CLINICAL INVESTIGATION

Medical Costs of Fatal and Nonfatal Falls in Older Adults

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OBJECTIVES: To estimate medical expenditures attributable to older adult falls using a methodology that can be updated annually to track these expenditures over time.
DESIGN: Population data from the National Vital Statistics System (NVSS) and cost estimates from the Web-based Injury Statistics Query and Reporting System (WISQARS) for fatal falls, quasi-experimental regression analysis of data from the Medicare Current Beneficiaries Survey (MCBS) for nonfatal falls.
SETTING: U.S. population aged 65 and older during 2015.
PARTICIPANTS: Fatal falls from the 2015 NVSS (N=28,486); respondents to the 2011 MCBS (N=3,460).
MEASUREMENTS: Total spending attributable to older adult falls in the United States in 2015, in dollars.
RESULTS: In 2015, the estimated medical costs attributable to fatal and nonfatal falls was approximately $50.0 billion. For nonfatal falls, Medicare paid approximately $28.9 billion, Medicaid $8.7 billion, and private and other payers $12.0 billion. Overall medical spending for fatal falls was estimated to be $754 million.
CONCLUSION: Older adult falls result in substantial medical costs. Measuring medical costs attributable to falls will provide vital information about the magnitude of the problem and the potential financial effect of effective prevention strategies. **J Am Geriatr Soc 2018.**

Key words: older adults; falls; medical costs; Medicare; Medicaid

Older adult falls are a common, serious, growing public health problem. Approximately 30% of adults aged 65 and older fall each year,[1,2] and these falls often result in serious injuries, decreases in mobility, and loss of independence.[3,4] Only one-third of those who fall seek medical care.[5] With the aging of the "boomer" generation, the growth of the older population in the United States is accelerating. Problems with mobility, balance, and loss of muscle strength contribute to the likelihood of falling. In addition, people are living longer and living with chronic conditions such as cardiovascular disease, diabetes mellitus, and arthritis. These illnesses, as well as many of the medications used to treat them, can increase fall risk.

The high incidence, long-term effects, and costs of falls will affect our healthcare system increasingly as time goes on. Over the next 20 years, the number of falls and the associated costs are projected to increase substantially.[6] This study was designed to estimate falls-attributable medical costs using a methodology that can be updated annually to track the effect of this rapidly evolving public health problem.

Although a number of studies have calculated the cost of fall injuries,[7–12] the results are difficult to compare and update. Methods for estimating the medical costs of falls vary because of the differing methods used to identify falls or fall injuries, the treatment facilities and populations included, the perspective from which costs are measured (e.g., societal, payer, provider), and variations in modeling methods. For example, 2 recent studies estimated the healthcare costs for falls across all types of healthcare providers.[13,14] These studies used multiple data sources to estimate the rate of falls and their associated costs, estimating falls using *International Classification of Diseases, Ninth Revision* (ICD-9) diagnosis and external cause codes. Research has shown that fall rates estimated using ICD-9 and external codes can vary substantially based on the combination of codes used.[15] Another approach is to include all fall costs in a defined period after a medically treated fall by comparing fallers and nonfallers.[7,8,16] These studies have the benefit of measuring changes in costs induced by a fall but use data specific to certain healthcare payers and do not estimate costs for all healthcare spending associated with falls.

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In this study, we proposed a different approach for estimating the cost of nonfatal falls using data that contained comprehensive information on healthcare spending and collected information on nonfatal falls: the Medicare Current Beneficiaries Survey (MCBS). The MCBS includes information on payments to hospitals and healthcare providers, including those that other data sources exclude (e.g., payments for professional services and payments that hospitals receive). The MCBS was used to estimate the attributable fraction (AF) of medical expenditures associated with a reported nonfatal fall in the previous year using the same methodology used to estimate healthcare costs attributable to smoking[17] and obesity.[18] This method treats falls as a risk factor for greater healthcare spending and does not attempt to match falls to specific healthcare events. These estimates were then applied to data from the National Health Expenditure Accounts (NHEAs) to derive total healthcare expenditures associated with falls[19] To measure the cost of fatal falls, we used the Web-based Injury Statistics Query and Reporting System (WISQARS) to obtain the latest counts and costs of fatal falls. This study produced estimates similar in magnitude to prior estimates but can be updated annually using vital statistics and national healthcare spending data.

