

Public Health Resources

Public Health Resources

University of Nebraska - Lincoln

Year 2008

Self-Reported Falls and Fall-Related
Injuries Among Persons Aged ≥ 65
Years—United States, 2006

J.A. Stevens*

K.A. Mack[†]

L.J. Paulozzi[‡]

M.F. Ballesteros**

*National Center for Injury Prevention and Control, Centers for Disease Control and Prevention, Atlanta, Georgia, USA

[†]National Center for Injury Prevention and Control, Centers for Disease Control and Prevention, Atlanta, Georgia, USA

[‡]National Center for Injury Prevention and Control, Centers for Disease Control and Prevention, Atlanta, Georgia, USA

**National Center for Injury Prevention and Control, Centers for Disease Control and Prevention, Atlanta, Georgia, USA

This paper is posted at DigitalCommons@University of Nebraska - Lincoln.

<http://digitalcommons.unl.edu/publichealthresources/82>



ELSEVIER

www.elsevier.com/locate/jsr

Journal of Safety Research 39 (2008) 345–349



www.nsc.org

Special Report from the CDC

Self-Reported Falls and Fall-Related Injuries Among Persons Aged ≥ 65 Years—United States, 2006[☆]

J.A. Stevens^{*}, K.A. Mack, L.J. Paulozzi, M.F. Ballesteros

National Center for Injury Prevention and Control, Centers for Disease Control and Prevention, Atlanta, Georgia, USA

Accepted 5 May 2008

Available online 4 June 2008

The *Journal of Safety Research* has partnered with the Office of the Associate Director for Science, Division of Unintentional Injury Prevention, National Center for Injury Prevention and Control at the Centers for Disease Control and Prevention (CDC) in Atlanta, Georgia, USA, to briefly report on some of the latest findings in the research community. This report is the 10th in a series of articles from the CDC. This article was adapted from the CDC's *Morbidity and Mortality Weekly Report*, published on March 7, 2008/ Vol 57/No. 9:225–229, and is used here by permission.

Abstract

Problem: In 2005, 15,802 persons aged ≥ 65 years died from fall injuries. How many older adults seek outpatient treatment for minor or moderate fall injuries is unknown. **Method:** To estimate the percentage of older adults who fell during the preceding three months, the Centers for Disease Control and Prevention (CDC) analyzed data from two questions about falls included in the 2006 Behavioral Risk Factor Surveillance System (BRFSS) survey. **Results:** Approximately 5.8 million (15.9%) persons aged ≥ 65 years reported falling at least once during the preceding three months, and 1.8 million (31.3%) of those who fell sustained an injury that resulted in a doctor visit or restricted activity for at least one day. **Discussion:** This report presents the first national estimates of the number and proportion of persons reporting fall-related injuries associated with either doctor visits or restricted activity. **Summary:** The prevalence of falls reinforces the need for broader use of scientifically proven fall-prevention interventions. **Impact on industry:** Falls and fall-related injuries represent an enormous burden to individuals, society, and to our health care system. Because the U.S. population is aging, this problem will increase unless we take preventive action by broadly implementing evidence-based fall prevention programs. Such programs could appreciably decrease the incidence and health care costs of fall injuries, as well as greatly improve the quality of life for older adults.

Published by Elsevier Ltd.

Keywords: Aged; BRFSS; elderly; falls; injury

1. Problem

Among people aged ≥ 65 years, falls are the leading cause of both fatal and nonfatal unintentional injuries (Centers for Disease Control and Prevention [CDC], 2007). One out of three older adults falls annually and the likelihood of falling increases rapidly with advancing age. In 2005, 15,802 persons aged ≥ 65 years died as a result of fall injuries (CDC, 2007). However, the number of older adults who fall and are not injured or who sustain minor or moderate injuries and seek treatment in clinics or physician offices are unknown. To estimate the proportion of older adults who fell during the preceding three months, Centers for Disease Control and Prevention (CDC) analyzed data from the 2006 Behavioral Risk Factor Surveillance System (BRFSS) survey.

[☆] Disclaimer: The findings and conclusions in this report are those of the authors and do not necessarily represent the official views of the funding agency.

