

Disparities in Diabetes-Related Preventable Hospitalizations among Working-Age Native Hawaiians and Asians in Hawai'i

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Abstract

Elderly (65+) Native Hawaiian, Filipino, and Japanese men and Filipino women have a higher risk of diabetes-related potentially preventable hospitalizations than Whites even when demographic factors and the higher diabetes prevalence in these populations is considered. The study objective was to determine if similar disparities are seen among the non-elderly (< 65). We used discharge data for all non-maternity hospitalizations by working-age adults (18-64 years) in Hawai'i from December 2006 to December 2010. Annual diabetes-related preventable hospitalization rates (by population diabetes prevalence) were compared by race/ethnicity (Japanese, Chinese, Native Hawaiian, Filipino, and White) and gender. Adjusted rate ratios (aRR) were calculated relative to Whites using multivariable models controlling for insurer, comorbidity, residence location, and age. After adjusting for ethnic-specific prevalence of diabetes and demographic factors, preventable hospitalizations rates were significantly higher for Native Hawaiians males (aRR: 1.48; 95%CI: 1.08-2.05) compared to Whites, but significantly lower for Chinese men (aRR: 0.43; 95%CI: 0.30-0.61) and women (aRR: 0.18; 95%CI: 0.08-0.37), Japanese men (aRR: 0.33; 95%CI: 0.25-0.44) and women (aRR: 0.34; 95%CI: 0.23-0.51), and Filipino men (aRR: 0.35; 95%CI: 0.28-0.43) and women (aRR: 0.47; 95%CI: 0.36-0.62). Rates for Native Hawaiian females did not differ significantly from Whites. Disparities in diabetes-related preventable hospitalizations were seen for working-age (18-64) Native Hawaiian men even when their higher population-level diabetes prevalence was considered. Further research is needed to determine factors affecting these disparities and to develop targeted interventions to reduce them. Significantly lower preventable hospitalization rates were seen among Asian groups compared to Whites. A better understanding of these findings may provide guidance for improving rates among Asian elderly as well as other non-elderly groups with disparities.

Keywords

Diabetes, Asians, Pacific Islanders, Hospitalizations

Native Hawaiians and many Asian American populations have higher rates of diabetes than Whites and suffer disproportionately from diabetes-related morbidity and mortality.^{1,2} This is due, in part, to limited access to high-quality, culturally relevant primary care for these groups.^{1,2} Preventable hospitalizations are defined by the Agency for Health Care Research and Quality (AHRQ) as those that could have been potentially avoided, particularly with better access to primary care.³ As the reduction of preventable hospitalizations has the potential to both reduce costs and increase health care quality, these are a focus of considerable recent policy and clinical action.^{4,5} Four of the AHRQ preventable hospitalization types include diabetes-related conditions. These are hospitalizations for uncontrolled diabetes, short-term diabetes complications (eg, ketoacidosis, coma), long-term diabetes complications (eg, renal, eye) and lower-extremity diabetes-related amputations.³ Among individuals 65 years and older, disparities have been identified for these diabetes-related preventable hospitalizations (DRPH) in Native Hawaiian

men, Japanese men, and Filipino men and women compared to Whites even when other factors, including the higher diabetes prevalence among these groups, was controlled.⁶

Rates of DRPH among working-age Native Hawaiian and Asian groups are unknown. It is important to examine this issue for several reasons. First, the burden of diabetes is heavier among Native Hawaiian and many Asian groups at a younger age.^{1,2,7-10} Also, lost productivity and absenteeism due to poorly controlled chronic conditions among those 18-65 years present significant economic costs, as do diabetes-related hospitalizations.¹¹ Medicare also becomes generally available at age 65 and can provide more uniform access to care across racial/ethnic groups, which can decrease racial/ethnic disparities.¹² Finally, with diabetes on the rise in adolescence and young adulthood, long-term complications that can contribute to hospitalization may occur more often in working-age adults representing a major public health problem that needs further investigation in order to better design sustainable solutions.¹³

