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Sex- and Ethnic-specific Patterns in the Incidence of Hip Fracture among Older US Asian and Non-Hispanic White Adults

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Abstract

BACKGROUND: Asian and Pacific Islander (Asian/PI) adults have lower hip fracture incidence than non-Hispanic White (NHW) adults, but data regarding Asian/PI subgroups are limited. We compared hip fracture incidence among older US Asian/PI and NHW populations, including ethnic subgroup differences.

METHODS: Using observational data from a California healthcare system, we identified Asian/PI and NHW adults aged ≥ 50 years (2000–2019) and followed subjects to 2021 for hip fracture determined by principal/primary hospital diagnosis or by secondary hospital diagnosis with hip/femur procedure codes. Age-adjusted hip fracture incidence was calculated with 95% confidence intervals [CI]. Log-Poisson regression was used to determine fracture incidence rate ratios (IRR, [CI]; NHW or Chinese as reference) adjusting for age and year.

RESULTS: Among 215,359 Asian/PI and 776,839 NHW women, hip fracture incidence was 1.34 [1.28–1.40] and 2.97 [2.94–3.01] per 1000 person-years, respectively, with IRR 0.45 [0.43–0.47]. Among 188,328 Asian/PI and 697,046 NHW men, hip fracture incidence was 0.62 [0.58–0.67] and 1.81 [1.78–1.84] per 1000 person-years, respectively, with IRR 0.34 [0.32–0.37]. For the four largest Asian/PI subgroups, Filipina women (IRR 0.85 [0.75–0.96]) had lower, and Japanese

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CONFLICT OF INTEREST: Joan Lo, Malini Chandra, David Lee, Jeanne Darbinian, Nancy Gordon, David Zeltser, Christopher Grimsrud, and Catherine Lee have no conflicts of interest to report.

(IRR 1.36 [1.20–1.54]) and South Asian (IRR 1.36 [1.07–1.72]) women had higher hip fracture incidence compared to Chinese women. Hip fracture incidence was only higher among South Asian (IRR 1.61 [1.21–2.14]) compared to Chinese men.

CONCLUSION: Hip fracture incidence among US Asian/PI adults was 55% (women) and 66% (men) lower than NHW adults, but incidence varied by Asian/PI subgroup. The heterogeneity among Asian/PI adults highlights the importance of examining fracture risk by ethnic subgroup.

Keywords

hip fracture; osteoporosis; Asian; ethnicity; Chinese; Japanese; Filipino; South Asian

INTRODUCTION

The Asian population is one of the fastest growing racial groups within the US, increasing from 14.7 million in 2010 to 19.9 million in 2020.¹ They represent a heterogeneous group with ancestry largely originating from East, South, and Southeast Asia regions. Nearly one-third of all US Asian individuals reside in California,¹ with large numbers in Sacramento and the San Francisco Bay Area. The Native Hawaiian and Pacific Islander (PI) population is also fast-growing, increasing from 0.5 million in 2010 to 0.7 million in 2020.¹ Chinese and Filipino ethnicity currently represent the two largest Asian/PI subgroups in the California,¹ where 16.9% of all older adults are of Asian/PI race.² However, skeletal health outcome data among the major US Asian/PI subgroups remain limited.³

Hip fractures are the most serious consequence of osteoporosis, with the majority occurring among those aged 75 years.⁴ Early US data from 1983 to 2000 demonstrate much lower incidence of hip fracture among Asian compared to non-Hispanic White (NHW) populations.^{5–7} To account for this lower background risk, calibration factors (0.50 for Asian women, 0.64 for Asian men)⁸ are applied to the US FRAX fracture risk calculator when calculating 10-year hip fracture probability for older US Asian adults.^{9,10} Subsequent studies using national¹¹ and California^{12–14} data similarly identify lower hip fracture incidence among Asian compared to NHW populations. Whether hip fracture rates vary among Asian/PI subgroups is less clear and understanding the variation in population fracture rates could be important for individualized fracture prevention care within this diverse population.

