Cause, Nature, and Care-Seeking Behavior for Injuries among Community-Dwelling Older Adults, United States 2001-2013

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ABSTRACT

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

Methods We used 13 years of the nationally representative IHIS (Integrated Health Interview Series) data, providing information on individual characteristics, cause and nature of injuries, and care-seeking behavior for 3,676 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 characterized 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-seven percent of injuries required a visit to the emergency room or transportation via an emergency vehicle, and 18% required hospitalization. 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 ADL/IADL 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 hospitalization, more interventions should be designed for general injury prevention and outpatient settings.

INTRODUCTION

The U.S. has a rapidly aging population, with the number aged 65 and older expected to double and the number aged 85 and older expected to increase by 20% by 2050[1]. Two major concerns associated with the growing population of older adults are maintaining a high quality of life in old age and slowing the growth of health care-related expenses[2]. Because institutionalization is associated with diminished quality of life and high health care 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 institutionalization[5,6] and accordingly the financial burden of injuries is substantial. In 2000, direct medical care costs among older adults totaled $19 billion for non-fatal injuries and $200 million for fatal injuries[4].

The available evidence suggests that injuries among older adults are common, increasing over time, and frequently fatal. During 2001, 2.7 million adults aged 65 and older were treated in emergency departments for nonfatal injuries[7], and 39,000 adults age 65 and older die from injuries each year[8]. Nonfatal injuries due to falls increased by 2.8% between 2001 and 2005, and fatal falls increased by 55.3%[9]. Although not all falls are life-threatening or injurious, falls often result in injuries serious enough to lead to hospitalization or death[10]. In fact, injury is the eighth leading cause of death among older adults and from the mortality perspective, it is comparable in magnitude to Alzheimer's disease, diabetes, and influenza[11].

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 hospitalized with a fall-induced hip fracture than men[9]. 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 U.S. older

adult population is limited to fall-related injuries,[9, 12-15] with some exceptions[8,11]. Second, most studies of injuries among older adults in the U.S. use emergency department or hospital-based samples[9,12,16-18]. 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]. As a result of these limitations, findings from previous studies are unlikely to generalize to the population of community-dwelling older Americans. Those receiving care in emergency rooms or hospitals are likely to be older and frailer than those receiving care in outpatient settings, and studies reliant on emergency room and hospital-based samples may overestimate the number of serious injuries, such as hip fractures or head injuries.

To guide injury prevention efforts among older adult populations, we must have high quality, nationally-representative information about injuries 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 13 years of a large, nationally representative survey of the community-dwelling United States population to characterize the cause and nature of injuries, and care-seeking behavior following injury among the older adult population. Second, it determines whether the cause and nature of injuries and care-seeking behavior differ by age group, sex, living arrangements, and ADL (activities of daily living) or IADL (instrumental activities of daily living) 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 2001-2013 Integrated Health Interview Series (IHIS), an integrated database of the National Health Interview Surveys (NHIS). Using the IHIS[19] made it dramatically easier to make consistent comparisons across samples and manage the complex NHIS data. The NHIS is a nationally representative survey of the non-institutionalized, civilian United States population, and collects information about health status, health care access and utilization, health behaviors, and key sociodemographic characteristics. Information for this study was drawn from the core family questionnaire covering all NHIS participants and the injury supplement, asked of all persons reporting an injury in the family questionnaire. The

samples for this study were limited to adults aged 65 and older who sustained at least one injury in the three months prior to the survey, yielding a sample size of 3,676 to describe the cause of and care-seeking behavior for injuries (2001-2013) and 3,074 to describe the nature of injuries (2004-2013).

Variables

An injury here refers to the traumatic event in which a person was harmed seriously enough by an external cause (e.g., a fall or a motor vehicle accident) to seek medical advice or treatment in the past 3 months. For analyses, we dichotomized injury into "at least one injury vs. no injuries." Nearly all survey participants who were injured during the three-month recall period sustained only one injury. We identified the cause of the injury – including transportation-related accidents, 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. We also described where the injured person sought medical care for the injury. The places persons could have sought care included doctor's office or clinic, emergency room 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 behavior were analyzed by four key characteristics: age, sex, 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. 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, the most common living situation was living with an adult child. Disability was defined in two ways: 1) ADL disability lasting more than 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 more than 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 three-month injury recall period were considered to have a disability so that we could evaluate those with disabilities separately from those who may have incurred disabilities as a result of their injuries.

