

Cause, nature and care-seeking behaviour for injuries among community-dwelling older adults, USA, 2004–2013

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ABSTRACT

Objective To describe the cause and nature of injuries, and care-seeking behaviour following injury, among community-dwelling older adults.

Methods We used 10 years of the nationally representative Integrated Health Interview Series data, providing information on individual characteristics, cause and nature of injuries, and care-seeking behaviour for 3074 adults 65 years of age and older. Univariate and bivariate analyses were used to evaluate overall patterns and test for group-level differences.

Results Approximately 40% of injuries were characterised as hip fracture, head injury and/or other fracture, with the remaining 60% consisting of other, milder types of injuries like bruises, strains and sprains. Fifty-eight per cent of injuries required a visit to the emergency room or transportation via an emergency vehicle, and 19% required hospitalisation. Injuries sustained in a fall were more likely to be serious than those due to other reasons. Older women, those ages 80+, those living with others with no spouse or partner present and those with activities of daily living/instrumental activities of daily living disabilities were more vulnerable to serious injuries and serious injury consequences relative to other older adults.

Conclusions Our results suggest that injuries, especially falls, are a pressing public health concern for the growing population of older adults. Injury prevention outreach should take extra measures to reach certain subgroups of older adults that have been identified as especially vulnerable. Because so many injuries are due to reasons other than falling and/or do not result in hospitalisation, more interventions should be designed for general injury prevention and outpatient settings.

INTRODUCTION

The USA has a rapidly ageing population, with the number aged 65 and older expected to double and the number aged 85 and older expected to increase 20% by 2050.¹ Two major concerns associated with the growing population of older adults are maintaining a high quality of life and slowing the growth of healthcare-related expenses.² Because institutionalisation is associated with diminished quality of life and high healthcare expenses,^{2–4} it is important to delay admission to long-term care facilities for as long as possible. Injuries sustained by older adults, especially falls, are a major predictor of institutionalisation^{5,6} and accordingly the financial burden of injuries is substantial. In 2010, direct medical care costs among older adults totalled \$28.6 billion for non-fatal injuries and \$1.1 billion for fatal injuries.⁷

The available evidence suggests that injuries among older adults are common, increasing over time and frequently fatal. In fact, injury is the eighth leading cause of death among older adults and from the mortality perspective is comparable in magnitude to Alzheimer's disease, diabetes and influenza.⁸ During 2001, 2.7 million adults aged 65 and older were treated in emergency departments for non-fatal injuries⁹ and 39 000 adults age 65 and older died from injuries.¹⁰ Non-fatal injuries increased 18% between 2001 and 2013, with 2.9 million older adults treated in emergency rooms (ERs) for non-fatal injuries and 54 500 dying from injuries in 2013.⁷

Previous research also indicates that there are important group differences in injury incidence rates and consequences. For example, older women experience a higher rate of falls and are more likely to be hospitalised with a fall-induced hip fracture than men.¹¹ Despite the higher rate of falls and fall-induced hip fracture among women, however, men are much more likely to die after a fall. There may be other important group differences that have not been considered in previous research on injuries among older adults.

Despite the urgent need for good information on injuries among older adults, available information is limited in at least two important ways. First, most information on the US older adult population is limited to fall-related injuries,^{7,12–15} with some exceptions.^{8,10,16} Second, most studies of injuries among older adults in the USA use emergency department or hospital-based samples.^{11,12,17–19} Those receiving care in ERs or hospitals are likely to be older and frailer than those receiving care in outpatient settings, and studies reliant on ER and hospital-based samples may overestimate the number of serious injuries. Of the information collected from community-based samples, most use a single year of data,¹³ small samples^{13–15} and/or draw from a single community.¹⁵ One notable exception¹⁶ investigated injuries using the National Health Interview Surveys (NHIS) among the US community-dwelling population and provided selected estimates for older adults, but their primary focus was the general population and they provided estimates through 2007 only. As a result of these limitations, the majority of findings from previous studies are unlikely to generalise to the population of community-dwelling older Americans.

