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Final published version: http://dx.doi.org/10.1097/PHH.0000000000000816

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Abstract

Objective—Unintentional falls in older adults (persons 65 and older) impose a significant economic burden on the healthcare system. Methods for calculating state specific healthcare costs are limited. This study describes two methods to estimate state-level direct medical spending due to older adult falls and explains their differences, advantages and limitations.

Design—The first method, *partial attributable fraction*, applied a national attributable fraction to the total state health expenditure accounts in 2014 by payer type (Medicare, Medicaid, and Private Insurance). The second method, *count applied to cost*, obtained 2014 state counts of older adults treated and released from an emergency department and hospitalized due to a fall injury. The counts in each state were multiplied by the national average lifetime medical costs for a fall-related injury from the Web-based Injury Statistics Query and Reporting System (WISQARS). Costs are reported in 2014 US-dollars.

Setting: United States.

Participants: Older adults.

Main Outcome Measure: Health expenditure on older adult falls by state.

Results: The estimate from the *partial attributable fraction* method was higher than the estimate from the *count applied to cost* method for all states compared, except Utah. Based on the *partial attributable fraction* method, in 2014, total personal healthcare spending for older adult falls ranged from $48 million in Alaska to $4.4 billion in California. Medicare spending attributable to older adult falls ranged from $22 million in Alaska to $3.0 billion in Florida. For the *count applied to cost* method, available for 17 states, the lifetime medical costs of 2014 fall-related injuries ranged from $68 million in Vermont to $2.8 billion in Florida.

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Conclusions: The two methods offer states options for estimating the economic burden attributable to older adult fall injuries. These estimates can help states make informed decisions about how to allocate funding to reduce falls and promote healthy aging.

Keywords

Older adults; falls; health expenditures

Introduction

A recent report by the U.S. Centers for Disease Control and Prevention found that in 2014, approximately 29% of older adults, persons 65 and older, reported a fall.[1] In 2015, there were more than 3 million emergency department (ED) visits due to a fall and 28 000 fall-related deaths.[1,2] Overall, in 2015, falls accounted for approximately 64% of injury-related ED visits and 54% of injury-related deaths among older adults.[2] The injuries sustained after a fall can result in prolonged use of healthcare services incurring high healthcare costs.[3–6] Given the older adult population in the United States is projected to increase by 55% between 2015 and 2030,[7] projected fall rates and healthcare spending are also likely to soar. [8,9]

A number of studies have estimated what the United States spends on fall-related medical costs.[3,5,10–14] Each uses different methods and obtains only national estimates. For example, Florence et al. (2017) used the Medicare Current Beneficiary Survey data to estimate the fraction of total healthcare expenditures attributable to falls, and then applied that fraction to the total U.S. expenditures for medical care from the Centers for Medicare & Medicaid Service's (CMS) National Health Expenditure Accounts (NHEA). The result was an estimated annual cost of $49.5 billion dollars.[15] Another study calculated a total cost to treat falls by using direct medical cost estimates in 2015 for both fatal and non-fatal fall injuries in the hospital, ED, and outpatient settings.[11] The authors found that in 2015 there were 3.2 million non-fatal falls that received medical treatment at an estimated cost of $31.3 billion to Medicare.[11] Dieleman et al. (2016) estimated spending for 155 health conditions including fall-related injuries using 183 data sources (e.g. government budgets, insurance claims, facility surveys, and official records).[13] They found fall injuries among older adults ranked fifth among the 155 health conditions in personal healthcare spending in 2013 with an estimated $36.8 billion spent.[13] These national estimates vary due to differences in methods used to identify a fall, the databases used to extract cost and count information, and in the study designs. While each study uses the same target population, adults 65 and older, the population composition varies based on the data source used (e.g. hospital discharge, Medicare data, Medical Expenditure Panel Survey). These differences make it difficult to compare across estimates. In addition, these estimates provide no information on the economic burden within individual states.

The economic burden of older adult falls impacts government funded programs heavily. Eight percent of Medicaid expenses for older adults are spent on falls.[15] Medicaid, jointly funded by states and the federal government, is the largest single source of healthcare coverage in the U.S and has a substantial impact on state budgets.[16] As fall prevention

strategies for older adults are commonly implemented at the state level or below,[17] it is vital for states to calculate how much of their Medicaid spending is for specific health conditions. Currently, states have limited data for estimating their fall-related medical costs. The purpose of this study is to provide guidance to states on how to estimate their economic burden of older adult falls. Specifically, we describe two methods states can use to estimate state-level healthcare spending for older adult falls in the absence of comprehensive state data and discuss the strengths and weaknesses of each method. The intended audience for this study are state policy makers, healthcare practitioners, and public health practitioners addressing fall prevention in their states. They could benefit from the state-level estimates as they prioritize expenditure and policy development on proposed interventions and projects.

