Racial and Ethnic Difference in Falls Among Older Adults: Results from the California Health Interview Survey

Simona C. Kwon, DrPH, MPH [Assistant Professor],
Department of Population Health, New York University School of Medicine, New York, NY

Benjamin H. Han, MD [Assistant Professor],
Division of Geriatric Medicine and Palliative Care, Department of Medicine, New York University School of Medicine, New York, NY

Julie A. Kranick, MA [Program Manager],
Department of Population Health, New York University School of Medicine, New York, NY

Laura C. Wyatt, MPH [Research Coordinator],
Department of Population Health, New York, University School of Medicine, New York, NY

Caroline S. Blaum, MD [Professor],
Division of Geriatric Medicine and Palliative Care, Department of Medicine, New York University School of Medicine, New York, NY

Stella S. Yi, PhD [Assistant Professor], and
Department of Population Health, New York University School of Medicine, New York, NY

Chau Trinh-Shevrin, DrPH [Associate Professor]
Department of Population Health, New York, University School of Medicine, New York, NY

Abstract

Background—Research suggests that fall risk among older adults varies by racial/ethnic groups; however, few studies have examined fall risk among Hispanics and Asian American older adults.

Methods—Using 2011-2012 California Health Interview Survey data, this study examines falling 2 times in the past year by racial/ethnic groups (Asian Americans, Hispanics, and Blacks) aged 65, adjusting for socio-demographic characteristics, body mass index, co-morbidities, and functional limitations. A secondary analysis examines differences in fall risk by English language proficiency and race/ethnicity among Asian Americans and Hispanics.

Results—Asian Americans were significantly less likely to fall compared to non-Hispanic whites, individuals with 2 chronic diseases were significantly more likely to fall than individuals

Corresponding author: Laura C. Wyatt, address: 550 First Avenue VZN, 838F, New York, NY 10016, telephone: 212-263-0288, fax: 212-263-4086, Laura.Wyatt@nyumc.org.

with <2 chronic diseases, and many functional limitations were significantly associated with fall risk, when adjusting for all factors. African Americans and Hispanics did not differ significantly from non-Hispanic whites. Analysis adjusting for race/ethnicity and English language proficiency found that limited English proficient Asian Americans were significantly less likely to fall compared to non-Hispanic whites, individuals with ≥2 chronic diseases were significantly more likely to fall than individuals with <2 chronic diseases, and all functional limitations were significantly associated with fall risk, when adjusting for all factors. No differences were found when examining by racial/ethnic and English proficient/limited English proficient groups.

Conclusion—Further research is needed to explore factors associated with fall risks across racial/ethnic groups. Culturally relevant and targeted interventions are needed to prevent falls and subsequent injuries in the increasingly diverse aging population in the U.S.

Keywords

Falls; health disparity research; racial/ethnic minority; older adults

Introduction

Falls are a common event among older adults and a leading cause of fatal and nonfatal injury associated with a decline in functional status and disability [1, 2]. Fall rates differ widely between states, and variations in falls have been noted between urban and rural environments [3]. In addition, weather and the built environment (e.g. poor walking surfaces, traffic, and inadequate light) vary by location and may affect fall risk and physical activity behavior in those areas [4]. Research has identified several key individual risk factors for fall risk that include age, female gender, visual impairments, cognitive decline, gait limitations, chronic diseases, non-Hispanic white race, and a history of previous falls [5-7].

Many minority groups experience worse health outcomes due to limited healthcare access, discrimination, socioeconomic status, and other factors [8]. Geriatric conditions which affect fall risk, such as greater disease burden [9] and osteoporosis [10], differ by racial/ethnic status. Body mass index, may also influence risk of falling [11] and differs by group, as Asian Americans on average have lower BMIs [12]. Among older age groups, blacks, Hispanics and Asians have greater rates of poverty (18.0%, 18.0%, and 14.6%) compared to whites (7.7%) and blacks and whites tend to have a greater percentage of individuals living alone (44.0% and 43.0%) than Hispanics and Asians (33.9% and 30.4%) [10]. Furthermore, differences in cultural factors, such as perceptions of frailty, and lifestyle factors, such as living with a relative, may also influence susceptibility to falling [13].

Several studies have suggested that variations in fall risk exists among different racial/ethnic groups [14]. For example, older African Americans and blacks, even with a higher risk profile, are less likely or not as likely to fall when compared to whites [9, 15, 16], but for unclear reasons. Few studies have examined falls among Hispanics and Asian Americans [14]; however, one study found similar fall rates between Hispanics and non-Hispanic whites [9] and evidence from other countries indicates a decreased fall risk among Asians living in their home country compared to Asian immigrants and whites [13]. New York City mortality

data has shown that death due to falls is higher among whites and Asians, and lower among blacks and Hispanics [17].