To guide injury prevention efforts among older adult populations, we must have high-quality, nationally representative information about injuries

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sustained by older adults living in the community. The current study makes two contributions to the body of knowledge about injuries among older adults. First, it uses 10 years of a large, nationally representative survey of the community-dwelling US population to characterise the cause and nature of injuries, and care-seeking behaviour following injury among the older adult population. Second, it determines whether injuries and care-seeking behaviour differ by age group, sex, race and ethnicity, living arrangements and activities of daily living (ADL) or instrumental activities of daily living (IADL) disability. Our investigation will help define prevention needs and enable more effective targeted interventions.

MATERIALS AND METHODS

Data

This study used a pooled sample of the 2004–2013 Integrated Health Interview Series (IHIS), an integrated database of the NHIS. Using the IHIS²⁰ made it dramatically easier to make consistent comparisons across samples and manage the complex NHIS data. The NHIS is an annual, nationally representative survey of the non-institutionalised, civilian US population, funded by the National Centers for Health Statistics. Each year, the NHIS interviews 80 000–100 000 people. The NHIS collects information about health status, healthcare access and use, health behaviours and key socio-demographic characteristics. Information for this study was drawn from the core family questionnaire, covering all members of NHIS-participating households, and the injury supplement, asked about all persons reporting an injury in the family questionnaire. The sample for this study was limited to adults aged 65 and older who sustained at least one medically attended, non-fatal injury in the 3 months prior to the survey, yielding a sample size of 3074. Although the injury questions are available prior to 2004, changes in the collection of injury data instituted in 2004 limit the comparability of these data with pre-2004 data.

Variables

An injury here refers to the traumatic event in which a person was harmed seriously enough by an external cause (eg, a fall or a motor vehicle incident) to seek medical advice or treatment in the past three months. For analyses, we consider only one injury episode per person. Nearly all survey participants injured during the 3-month recall period (94.6%) sustained only one injury, which is consistent with published research using the NHIS.¹⁶ We conducted supplementary analyses that included all injuries and that used the second, rather than the first, injury episode per person and found that results were identical. We identified the cause of injury—including transportation-related incidents, falls, overexertion, being struck by an object or person, or some other cause—and the nature of injury—including hip fracture, head injury, other fracture or other injury. Other causes of injury included animal or insect bite, cut or pierced, poisoning, fire, burn, or scald-related injury, machinery and a residual 'other' category, which constituted 7.8% of the total injuries. We also described where the injured person sought medical care for the injury, including doctor's office or clinic, ER or emergency vehicle, call to medical professional or hospital. Injured persons could have received more than one type of care.

Patterns in cause of injury, nature of injury and care-seeking behaviour were analysed by five key characteristics: age, sex, race and ethnicity, living arrangements and disability. Age was grouped into four categories: 65–69, 70–74, 75–79 and 80+. Sex was defined as male or female. Race and ethnicity was defined as a three-category variable: non-Hispanic white,

non-Hispanic black and a residual other category. Living arrangements were classified into three categories: living with spouse or partner (regardless of whether they also lived with others), living alone and living with others without spouse or partner. For those living with others without spouse or partner, 80% lived with an adult child, 7% lived with a grandchild and 6% lived with a brother or sister (not shown). Disability was defined in two ways: (1) ADL disability lasting >3 months, that is, needed help in eating, bathing, toileting, dressing and/or getting around inside of the home; and (2) IADL disability lasting for >3 months, that is, needed help to perform light housework, shop for oneself, manage money or take the right amount of medication at the right times. Only those who had a disability prior to the 3-month injury recall period were considered to have a disability so that we could evaluate those with disabilities separately from those that may have been incurred as a result of injuries.

METHODS

We employed univariate analyses to describe the cause and nature of injury and care-seeking behaviour following injury, and bivariate analyses to evaluate group differences. Statistical significance of group differences was evaluated using a set of two-tailed χ^2 or t tests. All estimates were population weighted and adjusted for complex survey design.²¹ All statistical analyses were performed using Stata V.12.1. Statistical significance was accepted at the $p < 0.05$ level.

RESULTS

Population-weighted characteristics of community-dwelling older adults who sustained at least one injury are presented in [table 1](#). The mean age was approximately 76 years of age and roughly 65% of injured older adults were women. Almost half lived with a spouse or partner, 40% lived alone and 13% lived with others without a spouse or partner. About 10% of injured older adults living in the community needed help with ADLs or IADLs.