A study of 1992–1993 Medicare enrollees found lower age-adjusted hip fracture incidence among Chinese compared to Japanese Americans, with both groups experiencing lower fracture incidence compared to White populations.⁵ Our group also studied 449 US South Asian women and age-matched populations of US Chinese and NHW women and found that wrist fracture incidence in South Asian women was similar to NHW women and significantly higher than Chinese women,¹⁵ but the cohort size was too small to compare hip fracture incidence. Population-based estimates of hip fracture incidence among US Filipino and South Asian adults are lacking, including comparisons with US East Asian populations.

In the current report, we present findings from a large population study of sex-specific hip fracture incidence among older US Asian/PI and NHW populations. This is one of

the first studies to examine hip fracture incidence among major Asian/PI subgroups using contemporary data.

METHODS

Setting

This observational study was conducted using health record data from Kaiser Permanente Northern California (KPNC), a large integrated healthcare delivery system serving >4 million members annually. Within KPNC, centralized databases have tracked hospital admissions, procedures, and non-hospital care for over three decades. Hip fracture events are identified with nearly complete capture as they are managed in KPNC hospitals or tracked through claims data for the small percentage of outside hospitalizations for which KPNC remains fiscally responsible. The study was reviewed and approved by the KPNC Institutional Review Board.

Study Population

The study cohort included KPNC men and women aged ≥ 50 years who were members anytime during 1/1/2000–12/31/2019 and identified as NHW or Asian/PI based on self-reported race and ethnicity from electronic health record and administrative data sources. Those identified as Asian/PI race were subclassified based on self-reported data as Chinese, Filipino, Japanese, South Asian, Vietnamese, other Southeast Asian, Korean, Native Hawaiian/PI, Central Asian, and mixed Asian ethnicity; the remainder had Asian ethnic subgroup unspecified. The Filipino subgroup included 2.7% dually identified by Hispanic ethnicity,¹⁴ but non-Filipino Asian/PI adults dually identified by Hispanic ethnicity were not included.

Incident hip (proximal femur) fractures were identified by principal or primary hospitalization diagnosis of femoral neck or pertrochanteric fracture, using International Classification of Diseases Clinical Modification 9th/10th revision (ICD-9/10)-coded diagnoses of closed fractures of the femoral neck and pertrochanter (ICD-9 820.0x, 820.20, 820.21, 820.8x; ICD-10 S72.0xxA, S72.1xxA). We also included hospitalizations with secondary diagnosis of hip fracture if surgical hip repair occurred within 30 days, based on procedure codes (an additional 5.2% hip fractures). Fractures events associated with open fracture codes (ICD-9 820.1x, 820.3x, 820.9x, ICD-10 S72.0xxB/C, S72.1xxB/C; 0.3%) or secondary codes for major trauma (ICD-9 E800–848, ICD-10 V00-V99; 1.9%) were excluded. We did not include subtrochanteric-coded femur fractures, an additional 4.1% of hip fracture events.

Statistical Analyses

Hip fracture incidence was estimated per 1000 person-years with 95% confidence intervals (CI). Sex, race, and ethnicity specific hip fracture incidence rates were reported overall (adjusted for age using the 2010 US Census distribution for adults aged ≥ 50 years) and by five-year age group. After cohort entry (1/1/2000–12/31/2019), subjects contributed person-time to each qualifying age strata during follow-up until the first qualifying hip fracture, death, membership disenrollment (allowing ≥ 3 -month gaps) or end of observation

(12/31/2021), whichever came first. We compared hip fracture incidence between NHW and Asian/PI groups and among the four largest Asian/PI subgroups using log-Poisson regression (reported as incidence rate ratios), adjusting for 5-year age group and calendar year to account for temporal variation in hip fracture incidence. All analyses were conducted using SAS statistical software (version 9.4, SAS Institute, Cary, NC).

RESULTS

The study population was comprised of 403,687 Asian/PI adults and 1,473,885 NHW adults age 50 years at cohort entry (mean age 57.5±9.6 years). During median follow-up of 7.3 years (interquartile range 3.3–14.6), 1,842 hip fractures occurred among 215,359 Asian/PI women and 25,670 hip fractures occurred among 776,839 NHW women. During median follow-up of 7.0 years (interquartile range 3.1–13.7), 679 hip fractures occurred among 188,328 Asian/PI men and 11,087 hip fractures occurred among 697,046 NHW men. The average age at fracture was 80.7±9.7 (Asian/PI) and 81.2±9.6 (NHW) years for women and 78.3±11.1 (Asian/PI) and 79.5±10.3 (NHW) years for men.