Few studies about diabetes-related preventable hospitalizations have examined high-risk minority populations such as Native Hawaiians and Asian subgroups. One recent study, mentioned above, focused on diabetes-related preventable hospitalizations specifically among Native Hawaiian and Asian elderly.⁶ Another recent study of preventable hospitalizations across disaggregated Pacific Islander and Asian American subgroup found strong evidence of disparities for some subgroups.¹⁴ However, this study did not consider working-age adults separately from the elderly, though they may have distinct patterns of preventable hospitalizations. Also, it focused on all types of preventable hospitalizations together, rather than looking specifically at diabetes-related hospitalizations, and did not control for gender, insurance status, or other factors that vary across Native Hawaiian and Asian American subgroups and might impact access to diabetes-related care and/or hospitalizations.^{1,2}

To fill in important gaps in the research literature, our study goal was to investigate disparities in the prevalence of diabetes-related preventable hospitalizations for working-age Native Hawaiians and Asian subgroups compared to Whites.

Research Design and Methods

Inclusion and Exclusion Criteria: We used data from all non-pregnancy hospitalizations in Hawai'i collected by Hawai'i Health Information Corporation (HHIC) for those aged 18-64 years from December 2006 to December 2010 (n = 193,082). We excluded hospitalizations: (1) without race/ethnicity including

data with Department of Defense as payer (n=193,082) and with other payers (n=3,963); (2) for patients not from one of the five largest ethnic groups (eg, Japanese, Chinese, Native Hawaiians, Filipinos, or White, n=33,808); (3) for individuals not from Hawai'i (n=5,917); and (4) involving transfers and unknown admission source (n=4,988). After exclusions, the number of eligible hospitalizations was 117,281. This study was deemed exempt from human subjects review by the University of Hawai'i IRB.

Diabetes-Related Preventable Hospitalizations (DRPH): HHIC collects detailed discharge data from all hospitalizations by all payers and the uninsured in Hawai'i.¹⁵ DRPH were defined with AHRQ diabetes-related preventable hospitalization definitions using ICD-9 diagnosis and procedure codes for (1) uncontrolled diabetes without mention of a short-term or long-term complication (ICD-9-CM principal diagnosis codes 250.02-250.03); (2) diabetes with short-term complications, eg, ketoacidosis, hyperosmolarity, coma (ICD-9-CM principal diagnosis codes 250.1-250.33); (3) diabetes with long-term complications, eg, renal, eye, neurological, circulatory, or complications not otherwise specified (ICD-9-CM principal diagnosis codes ; 250.4-250.93) and (4) lower-extremity diabetes-related amputations based on ICD-9 and procedure codes ICD-9-CM procedure codes for lower-extremity amputation in any field and diagnosis code for diabetes in any field.¹⁶ If a trauma diagnosis code was in any field, the amputation was not considered a DRPH. More detail about AHRQ definitions of preventable hospitalizations is available at http://www.qualityindicators.ahrq.gov/downloads/pqi/pqi_guide_v31.pdf.

Race/Ethnicity: Race/ethnicity categorization was based on primary race as reported consistently across all hospitals.¹⁵ Individuals with multiple races were assigned to their primary reported race.

Control Variables: Analyses were stratified by gender. Control variables included age, Charlson comorbidity index (CCI),¹⁷ type of coverage (Medicare, Medicaid, Private, and Other), and location (O'ahu vs other Hawaiian island), all obtained from HHIC data.

Denominators: Our analyses estimated rate estimates with two distinct denominators. The first denominator was number of people in the state by race/ethnicity and gender. Rates calculated with this denominator estimated the total burden of DRPH for each subgroup. The second denominator was the estimated number of patients with diabetes in Hawai'i by race/ethnicity and gender.¹⁸ Rates calculated with this denominator estimated DRPH burden among those known to have diabetes and may reflect difference in quality and access to health care.^{18,19} Denominators were from the 2007-2010 Hawai'i Behavioral Risk Factor Surveillance System.²⁰ Four years of BRFSS data were combined to provide more reliable estimates for racial/ethnic and gender subgroups.