Among those who sustained an injury, 63% were injured due to a fall. Four per cent of injuries resulted in hip fracture, 10% in head injury, 23.2% in other fracture and 62.8% in some other type of injury, mainly bruises, sprains and strains. Injured older adults most frequently sought care at a doctor's office or clinic and using an emergency vehicle or ER was also common. Approximately 40% called a medical professional and nearly one in five were hospitalised. Forty-one per cent of injured older adults did not visit an ER or hospital (not shown).

When we compared the nature of injuries of those who fell to those injured from another cause, we saw that fallers sustained more serious injuries—that is, hip fractures, head injuries and other fractures—compared with non-fallers (see [figure 1](#)). Incidence of hip fracture was five times higher, head injury was four times higher and other fracture was two times higher among those injured due to a fall than those injured due to some other cause. When we compared older adults who were hospitalised for their injuries with those who were not, we observed that hospitalised older adults sustained more serious injuries (see [figure 2](#)). Notably, those with hip or other fractures were more likely to be hospitalised, but hospitalisation was not significantly associated with head injury.

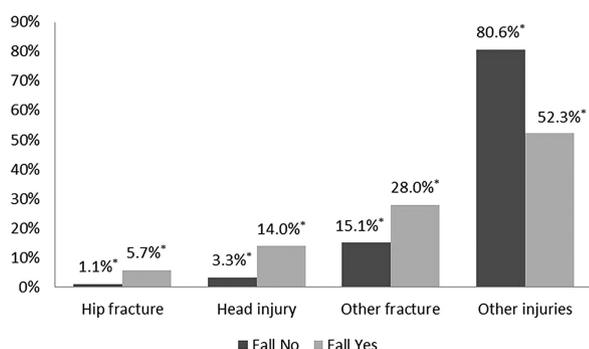
There were several significant group differences in the cause of injury (see [table 2](#)). Women were more likely to fall than men, and those living with others were at greater risk of falling compared with those living with a spouse or partner and those living alone. Older adults with disabilities were also significantly more likely to fall relative to those without disabilities. Falls

Table 1 Characteristics of the population of community-dwelling injured older adults, 2004–2013

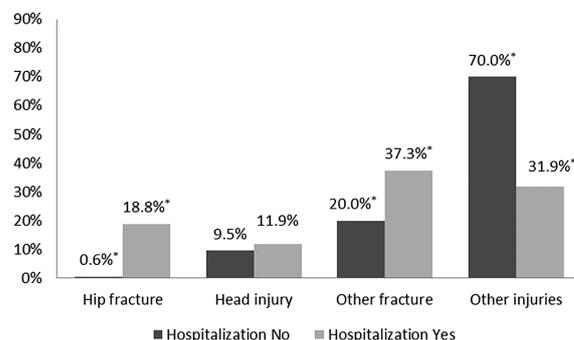
Variables	Per cent (95% CI) (sample N=3074) (population N=866 043)
Age (mean)	75.6 (75.3 to 76.0)
65–69	26.2 (24.4 to 28.1)
70–74	20.2 (18.7 to 21.8)
75–79	17.8 (16.3 to 19.3)
≥80	35.8 (33.8 to 37.9)
Female	64.9 (63.0 to 66.7)
Race/ethnicity	
Non-Hispanic white	86.5 (85.3 to 87.7)
Non-Hispanic black	5.6 (4.8 to 6.5)
Other	7.8 (7.0 to 8.8)
Living arrangements	
Living with spouse/partner	46.7 (44.6 to 48.8)
Living alone	40.0 (38.0 to 42.1)
Living with others	13.3 (11.9 to 14.8)
ADL/IADL disability before injury	10.4 (9.2 to 11.8)
Cause of injury	
Fall	63.0 (61.0 to 64.9)
Overexertion or strenuous movements	7.7 (6.7 to 8.9)
Struck by object or person	6.5 (5.6 to 7.5)
Transportation-related	6.4 (5.5 to 7.4)
Some other cause	16.5 (15.0 to 18.0)
Nature of injury	
Hip fracture	4.0 (3.3 to 4.9)
Head injury	10.0 (8.8 to 11.4)
Other fracture	23.2 (21.6 to 25.0)
Other injury	62.8 (60.9 to 64.6)
Care-seeking behaviour	
Visited doctor's office or clinic	78.0 (76.3 to 79.6)
Used emergency vehicle or emergency room	57.6 (55.5 to 59.8)
Called medical professional	39.3 (37.4 to 41.2)
Hospitalised	18.6 (17.1 to 20.1)