METHODS AND DATA

The incidence and costs of fatal and nonfatal falls were calculated separately because no single data source measured fatal and nonfatal falls.

Fatal Falls

The 2015 incidence and healthcare-related costs of unintentional fatal falls in older adults were obtained from WISQARS.[20] Information on fatal injuries in WISQARS comes from the National Center for Health Statistics Multiple Cause of Death (MCD) data. The MCD data are coded using the ICD-10, with unintentional falls coded W00-W19. Healthcare costs for fatal falls were estimated using the WISQARS cost module that estimates healthcare costs based on place of death (on scene or at home, dead on arrival at hospital, emergency department, hospital after admission, nursing home, hospice). All cases, regardless of location of death, were assigned the average cost of coroner or medical examiner administration. Deaths recorded as having an autopsy performed had the average costs of an autopsy added. Deaths that occurred in healthcare facilities had the average costs for facilities included based on the diagnosis and mechanism of injury. Specific details of how the cost estimates were developed is available elsewhere.[21] All cost estimates were based on 2015 dollars.

Nonfatal Falls

The data source for the incidence and attributable cost of nonfatal falls was the MCBS Cost and Use file. The MCBS is a nationally representative rolling cohort survey of Medicare beneficiaries. It combines a survey of Medicare beneficiaries with Medicare administrative data from billing files that include Medicare payments for services provided. Self-reported survey data include beneficiary demographic characteristics, living arrangements, health status, and physical functioning, as well as payments of Medicare supplemental plans (directly purchased and employer sponsored) and Medicaid for low-income beneficiaries. The survey also collects information on health services that Medicare does not cover, most notably nursing home and other long-term care. This analysis used data from the 2011 Cost and Use files limited dataset (the most recent survey year of the research team's data use agreement).

Sample

Of the 10,901 respondents in the 2011 MCBS, 10,102 completed the section on health status and functioning. The sample evaluated here included 3,460 individuals. Respondents were excluded if they were younger than 65 or employed, died during the survey period, or lived in Puerto Rico or in a long-term care facility. These exclusions were made because the healthcare spending measures were unreliable for these groups (e.g., employees may be covered by employer insurance, and it is difficult for employees to report how much the employer plan pays), or full-year data were not available which might have resulted in double counting of the fatal cost estimates (e.g., died during the survey year). Respondents were also excluded if they had a full year of private managed care insurance or Medicare Advantage because the MCBS does not report spending for these respondents because of capitated payment.

Regression models of healthcare spending

To estimate the effect of falls on medical spending, we used a regression model with total individual spending as the dependent variable and falls and demographic, health, and other factors as control variables. MCBS includes two falls questions annually: "Since (last interview), have you fallen down?" and "Since (last interview), how many times have you fallen down?" Both falls questions are in the Survey Health Status and Functioning file and the R61 Health Status Functioning questionnaire section. Because the primary focus of this study was to estimate the healthcare costs attributable to all falls and not the increase in costs as the number of falls increases, this analysis used the first question to create a dichotomous variable representing having fallen versus not having fallen in the past year.

Control variables included sex, race, age, income, education, region of residence, and health status measures, including self-rated health, several chronic conditions (Table 1), and body mass index. The health status measures are associated with medical spending, and if excluded, their costs could incorrectly be attributed to falls. Regression models were estimated according to healthcare payer category (Medicare; Medicaid (conditional on having coverage from this source); private, out of pocket, other) and service type category (hospital, physician or other health professional, dental, prescription

Table 1. Characteristics of Older Adults According to Whether They Reported Falling in Past Year: Medicare Current Beneficiaries Survey, 2011