Statistical Analysis: Differences in patient characteristics among five race/ethnicity groups were examined using Chi-squared or Fisher's exact tests for categorical variables and one-way ANOVA or Kruskal-Wallis tests for continuous variables. We calculated unadjusted average annual rates of DRPH using population and disease prevalence denominators. Unadjusted rate ratios (RR) of DRPH and their 95% confidence intervals (95% CI) were estimated by comparing the unadjusted rate for each racial/ethnic and gender subgroup with that of Whites.

Multivariable negative binomial models were used to further adjust for age, gender, co-morbidity, residence on O'ahu, and insurer, providing adjusted rate ratios (aRR) for DRPH by race/ethnicity and gender. We ran models with population (Model A) and diabetes prevalence (Model B) denominators. For patients with multiple hospitalizations, patient characteristics from the first admission were used. As a sensitivity analysis, we also ran the multivariable adjusted models using the last admission. We found no substantive differences in results and only findings based on the first admission are reported here. All data analyses were performed in SAS 9.3 (Cary, N.C., 2011) and a two-tailed *P*-value of less than 0.05 was regarded as statistically significant.

Results

Over the four years, there were 2,531 diabetes-related preventable hospitalizations by 1,488 unique individuals. Among those with a DRPH, significant differences were found across racial/ethnic groups for most patient characteristics except for gender and the number of hospitalizations per patient (Table 1). The mean age at the time of DRPH for Native Hawaiians was 48.2 years, younger than for any other subgroup. There were also significant differences by race/ethnicity for all specific categories of DRPH.

Preventable Hospitalization Rates by Race/Ethnicity and Gender

For models in which population totals were used as denominators, substantial and significant disparities in unadjusted DRPH rates were seen for Native Hawaiians females (RR=2.51; 95% CI: 2.06-3.05) and males (RR=2.84; 95% CI: 2.41-3.34) compared to Whites (Table 2).

After adjustment for age, insurer, residence location, and comorbidity, significant disparities remained for Native Hawaiian females (aRR=3.68; 95% CI: 2.54-5.32) as well as Native Hawaiian males (aRR=4.10; 95% CI: 2.92-5.76) compared to Whites. Rates were significantly lower for Japanese men (aRR=0.66; 95% CI: 0.49-0.89) and women (aRR=0.54; 95% CI: 0.36-0.82) as well as for Chinese women (aRR=0.27; 95% CI: 0.13-0.56) compared to Whites.

Preventable Hospitalization Rates Adjusting for Diabetes Prevalence

When the number of individuals with diabetes was used as the denominator (Table 3), differences in the unadjusted DRPH rate for Native Hawaiian females and males compared to White were no longer statistically significant.

Table 1. Patient Characteristics and Utilization for those with Diabetes-Related Preventable Hospitalization (DRPH) in Hawai'i from December 2006-December 2010 by Race/Ethnicity