Statistics are population weighted and adjusted for complex survey design.
ADL/IADL, activities of daily living/instrumental activities of daily living.

increased with age, whereas overexertion and transportation-related injuries decreased. There was no association between age and being struck by an object or person. Women sustained fewer overexertion injuries than men. Those living with others had the lowest incidence of overexertion injuries. Those with



*P<0.001

Figure 1 Nature of injury by whether a person was injured from a fall.

*P<0.001

Figure 2 Nature of injury by whether a person was hospitalised for injury.

disabilities were less likely to be injured as a result of being struck compared with those without disabilities. There were no differences in the cause of injury by race and ethnicity.

There were several differences in the nature of injury by group. The incidence of hip fracture due to injury for adults 80+ years old was almost seven times that of adults aged 65–69 years, and the incidence of head injury was more than twice as high (see [table 3](#)). Fractures, especially hip fractures, were higher among women. There was no difference in head injury incidence by sex, and men were more likely to sustain other types of injuries than women. Non-Hispanic blacks were less likely to sustain other types of fractures and more likely to sustain other types of injuries compared with other groups; there were no differences in the incidence of hip fracture or head injury by race and ethnicity. Older adults living with others had an incidence of hip fracture 2.3 times greater than those living with a spouse and 1.9 times more than solo dwellers. The incidence of hip fracture for older adults with disabilities was over eight times that of older adults without disabilities, and the incidence of other fracture for those with disabilities was over twice that of those without disabilities.

The likelihood of visiting an ER or being hospitalised varied considerably by group (see [table 4](#)). The share hospitalised for adults 80+ years old was 2.9 times that of adults aged 65–69 years, and adults aged 80+ were also more likely to seek emergency care. Women were slightly more likely than men to be hospitalised, and there were no other significant differences in care-seeking behaviour by sex. Non-Hispanic blacks were more likely to use an ER or emergency vehicle compared with other groups; otherwise, there were no differences in care-seeking behaviour by race and ethnicity. The hospitalisation rate was highest for older adults living with others, which was about double the rate for those living with a spouse or partner and 1.5 times greater than those living alone. Older adults with disabilities were nearly 1.5 times as likely to seek emergency care and more than three times as likely to be hospitalised compared with those without disabilities.

DISCUSSION

This study found that falls constitute the main cause of injuries among older adults, with approximately 40% of injuries due to other causes. These findings are consistent with previous findings about injuries among older adults.^{7 9 16} Additionally, we found that fall-related injuries were more likely to be serious than other injuries, which is also consistent with prior research.¹⁶ We add to the previous literature with our findings that those hospitalised for their injuries were much more likely

Table 2 Cause of injury by age, sex, race/ethnicity, living arrangements and ADL/IADL disability, 2004–2013

Cause of injury (sample N=3074) (population N=866 043)	Fall (%)	p Value	Overexertion (%)	p Value	Transportation (%)	p Value	Struck (%)	p Value
Age								
65–69	50.1	<0.001	11.4	<0.001	8.6	0.006	6.9	0.347
70–74	58.9		8.2		7.2		5.0	
75–79	61.8		7.3		6.0		7.5	
≥80	75.4		4.9		4.5		6.5	
Sex								
Female	67.1	<0.001	6.7	0.017	6.0	0.301	6.5	0.975
Male	55.4		9.5		7.0		6.5	
Race/ethnicity								
Non-Hispanic white	63.1	0.266	7.7	0.918	6.1	0.059	6.7	0.444
Non-Hispanic black	58.1		6.9		10.4		6.1	
Other	65.2		7.9		6.2		4.8	
Living arrangements								
With spouse/partner	57.1	<0.001	9.6	0.002	6.9	0.328	6.5	0.342
Alone	65.5		6.9		6.4		7.0	
With others	76.2		3.7		4.6		4.9	
ADL/IADL disability								
Yes	77.7	<0.001	4.9	0.068	5.0	0.348	3.3	0.019
No	61.3		8.0		6.5		6.8	

Statistics are population weighted and adjusted for complex survey design.
ADL/IADL, activities of daily living/instrumental activities of daily living.

to have serious injury relative to those who were not hospitalised, suggesting that estimates from hospital-based samples may overestimate the incidence of serious injury.