Methods

We employed univariate analyses to describe the cause of injury (2001-2013), nature of injury (2004-2013), and care-seeking behavior (2001-2013), and bivariate analyses to evaluate group differences. The statistical significance of group differences was evaluated using a set of two-tailed chi-square or t-tests. All estimates were population weighted and adjusted for complex survey design. All statistical analyses were performed using Stata 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, 41% lived alone, and 13% lived with others without a spouse or partner. About 11% of injured older adults living in the community needed help with ADLs or IADLs.

Among those who sustained an injury, 62.7% were injured due to a fall. The remainder were injured due to overexertion or strenuous movements (7.6%), transportation-related causes (6.6%), being struck by an object or person (6.2%), or some other cause (16.9%). Four percent 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 (73.6%). Using an emergency vehicle or emergency room was also common, with 56.8% seeking this type of care. Approximately 35% called a medical professional and nearly 18% were hospitalized. Forty-one percent of injured older adults did not visit an emergency room or hospital (not shown).

Table 1 Characteristics of the Community-Dwelling Older Adult Population, 2001-2013

Variables	**Percent (95% CI)** (Sample N = 3,676) (Population N =1,014,025)
Age (Mean)	75.7 (75.5 to 76.0)
65-69	25.2 (23.6 to 26.9)
70-74	20.4 (19.0 to 21.9)
75-79	18.7 (17.4 to 20.1)
≥80	35.7 (33.8 to 37.5)
Female	64.9 (63.2 to 66.5)
Living arrangements	
Living with spouse/partner	45.9 (44.0 to 47.8)
Living alone	40.8 (39.0 to 42.7)
Living with others	13.3 (12.0 to 14.6)
ADL/IADL disability before injury	11.0 (9.9 to 12.2)
Cause of injury	
Fall	62.7 (60.9 to 64.4)
Overexertion or strenuous movements	7.6 (6.7 to 8.6)
Transportation-related	6.6 (5.8 to 7.6)
Struck by object or person	6.2 (5.4 to 7.1)
Some other cause	16.9 (15.6 to 18.3)
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 behavior	
Visited doctor's office or clinic	73.6 (72.1 to 75.1)
Used emergency vehicle or emergency room	56.8 (54.9 to 58.7)
Called medical professional	34.8 (33.1 to 36.6)
Hospitalized	17.8 (16.5 to 19.2)

Note: Statistics are population weighted and adjusted for complex survey design.

There were several significant group differences in the cause of injury (see Table 2). Women were more likely to fall than men (67% vs. 55%), and those living with others were at the greatest risk of falling (76%) compared with those in other living arrangements (57% of those living with a spouse or partner and 64% of those living alone). Older adults with disabilities were also significantly more likely to fall relative to those without disabilities (78% vs. 61%). Falls increased with age (65-69: 50%; 70-74: 58%; 75-79: 62%; and 80+: 75%), whereas overexertion

and transportation-related injuries decreased. The proportion with an overexertion injury for the 65-69, 70-74, 75-79, and 80+ age groups were 11%, 9%, 7% and 5%, respectively and with transportation-related injury were 10%, 7%, 6% and 5%, respectively. There was no association between age and being struck by an object or person. Women sustained fewer overexertion injuries than men (7% vs. 9%). Those living with others had the lowest incidence of overexertion injuries (3% relative to 10% of those living with a spouse and 7% of those living alone). Those with disabilities were less likely to be injured as a result of being struck by an object or person, compared with those without disabilities (3% vs.7%).