^{*} Corresponding author. National Center for Injury Prevention and Control, Centers for Disease Control and Prevention, 4770 Buford Highway NE, Mailstop F-62, Atlanta, GA 30340. Tel.: +770 488 4649; fax: +770 488 1317.

E-mail address: jas2@cdc.gov (J.A. Stevens).

Table 1
Persons aged ≥65 years who reported falls and fall-related injuries during the preceding three months, by state*-Behavioral Risk Factor Surveillance System, 2006

State	Reported at least one fall during the preceding 3 months			Among those who fell, reported being injured at least once		
	%	(95% CI**)	Estimated Number [†]	%	(95% CI)	Estimated number
Overall	15.9	(15.4–16.4)	5,828,731	31.3	(29.7–32.8)	1,812,315
Alabama	17.4	(14.7–20.6)	103,772	40.0	(31.3–49.3)	41,241
Alaska	19.6	(13.5–27.6)	8,654	24.2§	—	2,097
Arizona	13.9	(11.1–17.3)	104,105	36.8	(25.0–50.5)	38,298
Arkansas	16.4	(14.5–18.5)	63,752	26.8	(21.5–33.0)	17,116
California	17.7	(15.0–20.7)	649,771	33.8	(25.5–43.2)	219,493
Colorado	16.6	(14.5–19.0)	75,760	28.9	(22.9–35.8)	21,723
Connecticut	13.6	(12.0–15.4)	64,083	28.6	(23.1–34.9)	18,347
Delaware	14.8	(12.1–17.9)	16,637	39.1	(29.0–50.2)	6,502
District of Columbia	14.5	(11.9–17.5)	9,400	28.4‡	—	2,672
Florida	13.6	(12.1–15.1)	406,745	34.7	(29.4–40.4)	140,319
Georgia	17.5	(15.3–19.8)	152,546	35.3	(28.7–42.6)	53,613
Hawaii	12.8	(10.8–15.1)	22,172	28.2	(20.9–36.8)	6,231
Idaho	19.5	(17.1–22.3)	31,347	34.8	(27.8–42.4)	10,831
Illinois	14.8	(12.6–17.3)	228,551	31.5	(23.8–40.5)	71,851
Indiana	15.6	(13.7–17.7)	120,338	33.0	(26.9–39.6)	39,105
Iowa	14.4	(12.5–16.5)	60,738	27.0	(21.1–34.0)	16,340
Kansas	17.4	(15.8–19.2)	61,809	30.2	(25.5–35.3)	18,548
Kentucky	17.6	(15.3–20.2)	84,252	30.8	(24.3–38.1)	25,375
Louisiana	16.1	(14.1–18.3)	84,210	28.9	(23.1–35.6)	24,070
Maine	16.9	(14.3–19.8)	32,300	23.0§	—	7,373
Maryland	15.7	(13.8–17.9)	99,342	27.8	(22.1–34.3)	27,472
Massachusetts	16.6	(14.9–18.6)	139,314	29.3	(24.3–34.9)	40,590
Michigan	15.9	(13.9–18.0)	199,553	29.4	(23.5–36.2)	58,741
Minnesota	15.5	(13.4–18.0)	97,794	31.5	(24.6–39.2)	30,762
Mississippi	18.4	(16.4–20.7)	65,852	34.2	(28.2–40.6)	22,342
Missouri	16.2	(13.6–19.3)	125,146	30.8	(23.6–39.0)	38,502
Montana	18.0	(15.9–20.4)	22,909	27.2	(21.5–33.8)	6,232
Nebraska	15.0	(13.3–16.9)	34,589	23.7	(18.7–29.6)	8,183
Nevada	15.1	(12.1–18.7)	41,465	36.9§	—	15,291
New Hampshire	16.5	(14.3–18.9)	26,200	33.1	(26.2–40.8)	8,680
New Jersey	13.1	(11.9–14.5)	145,105	30.0	(25.5–35.0)	43,163
New Mexico	18.4	(16.1–20.9)	42,491	30.7	(24.4–37.7)	12,885
New York	15.2	(13.2–17.3)	366,860	27.0	(21.2–33.8)	98,348
North Carolina	16.7	(15.4–18.1)	177,518	34.0	(29.8–38.4)	59,953
North Dakota	16.4	(14.1–18.9)	15,007	29.8	(23.0–37.6)	4,466
Ohio	14.3	(11.6–17.6)	214,596	31.6	(22.0–43.1)	67,448
Oklahoma	16.0	(14.3–17.9)	74,965	30.1	(24.7–36.1)	22,474
Oregon	15.3	(13.3–17.6)	71,255	28.7	(22.6–35.7)	20,466
Pennsylvania	15.7	(13.7–17.8)	291,355	26.7	(20.9–33.3)	77,622
Rhode Island	16.5	(14.3–19.0)	24,877	48.0	(40.5–55.7)	11,899
South Carolina	14.2	(12.6–16.0)	76,214	39.6	(33.6–46.0)	30,040
South Dakota	16.1	(14.2–18.0)	17,602	29.1	(23.5–35.4)	5,100
Tennessee	15.0	(12.4–18.0)	111,181	28.8§	—	30,642
Texas	17.9	(15.3–20.8)	401,689	28.5	(21.6–36.7)	113,820
Utah	18.8	(15.9–22.1)	39,967	27.5	(20.5–35.9)	10,924
Vermont	20.1	(18.1–22.2)	16,600	28.7	(23.7–34.3)	4,738
Virginia	14.4	(12.1–17.0)	122,966	28.2	(21.1–36.6)	34,400
Washington	18.3	(17.1–19.5)	132,251	32.0	(28.6–35.6)	42,218
West Virginia	16.6	(14.3–19.3)	46,979	35.7	(28.4–43.7)	16,654
Wisconsin	15.0	(12.6–17.6)	106,861	27.4 [†]	—	29,290
Wyoming	18.0	(15.8–20.5)	11,361	33.8	(27.3–40.9)	3,816
Puerto Rico	18.6	(16.3–21.0)	86,640	39.0	(32.3–46.2)	33,573
Virgin Islands	14.8	(11.4–19.0)	1,284	33.9 [†]	—	435