Several subgroups of older adults emerged as consistently more vulnerable than other groups. Older women and adults aged 80 and older experienced more serious injuries and injury consequences relative to men and younger adults, respectively. These results are largely comparable to previous estimates.^{7 16 22}

We found no differences in injury cause by race and ethnicity, and found that non-Hispanic blacks were less likely to experience severe injury, but more likely to use an ER or emergency vehicle compared with others, findings consistent with prior research.¹⁶ We observed that those with disabilities were significantly more likely to experience fall-related injuries and their consequences than those without disability. These results indicate that prior research on the association between disability

Table 3 Nature of injury by age, sex, race/ethnicity, living arrangements and ADL/IADL disability, 2004–2013

Nature of injury (sample N=3074) (population N=866 043)	Hip fracture (%)	p Value	Head injury (%)	p Value	Other fracture (%)	p Value	Other injuries (%)	p Value
Age								
65–69	1.0	<0.001	6.3	<0.001	25.1	0.553	67.6	<0.001
70–74	3.4		8.0		22.3		66.3	
75–79	4.0		10.5		21.8		63.7	
≥80	6.6		13.6		23.1		56.8	
Sex								
Female	5.0	<0.001	10.2	0.708	25.3	<0.001	59.5	<0.001
Male	2.2		9.7		19.4		68.7	
Race								
Non-Hispanic white	4.1	0.603	9.6	0.056	24.0	0.010	62.3	0.009
Non-Hispanic black	2.7		9.7		15.1		72.4	
Other	3.8		14.4		21.0		60.8	
Living arrangements								
With spouse/partner	3.2	0.005	8.8	0.065	23.9	0.261	64.2	0.002
Alone	3.9		10.5		21.7		63.9	
With others	7.3		13.0		25.7		54.1	
ADL/IADL disability								
Yes	18.8	<0.001	7.2	0.124	43.7	<0.001	30.3	<0.001
No	2.3		10.3		20.9		66.5	

Statistics are population weighted and adjusted for complex survey design.
ADL/IADL, activities of daily living/instrumental activities of daily living.

Table 4 Care-seeking behaviour by age, sex, race/ethnicity, living arrangements and ADL/IADL disability, 2004–2013

Care-seeking behaviour (sample N=3074) (population N=866 043)	Doctor's office or clinic (%)	p Value	Emergency room or vehicle (%)	p Value	Call to medical professional (%)	p Value	Hospital (%)	p Value
Age								
65–69	82.3	0.002	50.6	<0.001	38.7	0.681	9.2	<0.001
70–74	79.9		53.4		40.8		15.6	
75–79	77.3		61.5		37.2		20.2	
≥80	74.1		63.3		39.9		26.3	
Sex								
Female	77.5	0.400	59.0	0.064	39.1	0.794	19.7	0.041
Male	78.9		55.1		39.6		16.4	
Race								
Non-Hispanic white	78.2	0.227	57.1	0.027	39.5	0.213	18.3	0.510
Non-Hispanic black	72.8		67.9		33.2		19.1	
Other	80.1		56.4		40.6		21.1	
Living arrangements								
With spouse/partner	80.3	0.061	53.8	<0.001	39.0	0.259	15.0	<0.001
Alone	75.9		59.3		38.3		19.2	
With others	76.3		66.0		43.3		29.0	
ADL/IADL disability								
Yes	78.2	0.953	75.4	<0.001	44.3	0.095	50.5	<0.001
No	78.0		55.6		38.7		14.9	

Statistics are population weighted and adjusted for complex survey design.
Older adults may have sought care from more than one source.
ADL/IADL, activities of daily living/instrumental activities of daily living.

and the likelihood of injurious falls^{23 24} extend to a greater risk of serious consequences of such injuries. People with disabilities may be more vulnerable to falls because they experience higher rates of conditions like lower-limb weakness and vision problems,²⁴ and may suffer more serious consequences of injuries because they are already more frail than other older adults.²⁵

