,041; AIS 3) (Table 6), however 166 (1.2%) of the hospitalized fall injuries were ultimately fatal.

Forty-four percent (44%) of the injured were admitted to a hospital for only one or two days, although 5% of the injured remained in the hospital over 15 days. There were 1,803 (13.2%) fall patients with alcohol involvement documented in their medical records.

Among all fall injuries in the study (13,705 hospitalized injuries and 18 scene deaths), there were 1,547 (11.3%) fatal and non-fatal falls that resulted in traumatic brain injuries. However, 54 (29%) of the fall fatalities were due to a traumatic brain injury.

Table 3. Falls, Types, N=13,705

<b>Type of Fall</b>	<b>Number</b>	<b>Percent</b>
Slipping/Tripping/Stumbling	5027	36.7
Stairs/Steps	1429	10.4
Sports	1075	7.8
One Level to Another	979	7.1
From Furniture	775	5.6
From Building/Structure	755	5.5
Ladders	695	5.0
From Playground Equipment	331	2.4
Into Hole	142	1.0
From Cliff	120	.9
Other Fall*	2377	17.3

\*Ecodes: 884.9, 885.9, 886.9, 888.9. Examples from the ATR Narrative include: Fell, Fell During Seizure, Fell at Home, Fell Walking, Fell After Being Pushed, etc.

Table 4. Falls, Type of Injury, N=13,705

<b>Type of Injury</b>	<b>Number</b>	<b>Percent</b>
Fracture	10,294	75.1
Concussion/intracranial	813	5.9
Contusion	523	3.8
Sprain	518	3.8
Open Wound	358	2.6
Dislocation	242	1.8
Internal Injury	86	.6
Other*	871	6.4

\*Nerve injuries, lacerations, unspecified, or unknown injuries

Table 5. Falls, Type of Fracture, N=10,294

<b>Type of Fracture</b>	<b>Number</b>	<b>Percent</b>
Ankle/Foot	2796	27.2
Arm/Hand/Finger/Wrist	2267	22.0
Hip	1945	18.9
Tibia and/or Fibula	1014	9.9
Back	582	5.7
Femur	515	5.0
Skull	330	3.2
Rib (s)	240	2.3
Other	605	5.9

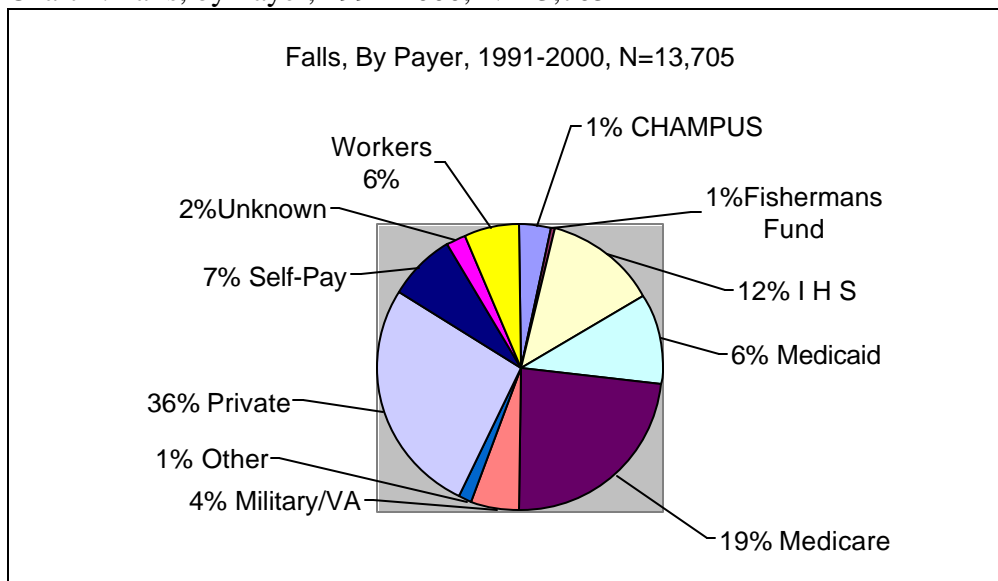
Table 6. Falls, Injury Severity, N=13,705