Acculturation may influence health risks among immigrant populations [18, 19]. It has previously been proposed that immigrants migrate with favorable health behaviors that may change with increased time in the U.S. [20, 21] and that immigrant populations, even those with lower socioeconomic backgrounds and less access to healthcare, experience better health [22]. The 'healthy immigrant effect,' which suggests that healthy individuals migrate from home, has been cited to explain why individuals within recent migration groups may initially appear healthier and have better health outcomes compared to those born within their host country [21, 23, 24]. Furthermore, recent immigrants tend to have better health profiles compared to individuals born in the U.S., such as lower rates of smoking and obesity [20], which get worse the longer they stay in the U.S. [20, 21, 24], and stronger social-networks [20]. It is not clear, however, how acculturation may affect common conditions of older adults, such as falls and gait disorders. It can be hypothesized that specific, culturally-embedded behaviors, such as living with relatives, using walking sticks, or engaging in low risk strengthening exercise like Tai Chi or squatting, may contribute to a decrease in fall risk [13, 25] among specific immigrant populations. These advantages may be lost the longer an individual lives outside their home country. The acculturation model, which posits "the gradual adoption of the norms and behaviors of the dominant culture" [26] helps to explain how positive traditional health behaviors may be lost once an individual has become immersed in a new culture. Previous studies have not focused on older Asian and Hispanic immigrants or on understanding how acculturation and its related changes in health behaviors may influence the risks of falls for older adults in the U.S.

Thus, there is a great need to address this knowledge gap, as the older adult population in the U.S. is rapidly growing and substantial demographic shifts by race/ethnicity are projected—racial/ethnic minority communities will comprise the new majority in the near future, with the largest increases projected for immigrant groups such as Hispanics (141.7%) and Asian Americans (116.4%) [27]. Given the rapidly increasing racial/ethnic older adult population and the limited information regarding the impact of falls in these groups, the objective of this study was to examine whether there is an association between race/ethnicity and falling ≥ 2 times in the past year; in addition, we further examine if the relationship between race/ethnicity and English proficiency is associated with falling ≥ 2 times in the past year among Asian Americans and Hispanics as compared to non-Hispanic whites.

Methods

Sample and study population

The sample for this study was drawn from the adult 2011-2012 California Health Information Survey (CHIS), a random-digit-dial telephone survey that collects cross-sectional data representative of the Californian non-institutionalized population. The CHIS is suitable for this study because it oversamples smaller racial/ethnic subgroups within the state, including Asian Americans and Hispanics. The 2011-2012 survey was conducted in five languages: English, Spanish, Chinese (Mandarin and Cantonese), Korean, and Vietnamese. The overall adult response rate for the CHIS (31.6%) is similar to that of other

large, population-based telephone surveys such as the California Behavioral Risk Factor Surveillance System survey [28]. Missing values in the dataset were replaced through imputation using either completely random selection from the observed distribution of respondents or by using hot deck imputation [29].

The analytic subsample of the present study included 13,744 individuals aged ≥ 65: 10,527 non-Hispanic whites, 595 African Americans, 1,199 Asian Americans, and 1,423 Hispanics. Among the sample of Asian Americans, 503 were English Proficient (EP) and 696 were Limited English Proficient (LEP); while among Hispanics, 842 were EP and 581 were LEP. Thirty-six non-Hispanic whites met criteria for LEP and no African Americans met criteria for LEP.

Key Measures

The dependent variable for this study, ≥ 2 falls in the past year, was based on the question, "During the past 12 months, have you fallen to the ground more than once?" The main independent variable is racial/ethnic group, based on the Office of Management and Budget Standards for Data on Race and Ethnicity [30]; these groups include Hispanic, non-Hispanic white, non-Hispanic African American, and non-Hispanic Asian. English proficiency, a proxy for acculturation, was also included. Respondents speaking a language besides English at home were asked, "Would you say you speak English…" with responses "very well," "well," "not well," and "not at all." (LEP was defined as self-reporting speaking English "not well" or "not at all", while EP was defined as speaking only English or speaking English "very well" or "well." This LEP definition has been extensively validated [19, 31-34] and English ability has previously been used as a proxy for acculturation [24, 35-38], defined as 'changes in values, beliefs, attitudes and behaviors' [39].

Control Variables

Potential control variables for logistic regression analyses were based upon past research. Socio-demographic variables include age (continuous), sex, marital status (married or not married), and poverty [<200% federal poverty line (FPL) or ≥ 200% FPL]. Health-related variables include body mass index (BMI, continuous) and chronic disease status (≥ 2 co-existing chronic conditions, commonly described as multi-morbidity, which include diabetes status based on treatment, hypertension based on blood pressure medication use, stroke, arthritis, heart disease, or vision/hearing impairment) [40]. Functional limitations are dichotomous and include a self-reported condition that limits physical activity, difficulty dressing, bathing, or getting around, difficulty going outside alone, or a self-reported cognitive problem, which includes having difficulty learning, remembering, or concentrating.