Last, we found that those living with others with no spouse or partner present were more vulnerable than those in other living arrangements. Although 7% of men and 18% of women 65 and older live with non-spouse others,²⁶ we were unable to locate previous studies that considered injuries or falls for older adults in such living arrangements. In the USA, coresidence of older adults with others may signal fragile health and need for live-in assistance. For example, prior research found that older adult women living with non-spouse others had lower levels of physical function, mental health and social engagement,²⁷ and were more likely to die,²⁸ than those in other living arrangements.²⁸ However, we are uncertain about the applicability of these findings to older adults in other countries, where coresidence with adult children is more normative^{29 30} and therefore may not signal a similar vulnerability to serious injury.

While this study identifies characteristics placing older adults at increased risk for serious injuries, it has several limitations. First, our sample included older adults who sustained an injury serious enough to seek medical treatment but which did not result in death; less serious and fatal injuries were excluded. Second, injury information was retrospective and reported by a single respondent for each family. This introduces the possibility of underreporting from both recall bias, where injuries are less likely to be reported as the time between injury episode and interview increases, and the fact that the family respondent may have been unaware of the injuries of other family members. A third limitation is our dichotomous measure of injury, which led to some loss of information. However, the ratio of injury

episodes to persons was 1.02–1.06 over the years considered¹⁶ and the number of participants with multiple injuries was small (165, or 5.4% of the sample). Fourth, the NHIS sampling frame excludes institutionalised persons who may sustain a disproportionately high number of serious injuries;¹⁶ however, only a small percentage of older adults (3.6%) reside in institutions,³¹ so that estimates based on the NHIS sample represent the experience of the majority of older adults. Fifth, we combined 10 years of NHIS data to assemble a sufficient sample size for analysis, introducing the possibility that the pooled data mask changes in associations over time. However, this is not likely to be the case because questions were asked in the same way over the 10-year period, analyses comparing results for subsets of years revealed similar associations over time (available upon request) and our results are consistent with prior research.¹⁶

CONCLUSION

This study takes advantage of a key strength of the NHIS data: the ability to analyse injuries by an array of demographic characteristics of the injured.¹⁶ Our results suggest that injuries, especially falls, are a pressing public health concern for the growing population of older adults, and that older women, adults age 80 and older, adults with ADL or IADL disability and older adults living with others are particularly vulnerable to falling, hip fracture and hospitalisation. Because many injuries are not due to falls and do not result in hospitalisation, more interventions should be designed for general injury prevention and outpatient settings. Although we show that fall-related injuries are the most serious, previous research has shown that fall history is one of the most important predictors of serious fall-related injuries.²² Similarly, it is possible that the more minor injuries we observe in our data are precursors to more serious injuries later. Thus, intervening to lessen the impacts of minor injuries may mitigate the risk of more serious injuries later. Our

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study also identifies particularly vulnerable subgroups of older adults that should be key targets for prevention efforts. While some of these groups have already been identified by others, to our knowledge, this is the first investigation to consider the risks of older adults who live with non-spouse others, and our study suggests a need for prevention efforts specifically designed for this group.

What is already known on the subject

- ▶ Injuries among older adults are common, increasing over time.
- ▶ There are gender differences on fall-related injuries and consequences among older adults.
- ▶ Most injury information on the US older adult population is limited to fall-related injuries and most studies of injuries among older adults in the USA use emergency department or hospital-based samples.

What this study adds

- ▶ We find that nearly 40% of community-dwelling older adults are injured for reasons other than a fall and that 41% did not seek care in an emergency room or hospital. We find a lower rate of hip fractures and head injuries than published studies using emergency room or hospital-based samples.
- ▶ We find important group differences in the vulnerability to serious injury and hospitalisation among community-dwelling older adults. Older adults aged 80+, women, those living with others without their spouse or partner and those with activities of daily living or instrumental activities of daily living disability were significantly more likely to fall, to experience hip fracture, and to be hospitalised than other groups of older adults.
- ▶ This study is the first to investigate differences in injury by living arrangements among community-dwelling older adults. Our study indicates that greater prevention efforts should be targeted at older adults who live with others without their spouse or partner.

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