Characteristic	No Fall, 76.1%	Fall, 23.9%	P-Value
Number of falls, %			
1		52.1	
2		21.3	
3		10.5	
4		4.2	
5		3.7	
≥6		5.7	
Female, %	55.8	63.0	.01
Caucasian, %	86.0	91.7	<.001
Age, average	76.5	78.4	<.001
Income, average, $	40,318	37,688	<.001
Education, %[a]			
<High school	23.4	25.5	
High school graduate	24.2	23.2	
Some college	23.5	25.0	
College graduate	24.5	21.5	.41
Region, %[a]			
Northeast	15.7	12.3	
Midwest	23.0	26.1	
South	42.5	42.1	
West	16.6	17.6	.07
Self-rated general health, %[a]			
Excellent	17.7	11.3	
Very good	34.1	24.7	
Good	30.7	31.1	
Fair	13.8	23.3	
Poor	3.2	9.3	<.001
Depression, %	18.8	33.3	<.001
Hypertension, %	71.2	76.1	.01
Diabetes mellitus, %	24.0	32.8	<.001
Osteoporosis, %	22.3	30	<.001
Emphysema, asthma, chronic obstructive pulmonary disease, %	17.7	24.0	<.001
Other heart condition, %	11.7	14.4	.05
Stroke, brain hemorrhage, %	9.8	15.0	<.001
High blood pressure within last 12 months, %	50.9	56.1	.01
Myocardial infarction within last 12 months, %	1.9	1.8	.82
Stroke/brain hemorrhage within last 12 months, %	1.7	3.2	.01
Legally blind, %	0.6	0.9	.30

[a]P-value based on chi-square test of difference of distribution across categories.

drugs, other). The regression models used a generalized linear model with a gamma distribution and a log link. In cases in which there was a substantial percentage of observations with no expenditures (for hospital, dental, and other service types), a 2-part model was used[22] that had a logit regression for any expenditures and a generalized linear model for expenditure level.

Attributable Fractions

The AF of medical expenditures is the percentage of total expenditures attributable to a particular condition or risk factor. The AF for nonfatal falls was calculated in two steps. First, total expenditures were estimated at the observed values of all independent variables in the regression model. Then, the hypothetical level of expenditures if no falls had occurred was estimated, with the "any falls" variable equal to 0 and all other independent variables left at their observed values. The AF due to falls was calculated as: falls AF = (total expenditures–total expenditures if no falls)/total expenditures.

The resulting fraction estimated the percentage of all expenditures attributable to falls, controlling for the other variables in the regression model. Bootstrap estimates were replicated 1,000 times to develop a distribution of estimates for calculating confidence intervals.

The Centers for Medicare and Medicaid Services produces the NHEA annually, which provides the official measure of total healthcare consumption in the United States. The NHEA provides spending amounts according to type of service (e.g., hospital care, professional services) and source of funds (e.g., out of pocket, private health insurance, Medicare, Medicaid)[19] and provides periodic measures of spending according to age, sex, and state of residence. The current study used the 2013 NHEA to measure overall healthcare spending according to type of service and source of funds and the 2012 age and sex report to estimate the share of expenditures for persons aged 65 and older.[23] A detailed description of the NHEA methodology is available elsewhere.[24]

Overall healthcare expenditure levels for the older adult population were extrapolated from the NHEA using a 2-step process. First, the percentage of total national health expenditures for the population aged 65 and older was derived from 2012 estimates,[23] which are the most recently published NHEA breakdowns according to age. These proportions were estimated separately for each payer and service type category used in our regression models. Then, these proportions were multiplied by total expenditures from the 2015 NHEA data for each payer and service type category. These calculations can be shown as: expenditures for aged 65 and older = (expenditures for aged 65 and older/total expenditures in current year)*total expenditures.

Once the estimated expenditures for the population aged 65 and older were determined for each payer and service type category, these expenditure amounts were multiplied by the falls AF to estimate falls attributable expenditures: falls attributable expenditures= expenditures for aged 65 and older in current year*falls AF.

Confidence intervals for the expenditure estimates were calculated using the upper and lower confidence limits of the AF estimates.

RESULTS

Fatal falls

WISQARS identified 28,486 unintentional fall deaths in people aged 65 and older in 2015, which represented a rate of 59.64 unintentional fall deaths per 100,000 population aged 65 and older. The estimated medical costs associated with these deaths were approximately $754 million in 2015.

Table 2. Nonfatal Falls Attributable Fraction of Expenditures and Associated Healthcare Spending According to Payer: 2011 Medicare Current Beneficiary Survey and 2015 National Health Expenditure Accounts

Payer	Attributable Fraction, % (95% CI)	Healthcare Spending, Billion $ (95% CI)
Medicare	6.0 (1.9–10.0)	28.9 (9.1–48.6)
Medicaid[a]	8.0 (–2.0–18.0)	8.7 (–2.1–19.4)
Private, out of pocket other	5.0 (1.2–8.8)	12.0 (2.5–21.6)
Total		49.5 (9.5–89.6)

[a]N = 571. Attributable fraction for Medicaid is statistically significantly different from 0 at the 10% level.
CI = confidence interval.