Table 2 Cause of Injury by Age, Sex, Living arrangement, and ADL/IADL disability, 2001-2013

Cause of Injury (Sample N = 3,676) (Population N =1,014,025)	**Fall (%)**	**P Value***	**Overexertion (%)**	**P value***	**Transportation (%)**	**P value***	**Struck (%)**	**P value***
Age								
65-69	50.2		11.2		9.5		6.6	
70-74	57.8	**<0.001**	8.5	**<0.001**	7.1	**<0.001**	4.9	0.380
75-79	62.0		7.2		5.8		7.1	
≥80	74.7		4.9		4.7		6.2	
Sex								
Female	66.7	**<0.001**	6.7	**0.011**	6.1	0.084	6.2	0.850
Male	55.3		9.4		7.6		6.1	
Living arrangements								
With spouse/ partner	57.3		9.5		7.0		6.0	
Alone	64.4	**<0.001**	6.9	**<0.001**	6.9	0.222	6.9	0.199
With others	75.9		3.3		4.6		4.6	
ADL/ IADL disability								
Yes	78.4	**<0.001**	5.9	0.170	5.4	0.330	2.7	**0.003**
No	60.8		7.8		6.8		6.6	

Note: Statistics are population weighted and adjusted for complex survey design.

There were several important 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 (25% vs. 19%, and 5% vs. 2%, respectively).

There was no difference in head injury incidence by sex, and men were 9 percentage points more likely to sustain other types of injuries than women. Older adults living with others had an incidence of hip fracture that was about 2.3 times greater than those living with a spouse, and 1.8 times greater than those living alone. The incidence of hip fracture for older adults with disabilities was over 8 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.

Table 3 Nature of Injury by Age, Sex, Living arrangement, and ADL/IADL disability, 2004-2013

Nature of Injury (Sample N = 3,074) (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		6.3		25.1		67.6	
70-74	3.4	**<0.001**	8.0	**<0.001**	22.3	0.553	66.3	**<0.001**
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	
Living arrangements								
With spouse/ partner	3.2		8.8		23.9		64.2	
Alone	3.9	**0.005**	10.5	0.065	21.7	0.261	63.9	**0.002**
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	

Note: Statistics are population weighted and adjusted for complex survey design.

The likelihood of visiting an emergency room or using an emergency vehicle, or being hospitalized varied considerably by age, sex, living arrangements, and disability status (see Table 4). The hospitalization rate for adults 80+ years old was 2.7 times that of adults aged 65-69 years. Women were more likely than men to seek care via an emergency room or vehicle (58% vs. 54%) or hospital (19% vs. 16%). The hospitalization rate was highest for older adults living with others, which was about 1.9 times greater than those living with a spouse or partner and 1.5 times greater than those living alone. Older adults with disabilities were more likely to seek help via an

emergency room/vehicle or hospital. The percentage of hospitalized those with disabilities was more than three times that of those without disabilities.

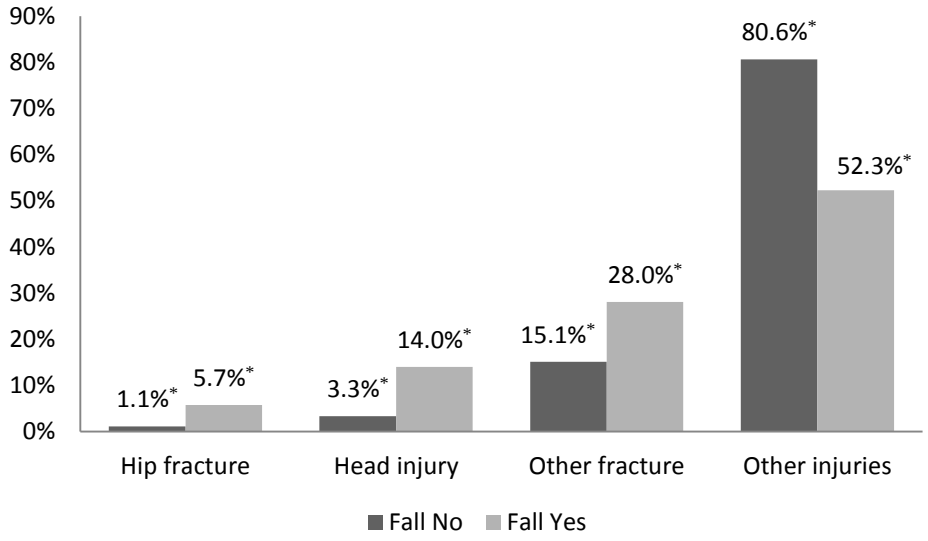
Table 4 Care-Seeking Behavior by Age, Sex, Living arrangements, and ADL/IADL disability, 2001-2013