Methods

The two methods we used to estimate state-level healthcare spending are the *partial attributable fraction* and the *count applied to cost*. The incidence and cost of falls were limited to older adults (65 and older) for both cost estimation methods.

Partial Attributable Fraction

The first method was to calculate state spending on personal healthcare attributable to older adult falls using the *partial attributable fraction* method (Figure 1). First, we obtained each state's estimate of the personal healthcare spending by payer type (Medicare, Medicaid, private insurance) from the State Health Expenditure Account (SHEA), a file within the NHEA.[18] These data included spending for all ages in 2014, the most recent data available. The personal healthcare spending estimate is reported by the three major payer types and includes healthcare services cost estimates such as inpatient and outpatient hospital services, prescriptions, durable medical equipment, physician and clinical services, other professional services, and adjusted estimates for freestanding home healthcare and skilled nursing facilities expenditures for Medicare and Medicaid.[19] Detailed methodology and model specifications can be found on the Centers for Medicare and Medicaid Services website.[19]

Second, we obtained the proportion of the population aged 65 years and over by state using the United States Census Bureau files.[20] We calculated an older adult factor by comparing the state proportion to the national proportion of older adults in the population.

Third, we calculated the proportion of national personal healthcare spending attributable to older adults by payer type. To do this, we used the national age and gender files (not available by state) from the 2012 NHEA, the most recent data available, to obtain the proportion of spending on older adults by type of payer in each state multiplied by the states' older adult factor. In 2012, 80.1% of Medicare spending, 22.2% of Medicaid spending, and 14.2 % of private insurance were on older adults nationally.[18]

Fourth, we used recently published data on the national attributable fraction for healthcare spending due to falls by payer type.[15] Florence et al. (2017) reported that falls among older adults constitutes 6.0% of Medicare spending (95% CI: 1.9%; 10.0%); 8.0% of Medicaid spending (95% CI: −2.0%; 18.0%); and 5.0% of private and out of pocket healthcare spending (95% CI: 1.2%; 8.8%).

Lastly, the four data points were multiplied together for each payer type. The results are state-specific estimates of personal healthcare spending for older adult falls by payer type adjusted for population estimates of older adults in the states. The 95% confidence intervals (CI) were estimated using the range of estimated confidence limits for the national attributable fraction.[15]

Count applied to cost

To calculate the state spending on healthcare attributable to older adult falls using the *count applied to cost* method we used counts of fall injuries from the Healthcare Cost and Utilization Project (HCUP) (Figure 1). HCUP includes the largest collection of longitudinal hospital care data in the United States. The HCUP State Emergency Department Databases (SEDD), and the State Inpatient Databases (SID), contain data on hospital discharges, ED visits, diagnosis on admission and other information that can be used to determine the number of fall-related ED visits and hospitalizations.[21]

First, we obtained the number of older adult fall hospitalizations per state from the HCUP SID. The number of participating states varies by year. In 2014, we obtained data from 26 states including Arizona, Arkansas, Colorado, District of Columbia, Florida, Georgia, Hawaii, Iowa, Kentucky, Maryland, Michigan, Minnesota, Nebraska, Nevada, New Jersey, New Mexico, New York, North Carolina, Oregon, Rhode Island, South Dakota, Utah, Vermont, Washington, West Virginia, and Wisconsin. Fall hospitalizations in SID were determined by a fall-related injury diagnosis (e.g., fracture of skull, fracture of upper or lower limb, intracranial injury, dislocation, sprains) in any of the first three fields and a fall-related external cause of injury E-code (E880.0-E886.9, E888; e.g., accidental fall from a chair, accidental fall on or from stairs, fall on same level from collision).[22] Twelve states (Arkansas, Florida, Georgia, Iowa, Maryland, Nebraska, New Mexico, New York, Utah, Vermont, Washington, and Wisconsin) in the SID included two additional variables: VisitLink and DaystoEvent. These variables allowed us to identify and remove any readmissions in the same year for fall injury. Readmission rates ranged from 4% to 9%. Readmissions could not be removed from the fall hospitalization counts for the other states.