Nonfatal falls

One-quarter of older adults reported falling in the past year (Table 1). Of those who fell, 52.1% fell once, 21.3% fell twice, and 24.1% fell three or more times. Those who fell were significantly more likely to be female, Caucasian, older, and lower income. Fallers also had significantly lower self-rated health and reported more chronic conditions. A substantial share of healthcare expenditures for adults aged 65 and older was attributable to falls (Table 2). Approximately 6.0% of Medicare expenditures and 8.0% of Medicaid expenditures were attributable to falls. Five percent of other sources of payment, which included private insurance and out-of-pocket spending, was attributable to falls. These percentages suggest falls-attributable expenditures of $28.9 billion for Medicare, $8.7 billion for Medicaid, and $12.0 billion for other payment sources. In 2015, total healthcare spending attributable to falls was more than $49.5 billion. The Medicaid AF was not significant ($p<.10$), which may have been because of the small sample of persons covered (n=571).

Healthcare expenditures attributable to older adult falls varied according to service type (Table 3); 4.4% of hospital expenditures ($12.9 billion), 5.7% of physician and other health professionals expenditures ($10.8 billion), and 2.0% of prescription drug expenditures ($2.1 billion) were due to falls. The "other" category had the highest falls AF, which included spending for home health services, long-term care facilities, and durable medical equipment. Older adult falls accounted for 11.8% of expenditures in this category, which represented spending of $29.2 billion.

Table 3. Nonfatal Falls Attributable Fraction of Expenditures and Associated Healthcare Spending According to Type of Service: 2011 Medicare Current Beneficiary Survey and 2015 National Health Expenditure Accounts

Service Type	Attributable Fraction, % (95% CI)	Healthcare Spending, $ (95% CI)
Hospital[a]	4.4 (–0.6–9.3)	12.9 (–1.7–27.5)
Physician, other provider	5.7 (2.5–9.0)	10.8 (4.7–16.9)
Dental	1.6 (–3.0–6.2)	0.4 (–0.7–1.4)
Prescription drugs	2.0 (–1.1–5.1)	2.1 (–1.2–5.4)
Other[b]	11.8 (2.3–21.4)	29.2 (5.6–52.9)
Total		55.4 (6.8–104.0)

[a]Statistically significantly different from 0 at the 10% level.
[b]Includes other health, residential, and personal care; home health care; nursing care facilities and continuing care retirement communities; durable medical equipment; other nondurable medical products.
CI = confidence interval.

DISCUSSION

Older adult falls impose a large economic burden on the U.S. healthcare system.[6] The estimated costs of fatal and nonfatal falls combined totaled approximately $50.0 billion. Almost 99% of this cost was attributable to health care for nonfatal falls. In comparison, a 2013 estimate of U.S. healthcare spending on medical events for specific conditions estimated $38 billion (adjusted to 2015 dollars) in total spending for nonfatal older adult falls.[14] By applying an AF to the NHEA, the current study was able to incorporate a more comprehensive set of healthcare costs, including outpatient expenditures that were not directly associated with hospitalization or an emergency department visit.

This study estimated that Medicare spending attributable to nonfatal older adult falls totaled $28.9 billion. This estimate is consistent with estimates from prior studies of $30.8 billion to $34.5 billion (adjusted to 2015 dollars) and validates the approach used here.[13,25] Previous studies have used methodology similar to that of the current study and estimated Medicare costs for other causes of disease that are comparable with ours. For example, one previous study[18] estimated that Medicare expenditures attributable to obesity were $39 billion (data inflated to 2015 dollars from published 2008 estimate). Another study[17] estimated Medicare costs attributable to smoking of $48 billion (data inflated to 2015 dollars from published 2010 estimate), although the obesity and smoking estimates included all persons covered by Medicare (including disabled persons aged <65), not only older adults, as in our estimates.