Care-Seeking Behavior (Sample N = 3,676) (Population N =1,014,025)	**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	78.4		50.4		35.4		9.3	
70-74	75.2	**<0.001**	53.1	**<0.001**	35.8	0.258	15.4	**<0.001**
75-79	73.1		59.2		31.1		18.6	
≥80	69.6		62.1		35.9		24.9	
Sex								
Female	73.1	0.361	58.2	**0.032**	34.7	0.787	18.8	**0.042**
Male	74.6		54.2		35.2		16.0	
Living arrangements								
With spouse/ partner	76.3		53.6		34.7		14.7	
Alone	71.6	**0.018**	57.2	**<0.001**	34.0	0.302	18.2	**<0.001**
With others	70.9		66.6		38.1		27.5	
ADL/ IADL disability								
Yes	72.0	0.475	71.6	**<0.001**	37.1	0.367	46.1	**<0.001**
No	73.8		55.0		34.6		14.4	

Note: Statistics are population weighted and adjusted for complex survey design.
Older adults may have sought care from more than one source.

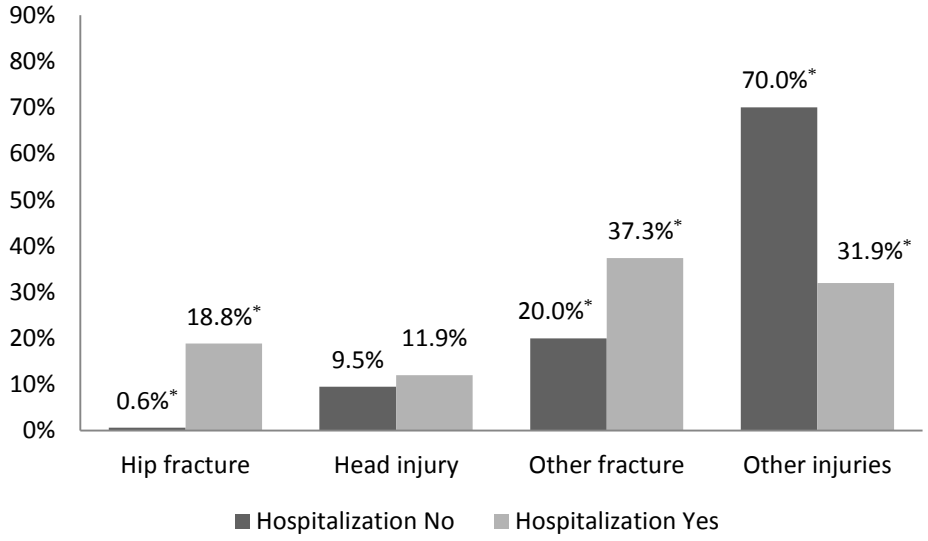
When we compared the nature of injuries of those injured due to a fall to those injured due to some other cause, we saw that fallers sustained more serious injuries – that is, hip fractures, head injuries, and other fractures – compared with non-fallers (see Figure 1). Incidence of hip fracture was 5 times higher, head injury was 4 times higher, and other fracture was 2 times higher among those injured due to a fall than those injured due to some other cause. When we compared older adults who were hospitalized for their injuries to those who were not, we observed that hospitalized older adults sustained more serious injuries. Among those hospitalized, 37.3% had other fracture, 18.8% had hip fracture, and 11.9% had head injury. Among non-hospitalized older adults, 20% had other fracture, 0.6% had hip fracture, and 9.5% had head injury (see Figure 2). Those with hip fractures or other fractures were more likely to be hospitalized, but there was not a significantly higher chance of hospitalization associated with head injury.

Figure 1 Nature of Injury by Whether Person Was Injured from a Fall



*P<0.001

Figure 2 Nature of Injury by Whether Person Was Hospitalized for Injury



*P<0.001

DISCUSSION

The current study used 13 years of the nationally representative IHIS data to develop a better understanding of the causes and nature of injuries sustained by older adults and their care-seeking behavior following injury. We found that, although falls comprise the main cause of injuries among older adults, nearly 40% of injuries were due to other causes. Other causes were assorted, including overexertion and transportation-related injuries. Approximately 40% of injuries resulted in hip fracture, head injury, or other fracture, with the remaining 60% consisting of other, milder types of injuries like bruises, strains, and sprains. Fifty-seven percent of injuries required a visit to the emergency room or transportation via an emergency vehicle, and 18% required hospitalization. Injuries sustained in a fall were more likely to be serious than those due to other reasons and, unsurprisingly, those who were hospitalized for their injuries were much more likely to have serious injury relative to those who were not hospitalized for their injuries.