	Chinese	Filipino	Native Hawaiian	Japanese	White	P-value ^a
	n (%)	n (%)	n (%)	n (%)	n (%)	
Number of patients	57 (3.8)	226 (15.2)	538 (36.2)	212 (14.3)	455 (30.6)	
Number of hospitalizations	83 (3.3)	375 (14.8)	991 (39.2)	295 (11.7)	787 (31.1)	
Female	18 (31.6)	100 (44.3)	229 (42.6)	83 (39.2)	181 (40.0)	.40
Payer						
Medicaid	11 (19.3)	55 (24.3)	182 (33.8)	26 (12.3)	146 (32.1)	.024
Medicare	11 (19.3)	59 (26.1)	134 (24.9)	59 (27.8)	83 (18.2)	<.001
Private	35 (61.4)	94 (41.6)	202 (37.6)	122 (57.6)	190 (41.8)	<.001
Other	0 (0)	18 (8.0)	20 (3.7)	___ ^b	36 (7.9)	<.001
Live on O'ahu = Yes	51 (89.5)	169 (74.8)	348 (64.7)	163 (76.9)	241 (53.0)	<.001
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	
Charlson comorbidity index	4.56 (3.49)	4.75 (3.28)	5.02 (3.13)	4.73 (3.09)	3.98 (2.92)	<.001
Age	53.86 (9.66)	49.43 (12.06)	48.17 (11.38)	51.67 (9.74)	49.08 (11.92)	<.001
Number of hospitalizations per patient	1.46 (1.89)	1.65 (2.22)	1.83 (2.48)	1.39 (1.06)	1.75 (2.15)	.12
	n (%)	n (%)	n (%)	n (%)	n (%)	
Types of DRPH						
Uncontrolled diabetes (DM)	___ ^b	19 (5.1)	24 (2.4)	___ ^b	35 (4.5)	.003
Short-term DM complications	30 (36.1)	129 (34.4)	336 (33.9)	70 (23.7)	339 (43.1)	<.001
Long-term DM complication	35 (42.2)	160 (42.7)	406 (41.0)	140 (47.5)	274 (34.8)	.002
Lower-extremity DM-related amputations	14 (16.9)	67 (17.9)	225 (22.7)	83 (28.1)	139 (17.7)	.001

^a P-values based on Chi-squared tests (or Fisher's exact tests) for categorical variables and one-way ANOVA or Kruskal-Wallis test for continuous variables.

^b Number too small (<10) to report.

Table 2. Unadjusted and Adjusted Rate Ratios of Individuals with Diabetes-Related Potentially Preventable Hospitalizations (DRPH) in Hawai'i for those 18-64 years from December 2006-December 2010 by Race/Ethnicity and Gender from Hawai'i Health Information Corporation Inpatient Data using population totals as the rate denominator.^a

	Population totals	# of unique individuals with DRPH ^b	Unadjusted annual rate by population x 10,000	Unadjusted Rate ratio by population totals, compared to whites [95% CI]	Adjusted Rate ratio by population, compared to white [95% CI]	P-value ^c
Model A						
Female						
Chinese	21,386	18	2.06	0.55 [0.34-0.90]	0.27 [0.13-0.56]	<.001
Filipino	71,323	100	3.43	0.92 [0.72-1.17]	1.03 [0.77-1.37]	.86
Native Hawaiian	59,968	229	9.35	2.51 [2.06-3.05]	3.68 [2.54-5.32]	<.001
Japanese	79,289	83	2.56	0.69 [0.53-0.89]	0.54 [0.36-0.82]	.003
White	118,856	181	3.73	1.00	ref	ref
Male						
Chinese	24,048	39	3.97	0.80 [0.57-1.12]	0.85 [0.58-1.25]	.4143
Filipino	70,467	126	4.38	0.89 [0.72-1.09]	0.91 [0.71-1.16]	.45
Native Hawaiian	53,937	309	14.03	2.84 [2.41-3.34]	4.10 [2.92-5.76]	<.001
Japanese	82,551	129	3.83	0.78 [0.63-0.96]	0.66 [0.49-0.89]	.007
White	135,936	274	4.94	1.00	ref	Ref

^a Based on first visit. No substantive difference in findings using last visit.

^b From Hawai'i Health Information Corporation analysis

^c Multivariable models adjusted for age, median Charlson Comorbidity Index, percentage of public insurer, and location of residence.