The methodology used here estimated total health expenditures for falls across all payers and provides a more comprehensive picture of the economic burden of falls. Only two datasets, the MCBS and the NHEA, were required to produce the estimate for nonfatal falls. Because the NHEA is updated annually, this method can be used for yearly healthcare cost estimates for older adult falls. Approximately 10,000 Americans turn 65 each day[26] and people aged 85 and older are the fastest growing segment of the older population[27] and those at highest risk of falls.[1] Therefore, the economic burden from falls is likely to increase substantially in the coming years.[1] Monitoring cost trends is important, because 75% of the cost of older adult falls is financed through public health insurance programs that are already financially stressed.[14]

This study is subject to several limitations. The coding of cause of death for fatal falls may have varied across jurisdictions.[28] Healthcare costs for fatal falls were derived from secondary sources based on average cost per case. Nonfatal falls were treated as a risk factor for greater

health care spending and were estimated using regression modelling. If the likelihood of falls was correlated with comorbid conditions not in our model or unobserved individual characteristics in our sample, the fall AF estimates would be biased. The study applied the falls AF based on community-dwelling older adults who had fee-for-service Medicare coverage and were not currently employed to all older adult health expenditures. Excluded groups, such as those with Medicare Advantage plans or who were institutionalized, could have different fall rates and healthcare costs. Applying the falls AF to subsequent years of healthcare expenditure data assumed that the AF was constant over time. Summation of expenditures according to service category produced an estimate of total expenditures that was approximately 12% larger than the total when summed according to payer type ($55.4 billion). It is likely that this discrepancy is due to the nonlinear models used to estimate the AFs. Somewhat different results were produced when summing across different category definitions, although the service category total was within the confidence interval of the payer category total (and vice versa). Finally, many costs of older adult falls are not addressed here, such as poor quality of life and costd to informal caregivers.

Preventive strategies that reduce falls in older adults could lead to a substantial reduction in healthcare spending. Evidence-based strategies including medication management and strength and balance exercises (e.g., tai chi), have been associated with reductions in older adult falls.[29] Strength and balance programs usually charge the participant, although some Medicare Advantage plans cover some of these programs. Multifactorial interventions, often conducted in clinical settings, address multiple fall risk factors. These types of interventions have been shown to reduce falls as much as 24%.[29] Screening and assessing for falls risk is one of the minimum requirements for the Medicare Annual Wellness Visit, with no beneficiary charge. Medicare also reimburses medication review by a pharmacist, but most healthcare providers do not routinely screen patients for falls or conduct fall factor risk assessments to identify individuals who would benefit from prevention strategies.[30]

To help healthcare providers implement the American Geriatrics Society's and British Geriatrics Society's clinical guidelines for the prevention of older adult falls, the Centers for Disease Control and Prevention (CDC) Injury Center developed the Stopping Elderly Accidents, Deaths, and Injuries (STEADI) initiative, which incudes screening older adults to identify their fall risk, assessing at-risk individuals to identify their modifiable fall risk factors, and intervening by using effective strategies to reduce fall risk factors.

Clinical care is an important component of falls prevention. By broadly implementing and scaling up initiatives like STEADI, we can improve health and decrease the future economic burden of older adult falls.

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The findings and conclusions in this study are those of the authors and do not necessarily represent the official position of the CDC.

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Author Contributions: Florence: study design, data analysis, interpretation of results. Bergen: literature review, study design, interpretation and discussion of results. Atherly: data acquisition, study design, data analysis, interpretation of results. Burns, Stevens: literature review, study design, discussion of results. Drake: study design, data analysis. All authors: drafting and editing of manuscript.

