

Trends in emergency department visits for fall-related fractures in U.S. older adults, 2001- 2020

Carlos H Orces 

Correspondence to

Dr Carlos H Orces, Medicine, Laredo Medical Center, Laredo, Texas, USA; corces07@yahoo.com

Published Online First
10 August 2023

ABSTRACT

The present study analysed data from the National Electronic Injury Surveillance System All Injury Programme to examine trends in emergency department visits (EDs) for fall-related fractures in adults aged 65 years or older between 2001 and 2020. Overall, the estimated number of ED's visits for fall-related fractures increased from 574 000 in 2001 to 984 000 in 2020. After adjusting for age, fall-related fracture rates increased annually by 1.1% (95% CI: 0.4%, 1.7%) in women and by 1.3% (95% CI: 0.4%, 2.2%) in men between 2001 and 2012. Moreover, a non-significant increase in fracture rates was seen in both sexes between 2012 and 2016. From 2016 onward, fracture rates decreased annually in women by -5.0% (95% CI: -7.9%, -2.0%) and did not significantly change in men. This downward trend was mostly attributed to a decrease in fall-related fractures of the arm/hand, lower trunk, and among subjects aged 75 years and older. Therefore, it appears that fall-related fracture rates have recently decreased in U.S. older women.

INTRODUCTION

Background

Falls in older adults represent a major public health burden associated with increased morbidity, mortality, and healthcare costs.^{1 2} Of fall-related injury visits to the emergency department (EDs) in older adults, fractures account for 37.8% of women's and 28.3% of men's injuries.³ Moreover, fractures in older adults are associated with long-term disability and poor health-related quality of life.^{4 5} In the U.S., about 5 million EDs visits for fall-related fractures occurred among older adults between 2001 and 2008. Of those, adults aged 80 years and older, women, and trunk fractures (lumbar spine, pelvis, and hip) accounted for most of these injuries.⁶

Notably, EDs visits for fall-related injuries among U.S. older adults increased on average by 2% per year from 2001 to 2012. Moreover, it was projected that about 5.7 million EDs visits for fall-related injuries will occur by 2030.⁷ Similarly, Drew *et al*,⁸ in a recent analysis of the National Health Interview Survey (NHIS) demonstrated that self-reported fall-related injuries in U.S. older adults increased by 42% between 2004 and 2017. Although EDs visits for fall-related fractures among U.S. older adults was reported to increase in men and remain stable in women between 2001 and 2008,⁶ whether fall-related fracture rates have changed over the past decade is undetermined. Given the adverse health consequences of low impact fractures among

WHAT IS ALREADY KNOWN ON THIS TOPIC

- ⇒ Fall-related fractures are a major public health burden in older adults.
- ⇒ Previous research reported stable emergency department visits for fall-related fractures in U.S. older women between 2001 and 2008.

WHAT THIS STUDY ADDS

- ⇒ The estimated number of EDs visits for fall-related fractures increased in U.S. older adults from 2001 to 2020.
- ⇒ Age-adjusted fall-related fracture rates decreased in women from 2016 onward.
- ⇒ Hospitalizations for fall-related fractures progressively increased during the study period.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

- ⇒ To target older adults at risk for fall-related fractures and its related hospitalizations.

older adults, the present study aimed to examine temporal trends in EDs visits for fall-related fractures in U.S. adults aged 65 years and older between 2001 and 2020.

METHODS

Study population

The National Electronic Injury Surveillance System All Injury Programme (NEISS-AIP) is a collaborative effort by the National Centre for Injury Prevention and Control and the Consumer Product Safety Commission designed to provide national incidence estimates of all types and external causes of non-fatal injuries visits to the EDs. A detailed description of the NEISS-AIP methods and analytic guidelines can be found at: <https://www.icpsr.umich.edu/web/ICPSR/search/studies?q=NEISS-AIP>.

The present analysis was limited to EDs visits for unintentional fall-related fractures in adults aged 65 years and older between 2001 and 2020. Age-adjusted fall-related fracture rates by sex and primary body parts were calculated using the direct method and adjusted to the 2000 U.S. standard population. Moreover, the percentage of older adults hospitalised for fall-related fractures according to body parts was examine over time.