Statistical Analyses

To compare between-group characteristics by race/ethnicity, means and percentages are used to describe the study population by racial and ethnic group; ANOVAs were used for continuous variables and chi-square tests were used for categorical variables to examine group differences, and p-values are presented. Multivariable logistic regression models were run to examine the likelihood of ≥ 2 falls in the past year by race/ethnicity. A secondary

analysis includes a variable for race/ethnicity and EP/LEP among Asian Americans and Hispanics, while using non-Hispanic whites as the reference group. For both analyses, model 1 adjusted for race/ethnicity, age, and sex; model 2 adjusted for race/ethnicity, age, sex, marital status, poverty, BMI, ≥2 chronic diseases, and functional limitation variables. Odds ratios (ORs) and 95% confidence intervals (CIs) are reported for all logistic models. Two-sided p-values were considered significant at p ≤ 0.05. Data was analyzed using SAS-callable SUDAAN, version 11.0 (Research Triangle Institute, Research Triangle Park, NC, USA) to account for the complex sampling design. All results are weighted, unless stated otherwise.

Results

Demographic and Health-Related Characteristics

African Americans were most likely to experience ≥2 falls in the past year (14.2%), followed by Hispanics (13.8%), non-Hispanic whites (12.8%) and Asian Americans (7.6%).

Non-Hispanic whites had the highest mean age (74.8 years) while Hispanics had the lowest mean age (72.8 years). Asian Americans were primarily foreign-born (84.7%), while non-Hispanic whites and African Americans were most likely to be born in the U.S. (91.0% and 96.8%, respectively). Asian Americans were most likely to be married (61.7%), while African Americans were least likely to be married (35.4%). Non-Hispanic whites were most likely to have graduated from high school (93.2%), while less than half of Hispanics (48.0%) had graduated from high school. Overall, African Americans reported the largest percentages of chronic diseases and functional limitations, while Asians reported the smallest percentages. African Americans and Hispanics had the highest mean BMI (28.5 and 28.7, respectively), while Asians had the lowest mean BMI (24.8). All group differences were statistically significant. Detailed results can be found in Table 1.

Multivariable analysis

Table 2 presents logistic regression models, adjusting for race/ethnicity. Asian Americans were significantly less likely to have fallen ≥2 times in the past year compared to non-Hispanic whites in both models. Older age was associated with fall risk in model 1 (OR: 1.04, 95% CI: 1.03-1.05), but age was no longer significant in model 2. When adjusting for all factors (model 2), Asian Americans were 37% less likely to fall ≥2 times in the past year compared to non-Hispanic whites (OR: 0.63, 95% CI: 0.43-0.92). Additionally, unmarried individuals were more likely to have fallen ≥2 times in the past year compared to married individuals (OR: 1.23, 95% CI: 1.00-1.51), individuals with ≥2 chronic diseases were more likely to have fallen ≥2 times in the past year compared to those with <2 chronic diseases (OR: 1.59, 95% CI: 1.30-1.94), and individuals with functional limitations were more likely to have fallen ≥2 times in the past year compared to individuals without functional limitations (having a condition that limits physical activity, difficulty dressing, bathing, or getting around, and difficulty learning, remembering, or concentrating).

Table 3 presents logistic regression models adjusting for race/ethnicity and EP/LEP. Similarly, older age was associated with fall risk in model 1 (OR: 1.04, 95% CI: 1.02-1.05),

but age was no longer significant in model 2. When adjusting for all factors (model 2), LEP Asian Americans were 44% less likely to fall ≥ 2 times in the past year compared to non-Hispanic whites (OR: 0.56, 95% CI: 0.33-0.96). No significant differences were shown for Hispanics, regardless of EP. Additionally, individuals with ≥ 2 chronic diseases were more likely to have fallen ≥ 2 times in the past year compared to those with <2 chronic diseases (OR: 1.49, 95% CI: 1.20-1.84) and individuals with functional limitations were more likely to have fallen ≥ 2 times in the past year compared to individuals without functional limitations (having a condition that limits physical activity, difficulty dressing, bathing, or getting around, difficulty going outside home alone, and difficulty learning, remembering, or concentrating).

Additional logistic models were run to compare LEP Asian Americans to EP Asian Americans, and LEP Hispanics LEP to EP Hispanics; no significant differences were found between these groups (results not shown).

Discussion

The findings from this study add important insight to the current literature regarding fall risks among different racial/ethnic groups. Race/ethnicity was a significant predictor for the risk of falling ≥ 2 times in the past year among older individuals, and Asian Americans were significantly less likely to have fallen ≥ 2 times in the past year compared to non-Hispanic whites. Further analysis found that this risk was significant for the LEP Asian American group. No significant differences in the risk of falling were found among African Americans or Hispanics when compared to non-Hispanic whites. Our final model also found several traditional individual level risk factors for falling to be significant within our diverse study population, including marital status, chronic disease status and functional limitations. Previous research indicates that females are more likely to fall than males; our gender findings were not significant.