AIS Score	Number	Percent
Unscorable	292	2.1
1 – Minor	1124	8.2
2 - Moderate	7947	58.0
3 – Serious	4041	29.5
4 – Severe	242	1.8
5 - Critical	59	.4

### Cost and Payer

The medical cost of hospitalization due to falls in Alaska during the study period was estimated to be \$157,619,000 or \$15,761,900 per year. The cost of hospitalization per person averaged \$11,500. Private medical insurance was used to cover the costs in 36% of the injuries; however, 25% of fall injuries were billed to Medicare/Medicaid, and 12% were billed to the Indian Health Service (IHS); 7% were not covered by any 3<sup>rd</sup> party insurance (Chart 4).

Chart 4. Falls, by Payer, 1991-2000, N=13,705



### Elderly Falls

The following information is based solely on ATR data. During the study period there were 2,948 falls in the elder Alaska population (70+) requiring hospitalization, including 100 fatalities. Most of these elder falls (85%) resulted in fractures (2,505); 54% of those fractures were fractured hips (Chart 5). There were 186 traumatic brain injuries. There was no significant increase in elder falls during the winter months, which is consistent with the finding that most (75%) elder falls occurred at home (Chart 6). Nine percent (9%) of home fall injuries occurred in the bath/shower (Chart 7).