Statistical analysis

Joinpoint trend analysis software, V.4.9.1.0, (<https://surveillance.cancer.gov/joinpoint/>) was used to examine the average annual percent change (AAPC) in rates. This summary measure describes the average annual percent changes over a period



© Author(s) (or their employer(s)) 2023. No commercial re-use. See rights and permissions. Published by BMJ.

To cite: Orces CH. *Inj Prev* 2023;**29**:528–531.

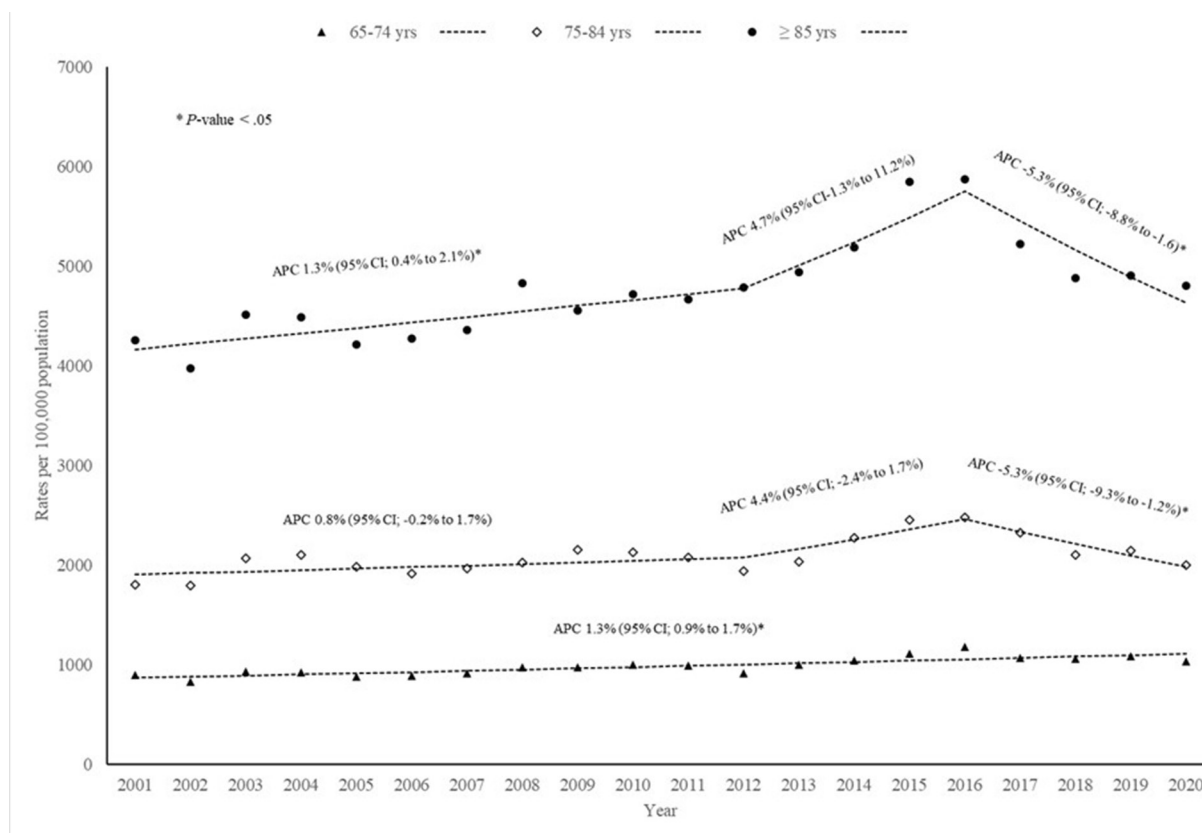


Figure 1 Trends in EDs Visits for fall-related fractures by age-groups.

of multiple years, which is valid even if the model indicates that changes in trend occurred over time. Moreover, the annual percent change (APC) in fracture rates was calculated if changes in trends was seen during the study period.⁹ A maximum of 2 joinpoints were allowed for each analysis. All statistical analyses were performed using SPSS Complex Sample software, V.25 (SPSS Inc, Chicago, Illinois, USA) to incorporate sampling weights and obtain nationally representative estimates from the NEISS-AIP sampling design.