Second, we obtained the total number of ED visits for older adult falls in each state. In 2014, we obtained data from 17 participating states. These states were Arizona, Arkansas, Florida, Georgia, Hawaii, Iowa, Kentucky, Maryland, Minnesota, Nebraska, Nevada, New Jersey, North Carolina, Rhode Island, Utah, Vermont, and Wisconsin. SEDD captures discharge information on all ED visits that do not result in a hospital admission. Similar to the first step, emergency department visits for fall injuries were identified by the presence of a fall-related injury diagnosis in any of the first three diagnosis fields and a fall-related external cause of injury E-code.[22] The two additional variables VisitLink and DaystoEvent were available for nine states and were used to remove readmissions in the same year for fall-related injury from Arkansas, Florida, Georgia, Iowa, Maryland, Nebraska, Utah, Vermont, and Wisconsin. Readmission rates ranged from 9% to 13%. For the other states, the readmissions could not be removed from the ED counts.

Third, we obtained the national lifetime average medical cost for an older adult ED visit and hospitalization due to a fall injury. These data were obtained from the Centers for Disease

Control and Prevention's WISQARS Cost of Injury database,[23] methods previously described.[24] The counts used for the 2014 cost estimates were based on the 2010 base year. Those costs reported for 2014 were for unintentional falls treated in the ED and released visit ($3 294) and unintentional fall hospitalizations ($41 091).

Finally, we multiplied the state specific number of ED visits and hospitalizations by applicable average costs obtained from WISQARS. The resulting ED and hospitalization costs were summed for the 17 states that had both cost estimates (Arizona, Arkansas, Florida, Georgia, Hawaii, Iowa, Kentucky, Maryland, Minnesota, Nebraska, Nevada, New Jersey, North Carolina, Rhode Island, Utah, Vermont, and Wisconsin).

All analyses were performed using SAS (version 9.3, SAS Institute Inc. Cary, NC).

An IRB application was submitted for review and approval from the Emory University institutional review board. Because the data used did not include research with human subjects, the project received an exemption and informed consent was waived.

Results

Partial Attributable Fraction

For 2014, the states with the highest estimated all payer healthcare spending for older adult falls using the *partial attributable fraction* method were California ($4.4 billion), Florida ($3.9 billion), and New York ($3.4 billion) (Supplemental table 1). The states with the lowest estimated personal healthcare spending on older adult falls were Alaska ($48 million), Wyoming ($60 million), and North Dakota ($91 million). Medicare spending for older adult falls ranged from an estimated $22 million in Alaska to $3.0 billion in Florida. Medicaid spending for older adult falls ranged from an estimated $9 million in Wyoming to $969 million in California. Private insurance spending for older adult falls ranged from an estimated $11 million in Alaska to $652 million in California.

Count Applied to Cost Method

For the 26 states available, in 2014, the states with the highest count of older adult fall hospitalizations were Florida (56 363) and New York (38 867). The states with lowest count of older adult fall hospitalizations were District of Columbia (1 210) and Vermont (1 281). For the 17 states available in 2014, the count of older adult fall ED treated and released cases ranged from Vermont at 4 769 visits to Florida at 138 581 visits (Table 1).

In 2014, the lifetime all payer medical costs of all hospitalizations ranged from $50 million in District of Columbia to $2.3 billion in Florida. The lifetime medical costs of ED treated and released falls ranged from $15 million in Vermont to $450 million in Florida (Table 1).

Discussion

By the year 2050, the older adult population in the United States will grow to an estimated 84 million.[9] Given falls are the leading cause of fatal and non-fatal injuries in older adults and fall rates are on the rise, we can anticipate falls will result in a significant economic

burden on the healthcare system if more is not done to prevent them.[8,9] Previous studies have only estimated the economic burden of falls on the national level. This study provides states with two different ways to estimate fall-related healthcare costs in older adults. States may benefit from estimating their state-level spending on older adult falls because a substantial proportion of state budgets are spent on Medicaid and eight percent of Medicaid spending on older adults are for fall-related medical expenses. The estimates provided in this study can help states make informed decisions about how to allocate funding to reduce falls and promote healthy aging. Effective programs and interventions can be implemented at the clinical, community, or local level.[25–28] The two healthcare cost estimation methods offer different advantages, disadvantages and limitations.

Partial Attributable Fraction

The *partial attributable fraction* method uses healthcare spending data from all 50 states by payer type: Medicare, Medicaid, and private insurance. Data on payer type is specifically important for state-based planning related to the government funded programs Medicare and Medicaid, which finance the majority of the costs of older adult falls.[29] This method uses publicly available healthcare expenditure data.