Chart 5. Elder Falls by Fracture Type, Age 70+, N=2,948

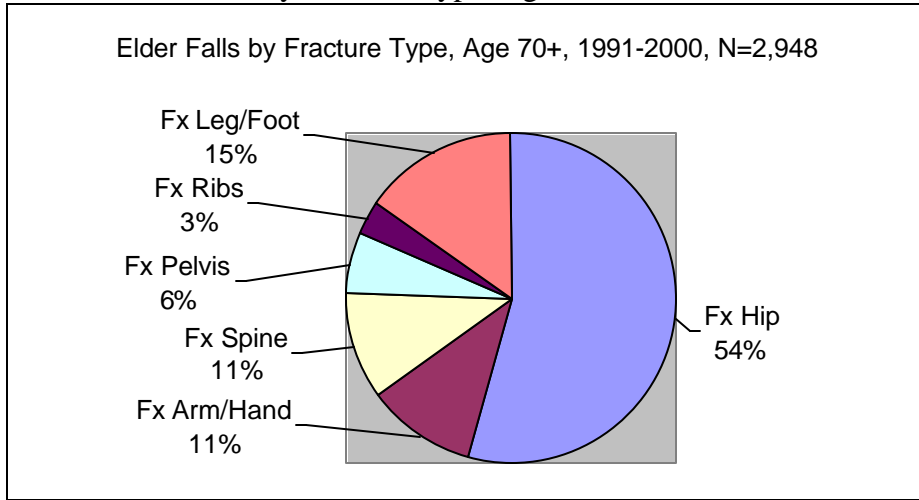


Chart 6. Elder Falls by Place, Age 70+, N= 2,948

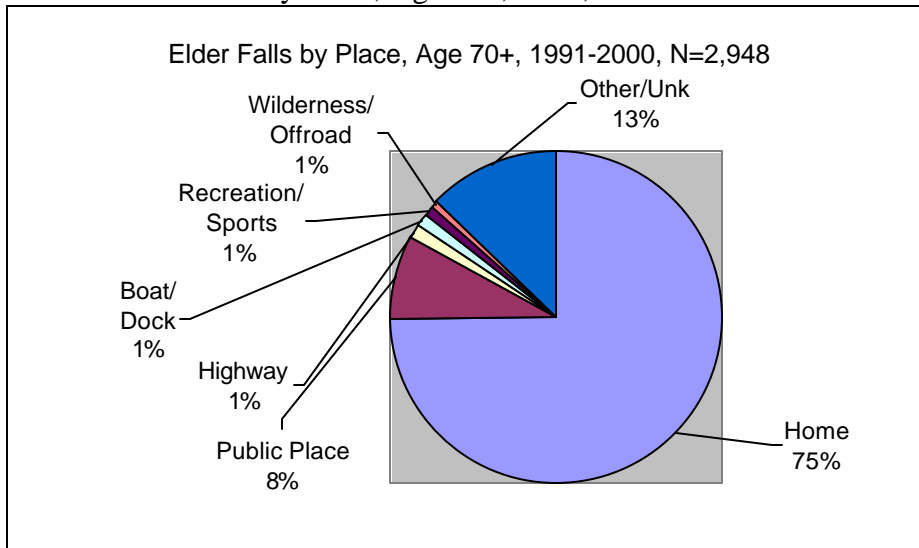
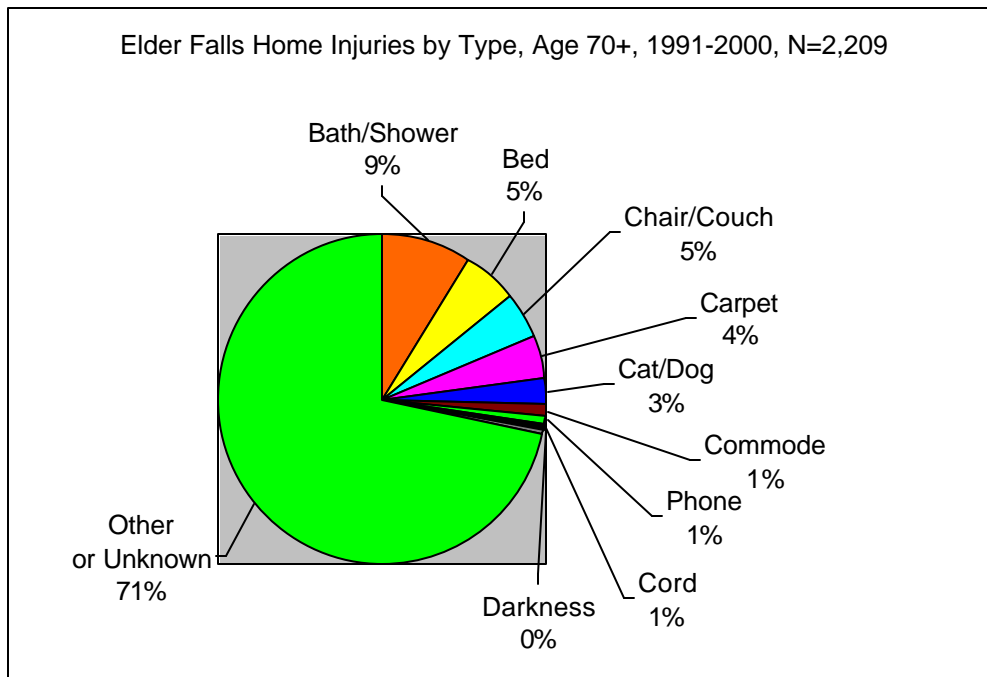