RESULTS

An estimated 15.8 million visits to the EDs for unintentional fall-related fractures occurred in U.S. older adults between 2001 and 2020. Of those, women accounted for 73.2% of the cases. Overall, 55% of fall-related fractures occurred at home, and lower trunk fractures were the most frequently affected body part. The estimated number of EDs visits for fall-related fractures in older adults increased from 574 000 in 2001 to 984 000 in 2020. Similarly, the percentage of older adults hospitalised for these injuries increased from 41.6% in 2001 to 51.5% in 2020.

As shown in [figure 1](#), fall-related fracture rates progressively increased on average by 1.3% (95% CI: 0.9%, 1.7%) per year in adults aged 65–74 years. From 2001 to 2016, fracture rates did not significantly change among those aged 75–84 and increased on average by 2.2% (95% CI: 0.6%, 3.7%) per year in subjects 85 years and older. From 2016 onward, annual rates significantly decreased by –5.6% in both age-groups.

As shown in [figure 2](#), the age-adjusted incidence of fall-related fractures in women increased annually by 1.1% (95% CI: 0.4%, 1.7%) between 2001 and 2012. Thereafter, a non-significant annual increase in rates by 4.2% (95% CI: –0.8%, 9.5%) was seen between 2012 and 2016. Notably, a marked decrease in

fracture rates by –5.0% (95% CI: –7.9%, –2.0%) per year occurred in older women during 2016–2020. In men, fracture rates also increased by 1.3% (95% CI: 0.4%, 2.2%) per year between 2001 and 2016. Moreover, a non-significant upward trend in rates by 5.4% (95% CI: –1.5%, 12.7%) per year was seen during the period 2012–2016. Subsequently, fracture rates did not significantly decrease by –3.0% (95% CI: –7.1%, 1.2%) per year from 2016 onward.

[Table 1](#) shows trends in age-adjusted EDs visits for fall-related fractures according to affected body parts. Head/neck fractures increased on average by 4.4% (95% CI: 3.1%, 5.8%) and upper trunk fractures by 2.1% (95% CI: 1.6%, 2.6%) per year during the study period. Similarly, lower trunk and leg/foot fractures significantly increased by 1.4% (95% CI: 0.6%, 2.2%) and 2.1% (95% CI: 0.0%, 4.3%) per year from 2001 to 2016, respectively. From 2016 onward lower trunk fractures did not significantly change. Notably, arm/hand fractures also decreased by –6.2% (–9.4%, –2.8%) during 2016–2020.

[Table 2](#) shows trends in hospitalisation for fall-related fractures according to body parts affected. Overall, lower trunk fractures accounted for about 59% of the fractures. Moreover, upward trends in hospitalisation were mostly attributed to increasing head/neck, upper trunk, and leg/foot fractures in older adults.

DISCUSSION

In a nationally representative sample of EDs visits for injuries, the estimated number of fall-related fractures increased in U.S. older adults between 2001 and 2020. After adjusting for age, fall-related fracture rates in men and women increased annually on average by 1.3% and 1.1% from 2001 to 2012, respectively. Moreover, a non-significant increase in fracture rates was seen in men and women during the period 2012–2016. From