*Includes the 50 states, District of Columbia, Puerto Rico, and U.S. Virgin Islands.

**Confidence interval.

[†]Estimates are weighted to account for probability of selection to match age-, race/ethnicity-, and sex-specific populations from annually adjusted intercensal estimates.

[‡]Estimate may be unstable (n < 50).

2. Methods

BRFSS surveys are conducted in all 50 states, the District of Columbia (DC), and selected U.S. territories (Puerto Rico, the U.S. Virgin Islands, and Guam; CDC, 2003). BRFSS uses a multistage sampling design based on random-digit-dialing methods to select a representative sample of the noninstitutionalized, civilian population aged ≥ 18 years in each state or territory. Details on the design, random sampling procedures, and reliability and validity of measures used in BRFSS have been described previously (Nelson, Holtzman, Bolen, Stanwyck, & Mack, 2001; CDC, 2004).

In 2006, the median response rate among states, based on Council of American Survey Research Organizations (CASRO) guidelines, was 51.4% (range: 35.1%–66.0%). Data were weighted to account for probability of selection and to match the age-, race/ethnicity-, and sex-specific populations from annually adjusted intercensal estimates. Statistical significance was determined by non-overlapping 95% confidence intervals. Estimates were considered unstable if the unweighted sample size for the subgroup was less than 50.

Two questions about falls were included in the 2006 BRFSS. The first was, “The next question asks about a recent fall. By a fall, we mean when a person unintentionally comes to rest on the ground or another lower level. In the past three months, how many times have you fallen?” Those who reported a fall were asked a second question, “How many of these falls caused an injury? By an injury, we mean the fall caused you to limit your regular activities for at least a day or to go see a doctor.” Data from the 50 states, District of Columbia, Puerto Rico, and the U.S. Virgin Islands were included in this study.