The age-adjusted incidence of hip fracture varied by race and sex. The incidence was 1.34 (CI 1.28–1.40) and 2.97 (CI 2.94–3.01) per 1000 person-years among Asian/PI and NHW women (Table 1) and 0.62 (CI 0.58–0.67) and 1.81 (CI 1.78–1.84) per 1000 person-years among Asian/PI and NHW men (Table 2), respectively. Tables 1 and 2 also provide the incidence of hip fracture by five-year age group. For each age stratum, hip fracture incidence was lower among Asian/PI compared to NHW populations.

The Asian/PI subset (N = 403,687) included 26.4% Filipino, 22.7% Chinese, 6.0% South Asian, 4.9% Japanese, 4.0% Vietnamese, 1.8% other Southeast Asian, 1.9% Korean, 3.2% Native Hawaiian/PI, 0.2% Central Asian, and 29.0% unspecified or mixed Asian ethnicity adults. Tables 1 and 2 show the age-adjusted and 5-year age-specific incidence of hip fracture among the four largest Asian/PI subgroups (Filipino, Chinese, South Asian, Japanese) by sex. Age-adjusted incidence rates of hip fracture were higher in Japanese and South Asian women and lower in Filipina women than in Chinese women. Chinese, Filipino, and Japanese men had lower age-adjusted hip fracture incidence than South Asian men.

We next examined age-adjusted incidence rate ratios for hip fracture in sex-specific models that compared Asian/PI and Asian/PI subgroups (Chinese, Filipino, South Asian, Japanese) to NHW adults, and Asian/PI subgroups to Chinese adults (Figure 1). Asian/PI women had 55% lower age-adjusted incidence of hip fracture compared to NHW women, but this varied by Asian/PI ethnicity (63% lower in Filipina, 55% lower in Chinese, 44% lower in South Asian, and 36% lower in Japanese women). Asian/PI men had 66% lower incidence of hip fracture compared to NHW men, varying from 68%, 65%, 61%, and 45% lower in Filipino, Chinese, Japanese, and South Asian men, respectively. Among Asian/PI subgroups, significant differences in hip fracture incidence (adjusted IRRs) were seen among Filipina (lower) and Japanese and South Asian women (higher) compared to Chinese women. Among Asian/PI men, hip fracture incidence was not significantly different for Filipino and Japanese men compared to Chinese men but was significantly higher for South Asian men.

DISCUSSION

This is the first large-scale study to report contemporary rates of hip fracture among US Asian/PI subgroups, including Filipino, Chinese, South Asian, and Japanese adults. In aggregate, Asian/PI adults had much lower incidence of hip fracture than NHW adults, with adjusted hip fracture incidence 55% and 66% lower in Asian/PI women and men compared to NHW counterparts, respectively. Findings among women were similar to previous studies comparing these groups,^{6,7,11} but differences in hip fracture incidence between Asian/PI and NHW men were larger than previously estimated.⁸ Importantly, we identified substantial variation in hip fracture incidence across Asian/PI subgroups. For women, fracture incidence was lower among Filipina and higher among South Asian and Japanese women compared to Chinese women. For men, fracture incidence was highest among South Asian men. Early studies using US Medicare data also showed lower rates of hip fracture among Chinese Americans compared to Japanese Americans, with differences greater among women.⁵

The lower incidence of hip fracture among Asian/PI compared to NHW adults may be multifactorial. Prior studies have observed shorter hip axis and femur length among East Asian compared to White or European women,^{16,17} hip geometry factors associated with lower risk of femoral neck fractures.¹⁸ Differences in skeletal microstructure (greater cortical density and thickness, reduced porosity and trabecular density among Chinese women),^{19,20} hip structure,²¹ and genetic factors²² may contribute to differences in fracture incidence. We previously reported similar femoral neck bone density among older Chinese, Filipina, and Japanese women, lower than NHW counterparts even after accounting for height differences.²³ However, few studies^{24,25} have examined diet, nutrition, physical activity, fall risk, and other lifestyle factors²⁶ that may contribute to the observed variation in hip fracture incidence by Asian/PI subgroup. In a study of Asian women with vitamin D levels assessed prior to osteoporosis therapy, we found that Chinese women had 40% higher risk of low Vitamin D than Filipina women, despite higher body mass index among Filipina women.²⁷