Several subgroups of older adults consistently emerged as more vulnerable than other groups. Older women were more vulnerable to serious injuries and serious injury consequences relative to men: they were more likely to be injured in a fall, more than twice as likely to suffer a hip fracture, and somewhat more likely to visit an emergency room or to be hospitalized. Adults age 80 and older were significantly more vulnerable to falling, hip fractures, and head injuries, and far more likely to visit an emergency room and/or be hospitalized for their injuries. We also observed those who lived with others with no spouse or partner present were more vulnerable than those in other living arrangements. They were much more likely to sustain a fall-related injury, twice as likely to have a hip fracture, and much more likely to visit an emergency room or to be hospitalized. Last, those with disabilities also proved to be significantly more vulnerable to serious injuries and consequences of injuries than those without disability. They were much more likely to be injured in a fall, 9 times more likely to fracture a hip, twice as likely to have another type of fracture, much more likely to visit an emergency room, and 3 times as likely to be hospitalized.

These findings are important for several reasons. First, they suggest that the ability of studies using emergency room or hospital-based data to represent the nature of injuries among the entire community-dwelling population of older adults is limited. Our study suggests that serious injuries, such as fractures or hip fractures, may be overestimated in such studies. For example,

one study using a hospital-based sample of fall-related injuries[17] estimated that 86% of older adult females and 76% of older adult males had fractures due to a fall, and 49% of women and 45% of men had a hip fracture. Using our community-based sample, we estimate a much lower incidence of fractures and hip fractures resulting from injury in the older adult population. We found overall rates of fracture and hip fracture of 61% and of 21%, respectively, among those injured due to a fall that resulted in hospitalization. Although we do not separate these out by sex in our analyses, additional investigation (not shown) confirmed that the sex-specific incidence rates of fracture and hip fracture were also much lower than previously reported estimates. Second, our study identifies subgroups of older adults that are particularly vulnerable to serious injury and hospitalization and that should be key targets for prevention efforts. While some of these groups have been identified by other studies as especially vulnerable (for example, another study[16] identifies women as disproportionately affected by serious injury), to our knowledge this is the first investigation of 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.

While this study identifies the characteristics that place older adults at high risk for serious injuries, it has several limitations. First, our population only included those older adults who sustained an injury serious enough to seek medical advice or treatment. Less serious injuries were excluded from the study. Second, all of our information about injuries was retrospective, which introduces the possibility of recall bias, where injuries are less likely to be reported as the time between injury episode and the time of the interview increases. However, for injury episodes resulting in serious outcomes that are more salient, recall bias should be minimized. A third limitation of this study is our dichotomous measure of injury. For survey participants sustaining more than one injury during the recall period, we lost some injury information. However, the number of participants with multiple injuries during the three-month period was very small and therefore this measurement decision should not influence the results.

CONCLUSIONS

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 hospitalization. Our results also indicate that 40% of community-dwelling older adults are injured from non-fall-related causes. Of injured older adults, 41% were never seen in an emergency room or hospital, and are thus missing from most studies of injury in older adults. Because so many injuries are due to reasons other than falling and/or do not result in hospitalization, more interventions should be designed for general injury prevention and outpatient settings.

What's 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 U.S. older adult population is limited to fall-related injuries and most studies of injuries among older adults in the U.S. use emergency department or hospital-based samples.

What this study adds

- We find that 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 hospitalization among community-dwelling older adults. Older adults aged 80+, women, those living with others without their spouse or partner, and those with ADL or IADL disability were significantly more likely to fall, to experience hip or other fracture, and to be hospitalized 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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Contributors DX: Contributed to the conceptualization and design of the study, carried out data management and analysis, drafted the initial manuscript, and approved the final manuscript as submitted. JRD: Contributed to the conceptualization and design of the study, critically reviewed and revised the manuscript, and approved the final manuscript as submitted.

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