3. Results

In 2006, 92,808 persons aged ≥ 65 years were interviewed. In response to the first question, the number of falls reported ranged from 0 to 76; the mean number of falls among those who fell was 1.9; median = 1.0. Of respondents who said they had fallen, 23.1% reported falling three or more times. Overall, 15.9% of respondents reported one or more falls (Table 1). The number of falls that

Table 2
Characteristics of persons aged ≥ 65 years who reported falls and fall-related injuries during the previous three months—Behavioral Risk Factor Surveillance System, 2006

	Reported at least one fall during the preceding 3 months			Among those who fell, reported being injured at least once		
	%	(95% CI*)	Estimated number**	%	(95% CI)	Estimated number
Overall	15.9	(15.4–16.4)	5,828,731	31.3	(29.7–32.8)	1,812,315
Gender						
Women	16.4	(15.8–17.0)	3,496,036	35.7	(33.7–37.9)	1,241,684
Men	15.2	(14.4–16.0)	2,332,696	24.6	(22.5–26.8)	570,631
Race [‡]						
American Indian/ Alaska Native	27.8	(19.1–38.5)	72,398	34.3	(18.2–55.0)	24,803
Asian/Hawaiian/ Pacific Islander	13.0	(8.3–19.7)	72,330	25.7 [†]		18,449
Black	13.0	(11.4–14.8)	346,155	32.8	(26.2–40.1)	111,527
Hispanic	17.4	(14.5–20.8)	457,096	41.0	(30.9–51.8)	185,595
Other/Multiple Race	18.8	(15.5–22.6)	149,891	28.9	(21.5–37.8)	43,217
White	15.8	(15.4–16.3)	4,643,692	30.3	(28.9–31.7)	1,400,498
Age Group						
65–69	13.4	(12.7–14.2)	1,419,074	29.9	(27.4–32.6)	421,955
70–74	14.0	(13.2–14.9)	1,196,065	31.8	(28.5–35.3)	378,685
75–79	15.7	(14.7–16.8)	1,372,992	31.0	(27.8–34.4)	423,300
80+	20.8	(19.7–21.9)	1,840,600	32.1	(29.1–35.3)	588,376
Marital Status [§]						
Married	14.2	(13.5–14.8)	2,951,196	28.4	(26.4–30.6)	836,610
Single	18.1	(17.4–18.9)	2,858,244	34.0	(31.7–36.3)	963,822
Self-reported general health						
Excellent	9.7	(8.7–10.9)	416,543	29.3	(23.9–35.3)	121,814
Very good	11.7	(11.0–12.4)	1,101,974	23.8	(21.3–26.5)	261,020
Good	14.4	(13.7–15.2)	1,771,034	28.1	(25.7–30.7)	495,184
Fair	19.8	(18.7–20.9)	1,438,467	35.9	(32.8–39.1)	514,058
Poor	32.5	(30.1–35.0)	1,056,012	39.1	(34.3–44.1)	409,705

*Confidence interval.

**Estimates are weighted to account for probability of selection to match age-, race/ethnicity-, and sex-specific populations from annually adjusted intercensal estimates.

[†]Estimate may be unstable ($n < 50$).

[‡]Except for the Hispanic category, all race categories exclude Hispanics.

[§]Single includes widowed, divorced, separated, and never married.

resulted in injury ranged from 0 to 50. Among those who fell and were injured, the mean number of injurious falls was 1.4; median=1.0. Overall, 31.3% of respondents who reported falling also reported a fall-related injury.

The percentages of men and women who reported falling during the preceding three months were similar (15.2% and 16.4%, respectively; Table 2), but women reported more fall-related injuries than men (35.7% vs. 24.6%). By race/ethnicity, American Indians/Alaska Natives reported the greatest percentage of falls (27.8%); Hispanics reported the greatest percentage of falls with injuries (41.0%). The percentage of persons aged 65–69 years and 70–74 years who reported falling during the preceding three months were similar (13.4% vs. 14.0%), but increased significantly for persons aged 75–79 years (15.7%) and ≥ 80 years (20.8%). Although the proportion of persons reporting falls increased with age, the percentage reporting fall-related injuries was nearly identical for each age group (range: 29.9%–32.1%).

Reports of falls ranged from 12.8% among respondents in Hawaii to 20.1% among those in Vermont, but no geographic patterns were apparent. The 50 states and the District of Columbia were ranked according to their age-adjusted fall mortality rates for 2003–2004. Of the seven states at or above the 90th percentile nationally (Arizona, Minnesota, New Mexico, Rhode Island, South Dakota, Vermont, and Wisconsin; CDC, 2007), only Vermont (first) and New Mexico (seventh) also were among the 10 states with the greatest proportion of reported falls; only Rhode Island (first) and Arizona (seventh) appeared among the 10 states with the greatest proportion of fall-related injuries. The percentage of respondents who fell and were injured ranged from 23.7% (Nebraska) to 48.0% (Rhode Island).