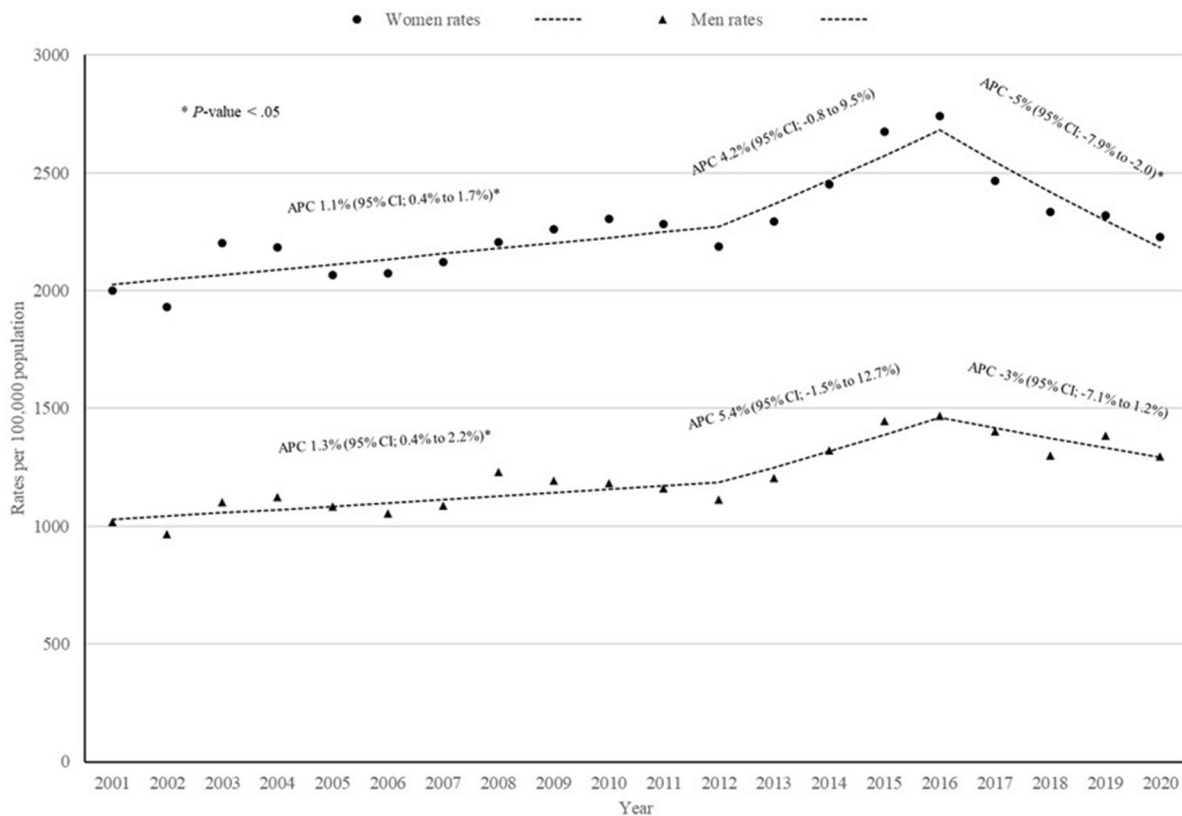


Figure 2 Trends in ED visits for fall-related fractures in men and women.

2016 onward, fracture rates decreased annually by 5% in older women, but did not significantly change in men. These findings were particularly attributed to similar trends in fall-related fractures of the arm/hand, lower trunk, and among subjects aged 75 years and older.

Baiden *et al*¹⁰ reported that EDs visits for geriatric fractures decreased in U.S. women by 2.5% between 2004 and 2014. The authors also described downward trends in the incidence of upper and lower trunk fractures during the 11 year period. These contradictory results may be related to the characteristic of the NEISS for consumer product-related injuries database, which do not report falls as an external cause of injury. Therefore, it is possible that EDs visits for geriatric fractures might have been underestimated in that latter study. Indeed, a secondary analysis of the National Hospital Ambulatory Medical Care Survey demonstrated that EDs visits for a fall or fall-related injury increased among U.S. older adults by 27% between 2003 and 2010.¹¹ Similarly, the incidence of self-reported fall, minor

injury, and severe injuries in U.S. older adults increased by 42%, 88.7, and 45.7% between 2004 and 2017, respectively.⁶

