



Published in final edited form as:

J Am Med Dir Assoc. 2016 September 1; 17(9): 865.e1–865.e3. doi:10.1016/j.jamda.2016.06.012.

Geographic Variation in Hip Fracture Among United States Long-Stay Nursing Home Residents

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Abstract

Introduction—Despite high rates of hip fracture among United States (US) nursing home (NH) residents, little is known about geographic variation in hip fracture incidence. We used nationally representative data to identify geographic variation in hip fracture among US NH residents.

Design and setting—Retrospective cohort study using Part A claims for a 100% of Medicare enrollees in 15,289 NHs linked to NH minimum data set and Online Survey, Certification, and Reporting databases.

Participants—A total of 891,085 long-stay (continuous residence of 100 days) NH residents 65 years old.

Measurements—Medicare Part A claims documenting a hip fracture. Mean incidence rates of hip fracture for long-stay NH residents were calculated for each state and US Census Division from 2007 to 2010.

Results—The age-, sex-, and race-adjusted incidence rate of hip fracture ranged from 1.49 hip fractures/100 person-years (Hawaii) to 3.60 hip fractures/100 person-years (New Mexico), with a mean of 2.38 (standard deviation 0.43) hip fractures/100 person-years. The mean incidence of hip fracture was 1.7-fold greater in the highest quintile than the lowest.

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The authors declare no conflicts of interest.

Conclusions—We observed modest US state and regional variation in hip fracture incidence among long-stay NH residents. Future studies should assess whether state policies or NH characteristics explain the variation.

Keywords

Hip fracture; nursing home; long-term care; geographic variation; Medicare

Hip fractures are a major public health concern associated with high morbidity, mortality, and cost.¹ They are recognized as the most serious consequence of osteoporosis because of their sequelae: chronic pain, disability, diminished quality of life, and premature death.² It is estimated that incident hip fractures comprise approximately 14% of osteoporotic fractures in the United States (US), which cost more than \$16.9 billion in 2005.³ NH residents have the highest incidence rates of hip fracture,^{4,5} with rates more than five times as high as community dwellers of the same age and sex.^{6,7} Individual risk factors for hip fractures in NH residents include female gender, older age, having more comorbidities, dementia, falls, and osteoporosis.^{8,9} Surprisingly few studies have investigated geographic variation in hip fracture rates within the US and among those that have, the focus was on limited geographic regions and county-level data.^{10,11} We described the geographic variation in hip fracture incidence rates in a nationwide sample of long-stay NH residents from across the US. This exploratory analysis is a necessary first step in examining how state policies and variation in other NH facility-level factors might explain variation in hip fracture incidence rates among NH residents, thus, eventually informing public health planning.

Methods

Our study was approved by the Brown University Institutional Review Board. For our study population, a 100% sample of Medicare Part A claims from May 2007 to May 2008 was linked to minimum data set NH resident assessments and the Online Survey, Certification and Reporting data in all NH residents enrolled in a fee-for-service Medicare program.¹² Our final sample size consisted of 892,837 long-stay residents, defined as those with 100 days in the same nursing facility with no more than 10 consecutive days outside the facility.

Incident hip fractures that occurred between the index date (ie, 100th day from NH admission) and up to 2 years of follow-up, but before 2010 (end of follow-up data), were ascertained using Medicare Part A claims data.¹³ A hip fracture was defined as a hospitalization with the primary or secondary International Classification of Diseases, Ninth Edition diagnosis of 820.xx with or without an accompanying procedural code.¹⁴ To be sure the analysis included only new fractures that occurred while in the NH, we excluded fractures after the index date if the resident had a hospitalization for a hip fracture in the previous 100 days.

We calculated the incidence rate of hip fracture for each state and US Census Division by dividing the number of hip fractures by the person-time at-risk estimate. We then adjusted hip fracture incidence rates by age, sex, and race by using direct standardization, with all US long-stay NH residents as the reference population. A 1-way analysis of variance was used

to compare hip fracture incidence rates between Census Divisions. All analyses were performed using SAS statistical software (v 9.4; SAS Institute Inc, Cary, NC).