Table 3. Unadjusted and Adjusted Rate Ratios of Individuals with Diabetes-Related Potentially Preventable Hospitalizations (DRPH) in Hawai'i for those 18-64 years from December 2006-December 2010 by Race/Ethnicity and Gender from Hawai'i Health Information Corporation Inpatient Data using those with diabetes as the rate denominator.^{ab}

	# with diabetes in Hawai'i ^c	# of unique individuals with DRPH ^d	Unadjusted annual DRPH rate by # with diabetes in Hawai'i x 10,000	Unadjusted rate ratio by # with diabetes in Hawai'i, compared to whites [95% CI]	Adjusted Rate ratio by # with diabetes in Hawai'i, compared to white [95% CI]	P-value
Model B						
Female						
Chinese	1,323	18	33.32	0.30 [0.19-0.49]	0.18 [0.13-0.37]	.007
Filipino	4,942	100	49.55	0.45 [0.35-0.57]	0.47 [0.36-0.62]	< .001
Native Hawaiian	5,745	229	97.62	0.88 [0.73-1.07]	1.15 [0.81-1.64]	.43
Japanese	4,249	83	47.84	0.43 [0.33-0.56]	0.34 [0.23-0.51]	< .001
White	4,007	181	110.62	1.00	Ref	ref
Male						
Chinese	1,532	39	62.34	0.42 [0.30-0.59]	0.43 [0.30-0.61]	< .001
Filipino	6,174	126	49.98	0.34 [0.27-0.42]	0.35 [0.28-0.43]	< .001
Native Hawaiian	4,469	309	169.33	1.14 [0.97-1.35]	1.48 [1.08-2.05]	.02
Japanese	5,639	129	56.02	0.38 [0.31-0.47]	0.33 [0.25-0.44]	< .001
White	4,532	274	148.06	1.00	ref	ref

^a Multivariable models adjusted for age, median Charlson Comorbidity Index, percentage of public insurer, and location of residence.

^b Based on first visit. No substantive difference in findings using last visit.

^c From Hawai'i Department of Health Behavioral Risk Factor Surveillance System data.

^d From Hawai'i Health Information Corporation.

However, after adjustment for covariates, DRPH rates were significantly higher for Native Hawaiians males (aRR = 1.48; 95% CI: 1.08-2.05), but did not differ significantly for Native Hawaiian females (aRR: 0.88; 95% CI: 0.73-1.07). Compared to Whites, DRPH adjusted rates were significantly lower for all Asian subgroups [Chinese men (aRR = 0.43; 95% CI: 0.30-0.61) and women (aRR = 0.18; 95% CI: 0.13-0.37); Japanese men (aRR = 0.33; 95% CI: 0.25-0.44) and women (aRR = 0.34; 95% CI: 0.23-0.51); Filipino men (aRR = 0.35; 95% CI: 0.28-0.43) and women (aRR = 0.47; 95% CI: 0.36-0.62)].

Conclusions

Significant disparities in DRPH were seen for working-age Native Hawaiians, a group already known to have higher rates of diabetes.^{1,7-10} Crude rates more than twice as high as Whites were seen in both females and males. Also, the mean age was younger for Native Hawaiians (48.2 years) than for any other subgroup. For Native Hawaiian women, these disparities appear to be explained by higher prevalence of diabetes, but for Native Hawaiian men, they persisted after adjusting for prevalence. This study adds new evidence about the consequences of diabetes among Native Hawaiians and suggests that, among Native Hawaiian men under 65, interventions are needed not just to reduce prevalence but to ensure access to chronic care management and primary care in order to reduce diabetes-related preventable hospitalizations.

In contrast, for Asian subgroups, DRPH rates were notably lower than in Whites. This was true even before the higher diabetes prevalence in Asian groups was considered. Once diabetes prevalence was considered, rates were significantly lower for Chinese, Japanese, and Filipino men and women compared to Whites. In Hawai'i, Japanese and Chinese populations tend to have extremely strong health profiles as well as good access to health care.²¹⁻²³ In many cases, average health outcomes are better for Japanese and Chinese in Hawai'i than for Whites (and every other racial/ethnic group), presenting a distinct pattern compared to the continental United States. Thus, it is not surprising that among working-age individuals we did not see a disparity in diabetes-related preventable hospitalizations among Chinese and Japanese groups. However, for many, but not all, health outcome and access variables in Hawaii, Filipinos tend to show health disparities similar to Native Hawaiians.²¹⁻²³ Thus, it is useful to see that among working-age Filipinos no disparities in diabetes-related preventable hospitalization were seen compared to Whites as this was not necessarily an expected finding.