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REFERENCES

1. Bergen G, Stevens M., Burns E. Falls and fall injuries among adults aged ≥65 years—United States, 2014. MMWR Morb Mortal Wkly Rep 2016; 65:993–998.
2. Morrison A, Fan T, Sen SS, Weisenfluh L. Epidemiology of falls and osteoporotic fractures: A systematic review. Clinicoecon Outcomes Res 2013:9–18.
3. Ambrose AF, Paul G, Hausdorff JM. Risk factors for falls among older adults: A review of the literature. Maturitas 2013;75:51–61.
4. Stevens JA, Sogolow ED. Gender differences for non-fatal unintentional fall related injuries among older adults. Inj Prev 2005;11:115–119.
5. Stevens JA, Ballesteros MF, Mack KA, Rudd RA, DeCaro E, Adler G. Gender differences in seeking care for falls in the aged Medicare population. Am J Prev Med 2012;43:59–62.
6. Houry D FC, Baldwin G, Stevens J, McClure R. The CDC Injury Center's response to the growing public health problem of falls among older adults. Am J Lifestyle Med 2016;10:74–77.
7. Bohl AA, Fishman PA, Ciol MA, Williams B, LoGerfo J, Phelan EA. A longitudinal analysis of total 3-year healthcare costs for older adults who experience a fall requiring medical care. J Am Geriatr Soc 2010;58:853–860.
8. Finkelstein EA, Chen H, Miller TR, Corso PS, Stevens JA. A comparison of the case-control and case-crossover designs for estimating medical costs of nonfatal fall-related injuries among older Americans. Med Care 2005; 43:1087–1091.
9. Englander F, Hodson TJ, Terregrossa RA. Economic dimensions of slip and fall injuries. J Forensic Sci 1996;41:733–746.
10. Roudsari BS, Ebel BE, Corso PS, Molinari NA, Koepsell TD. The acute medical care costs of fall-related injuries among the U.S. older adults. Injury 2005;36:1316–1322.
11. Shumway-Cook A, Ciol MA, Hoffman J, Dudgeon BJ, Yorkston K, Chan L. Falls in the Medicare population: Incidence, associated factors, and impact on health care. Phys Ther 2009;89:324–332.
12. Hoffman GJ, Hays RD, Shapiro MF, Wallace SP, Ettner SL. The costs of fall-related injuries among older adults: Annual per-faller, service component, and patient out-of-pocket costs. Health Serv Res 2017;52:1794–1816.
13. Burns ER, Stevens JA, Lee R. The direct costs of fatal and non-fatal falls among older adults—United States. J Saf Res 2016;58:99–103.
14. Dieleman JL, Baral R, Birger M et al. Us spending on personal health care and public health, 1996–2013. JAMA 2016;316:2627–2646.
15. Hoffman GJ, Hays RD, Shapiro MF, Wallace SP, Ettner SL. Claims-based identification methods and the cost of fall-related injuries among US older adults. Med Care 2016;54:664–671.
16. Carter MW, Porell FW. The effect of sentinel injury on Medicare expenditures over time. J Am Geriatr Soc 2011;59:406–416.
17. Xu X, Bishop EE, Kennedy SM, Simpson SA, Pechacek TF. Annual healthcare spending attributable to cigarette smoking. Am J Prev Med 2014;48:326–333.
18. Finkelstein EA, Trogdon JG, Cohen JW, Dietz W. Annual medical spending attributable to obesity: Payer-and service-specific estimates. Health Aff 2009;28:w822–w831.
19. National Health Expenditures by Type of Service and Source of Funds, CY 1960–2015. Baltimore, MD: Centers for Medicare and Medicaid Services, 2017.
20. Web-Based Injury Statistics Query and Reporting System (WISQARS). Atlanta, GA: Centers for Disease Control and Prevention, 2016.
21. Lawrence B, Miller, T. Medical and work-loss cost estimation methods for the WISQARS cost of injury module. Calverton, MD: Pacific Institute for Research and Evaluation, 2014.

22. Manning WG. Modeling cost and expenditure for healthcare. In Culyer AJ. Encyclopedia of Health Economics. San Diego: Elsevier, 2014, pp. 299–305.
23. U.S. Personal Health Care Spending by Age and Gender 2012. Baltimore, MD: Centers for Medicare and Medicaid Services, 2016.
24. National Health Expenditure Accounts: Methodology Paper, 2014: Definitions, Sources, and Methods. Baltimore, MD: Centers for Medicare and Medicaid Services, 2014.
25. Stevens JA, Corso PS, Finkelstein EA, Miller TR. The costs of fatal and non-fatal falls among older adults. Inj Prev 2006;12:290–295.
26. Baby Boomers Retire. Washington, DC: Pew Research Center, 2010.
27. National Institutes of Health, U.S. Department of Health and Human Services. NIH Health Disparities Strategic Plan and Budget Fiscal Years 2009–2013. March 11, 2016.
28. Breiding MJ, Wiersema B. Variability of undetermined manner of death classification in the US. Inj Prev 2006;12:ii49–ii54.
29. Gillespie LD, Robertson MC, Gillespie WJ et al. Interventions for preventing falls in older people living in the community. Cochrane Database Syst Rev 2012;9:CD007146.
30. Jones TS, Ghosh TS, Horn K, Smith J, Vogt RL. Primary care physicians perceptions and practices regarding fall prevention in adult's 65 years and over. Accid Anal Prev. 2011;43:1605–1609.