There are also disadvantages in using the *partial attributable fraction* method. The SHEA file of the NHEA used is available only for a limited number of years and updated approximately every 5 years. The most recent data available for this study were from 2014. Additionally, the *partial attributable fraction* spent on older adult falls is based on nationally calculated costs to estimate the state spending which may provide an over or under estimate of the state's actual costs. Notably this estimate is adjusted to account for state differences in the proportion of the population that is 65 years and older.

We acknowledge a considerable difference in the proportion of older adults residing in each state. We attempted to offset the variation by calculating an older adult factor. This factor compares the state's proportion of older adults to the national proportion of older adults, and applying it to the overall proportion of spending on older adults per states. Although we adjusted for state differences in the proportion of older adults in the population, there are limitations to this method in that it assumes that: (1) the proportion of healthcare spending on older adults by payer type is constant across states and years, (2) healthcare spending due to a fall by payer type is constant across states and years, and (3) the prevalence of falls is similar for all older adults (e.g. community dwelling, institutionalized etc.) in all states. From a previous study, we know the rate of falls reported by older adults varied across states ranging from 20.8 to 34.3%.[1] These assumptions may be invalidated if the costs of healthcare services (for falls or other health conditions) or the prevalence of falls among older adults vary substantially across states and years.

Count Applied to Cost Method

The *count applied to cost* uses data from the HCUP database, which is available for some but not all states each year. States can also use their own count of older adult fall injury hospitalizations and ED visits for the entire state, smaller localities or facility specific. Use of the state specific counts allows states to monitor trends in fall injuries and track changes

in healthcare costs across years. This is useful for evaluating effectiveness of established prevention strategies in reducing fall injuries and lowering healthcare costs.

There are also disadvantages in using the *count applied to cost* method. Not all states participate in the HCUP databases. Therefore, non-HCUP participating states would have to use the *partial attributable fraction* method or their own data from statewide ED and hospitalization records if available. The *count applied to cost* uses national average medical costs to estimate lifetime spending associated with a fall injury and may provide an over or under estimate of the state's actual costs.

A limitation of this method is that the HCUP data used in the *count applied to cost* method is subject to coding errors. Depending on the circumstances of the injury, the fall leading up to the injury may not be properly coded. There may also be coding differences across facilities, providers, and states. Additionally, not being able to remove readmissions from the HCUP data in some states can also bias the *count applied to cost* estimates. If data on readmissions cannot be removed, the *count applied to cost* method may overestimate the healthcare spending for that state.

Method Comparison and Implications

The *partial attributable fraction* method was the higher estimate between the two methods with the exception of Utah (Table 2).There are a number of reasons why a difference is seen between the estimates for the states with costs calculated from both methods (Supplemental table 2). First, the *partial attributable fraction* estimates the expenditures associated with an older adult fall regardless of injury or need for medical attention in ED or hospitalization. The *count applied to cost* method is limited to fall injuries in older adults that resulted in an ED visit or hospitalization. Second, the *partial attributable fraction* method captures added healthcare expenditures not directly associated with facility costs such as outpatient costs, prescriptions and other medical services received that is paid for by Medicare, Medicaid, or private insurance.[18] The *count applied to cost* method is limited to lifetime costs associated with fall injury hospitalizations and ED visits for falls including hospital readmission charges, rehabilitation costs, and follow up visits beyond 18 months for serious injuries.[23,24] While the *count applied to cost* method is a lifetime estimate, multiple studies have indicated that falls resulting in injury requiring hospitalization resulted in higher costs for up to 12 months after the fall, with approximately 90% of the costs incurred in the first three months after the fall. [30] The costs were mainly associated with hospitalization fees and post-acute care components immediately after a fall.[31] Therefore, it assumes that the majority of the lifetime costs captured in the *count applied to cost* method are also likely captured in the *partial attributable faction* method. Third, the *partial attributable fraction* provides a cross-sectional estimate of older adult falls for one year, while the *count applied to cost* method provides a lifetime estimate of a fall injury associated with a hospitalization or ED visit.