Further study would be useful to identify factors associated with reduced frequency of DRPH among non-elderly Japanese, Filipinos, and Chinese compared with Whites. These might include improved access to health care, home and social support, and health-related behaviors.² More extensive research on this topic would be particularly helpful as previous work

in the elderly (65+) found higher DRPH among Asian men compared to White men,⁶ which was unexpected based on the reasons discussed above. More research is needed to uncover underlying factors that might be affecting these differences in DRPH between elderly and non-elderly Asians.⁶

We also provide further evidence that using population totals versus disease prevalence totals as our denominator indicate different portraits of rates and of disparities.¹⁸ Both are valid estimates of a type of burden from preventable hospitalizations, but considering rates only using population totals may not fully illuminate disparities. Specifically in this study when only population size was considered, a large disparity was seen for diabetes-related preventable hospitalizations for Native Hawaiian women compared to White women. However, this disparity disappeared once the higher diabetes prevalence among Native Hawaiian women compared to Whites was considered. This suggests that a focus on decreasing diabetes prevalence among working-age Native Hawaiian to comparable rates to White women would also eliminate any disparities in diabetes-related preventable hospitalizations. However, our study finds that for Native Hawaiian men, equivalent diabetes rates would not be enough to eliminate disparities in diabetes-related preventable hospitalizations. Even when the higher diabetes rates among Native Hawaiian men compared to Whites were considered, a disparity in diabetes-related preventable hospitalizations was seen. This suggests that in efforts to reduce diabetes-related preventable hospitalizations for Native Hawaiian men, it is critically important to not only focus on diabetes prevention but also to ensure that all those with diabetes have access to strong, effective primary care as our findings underscore the fact that this is not necessarily the case currently.

This study also adds to the large evidence base showing the importance of disaggregating Asian American and Pacific Islander (AA/PI) subgroups in research generally and in diabetes and preventable hospitalization research specifically.^{2,6,14,24} Although previous research using combined AA/PI samples has not found significant DRPH disparities compared to Whites,²⁵⁻²⁷ we found significant disparities for Native Hawaiian men after disaggregating AA/PI subgroups.

There are several limitations to our study. As 40% of diabetes in the United States is undiagnosed,²⁷ underreporting of diabetes may impact our BRFSS denominator estimates and may differ by race/ethnicity. Interpretation of our results should take into account that it includes data from a single state and thus may not be generalizable to other US states. However, as access to culturally appropriate care may be worse for Native Hawaiian and Asian American groups in many other settings, our study may actually underestimate AA/PI disparities. Moreover, our analyses are based on administrative data, which has some general limitations,²⁸⁻³⁰ and lacks detail about some potential confounders, such as education, obesity, having a primary care provider, and diabetes duration.

Despite these limitations, we believe our study of over 2,500 DRPHs in a four-year period provides insight into subgroups of working-age adults who might benefit from improved primary care for diabetes. A disproportionate number of DRPHs were found among Native Hawaiians, particularly Native Hawaiian men.

These results have several implications for health care delivery as well as public health policy. First, reduced prevalence of diabetes among Native Hawaiians would significantly decrease DRPHs disparities. Second, for Native Hawaiian men under 65, interventions are needed not just to reduce prevalence but to ensure access to chronic care management and primary care in order to reduce diabetes-related preventable hospitalizations. Third, disaggregating AA/PI subgroups is important for revealing disparities and for designing effective interventions.^{1,2,14,24}

This study adds to growing body of knowledge aimed to reduce racial and ethnic disparities in diabetes among minorities, including Pacific Islanders and Asian Americans, and is consistent with the long term health policy goals of high quality, affordable health care that promotes equal and extended quality of life across all populations.³¹

Conflict of Interest

None of the authors identify any conflict of interest.

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