Understanding ethnic variation in hip fracture incidence can inform interpretation of fracture risk scores in the BMD report.^{8,26} Despite recognized limitations,^{9,10,28} FRAX is a tool used to support fracture prevention care by integrating age, bone density, clinical risk factors, and race and ethnicity to calculate fracture risk, including the Asian population in aggregate. Our findings suggest that hip fracture risk may be somewhat lower (Filipina women) or higher (Japanese women and South Asian adults) in selected subgroups, but the hip fracture rates among Asian/PI adults remain far lower than NHW counterparts. While these risk ratios may differ at other skeletal sites (higher wrist fracture incidence similar to NHW women has been observed in South Asian compared to Chinese women¹⁵ and the US Caucasian (versus Asian) FRAX has been considered for South Asian adults),^{29,30} our current findings are not intended to inform the choice of FRAX for US Asian/PI adults or its calibration factors. Rather, we provide context for considering which populations might be at higher or lower risk for hip fracture.

A major strength of our study is the use of data from a large integrated healthcare delivery system with an ethnically diverse membership, high membership retention among older

adults, and comprehensive tracking of hip fractures, including outside claims-based data. Large numbers of understudied Asian/PI subgroups were represented among >400,000 Asian/PI adults identified, including >106,000 Filipino and >24,000 South Asian adults. These findings may guide interventions to prevent osteoporotic fracture among higher risk Asian/PI subgroups.

Our study has some limitations. First, our analyses were restricted to older adults in a single Northern California healthcare system and may not be generalizable to other settings or populations, including those with different Asian/PI subgroup composition. Second, due to limited population size and/or fracture events, we did not report age-specific incidence for smaller Asian/PI subgroups. Third, we did not examine differences in fracture risk factors, weight status, or bone mineral density. Finally, we do not have information on country of origin and US immigration to support additional stratified analyses but anticipate that most Asian/PI adults ascertained were foreign-born.

In summary, our study provides contemporary data on ethnic differences in hip fracture incidence among Asian/PI adults in a large California population. While we recognize that fracture incidence may change over time and that the proportions of native-born Asian/PI adults and those with mixed Asian ethnicity will increase, these data may inform efforts to optimize prevention of hip fractures among older US Asian/PI adults.

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KEY POINTS

- In a community-based population of older adults in an integrated healthcare delivery system, the incidence of hip fracture among US Asian and Pacific Islander (Asian/PI) women and men was 55% and 66% lower than non-Hispanic White women and men, respectively.
- Sex-specific hip fracture incidence among Asian/PI adults also varied by ethnic subgroup and was lower among Filipina women and higher among Japanese and South Asian women compared to Chinese women.
- For Asian/PI men, the incidence of hip fracture was similar for Filipino and Japanese men and higher for South Asian men compared to Chinese men.

Why does this matter? Understanding ethnic variation in hip fracture incidence among US Asian/PI populations is helpful in determining which populations may be at higher or lower risk for hip fracture so that fracture prevention care can be tailored.