Economic analyses are dependent on the assumptions they make and may introduce inaccuracies in cost estimation by either method. Specifically, for *partial attributable fraction* we assumed fall prevalence and proportion of spending by payer type on older adult falls is similar for all states, after adjusting for differences in the proportion of older adults per state. For *count applied to cost* we used the WISQARS cost of injury reports, which assume the

cost of treatment for any hospitalized or ED-treated fall injury is similar in all states. While these are notable limitations, we view both methods introduced here as valuable resources for states and local governments to evaluate the economic burden of older adult falls in their communities. States and local governments can use one of the two methods, depending on data availability and needs, to estimate spending on older adult falls (Supplemental table 2). Specifically, by using the *partial attributable fraction* method, states can estimate spending on older adult falls by the publically funded healthcare programs Medicare and Medicaid. The *count applied to cost* method allows states to use their own counts for residents hospitalized or admitted to emergency departments to obtain an estimate of lifetime costs due to fall injuries. Additionally, the *count applied to cost* method is to track estimated economic burden across years to assess the economic impact of implemented prevention strategies on reducing the incidence of older adult fall injuries requiring hospitalization or medical care in an emergency department.

Summary

Previous studies have estimated the economic burden of falls at the national level using various data sources (e.g. Medicare data, Medical Expenditure Panel Survey, Medicare Current Beneficiaries Survey, National Health Expenditure Accounts, and national files of the Healthcare Utilization Project among others).[3,5,10–14] However, none of the previously described methods provided states with the capability of assessing their own economic burden. While both methods described here rely on nationally calculated costs, they are applied to actual state reported counts from HCUP SID and SEDD or state specific total health expenditures from NHEA to provide state estimates of spending on older adult falls. In the absence of comprehensive state-level data, states can use these two methods to estimate the medical costs of older adult falls. However, the estimates reported here should not be compared between states as state demographics and healthcare coverage may vary. Rather, these estimates can be used to quantify the state-specific expenditure on a common public health issue.

Conclusion

Given the growth in the older adult population and surge in older adult falls that is occurring across the United States, it benefits state decision makers and public health professionals to be able to calculate fall-related healthcare expenditures to inform efforts to efficiently allocate resources and implement cost-effective prevention strategies. This study describes and provides information on the strengths and limitations of two different cost-estimating methods. These methods can help evaluate the success of state driven prevention efforts and track the economic impact of fall prevention strategies on government funded healthcare programs.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.
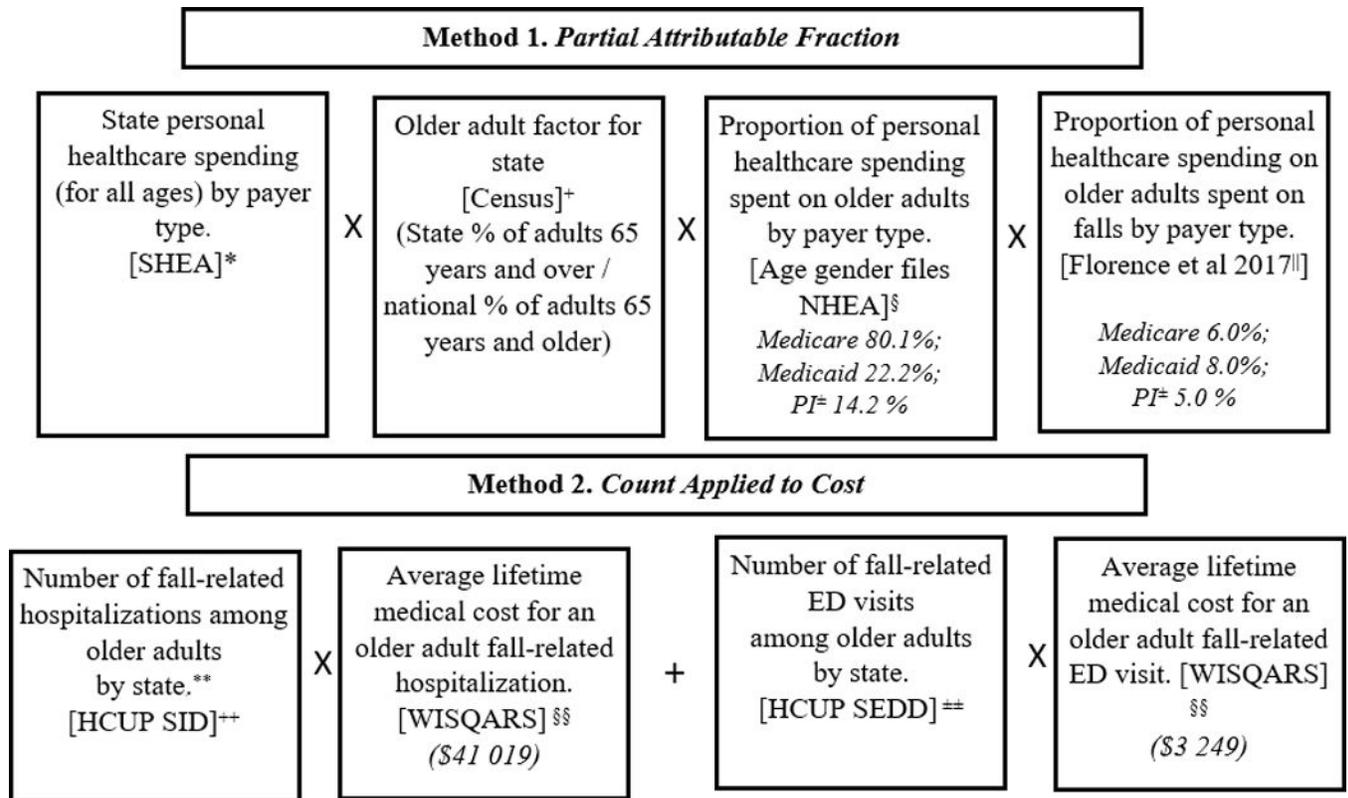
Acknowledgements:

References:

1. Bergen G, Stevens MR, Burns ER. Falls and Fall Injuries Among Adults Aged >/=65 Years - United States, 2014. MMWR Morb Mortal Wkly Rep 2016;65(37):993–998. [PubMed: 27656914]

2. (WISQARS)a. Web-based Injury Statistics Query and Reporting System (WISQARS) 2015; www.cdc.gov/injury/wisqars Accessed June, 2017.

3. Stevens JA, Corso PS, Finkelstein EA, Miller TR. The costs of fatal and non-fatal falls among older adults. Injury Prevention 2006;12(5):290–295. [PubMed: 17018668]

4. Carroll NV, Slattum PW, Cox FM. The Cost of Falls Among the Community-Dwelling Elderly. Journal of Managed Care Pharmacy 2005;11(4):307–316. [PubMed: 15871641]

5. Alexander BH, Rivara FP, Wolf ME. The cost and frequency of hospitalization for fall-related injuries in older adults. American Journal of Public Health 1992;82(7):1020–1023. [PubMed: 1609903]

6. 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. Physical Therapy 2009;89(4):324–332. [PubMed: 19228831]

7. (Census). Population Projections 2014; http://www.census.gov/population/projections/data/national/ Accessed Januray, 2017.

8. Houry D, Florence C, Baldwin G, Stevens J, McClure R. The CDC Injury Center's Response to the Growing Public Health Problem of Falls Among Older Adults. American Journal of Lifestyle Medicine 2015;10(1):74–77.

9. Wiener JM. Population ageing in the United States of America: implications for public programmes. International Journal of Epidemiology 2002;31(4):776–781. [PubMed: 12177018]

10. Corso P, Finkelstein E, Miller T, Fiebelkorn I, Zaloshnja E. Incidence and lifetime costs of injuries in the United States. Injury Prevention 2006;12(4):212–218. [PubMed: 16887941]

11. Burns ER, Stevens JA, Lee R. The direct costs of fatal and non-fatal falls among older adults — United States. Journal of Safety Research 2016;58:99–103. [PubMed: 27620939]

12. Roudsari BS, Ebel BE, Corso PS, Molinari N-AM, Koepsell TD. The acute medical care costs of fall-related injuries among the U.S. older adults. Injury 2005;36(11):1316–1322. [PubMed: 16214476]

13. Dieleman JL, Baral R, Birger M, et al. Us spending on personal health care and public health, 1996–2013. Jama 2016;316(24):2627–2646. [PubMed: 28027366]

14. Rizzo JA, Friedkin R, Williams CS, Nabors J, Acampora D, Tinetti ME. Health Care Utilization and Costs in a Medicare Population by Fall Status. Medical Care 1998;36(8):1174–1188. [PubMed: 9708590]

15. Florence CS, Bergen G, Atherly A, Burns E, Stevens JA, Drake C. The Medical Costs of Fall Injuries among Older Adults. Journal of the American Geriatrics Society (In Press) 2018.

16. University G. Center for Children and Families 2008; https://ccf.georgetown.edu/wp-content/uploads/2012/03/Medicaid_state-budgets-2008.pdf.

17. NCOA. Select Evidence-Based Falls Prevention Programs. 2017; Select Evidence-Based Falls Prevention Programs, 2017.

18. (CMS). National Health Expenditure Data 2016; https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/index.html. Accessed July 3, 2017.

19. (CMS). Econometric Analysis of State Health Expenditures: Methodology and Model Specification. National Health Expenditure Accounts 2014; https://www.cms.gov/Research-

Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/NationalHealthAccountsStateHealthAccountsResidence.html, 2017.