4. Discussion

Falls are the leading cause of fatal and non-fatal injuries among persons aged ≥ 65 years (CDC, 2007). National estimates for rates of fatal falls and fall-related injuries treated in emergency departments have been published previously (CDC, 2006); however, this report presents the first national estimates of the number and proportion of persons reporting fall-related injuries associated with either doctor visits or restricted activity. This study found that in 2006, approximately 5.8 million (almost 16%) of persons aged ≥ 65 years reported falling at least once during the preceding three months, and 1.8 million (nearly 5% of all older adults) sustained some type of fall-related injury. Even when such injuries are minor, they can seriously affect older adults' quality of life by inducing a fear of falling, which can lead to self-imposed activity restrictions, social isolation, and depression (Vellas, Wayne, Rommer, Baumgarner, & Garry, 1997). In addition, medical treatment for falls places a burden on U.S. healthcare services. In 2000, direct medical costs for fall-related injuries totaled approximately \$19 billion (Stevens, Corso, Finkelstein, & Miller, 2006). A recent study determined that 31.8% of older adults who sustained a fall-related injury required help with activities of daily living as a result, and among them, 58.5% were expected to require help for at least 6 months (Stevens et al., 2006).

Few studies of falls have used a 3-month time frame, so comparison with other studies is challenging. A recent analysis of data from the National Health Interview Survey (NHIS) presented the number and rate of medically attended falls reported during the preceding three months. However, the NHIS design did not permit calculation of the number of persons injured (Schiller, Kramarow, & Dey, 2007).

Other studies of persons aged ≥ 65 years have reported that women fall more frequently and are treated for fall-related injuries, especially fractures, more often than men (Schiller et al., 2007). Similarly, this analysis of BRFSS data indicated that a greater proportion of women than men reported fall-related injuries, but it did not find a significant difference between the proportion of women and men that reported falls. The reasons for the differences in results between these studies are uncertain. Women might be less likely than men to report a noninjurious fall, or more likely than men to restrict their activities or seek medical attention after a fall.

The BRFSS definition of a fall-related injury does not specify severity; an injury could be as minor as a small bruise or as severe as a broken hip. This broad definition could have obscured age-related differences if, for example, persons aged 65–69 years sustained less severe injuries and persons aged ≥ 80 years experienced more severe injuries.

These study findings are subject to at least five limitations. First, BRFSS is a telephone-based survey and excludes households without landline telephones, so the results might be subject to selection bias. Second, data are self-reported and subject to recall bias; therefore, prevalence estimates of falls might be underestimated. Third, BRFSS does not include institutionalized persons, thereby excluding persons in long-term care facilities, who are most at risk for falls. Fourth, the broad definition of injury might have led participants to report minor falls as injurious, resulting in an estimate of fall-related injuries that is higher than in other similar studies. Finally, the low response rate and possible response bias might have affected the representativeness of these data.

5. Summary

Falls and fall-related injuries seriously affect older adults' quality of life and present a substantial burden to the U.S. health care system. Modifiable fall risk factors include muscle weakness, gait and balance problems, poor vision, use of psychoactive medications, and home hazards (Gillespie, Gillespie, Robertson, Lamb, Cumming, & Rowe, 2004). Falls among older adults can be reduced through evidence-based fall-prevention programs that address these modifiable risk factors. Most effective interventions focus on exercise, either alone or as part of a multifaceted approach that may include medication management, vision correction, and

home modifications (Stevens & Sogolow). One example of an effective fall-prevention program is *Moving for Better Balance*, a Tai Chi program based on a randomized controlled trial (RCT) conducted at the Oregon Research Institute, which reduced the frequency of falls by 55% (Li et al., 2005). The program is conducted in senior centers in Oregon, and participants learn eight body-movement exercises during 1-hour classes offered twice weekly for 12 weeks.