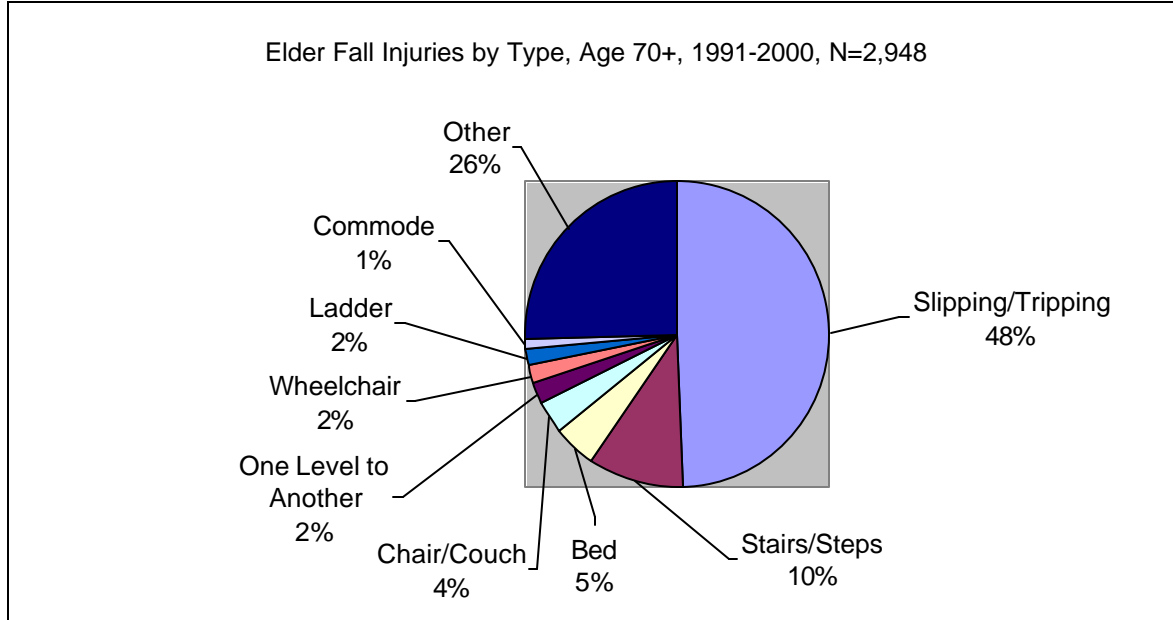


Chart 7. Elder Falls Home Injuries by Type, Age 70+, N=2,209



Forty-eight percent (48%) of elder falls were due to slipping/tripping/stumbling (Chart 8); 11% of elder falls by slipping occurred on ice/snow. According to the injury narrative, ice/snow locations included: sidewalks, driveways, outside public buildings, parking lots, hospital steps, outside doctor's offices, and getting in and out of cars. Many falls included multiple levels, for example: *fell from icy step or slipped on ice getting out of car*. Other injury narratives described falls as occurring while crossing the highway, outside the home, while carrying something, after drinking, or while walking the dog. Contributing factors to elder falls include pre-existing medical conditions (22%), residing in nursing homes or assisted living centers, and suspected alcohol use (5.3%). Other contributing medical conditions include dizziness, fainting, dementia, stroke, walker, crutches, wheelchair, poor vision, cancer, Parkinson's disease, heart disease, Chronic Obstructive Pulmonary Disease, and other sickness.

Chart 8. Elder Fall Injuries by Type, N=2,948



## Discussion

Fall injuries are a serious public health problem in Alaska. The cost of injury in terms of pain, suffering, disability, and death is immense and immeasurable. The financial cost of hospitalizations can be calculated, or at least estimated, and remains an essential element of the ongoing discussion of rising health care costs and competing health care dollars. Most of the costs of injuries – in medical and hospital care, time lost from school or work, rehabilitation, and disability – result from non-fatal injuries.

This surveillance study shows that certain types of falls are more prevalent in Alaska (slipping/tripping) and that certain groups are at higher risk for falls (e.g. the 70+ age group). In order to determine how to prevent some of these injuries, more information is needed on why certain population groups are more at risk than others and why some types of falls were more frequent than others.

Previous studies have suggested that “slips are primarily caused by either a slippery surface, inappropriate footwear, or inattention” (1,2,3,4,5,6,7). Swets and Zeitlinger (2000) cited four categories for examining slip and fall injuries, which include surfaces, both indoors and outdoors, footwear (or absence thereof), sanitary installations (shower/bathtub), and staircases.