20. Census. U.S. Census Bureau, 2010–2014 American Community Survey 5-Year Estimates https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_14_5YR_S0101&prodType=table. Accessed October 24, 2017.

21. (AHRQ). Cost-to-charge ratio files 2011; www.hcup-us.ahrq.gov/db/state/costtocharge.jsp Accessed December, 2016.

22. (CDC). Matrix of E-code Groupings. Injury Prevention and Control 2014; https://www.cdc.gov/injury/wisqars/ecode_matrix.html, 2017.

23. (WISQARS)b. Data and Statistics (WISQARS): Cost of Injury Reports 2014; https://wisqars.cdc.gov:8443/costT/cost_Part1_Intro.jsp.

24. Lawrence BA, Miller TR. Medical and Work Loss Cost Estimation Methods for the WISQARS Cost of Injury Module 2014; https://ftp.cdc.gov/pub/TBI/core/grantee_meeting/SPEB_presentation/WISQARS_cost_methods.pdf. Accessed June, 2017.

25. Casey CM, Parker EM, Winkler G, Liu X, Lambert GH, Eckstrom E. Lessons Learned From Implementing CDC's STEADI Falls Prevention Algorithm in Primary Care. The Gerontologist 2017;57(4):787–796.

26. Ory MG, Smith ML, Jiang L, et al. Fall Prevention in Community Settings: Results from Implementing Stepping On in Three States. Frontiers in Public Health 2015;3(232).

27. Smith ML, Schneider EC, Byers IN, et al. Reported Systems Changes and Sustainability Perceptions of Three State Departments of Health Implementing Multi-Faceted Evidence-Based Fall Prevention Efforts. Frontiers in Public Health 2017;5(120).

28. Stevens JA, Smith ML, Parker EM, Jiang L, Floyd FD. Implementing a Clinically Based Fall Prevention Program. American Journal of Lifestyle Medicine 2017:1559827617716085.

29. Hoffman G, Hays R, F. Shapiro M, Wallace S, L. Ettner S. Claims-Based Identification Methods and the Cost of Fall-Related Injuries among US Older Adults Vol 542016.

30. 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. Journal of the American Geriatrics Society 2010;58(5):853–860. [PubMed: 20406310]

31. Bohl AA, Phelan EA, Fishman PA, Harris JR. How are the costs of care for medical falls distributed? The costs of medical falls by component of cost, timing, and injury severity. The Gerontologist 2012;52(5):664–675. [PubMed: 22403161]

32. O'Loughlin JL, Robitaille Y, Boivin J-F, Suissa S. Incidence of and Risk Factors for Falls and Injurious Falls among the Community-dwelling Elderly. American journal of epidemiology 1993;137(3):342–354. [PubMed: 8452142]

Implications for Policy and Practice

- Non-fatal falls among older adults aged 65 and older can cause injuries associated with significant and prolonged economic costs to the patient and healthcare system.[5,11,13,32]

- The economic burden is often underestimated at the national level due to use of historic cost estimates, [11] inconsistencies in hospital discharge coding,[5] and inaccuracies of charges reported instead of costs.[13]

- There are no state-level cost estimates.

- As fall prevention strategies are often implemented at the state, county or local levels,[17] it is important for states to be able to estimate the economic impact of older adult falls.

- The methods highlighted in this study offer two ways of estimating state-based cost estimates.

- The more comprehensive *partial attributable fraction* method offers detail on spending on older adult falls by payer type: Medicare, Medicaid, and private insurance.

- The *count applied to cost* method allows states to use their own counts for residents hospitalized or admitted to emergency departments to obtain an estimate of lifetime costs due to fall injuries requiring medical treatment.

- The *count applied to cost* method may also be used to track whether implemented prevention strategies are successful in decreasing the economic burden across years.

Method 1. *Partial Attributable Fraction*

| State personal healthcare spending (for all ages) by payer type. [SHEA]* | X | Older adult factor for state [Census]+ (State % of adults 65 years and over / national % of adults 65 years and older) | X | Proportion of personal healthcare spending spent on older adults by payer type. [Age gender files NHEA]§ *Medicare 80.1%; Medicaid 22.2%; PI± 14.2 %* | X | Proportion of personal healthcare spending on older adults spent on falls by payer type. [Florence et al 2017‖] *Medicare 6.0%; Medicaid 8.0%; PI± 5.0 %* |

Method 2. *Count Applied to Cost*

| Number of fall-related hospitalizations among older adults by state.** [HCUP SID]++ | X | Average lifetime medical cost for an older adult fall-related hospitalization. [WISQARS] §§ *($41 019)* | + | Number of fall-related ED visits among older adults by state. [HCUP SEDD]±± | X | Average lifetime medical cost for an older adult fall-related ED visit. [WISQARS] §§ *($3 249)* |

Figure 1.