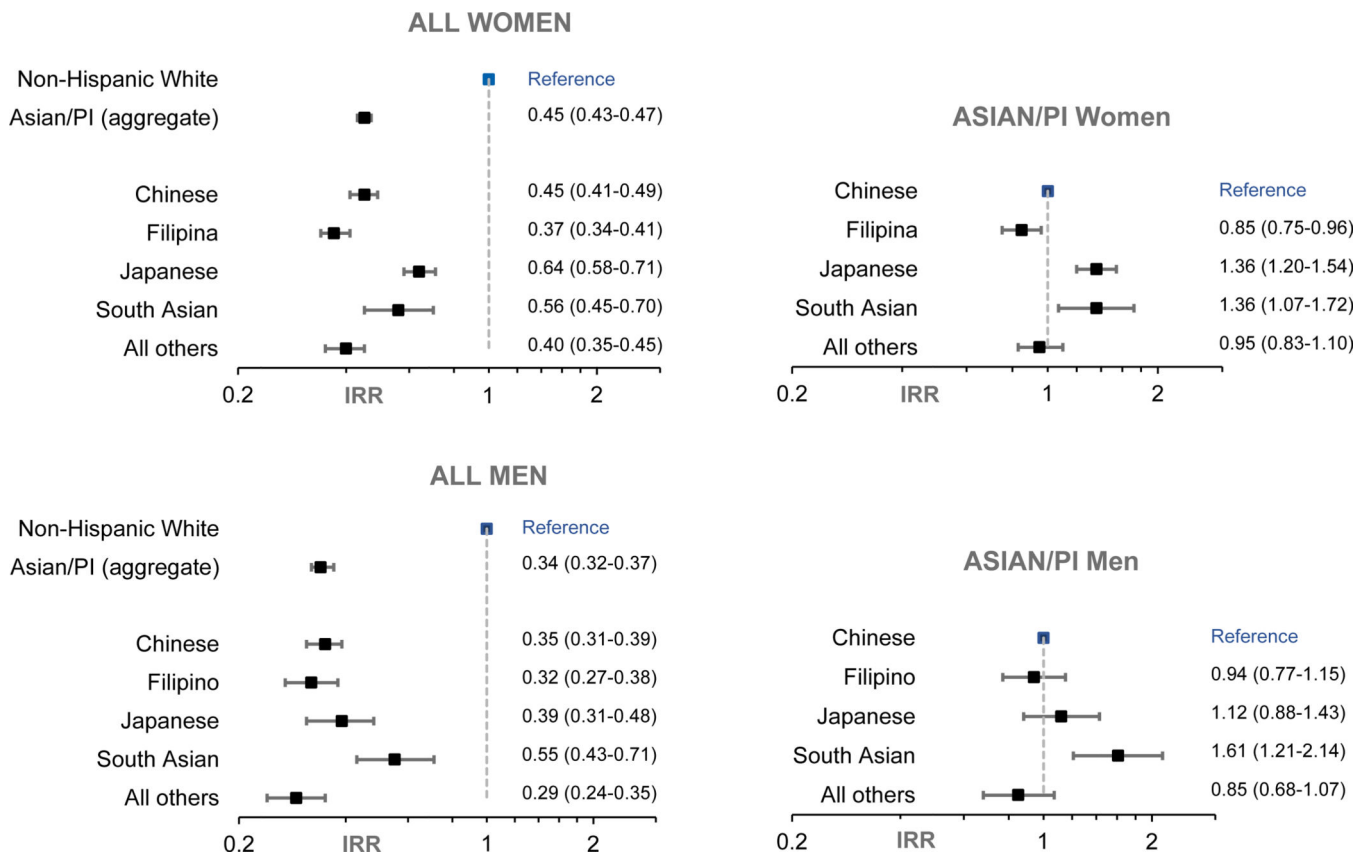


Figure 1. Sex-specific incidence rate ratio (IRR) for hip fracture in models comparing Asian and Pacific Islander (PI) adults to Non-Hispanic White adults and among Asian/PI subgroups compared to Chinese adults

Table 1.

Incidence of hip fracture per 1000 person-years among Asian/PI and non-Hispanic White women

	White N = 776,839	Asian/PI *215,359	Chinese 49,694	Filipina 60,864	Japanese 11,944	South Asian 11,037
Age- adjusted	2.97 (2.94–3.01)	1.34 (1.28–1.40)	1.30 (1.20–1.41)	1.09 (0.99–1.20)	1.80 (1.63–1.99)	1.74 (1.34–2.23)
Age (y)						
50–54	0.19 (0.17–0.22)	0.04 (0.03–0.07)	0.07 (0.03–0.13)	0.05 (0.02–0.10)	0.05 (0.01–0.36)	†
55–59	0.39 (0.36–0.43)	0.11 (0.09–0.15)	0.17 (0.11–0.27)	0.08 (0.04–0.14)	0.15 (0.05–0.46)	0.29 (0.13–0.64)
60–64	0.75 (0.70–0.80)	0.21 (0.17–0.27)	0.24 (0.16–0.37)	0.20 (0.13–0.31)	0.25 (0.10–0.60)	0.46 (0.22–0.97)
65–69	1.44 (1.37–1.51)	0.49 (0.40–0.59)	0.46 (0.33–0.66)	0.52 (0.38–0.71)	0.54 (0.30–0.98)	0.38 (0.14–1.01)
70–74	2.88 (2.77–3.00)	1.17 (1.01–1.34)	1.20 (0.94–1.55)	1.01 (0.77–1.31)	1.84 (1.33–2.54)	1.26 (0.66–2.42)
75–79	6.00 (5.82–6.19)	2.58 (2.31–2.89)	2.16 (1.73–2.70)	2.32 (1.88–2.87)	3.10 (2.38–4.04)	3.64 (2.23–5.94)
80–84	11.3 (11.0–11.6)	5.15 (4.66–5.70)	5.08 (4.27–6.05)	4.36 (3.57–5.32)	7.09 (5.81–8.65)	5.40 (3.13–9.29)
85+	23.3 (22.9–23.8)	12.2 (11.3–13.1)	11.7 (10.3–13.2)	8.89 (7.51–10.5)	16.6 (14.6–19.0)	17.1 (11.4–25.8)