Of particular importance for this study are findings related to footwear, inattention, and surface conditions. Swets and Zeitlinger (2000) emphasize the interaction between soles of shoes and floor or ground surfaces. In Alaska, during cold winter months, soft rubber soles are better on ice and snow than hard rubber or plastic soles. Others conclude similar findings (3). Though 45% of the serious slip and fall injuries in Alaska happened at home, many falls also occurred on ice and snow and some discussion needs to focus on the issues related to surface condition and the

appropriateness of footwear including wearing traction devices such as Yak-Trax (stainless steel coils wrapped around pliable plastic devices which cover the soles of outdoor footwear).

Other fall risk factors include inattention (4,8) and, in the elderly, the presence of other medical conditions such as COPD or Parkinson's disease, loss of visual acuity (9), and living in nursing homes, assisted living facilities, or low income housing (10). Kelly, Pickett, et al (2004) determined that while "controlling for the additional effects of co-morbid disease, narcotic pain-killers, anti-convulsants, and anti-depressants were significant independent predictors of sustaining an injurious fall."(13) The Centers for Disease Control and Prevention states that taking four or more medications or any psychoactive medications is a modifiable fall risk factor and seniors should ask their doctor or pharmacist to review all medications (prescription and over-the-counter) to reduce side effects and interactions.

### **Future Studies**

Additional research is needed to document the fall-related risk factors including types of footwear people were wearing when experiencing a serious slip and fall injury. This could be done by prospectively documenting types of footwear and types of soles worn by injured persons when they arrive at a hospital emergency department for treatment. If certain types of footwear are found to be particularly hazardous on slippery surfaces, it may be appropriate to request the Consumer Product Safety Commission to set standards for coefficient of friction of footwear soles, or to request that the shoe and boot industry conduct tests and either set voluntary standards or at least educate the general public on which types of footwear are less likely to slip on ice, snow, wet grass, wet floors, or other slippery surfaces.

A possible solution to reduce the numbers and severity of injury would be to study types of footwear, soles of footwear, and specific equipment to aid in walking on ice and snow (such as cleats or other grip-type foot coverings). Based on this research, standards could be set for footwear, and the general public could be educated on what types of footwear are safest on ice, snow, or other slippery surfaces.

A study could be performed that would measure the effectiveness of home surveys for fall risks and the efficacy of preventive devices such as bathtub/shower adhesives and grab bars installation.

Further study is also indicated in the area of medication management and visual acuity in the elder population as these issues can relate to fall injuries.

Another potential study could help determine if fall prevention activities such as balance exercises in nursing homes or assisted living facilities would decrease fall rates, such as was done in Australia (11) where a study was undertaken to test a falls prevention program in an acute medical setting. An evaluation five years after the prevention program was implemented determined that the falls rate was significantly reduced. However, Sherrington, Lord & Finch (2004) make the point that "for many individuals with physical risk factors for falls (impaired strength, balance, or functional ability), physical activity alone is unlikely to reduce the risk of

falls. For those with additional risk factors (visual impairments, psychoactive medication use), other interventions may also be required.” (12)

### **Conclusion**

Fall injuries are a serious public health problem resulting in pain, suffering, disability, death, and significant medical and non-medical costs. Older Alaskans (70+) experienced much higher fall rates than younger Alaskans. Most of the Older Alaskan falls resulted in fractures (2948), particularly hip fractures (1396). The CDC National Center for Injury Prevention and Control website mentions that of all fall-related fractures, hip fractures are the most serious and lead to the greatest number of health problems and deaths. Zuckerman (1996) states that “20% of seniors die within a year of a hip fracture”. (14)

This study suggests the need for future surveillance studies to help determine causes of serious fall injuries among different population groups and observation studies to investigate the effectiveness of fall prevention programs.

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