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Potentially Preventable Hospitalizations for Congestive Heart Failure among Asian Americans and Pacific Islanders in Hawai'i

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Abstract

Background—Many congestive heart failure (CHF) hospitalizations are considered potentially preventable with access to high-quality primary care. Some Asian American and Pacific Islander groups have poor access to health care compared to Whites, yet CHF preventable hospitalizations are understudied in these groups.

Methods—Hawai'i hospitalizations from December 2006 to December 2010 for Chinese, Japanese, Native Hawaiian, Filipino, and Whites aged 18+ years were considered (N=245,435). CHF preventable hospitalizations were compared in multivariable models by age group (<65 vs. 65+) and gender.

Results—Native Hawaiians and Filipinos with CHF preventable hospitalizations were significantly ($p<0.001$) younger than other racial/ethnic groups. In adjusted models, Native Hawaiians and Filipinos of all age and gender combinations had significantly higher CHF hospitalization rates than Whites as did Chinese women 65+.

Conclusions—High preventable CHF hospitalization rates are seen in some Asian and Pacific Islander groups, especially Native Hawaiians and Filipinos, who have these hospitalizations at younger ages than other studied groups.

INTRODUCTION

Potentially preventable hospitalizations are defined by the Agency for Health Care Research and Quality (AHRQ) as hospitalizations likely avoidable with access to high-quality primary care (1). Of the nine types of potentially preventable hospitalizations for chronic conditions, congestive heart failure (CHF) hospitalizations are by far the most common. An average of

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1,013,901 potentially preventable hospitalizations for CHF occurred each year in the United States (US) from 1995 to 2009 (2). The total annual cost of preventable CHF hospitalizations in the US is over $8,381 million (3). Efforts to understand and reduce potentially preventable hospitalizations for CHF are important for improving US health care system performance, reducing costs, and minimizing the burden of chronic disease on patients and families (4). Specifically identifying and understanding disparities across racial/ethnic groups in potentially preventable hospitalizations for CHF are important for the primary care providers, health centers, insurers, and hospitals that provide a high volume of care to vulnerable communities as well as to policy-makers at the local, state, and federal level who wish to reduce health care inequities (5, 6).

Asian Americans and Pacific Islanders include some of the fastest growing racial/ethnic groups in the US (7). Asian Americans and Pacific Islanders also have especially high burdens of cardiovascular disease (8). Some Asian American and Pacific Islander groups, particularly Native Hawaiians and Filipinos, additionally have poorer access to health care compared to Whites (8-9). This suggests that there may be significant disparities in potentially preventable CHF hospitalizations for these groups compared to Whites. However, typically due to sample size limitations, most existing research on preventable hospitalizations has either excluded Asian and Pacific Islander populations (10) or combined diverse subgroups into one category (2, 11-12), which can obscure disparities across heterogeneous groups (13-14). Whether CHF potentially preventable hospitalization rates are higher for Native Hawaiian and Asian Americans controlling for other factors is unknown, despite the importance of this topic.

While extremely limited information exists about CHF preventable hospitalizations among Asian Americans and Pacific Islanders, some research provides evidence that CHF preventable hospitalization disparities are likely to exist for some Asian American and Pacific Islander groups (2, 13, 15-16). Disparities in diabetes-related potentially preventable hospitalization were found for elderly (65+ years) Native Hawaiian men and elderly Filipino men and women (15) as well as working-age (18-64 years) Native Hawaiian men (16) compared to Whites even when other access and demographic factors were controlled. A recent study of preventable hospitalizations generally found that, though significantly lower rates were seen for Chinese and Japanese Americans compared to Whites, Native Hawaiian had higher rates, highlighting the importance of disaggregating distinct Asian American and Pacific Islander subgroups to fully understand disparities (13).

The study goal was to fill this research gap by comparing preventable CHF hospitalizations for Asian American and Pacific Islander populations to Whites. The study hypothesis was that disparities would be seen for CHF hospitalizations for Native Hawaiians and Filipinos compared to Whites. We studied this issue in Hawai'i because almost 25% of the population in Hawai'i identifies as Native Hawaiian and over 40% identifies as Asian (17). This provides a substantial sample to consider Asian American and Pacific Islander subgroups, data that is not typically available in population-level data in many other US locations.