While several studies have examined falls among African Americans or blacks and non-Hispanic whites [9, 14-16, 41], fewer studies, with mixed results, have examined falls among Hispanics [9]. The Health and Retirement Survey, a longitudinal population-based survey from 2000-2010 found that African Americans had a significantly lower risk of falls and the Hispanic population saw no difference compared to non-Hispanic whites [9]. A recent study using the National Health and Aging Trends longitudinal survey found that blacks had a 30% decreased risk for falls and a 40% decreased risk for recurrent falls compared to whites. Reasons for such a large difference were unclear when accounting for physical performance level, disability, and physical activity [16]. Other large cohort studies have not shown significant differences in fall rates between whites and African Americans or blacks [9, 14, 15], which are consistent with our findings. As far as the authors are aware, no current studies have examined fall risks among Asian Americans as compared to other groups.

Our study is consistent with previous international studies that indicate a lower fall rate among Asians compared to a range of white populations [13, 14]. A study by Kwan et al. examining fall rates among Chinese in Taiwan, Hong Kong, and Australia and whites in

Australia found that fall rates were significantly lower for all Asian groups when compared to the white cohort; the lowest fall rates were seen in the Taiwan and Hong Kong Chinese cohorts, followed by the Australian Chinese cohort [13]. The authors suggest that decreased falls risk among the Chinese cohorts may be due to increased concerns with falling and the subsequent adoption of protective behaviors against falls; behaviors which may be lost with migration per the higher falls risk found with the Chinese immigrant Australian cohort. The results of our secondary analyses suggest that LEP and EP Asian Americans both demonstrated decreased risk; however, this decreased risk was stronger in the LEP group. This association, however, was not seen within the Hispanic population. Specific culturally-imbedded health behaviors that may affect fall risk are unclear from our data, and it is possible that they may change with level of acculturation. For example Tai Chi, an ancient Chinese martial art, has been shown to be effective at reducing falls in certain populations [42, 43]. A systematic review of falls risk among Chinese older adults in Asia found that the overall decreased incidence in falls within this population may be due to a variety of factors, including a high incidence of squatting, less risk taking behaviors, and specific activity patterns [25]. Moreover, within certain populations, perceptions of frailty may differ. In Kwan et al.'s study, each Chinese cohort, compared to the white cohort, had high scores on the Falls Efficacy Scale-International (FES-I), which measures concerns about falling. The authors suggest that due to a heightened concern for falling, Chinese cohorts may be more likely to engage in 'cautious behaviors,' such as the use of walking sticks (especially in Hong Kong)—a behavior negatively associated with frailty in western cultures and therefore used less often [13].

Language-isolated or less-acculturated older adults may report lower levels of neighborhood social cohesion and may spend less time outside in the built environment, which could contribute to a slightly decreased fall risk [44-46]. Within the Asian American community, less acculturated immigrants may experience fewer falls because they are healthier when they arrive in the United States, as suggested by the healthy immigrant effect [20]. Furthermore, Asian Americans are less likely to live alone and therefore may be able to request assistance from household members thus avoiding activities that may increase their general likelihood of a fall. No differences were seen among Hispanics by acculturation level, however, even though they too are more likely to not live alone. Thus, further studies are needed to clarify the specific health behaviors among older Asian Americans and Hispanics and how they may be influenced by level of acculturation.

Additionally, data from New York City has shown that Asian Americans have a high falls mortality rate [17], suggesting that even if Asian Americans are falling less frequently, once they fall they are more likely to die. In their systematic review, Kwan et al. also reported a similar phenomenon between Chinese and white older adults, whereby Chinese older adults were less likely to fall, but when they fell, they sustained more serious injuries than their white counterparts. The authors postulated that this may be due to Chinese older adults being more likely to fall on the street or sidewalk, rather than on a softer surface [25], therefore increasing the risk of serious fracture [47]. The mechanisms underlying these complexities also require further examination

This study was subject to several limitations. First, the results may not be applicable to individuals who live in other areas of the country with different environmental influences on fall risk and/or different racial/ethnic heterogeneity. Moreover, heterogeneity within each racial/ethnic group may differ greatly based on location and immigration patterns [48]. Second, the CHIS only assesses more than one fall and does not specify the location of the fall (indoors versus outdoors), which may have different clinical and social implications [15]. Third, only a subset of risk factors for falls could be examined, and some key risk factors, including fear of falling [49], medication use, frailty, gait, and history of falls, could not be ascertained from the data [5, 6, 50]. Fourth, a discrepancy may exist between the decreased fall risk among Asian Americans in our study and increased mortality due to falls among Asian Americans as reported in NYC mortality data. This discrepancy could be due to the limitations of self-reported data in our study, in which certain groups may under-report falls. Finally, acculturation is a complex process, which is difficult to define and measure. While language is one of the strongest predictors of acculturation [51, 52], there are many other measures and scales that are used as proxies for acculturation, including survey language, years lived in the U.S., and validated acculturation scales [39]. Use of other scales or proxies for acculturation may result in different study outcomes, and should be further examined in future studies.