A recent report from the Behavioural Risk Factor Surveillance System demonstrated that the percentage of U.S. older adults who self-reported a fall or fall-related injury decreased between 2016 and 2018, which is consistent with the present results.¹² The precise reason for recent downward trends in fall-related fractures in older women remains undetermined. However, it is unlikely to be associated with adequate management of osteoporosis. In fact, the treatment of osteoporosis significantly decreased in U.S. postmenopausal women from 2007 to 2008 through 2017–2018.¹³ It is possible that interventions for preventing fall-related fractures in community-dwelling older adults such as exercise and basic fall risk assessment may partly explain the decrease in fall-related fractures rates among U.S. older adults from 2016 onward.¹⁴

Notably, the percentage older adults hospitalised for fall-related fractures increased during the study period, which was

Table 1 Trends in emergency department visits for fall-related fractures according to body parts

Primary body parts (n=205 399)	AAPC (95% CI)	Trend 1	APC (95% CI)	Trend 2	APC (95% CI)
Head/neck (6.5%)	4.4% (3.1%, 5.8%)*	2001–2015	6.7% (5.9%, 9.5%)*	2015–2020	-1.7% (-6.2%, 2.9%)
Upper trunk (16.4%)†	2.1% (1.6%, 2.6%)*	–	–	–	–
Arm/hand (24.2%)	-0.8% (-2.0%, 0.5%)	2001–2016	0.7% (-0.7%, 2.2%)	2016–2020	-6.2% (-9.4%, -2.8%)*
Lower trunk (35.8%)‡	-0.1% (-1.3%, 1.2%)	2001–2016	1.4% (0.6%, 2.2%)*	2016–2020	-5.4% (-10.8%, 0.3%)
Leg/foot (17.0%)	1.6% (-0.3%, 3.6%)	2001–2016	2.1% (0.0%, 4.3%)*	2016–2020	-0.4% (-5.5%, 4.9%)

*Significantly different from zero at alpha=0.05 level.
 †Thoracic spine, ribs, and sternum.
 ‡Lumbar spine, pelvis, and hip.
 AAPC, average annual percent change in rates 2001–2020; APC, annual percent change in rates for specific time period.

Table 2 Trends in hospitalisation for fall-related fractures according to body parts

Primary body parts (n=1 02 055)	AAPC (95% CI)	Trend 1	APC (95% CI)	Trend 2	APC (95% CI)
Head/neck (4.5%)	3.1% (1.5%, 4.8%) [*]	2001–2006	8.7% (2.8%, 15.0%) [*]	2006–2020	1.2% (0.0%, 2.4%) [*]
Upper trunk (10.4%)†	3.8% (3.4%, 4.3%) [*]	–	–	–	–
Arm/hand (8.6%)	1.9% (0.7%, 1.3%) [*]	2001–2012	3.3% (1.9%, 4.8%) [*]	2012–2020	–0.1% (–2.4%, 2.2%)
Lower trunk (59.2%)‡	0.1% (–0.1%, 0.3%)	–	–	–	–
Leg/foot (17.3%)	1.5% (1.0%, 2.0%) [*]	2001–2009	–0.7% (–1.6%, 0.3%)	2009–2020	3.2% (2.5%, 3.8%) [*]

*Significantly different from zero at alpha=0.05 level.

†Thoracic spine, ribs, and sternum.

‡Lumbar spine, pelvis, and hip.

AAPC, average annual percent change in rates 2001–2020; APC, annual percent change in rates for specific time period.

particularly attributed to an increase in head/neck, upper trunk, and leg/foot fractures. Previously, Hartholt *et al* reported that fall-related hospitalisation rates increased in U.S. older adults between 2001 and 2008.¹⁵ Similarly, age-adjusted hospitalisation rates for fall-related injuries in older adults increased annually by 4% between 2001 and 2012, which is consistent with the present results.⁷ In contrast, Reider *et al* recently demonstrated that the incidence of fall-related extremity fractures decreased by 13.6% and 4.6% in older women and men between 2003 and 2017. This downward trend was associated to a decline in femur fractures which accounted for 65% of all fracture hospitalizations.¹⁶

The present study has several limitations that should be mentioned. First, trends in fall-related fractures may have been underestimated because they represented only older adults treated in EDs. Second, fall-related fractures may have been missed because the NEISS-AIP reports the principal diagnosis and primary body part affected during the initial injury visit. In cases with multiple injuries, data for the most severe injury are recorded. Third, the NEISS-AIP coding system has a fixed number of categories for the primary body part affected. Therefore, specific fractures such as hip fracture may not be accurately identified.^{6,9} Despite these limitations, the present findings may be generalised to the U.S. older population.