Li's Tai Chi study (Li et al., 2005) and 13 other community-based RCT intervention studies that were effective in reducing falls among older adults are described in a new publication, *"Preventing Falls: What Works — A Compendium of Effective Community-Based Interventions from Around the World."* This resource gives public health practitioners and community organizations descriptions and relevant details about these proven interventions. The companion document, *"Preventing Falls: How to Develop Community-based Fall Prevention Programs for Older Adults"*, provides guidelines to help organizations develop fall-prevention programs. This useful 'how-to' document describes the building blocks of effective fall prevention programs and gives examples, resources, and tips for creating, promoting, and evaluating a fall prevention program. Both of these documents are available at www.cdc.gov/ncipc/preventingfalls.

Acknowledgments

The authors would like to acknowledge Dr. David Sleet, Dr. Daphne Moffat, and Dr. Ann Dellinger for their thoughtful comments and suggestions.

References

- Centers for Disease Control and Prevention [CDC]. (2003). Public health surveillance for behavioral risk factors in a changing environment: recommendations from the Behavioral Risk Factor Surveillance team. *MMWR*, 52 (No. RR-9).
- Centers for Disease Control and Prevention [CDC]. (2004). *Behavioral Risk Factor Surveillance System operational and user's guide, version 3.0*. Atlanta, GA: U.S. Department of Health and Human Services.
- Centers for Disease Control and Prevention [CDC]. (2006). Fatalities and injuries from falls among older adults—United States, 1993–2003 and 2001–2005. *MMWR*, 55, 1222–1224.
- Centers for Disease Control and Prevention [CDC]. (2007, July 10). Web-based Injury Statistics Query and Reporting System (WISQARS) [database online]. *National Center for Injury Prevention and Control, Centers for Disease Control and Prevention (producer)* Available from URL: www.cdc.gov/ncipc/wisqars
- Gillespie, L. D., Gillespie, W. J., Robertson, M. C., Lamb, S. E., Cumming, R. G., & Roe, B. H. (2004). *Interventions for preventing falls in elderly people (Cochrane Review)*. In: The Cochrane Library, Issue 3. Chichester, UK: John Wiley & Sons, Ltd.
- Li, F., Harmer, P., Fisher, K. J., McAuley, E., Chaumeton, N., & Eckstrom, E. (2005). Tai Chi and fall reductions in older adults: a randomized controlled trial. *J. Gerontol.*, 60A, 187–194.
- Nelson, D., Holtzman, D., Bolen, J., Stanwyck, C. A., & Mack, K. (2001). Reliability and validity of measures from the Behavioral Risk Factor Surveillance System (BRFSS). *Int. J. Public Health*, 46, S3–S35.
- Schiller, J. S., Kramarow, E. A., & Dey, A. N. (2007). Fall injury episodes among noninstitutionalized older adults: United States, 2001–2003. *Adv. Data*, 392, 1–16.
- Stevens, J. A., Corso, P. S., Finkelstein, E. A., & Miller, T. R. (2006). The costs of fatal and non-fatal falls among older adults. *Inj. Prev.*, 12, 290–295.
- Stevens, J. A., & Sogolow, E. D. (2005). Gender differences for non-fatal unintentional fall related injuries among older adults. *Inj. Prev.*, 11, 115–119.
- Vellas, B. J., Wayne, S. J., Romer, L. J., Baumgarter, R. N., & Garry, P. J. (1997). Fear of falling and restriction of mobility in elderly fallers. *Age Aging*, 26, 189–193.

Dr. Judy A. Stevens is a national expert on older adult falls and fall prevention. She received her doctorate degree from Emory University, and, in 1996, joined the National Center for Injury Prevention and Control (NCIPC), at the CDC. As a senior scientist in the Division of Unintentional Injury Prevention, Dr. Stevens conducts epidemiologic research on fatal and nonfatal fall-related injuries among older adults. She also provides technical assistance and oversight to NCIPC funded studies, conducted by universities and state health departments, that develop, implement, and evaluate senior fall prevention programs. Dr. Stevens is a frequent speaker at state, national, and international conferences, and has received recognition for prevention activities and educational materials including science-based fall prevention materials now being used by over 6,000 health care professionals, public health organizations, and individuals. She is the author of over 40 peer-reviewed publications.