Our study also has important implications. These findings, as well as future study findings, could be used by health providers and public health officials to inform programs and policies and to allocate additional resources on falls prevention. As the diversity in the U.S. continues to grow, especially among older racial and minority populations including Asian Americans, it is important to understand why and how specific groups fall, in order to identify those most at risk.

To our knowledge, this is the first study to examine fall risk among a racially and ethnically diverse sample of older individuals, and to examine the association of English language proficiency in relation to race/ethnicity on fall risk. Race/ethnicity may play an important role in many health behaviors, and it is important to understand the relationship between race/ethnicity and the risk of falling. Careful attention is needed to understand how migration and acculturation, environmental factors, and social support affect falls in older adults. Our findings inform this evolving body of research and underscore the need for further research to understand the risk of falls across diverse racial/ethnic populations. Culturally relevant and targeted interventions are needed to prevent falls and subsequent injuries in the increasingly diverse aging population in the U.S.

Acknowledgments

References

1. Centers for Disease Control and Prevention. [Accessed on [6/13/16]] Injury Prevention and Control: Data and Statistics (WISQARS). 2015. [updated 5/4/16]. Available from: http://www.cdc.gov/injury/wisqars/

2. Tinetti ME, Williams CS. The effect of falls and fall injuries on functioning in community-dwelling older persons. J Gerontol A Biol Sci Med Sci. 1998; 53(2):M112–9. [PubMed: 9520917]

3. Alamgir H, Muazzam S, Nasrullah M. Unintentional falls mortality among elderly in the United States: time for action. Injury. 2012; 43(12):2065–71. [PubMed: 22265137]

4. Balfour JL, Kaplan GA. Neighborhood environment and loss of physical function in older adults: evidence from the Alameda County Study. Am J Epidemiol. 2002; 155(6):507–15. [PubMed: 11882524]

5. Cauley JA. Defining ethnic and racial differences in osteoporosis and fragility fractures. Clin Orthop Relat Res. 2011; 469(7):1891–9. [PubMed: 21431462]

6. Ganz DA, Bao Y, Shekelle PG, Rubenstein LZ. Will my patient fall? JAMA. 2007; 297(1):77–86. [PubMed: 17200478]

7. Ambrose AF, Paul G, Hausdorff JM. Risk factors for falls among older adults: a review of the literature. Maturitas. 2013; 75(1):51–61. [PubMed: 23523272]

8. Wheeler SM, Bryant AS. Racial and Ethnic Disparities in Health and Health Care. Obstet Gynecol Clin North Am. 2017; 44(1):1–11. [PubMed: 28160887]

9. Nicklett EJ, Taylor RJ. Racial/Ethnic predictors of falls among older adults: the health and retirement study. J Aging Health. 2014; 26(6):1060–75. [PubMed: 25005171]

10. West, LA., Cole, S., Goodkind, D., He, W. [Accessed on [2/6/17]] 65+ in the United States: 2010: United States Census Bureau. 2014. Available from: https://www.census.gov/content/dam/Census/library/publications/2014/demo/p23-212.pdf

11. Ylitalo KR, Karvonen-Gutierrez CA. Body mass index, falls, and injurious falls among U.S. adults: Findings from the 2014 Behavioral Risk Factor Surveillance System. Prev Med. 2016; 91:217–23. [PubMed: 27575319]

12. Danaei G, Rimm EB, Oza S, Kulkarni SC, Murray CJ, Ezzati M. The promise of prevention: the effects of four preventable risk factors on national life expectancy and life expectancy disparities by race and county in the United States. PLoS Med. 2010; 7(3):e1000248. [PubMed: 20351772]

13. Kwan MM, Tsang WW, Lin SI, Greenaway M, Close JC, Lord SR. Increased concern is protective for falls in Chinese older people: the chopstix fall risk study. J Gerontol A Biol Sci Med Sci. 2013; 68(8):946–53. [PubMed: 23401568]

14. Han BH, Ferris R, Blaum C. Exploring ethnic and racial differences in falls among older adults. J Community Health. 2014; 39(6):1241–7. [PubMed: 24585104]

15. Faulkner KA, Cauley JA, Zmuda JM, Landsittel DP, Nevitt MC, Newman AB, et al. Ethnic differences in the frequency and circumstances of falling in older community-dwelling women. J Am Geriatr Soc. 2005; 53(10):1774–9. [PubMed: 16181179]

16. Sun DQ, Huang J, Varadhan R, Agrawal Y. Race and fall risk: data from the National Health and Aging Trends Study (NHATS). Age Ageing. 2016; 45(1):120–7. [PubMed: 26764401]