*The Asian/Pacific Islander (PI) group of 215,359 women includes Filipina (28.3%), Chinese (23.1%), Japanese (5.6%), South Asian (5.1%), Vietnamese (3.6%) and other Southeast Asian (1.6%), Native Hawaiian and Pacific Islander (2.9%), Korean (2.1%), Central Asian groups (0.2%), and those of multiple/mixed or unspecified Asian ethnicity (27.7%).

†No fracture events occurred among South Asian women who were aged 50–54 years during follow-up (27,796 person-years)

Table 2.

Incidence of hip fracture per 1000 person-years among Asian/PI and non-Hispanic White men

	White 697,046	Asian/PI * 188,328	Chinese 41,862	Filipino 45,779	Japanese 7,838	South Asian 13,322
Age- adjusted	1.81 (1.78–1.84)	0.62 (0.58–0.67)	0.63 (0.55–0.71)	0.57 (0.48–0.67)	0.70 (0.56–0.88)	0.99 (0.73–1.34)
Age (y)						
50–54	0.21 (0.18–0.23)	0.05 (0.03–0.08)	0.08 (0.04–0.16)	0.05 (0.02–0.11)	0.14 (0.03–0.56)	0.06 (0.02–0.25)
55–59	0.31 (0.28–0.34)	0.10 (0.07–0.14)	0.09 (0.05–0.19)	0.11 (0.06–0.20)	0.07 (0.01–0.46)	0.20 (0.08–0.48)
60–64	0.50 (0.46–0.55)	0.13 (0.09–0.18)	0.19 (0.11–0.32)	0.11 (0.06–0.22)	0.14 (0.03–0.55)	0.10 (0.03–0.42)
65–69	0.80 (0.75–0.87)	0.28 (0.22–0.37)	0.18 (0.10–0.33)	0.26 (0.16–0.44)	0.55 (0.26–1.15)	0.59 (0.30–1.18)
70–74	1.52 (1.43–1.62)	0.54 (0.43–0.68)	0.38 (0.24–0.61)	0.59 (0.39–0.88)	0.53 (0.24–1.18)	0.85 (0.42–1.70)
75–79	3.34 (3.19–3.50)	1.14 (0.95–1.38)	1.03 (0.74–1.43)	1.29 (0.91–1.82)	0.93 (0.48–1.78)	1.82 (1.01–3.29)
80–84	6.58 (6.32–6.85)	2.25 (1.90–2.67)	2.15 (1.65–2.82)	1.81 (1.22–2.68)	2.93 (1.93–4.45)	3.93 (2.23–6.92)
85+	14.8 (14.4–15.3)	5.36 (4.70–6.11)	5.96 (4.94–7.18)	4.50 (3.29–6.16)	5.50 (4.00–7.56)	8.07 (4.58–14.2)

*The Asian/Pacific Islander (PI) group of 188,328 men includes Filipino (24.3%), Chinese (22.2%), South Asian (7.1%), Japanese (4.2%), Vietnamese (4.4%) and other Southeast Asian (1.9%), Native Hawaiian and Pacific Islander (3.5%), Korean (1.7%), Central Asian groups (0.2%), and those of multiple/mixed or unspecified Asian ethnicity (30.6%)