Results

California had the greatest number of NH facilities ($n = 1193$), while Alaska had the fewest ($n = 15$). The age-, sex-, and race-adjusted incidence rate of hip fracture ranged from 1.49 hip fractures/100 person-years (Hawaii) to 3.60 hip fractures/100 person-years (New Mexico), with a mean of 2.38 [standard deviation (SD) 0.43] hip fractures/100 person-years (Figure 1). The mean incidence of hip fracture was 1.7-fold greater in the highest quintile than the lowest. The mean incidence rate of hip fracture among Census Divisions ranged from 1.89 (SD 0.26) hip fractures/100 person-years in the Pacific to 3.05 (SD 0.27) hip fractures/100 person-years in the West South Central (Figure 2). The Mountain Census Division had the largest range (2.28–3.60 hip fractures/100 person-years) in age-, sex-, and race-adjusted hip fracture rates among all its NH facilities. The results of the 1-way analysis of variance comparing mean hip fracture incidence rates between Census Divisions were statistically significant ($F = 8.36$, $P = .0001$).

The 5 states with the highest rates of hip fracture were New Mexico, Oklahoma, Kansas, Arizona, and Texas. The mean activities of daily living (ADL) score for these states was 13.40 (SD 1.45). The proportion of residents who fell in the last 30 days and the proportion of residents on antipsychotic medication was 15.12% (SD 0.02) and 25.85% (SD 0.03), respectively. The 5 states with the lowest rates of hip fracture were Hawaii, California, New York, Pennsylvania, and Rhode Island. The mean ADL score for these states was 16.58 (SD 2.35). The proportion of residents who fell and who were on antipsychotic medication was 11.37% (SD 0.03) and 22.14% (SD 0.05), respectively.

Discussion

We observed notable variation in the incidence rate of hip fracture in long-stay NH residents across states and US Census Divisions. By examining regional differences in hip fracture, we hoped to describe potential geographic and climate characteristics driving the variation in hip fracture rates across the country (eg, the effects of latitude). Geographic differences in fracture incidence among elderly individuals did not appear to be associated with living further from the equator, as was characterized in previous non-US literature.^{2,15} In the NH, nearly all hip fractures occur indoors.¹⁶ Distance from the equator may be a more influential factor in community dwellers that spend substantial time outdoors. Instead, we suspect that differences in state policies and NH characteristics may drive the geographic variation in hip fracture rates. Indeed, our preliminary results show that the states with lower rates of hip fracture had lower mean ADL scores, indicating that on average residents had less functional impairment compared with states with higher rates of hip fracture. The proportion of residents with a recent fall and using antipsychotics was greater in states with high rates of hip fracture compared to states with low rates of fracture.

Strengths of our study include a nationally representative and large sample that permitted relatively precise estimates of hip fracture incidence. Our exploratory study has some

potential limitations: we did not account for the differences in patient populations by state (eg, medication use, comorbid disease), and our analysis does not consider NH characteristics, such as staff-to-resident ratio, that are influenced in part by differences in state-specific policies.^{17,18} The influence of NH characteristics and state policies on hip fracture rates is a worthwhile topic for further examination. Future studies should also explore whether hip fracture incidence across states persists after adjustment for resident characteristics and facility level differences.

In conclusion, we found variation in the unadjusted hip fracture incidence rates between states and Census Divisions. The reasons for geographic variation in nursing home hip fracture rates merits investigation.

Acknowledgments

This work was supported by a National Institute on Aging (NIA) award (1R01AG045441).

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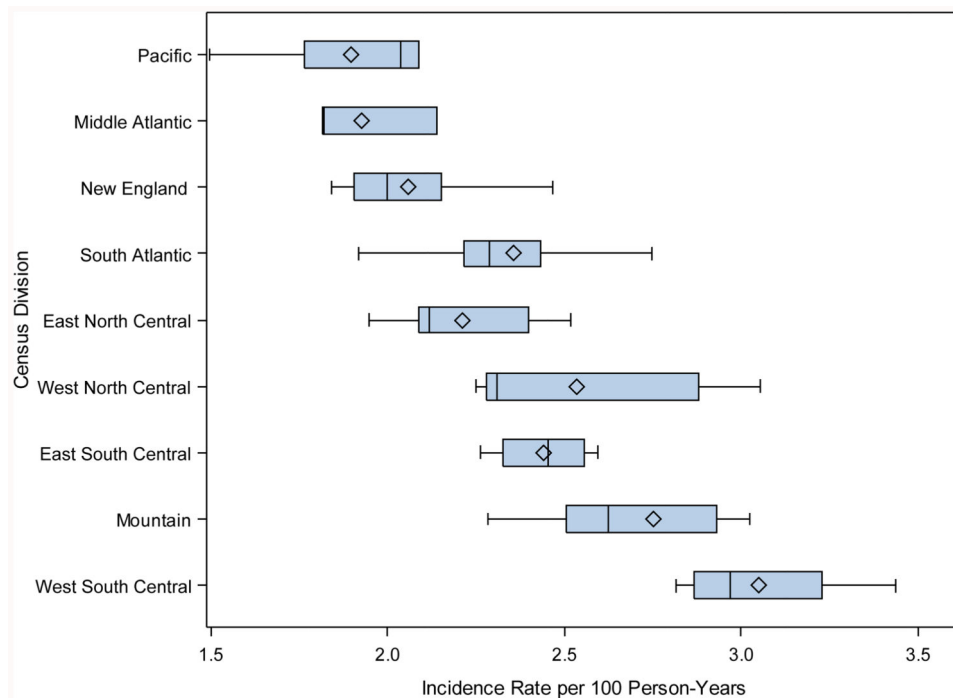