17. Injury Surveillance and Prevention Program Bureau of Environmental Disease Prevention NYC Department of Health and Mental Hygiene. [Accessed on [5/13/16]] Falls among Older Adults in New York City: A Data Profile. 2011. [updated 9/2011]. Available from: http://www.nyc.gov/html/dfta/downloads/pdf/health/profile_of_falls.pdf

18. Jasso G, Massey DS, Rosenzweig MR, Smith JP. The New Immigrant Survey Pilot (NIS-P): overview and new findings about U.S. legal immigrants at admission. Demography. 2000; 37(1):127–38. [PubMed: 10748994]

19. Lee S, Nguyen HA, Tsui J. Interview language: a proxy measure for acculturation among Asian Americans in a population-based survey. Journal of immigrant and minority health. 2011; 13(2):244–52. [PubMed: 19639411]

20. Singh GK, Miller BA. Health, life expectancy, and mortality patterns among immigrant populations in the United States. Can J Public Health. 2004; 95(3):I14–21. [PubMed: 15191127]

21. Delavari M, Sonderlund AL, Swinburn B, Mellor D, Renzaho A. Acculturation and obesity among migrant populations in high income countries--a systematic review. BMC Public Health. 2013; 13:458. [PubMed: 23663279]

22. Dey AN, Lucas JW. Physical and mental health characteristics of U.S.- and foreign-born adults: United States, 1998-2003. Adv Data. 2006; (369):1–19.

23. Lauderdale DS, Rathouz PJ. Body mass index in a US national sample of Asian Americans: effects of nativity, years since immigration and socioeconomic status. Int J Obes Relat Metab Disord. 2000; 24(9):1188–94. [PubMed: 11033989]

24. Gao XL, McGrath C. A review on the oral health impacts of acculturation. Journal of immigrant and minority health. 2011; 13(2):202–13. [PubMed: 21082253]

25. Kwan MM, Close JC, Wong AK, Lord SR. Falls incidence, risk factors, and consequences in Chinese older people: a systematic review. J Am Geriatr Soc. 2011; 59(3):536–43. [PubMed: 21361880]

26. Park SY, Anastas J, Shibusawa T, Nguyen D. The impact of acculturation and acculturative stress on alcohol use across Asian immigrant subgroups. Subst Use Misuse. 2014; 49(8):922–31. [PubMed: 24779491]

27. United States Census Bureau. [Accessed on [5/13/16]] National Population Projections: Summary Tables. 2012. [updated 12/18/14]. Available from: http://www.census.gov/population/projections/data/national/2012/summarytables.html

28. California Health Interview Survey. CHIS 2011-2012 Methodology Series: Report 1 - Sample Design. Los Angeles, CA: UCLA Center for Health Policy Research; 2014.

29. California Health Interview Survey. CHIS 2011-2012 Metholody Series: Report 5-Weighting and Variance Estimation. Los Angeles, CA: UCLA Center for Health Policy Research; 2014.

30. Office of Management and Budget. [Accessed on [5/13/16]] Standards for Classification of Federal Data on Race and Ethnicity. 1997. Available from: https://www.whitehouse.gov/omb/fedreg_race-ethnicity

31. Cordasco KM, Ponce NA, Gatchell MS, Traudt B, Escarce JJ. English language proficiency and geographical proximity to a safety net clinic as a predictor of health care access. Journal of immigrant and minority health. 2011; 13(2):260–7. [PubMed: 21170588]

32. Flores G, Abreu M, Tomany-Korman SC. Limited english proficiency, primary language at home, and disparities in children's health care: how language barriers are measured matters. Public Health Rep. 2005; 120(4):418–30. [PubMed: 16025722]

33. Ponce NA, Hays RD, Cunningham WE. Linguistic disparities in health care access and health status among older adults. J Gen Intern Med. 2006; 21(7):786–91. [PubMed: 16808783]

34. Nguyen D. Acculturation and perceived mental health need among older Asian immigrants. J Behav Health Serv Res. 2011; 38(4):526–33. [PubMed: 21598084]

35. Pew Research Center. [Accessed on [2/6/2017]] Assimiliation and Language Fact Sheet. 2004. Available from: http://www.pewhispanic.org/2004/03/19/assimilation-and-language/#fn-7121-3

36. Jia F, Gottardo A, Chen X, Koh P, Pasquarella A. English proficiency and acculturation among Chinese immigrant youth in Canada: a reciprocal relationship. Journal of Multilingual and Multicultural Development. 2016; 37(8):774–82.