In conclusion, EDs visits and hospitalisation for fall-related fractures increased in U.S. older adults over the past two decades. However, after accounting for the demographic changes of the population, the incidence of EDs visits for fall-related fractures in women significantly decreased from 2016 onward.

Collaborators None.

Contributors CHO designed the study, analyzed the data, and drafted the manuscript.

Funding The present study was conducted without external research funding.

Competing interests None declared.

Patient consent for publication Not applicable.

Provenance and peer review Not commissioned; externally peer reviewed.

ORCID iD

Carlos H Orces <http://orcid.org/0000-0003-2452-3423>

REFERENCES

- Rubenstein LZ, Josephson KR. The epidemiology of falls and syncope. *Clin Geriatr Med* 2002;18:141–58.
- Bohl AA, Fishman PA, Ciol MA, *et al*. A longitudinal analysis of total 3-year Healthcare costs for older adults who experience a fall requiring medical care. *J Am Geriatr Soc* 2010;58:853–60.
- Stevens JA, Sogolow ED. Gender differences for non-fatal unintentional fall related injuries among older adults. *Inj Prev* 2005;11:115–9.
- GBD2019 Fracture Collaborators. Global, regional, and national burden of bone fractures in 204 countries and territories, 1990–2019: a systematic analysis from the global burden of disease study 2019. *Lancet Healthy Longev* 2021;2:e580–92.
- Palacios S, Neyro JL, Fernández de Cabo S, *et al*. Impact of osteoporosis and bone fracture on health-related quality of life in postmenopausal women. *Climacteric* 2014;17:60–70.
- Orces CH. Emergency Department visits for fall-related fractures among older adults in the USA: a retrospective cross-sectional analysis of the National electronic injury surveillance system all injury program, 2001–2008. *BMJ Open* 2013;3:e001722.
- Orces CH, Alamgir H. Trends in fall-related injuries among older adults treated in emergency departments in the USA. *Inj Prev* 2014;20:421–3.
- Drew JAR, Xu D. Trends in fatal and nonfatal injuries among older Americans, 2004–2017. *Am J Prev Med* 2020;59:3–11.
- Orces CH, Orces J. Trends in the U.S. childhood emergency Department visits for fall-related fractures, 2001–2015. *Cureus* 2020;12:e11629.
- Baidwan NK, Naranje SM. Epidemiology and recent trends of geriatric fractures presenting to the emergency Department for United States population from year 2004–2014. *Public Health* 2017;142:64–9.
- Shankar KN, Liu SW, Ganz DA. Trends and characteristics of emergency Department visits for fall-related injuries in older adults, 2003–2010. *West J Emerg Med* 2017;18:785–93.
- Moreland B, Kakara R, Henry A. Trends in nonfatal falls and fall-related injuries among adults aged ≥65 years - United States, 2012–2018. *MMWR Morb Mortal Wkly Rep* 2020;69:875–81.
- Orces CH. Trends in osteoporosis medication use in US postmenopausal women: analysis of the national health and nutrition examination survey 1999–2000 through 2017–2018. *Menopause* 2022;29:1279–84.
- Dautzenberg L, Beglinger S, Tsokani S, *et al*. Interventions for preventing falls and fall-related fractures in community-dwelling older adults: A systematic review and network meta-analysis. *J Am Geriatr Soc* 2021;69:2973–84.
- Hartholt KA, Stevens JA, Polinder S, *et al*. Increase in fall-related hospitalizations in the United States, 2001–2008. *J Trauma* 2011;71:255–8.
- Reider L, Pollak A, Wolff JL, *et al*. National trends in extremity fracture hospitalizations among older adults between 2003 and 2017. *J Am Geriatr Soc* 2021;69:2556–65.