Two methods and the data sources used to calculate state healthcare spending to treat older adult (65+) falls.

*SHEA: State health expenditure accounts.

+Census: United States Census Bureau 2010–2014 American Community Survey 5-Year Estimates.

§NHEA: National health expenditure accounts.

±PI: Private Insurance.

‖ Source: Florence CS et al. The Medical Costs of Fall Injuries among Older Adults. Journal of the American Geriatrics Society. 2018. (In review)

**Remove readmissions if possible.

++HCUP SID: Healthcare Cost and Utilization Project, State In-patient Database.

§§WISQARS: Web-based Injury Statistics Query and Reporting System- cost of injury reports.

±±HCUP SEDD: Healthcare Cost and Utilization Project, State Emergency Department Database.

Table 1:

Lifetime healthcare spending by state for older adult fall injuries, 2014, United States. *Count applied to cost* method.

STATE	Older Adult Fall Hospitalizations		Older Adult Emergency Department Visits for Falls		Total Lifetime Cost *(million USD)*
	Number[+]	Lifetime cost[§] ($41 091) *(million USD)*	Number[±]	Lifetime cost[//] ($3 249) *(million USD)*	
Arizona	14 383	$591	43 364	$141	$732
Arkansas [*]	6 594	$271	18 996	$62	$333
Colorado	9 649	$396	---	---	---
Dis of Columbia	1 210	$50	---	---	---
Florida [*]	56 363	$2 316	138 581	$450	$2 766
Georgia [*]	15 070	$619	47 739	$155	$774
Hawaii	2 299	$94	8 780	$29	$123
Iowa [*]	6 456	$265	21 589	$70	$335
Kentucky	9 479	$390	33 688	$109	$499
Maryland [*]	10 257	$421	28 897	$94	$515
Michigan	15 244	$626	---	---	---
Minnesota	10 918	$449	29 523	$96	$545
Nebraska[*]	3 912	$161	9 956	$32	$193
Nevada	4 755	$195	13 434	$44	$239
New Jersey	19 871	$817	55 030	$179	$995
New Mexico [*]	2 988	$123	---	---	---
New York [*]	38 867	$1 597	---	---	---
North Carolina	16 754	$688	72 672	$236	$925
Oregon	7 141	$293	---	---	---
Rhode Island	2 406	$99	8 826	$29	$128
South Dakota	1 703	$70	---	---	---
Utah[*]	3 863	$159	10 781	$35	$194
Vermont[*]	1 281	$53	4 769	$15	$68
Washington [*]	10 978	$451	---	---	---
West Virginia	3 931	$162	---	---	---
Wisconsin [*]	11 635	$478	32 409	$105	$583

[*] Readmission of fall-related injury excluded.

[+] Obtained from Healthcare Cost and Utilization Project –State Inpatient Database for unintentional fall injury diagnosis and E-code, 2014.

[§] Lifetime cost from Web-based Injury Statistics Query and Reporting System (WISQARS) cost of injury report hospitalized, using 2014 counts, 2010 base year costs indexed to 2014 USD.

±Obtained from Healthcare Cost and Utilization Project –State Emergency Department Databases for unintentional fall injury diagnosis and E-code, 2014.

//Lifetime cost from WISQARS cost of injury report ED treated/ released, using 2014 counts, 2010 base year costs indexed to 2014 USD.

---Data not available for this state.

Table 2:

Cost Comparison of older adult falls by *partial attributable fraction* versus *count applied to cost* method.

STATE	*Partial Attributable Fraction* Method	*Count Applied to Cost* Method
Arizona	$857	$732
Arkansas *	$436	$333
Florida *	$3 935	$2 766
Georgia *	$904	$774
Hawaii	$172	$123
Iowa *	$432	$335
Kentucky	$651	$499
Maryland *	$759	$515
Minnesota	$713	$545
Nebraska *	$221	$193
Nevada	$295	$239
New Jersey	$1 349	$995
North Carolina	$1 229	$925
Rhode Island	$183	$128
Utah *	$165	$194
Vermont *	$110	$68
Wisconsin *	$781	$583

*
Readmission of fall-related injury excluded in the *count applied to cost* method.