37. Gee GC, Walsemann KM, Takeuchi DT. English proficiency and language preference: testing the equivalence of two measures. Am J Public Health. 2010; 100(3):563–9. [PubMed: 19696376]

38. Luo H, Wu B. Acculturation and Dental Service Use Among Asian Immigrants in the U.S. Am J Prev Med. 2016; 51(6):939–46. [PubMed: 27720339]

39. Thompson MD, Hoffman-Goetz L. Defining and Measuring Acculturation: A Systemic Review of Public Health Studies with Hispanic Populations in the United States. Soc Sci Med. 2009; 69(7): 983–91. [PubMed: 19525050]

40. Weiss CO, Varadhan R, Puhan MA, Vickers A, Bandeen-Roche K, Boyd CM, et al. Multimorbidity and evidence generation. J Gen Intern Med. 2014; 29(4):653–60. [PubMed: 24442333]

41. Hanlon JT, Landerman LR, Fillenbaum GG, Studenski S. Falls in African American and white community-dwelling elderly residents. J Gerontol A Biol Sci Med Sci. 2002; 57(7):M473–8. [PubMed: 12084812]

42. Li F, Harmer P, Fisher KJ, McAuley E, Chaumeton N, Eckstrom E, et al. Tai Chi and fall reductions in older adults: a randomized controlled trial. J Gerontol A Biol Sci Med Sci. 2005; 60(2):187–94. [PubMed: 15814861]

43. Wu G. Evaluation of the effectiveness of Tai Chi for improving balance and preventing falls in the older population--a review. J Am Geriatr Soc. 2002; 50(4):746–54. [PubMed: 11982679]

44. Mendoza-Vasconez AS, Linke S, Munoz M, Pekmezi D, Ainsworth C, Cano M, et al. Promoting Physical Activity among Underserved Populations. Curr Sports Med Rep. 2016; 15(4):290–7. [PubMed: 27399827]

45. Yen IH, Michael YL, Perdue L. Neighborhood environment in studies of health of older adults: a systematic review. Am J Prev Med. 2009; 37(5):455–63. [PubMed: 19840702]

46. Li Y, Kao D, Dinh TQ. Correlates of neighborhood environment with walking among older Asian Americans. J Aging Health. 2015; 27(1):17–34. [PubMed: 24943112]

47. Nevitt MC, Cummings SR. Type of fall and risk of hip and wrist fractures: the study of osteoporotic fractures. The Study of Osteoporotic Fractures Research Group. J Am Geriatr Soc. 1993; 41(11):1226–34. [PubMed: 8227898]

48. Pew Charitable Trust. [Accessed on [5/13/16]] Changing Patterns in U.S. Immigration and Population. 2014. [updated 12/18/14]. Available from: http://www.pewtrusts.org/en/research-and-analysis/issue-briefs/2014/12/changing-patterns-in-us-immigration-and-population

49. Friedman SM, Munoz B, West SK, Rubin GS, Fried LP. Falls and fear of falling: which comes first? A longitudinal prediction model suggests strategies for primary and secondary prevention. J Am Geriatr Soc. 2002; 50(8):1329–35. [PubMed: 12164987]

50. Graafmans WC, Ooms ME, Hofstee HM, Bezemer PD, Bouter LM, Lips P. Falls in the elderly: a prospective study of risk factors and risk profiles. Am J Epidemiol. 1996; 143(11):1129–36. [PubMed: 8633602]

51. Arcia E, Skinner M, Bailey D, Correa V. Models of acculturation and health behaviors among Latino immigrants to the US. Soc Sci Med. 2001; 53(1):41–53. [PubMed: 11386307]

52. Marin G, Gamba RJ. A New Measurement of Acculturation for Hispanics: The Bidimensional Acculturation Scale for Hispanics (BAS). Hispanic Journal of Behavioral Sciences. 1996; 18(3): 297–316.

Table 1

Descriptive characteristics of adults age ≥ 65 by race/ethnicity (n=13,744)[a]

Characteristic, n (%)	Non-Hispanic White (n=10,527)	African American (n=595)	Asian (n=1,199)	Hispanic (n=1,423)	P-value
≥ Falls in the past year	1,396 (12.8)	59 (14.2)	122 (7.6)	211 (13.8)	<0.001
Socio-demographics					
Age, Mean (SE)	74.8 (0.07)	73.6 (0.5)	73.5 (0.3)	72.8 (0.2)	<0.001
Female Gender	6,466 (57.3)	389 (59.6)	685 (58.1)	889 (52.0)	0.058
Born outside of U.S.	873 (9.0)	22 (3.2)	1,026 (84.7)	766 (57.9)	<0.001
Marital status					<0.001
Married	4,678 (56.0)	164 (35.4)	648 (61.7)	648 (57.0)	
Not married	5,849 (44.0)	431 (64.6)	551 (38.3)	775 (43.0)	
Education					<0.001
<High school	534 (6.8)	79 (18.5)	287 (25.3)	635 (52.0)	
High school	9,993 (93.2)	516 (81.5)	912 (74.7)	788 (48.0)	
% Federal Poverty Line					<0.001
<200	2,338 (20.3)	226 (39.3)	723 (51.6)	864 (61.1)	
≥200	8,189 (79.7)	369 (60.7)	476 (48.4)	559 (38.9)	
English proficiency					<0.001
Proficient (EP)	10,491 (99.5)	595 (100.0)	503 (52.9)	842 (55.1)	
Limited Proficiency (LEP)	36 (0.5)	0 (0.0)	696 (47.1)	581 (44.9)	
Health-related Variables					
Body mass index, Mean (SE)	26.9 (.06)	28.5 (0.4)	24.8 (0.3)	28.7 (0.3)	<0.001
≥ Chronic diseases[b]	5,290 (51.0)	373 (65.6)	621 (46.7)	810 (57.2)	<0.001
Functional Limitations					
Condition that limits basic physical activity	3,756 (35.2)	249 (42.8)	305 (23.5)	553 (39.4)	<0.001
Difficulty dressing, bathing, getting around	783 (7.1)	75 (13.5)	112 (6.1)	146 (10.0)	<0.001
Difficulty going outside alone	1,157 (11.0)	95 (17.4)	137 (8.8)	202 (12.6)	0.002
Difficulty learning, Remembering, Concentrating	1,941 (17.7)	135 (28.1)	266 (20.3)	353 (23.9)	<0.001