Fig. 1. Age-, sex-, and race-adjusted hip fracture incidence rates per 100 person-years by state, 2007–2010.

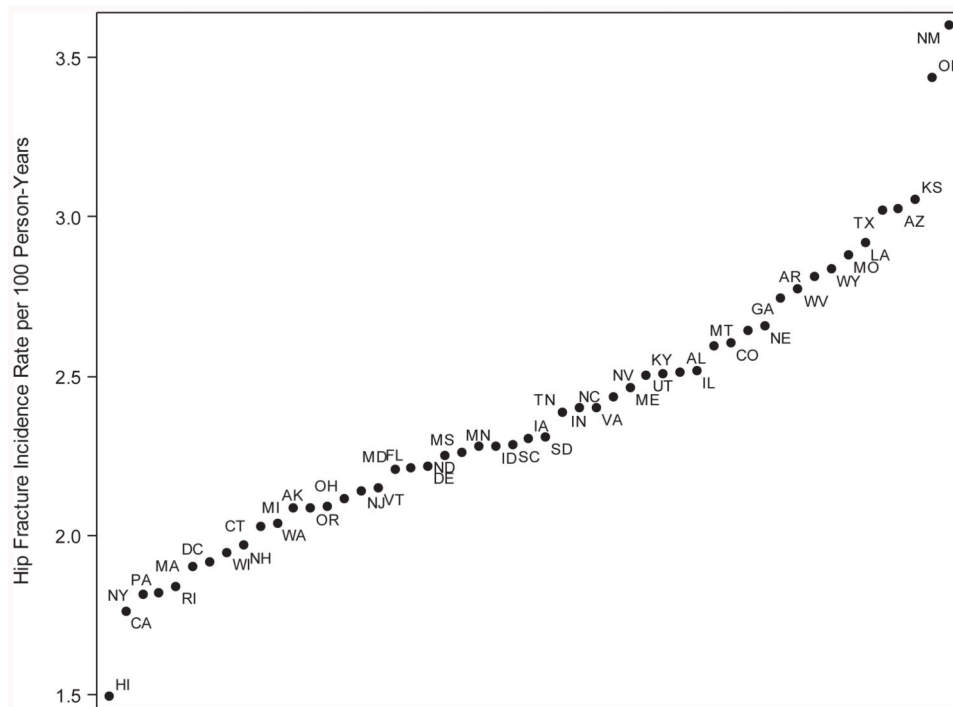


Fig. 2.

Variation of age-, sex-, and race-adjusted hip fracture incidence rate by 100 person-years by Census Division, 2007–2010. Diamonds represent the means. Vertical lines represent the medians. Blue boxes represent interquartile ranges. Whiskers represent minimum and maximum. US Census Divisions: Pacific: WA, OR, CA, AK, HI (n = 1622 NH facilities). South Atlantic: DE, MD, DC, WV, VA, NC, SC, GA, FL (n = 2293 NH facilities). Middle Atlantic: NY, NJ, PA (n = 349 NH facilities). New England: ME, NH, VT, MA, RI, CT (n = 981 NH facilities). East South Central: KY, TN, MS, AL (n = 1011 NH facilities). East North Central: MI, WI, IL, IN, OH (n = 3002 NH facilities). West North Central: MN, ND, SD, NE, IA, MO, KS (n = 2070 NH facilities). West South Central: AR, OK, LA, TX (n = 1928 NH facilities). Mountain: WY, ID, CO, UT, NV, NM, AZ (n = 732 NH facilities).