[a] All percentages are weighted, sample sizes are unweighted

[b]Chronic diseases - hypertension, stroke, diabetes, heart disease, arthritis, vision/hearing impairment

Table 2

Multivariable logistic regression predicting ≥2 falls in the past year among adults age ≥ 65

	Model 1		Model 2	
	OR (95% CI)	P-value	OR (95% CI)	P-value
Socio-demographics				
Race/ethnicity (Ref = Non-Hispanic White)				
African American	1.18 (0.75-1.85)	0.482	0.82 (0.51-1.30)	0.391
Asian	0.59 (0.42-0.83)	0.003	0.63 (0.43-0.92)	0.018
Hispanic	1.19 (0.89-1.59)	0.238	0.98 (0.72-1.34)	0.921
Age, continuous	1.04 (1.03-1.05)	<0.001	1.01 (0.99-1.02)	0.233
Male (Ref = Female)	0.84 (0.69-1.03)	0.091	0.97 (0.78-1.21)	0.814
Unmarried (Ref = Married)			1.23 (1.00-1.51)	0.045
<200% Federal Poverty Level (Ref = ≥200% Federal Poverty Level)			1.00 (0.82-1.22)	0.993
Health-related Variables				
BMI, continuous			1.00 (0.99- 1.02)	0.775
≥2 Chronic Diseases (Ref = <2)			1.59 (1.30-1.94)	<0.001
Functional Limitations				
Condition that limits basic physical activity (Ref = No)			2.11 (1.72-2.60)	<0.001
Difficulty Dressing, Bathing, Getting Around (Ref = No)			1.67 (1.20-2.33)	0.003
Difficulty Going Outside Home Alone (Ref = No)			1.31 (0.99-1.72)	0.056
Difficulty Learning, Remembering, Concentrating (Ref = No)			1.76 (1.45-2.14)	<0.001

Table 3

Multivariable logistic regression predicting   2 falls in the past year among non-Hispanic white, EP/LEP Asian and EP/LEP Hispanic adults among age   65

	Model 1		Model 2	
	OR (95% CI)	P-value	OR (95% CI)	P-value
Socio-demographics				
Race/ethnicity (Ref = Non-Hispanic White)				
Asian - LEP	0.56 (0.34-0.92)	0.022	0.56 (0.33-0.96)	0.035
Asian - EP	0.62 (0.38-1.00)	0.052	0.70 (0.42-1.18)	0.182
Hispanic - LEP	1.28 (0.88-1.86)	0.190	0.99 (0.64-1.53)	0.962
Hispanic - EP	1.12 (0.74-1.69)	0.579	0.96 (0.62-1.50)	0.867
Age, continuous	1.04 (1.02-1.05)	<0.001	1.01 (0.99-1.03)	0.251
Male (Ref = Female)	0.83 (0.68-1.01)	0.062	0.95 (0.76-1.19)	0.664
Unmarried (Ref = Married)			1.23 (1.00-1.51)	0.053
<200% Federal Poverty Level (Ref = 200% Federal Poverty Level)			1.01 (0.84-1.22)	0.911
Health-related Variables				
BMI, continuous			1.01 (0.99-1.02)	0.454
2 Chronic Diseases (Ref = <2)			1.49 (1.20-1.84)	<0.001
Functional Limitations				
Condition that limits basic physical activity (Ref = No)			2.26 (1.84-2.77)	<0.001
Difficulty Dressing, Bathing, Getting Around (Ref = No)			1.66 (1.16-2.38)	0.006
Difficulty Going Outside Home Alone (Ref = No)			1.31 (1.00-1.70)	0.046
Difficulty Learning, Remembering, Concentrating (Ref = No)			1.79 (1.47-2.19)	<0.001