METHODS

Hawai'i Health Information Corporation (HHIC) Data

HHIC inpatient data from December 2006 to December 2010 was analyzed. HHIC data has detailed discharge data from all hospitalizations by all payers (18), including patient race/ethnicity, insurer, age, gender, and International Classification of Diseases – 9th revision – Clinical Modification (ICD-9) primary diagnosis, secondary diagnosis, and procedure codes.

Sample

All non-pregnancy related hospitalizations by any individual aged >18 years from December 2006 to December 2010 were considered (N=360,010). Hospitalizations at Tripler (the Department of Defense hospital) (n=34,987) were excluded as these hospitalizations did not consistently report racial/ethnic data during the study period. Hospitalizations were also excluded if they otherwise did not report valid race/ethnicity data (n=7,016) or did not report a race/ethnicity for the 5 largest ethnic subgroups in Hawai'i (e.g., Japanese, Chinese, Native Hawaiian, Filipino, or White) that were the focus of this study (n=50,628). To be consistent with population and disease prevalence totals used for rate denominators that were estimated for Hawai'i residents, we also excluded individuals not living in Hawai'i (n=11,276). Finally, we excluded pregnancies, transfers, and unknown admission source (n=10,668) to meet AHRQ CHF preventable hospitalization guidelines (19). After exclusion, the total number of eligible hospitalizations was 245,435 (68.2% of total hospitalizations).

CHF Preventable Hospitalizations

To measure CHF preventable hospitalizations, we followed AHRQ definitions (19) using the following International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) principal diagnosis codes: 398.91, 428.0, 428.1, 428.9, 428.20, 428.21, 428.22, 428.23, 428.30, 428.31, 428.32, 428.33, 428.40, 428.41, 428.42, and 428.43.

Race/Ethnicity

The HHIC race/ethnicity variable was created from race/ethnicity categories available consistently across all hospitals in Hawai'i from December 2006 to December 2010 (18). In 2006, HHIC confirmed standardization of the collection of this variable across all Hawai'i hospitals. Race/ethnicity data is typically provided by patient self-report at intake and include only one primary race. Mixed-race individuals are represented by self-report of their primary race of identification or were excluded as part of the "other" racial/ethnic category if patients did not wish to choose one primary racial/ethnic identification.

Analyses

Previous work has found that racial/ethnic patterns of preventable hospitalizations vary by age and gender (2, 13, 15-16). Because of these differences, analyses were stratified by age group and gender to be more useful for clinical and policy considerations. To ensure that multiple visits by individuals of certain racial/ethnic groups were not driving disparities (20), we analyzed data at the patient level. For patients with multiple visits, following

previous research (15, 16), we used the patient's first hospitalization in the analysis. (We also ran sensitivity analyses using data from the last hospitalization and from a random hospitalization. Results did not differ substantially, giving us confidence in our results.)

Control Variables

In multivariable models, using the HHIC data to obtain to create variables, we included sex (male or female), because CHF varies by this factor (2, 21), payer (Medicare, Medicaid, Private, and Other), location of residence (live on Oahu vs. other Hawaiian islands) based on evidence that access to care is often worse on the other islands, compared to the more urban Oahu, age (continuous) because of differences in age structure by racial/ethnic groups. Additionally, we included co-morbidity, defined by the Charlson Comorbidity Index (CCI) (22), a commonly used measure based on the presence of 16 comorbid conditions, including dementia, diabetes, and cancer. Each condition is assigned a weight based on the severity of the disease and a weighted sum of these conditions becomes the CCI score, which can range from 0 (low) to 27 (high). We also included substance abuse (yes = 1; no = 0) derived from ICD-9 codes (23) based on evidence that this would likely be a significant factor in predicting preventable CHF hospitalizations (24).

Denominators

We used population totals by race/ethnicity, age group, and gender for the state of Hawai'i. This takes into account the fact that subpopulations have differential sizes allowing identification of the burden of preventable hospitalizations in specific subpopulations. Population totals were obtained from Hawai'i Behavioral Risk Factor Surveillance System (BRFSS) data (25) from 2007 to 2010 provided by the Hawai'i Department of Health. Four years of data were combined to provide more reliable state-level estimates by race/ethnicity. The BRFSS race/ethnicity classification scheme is compatible with that used by HHIC as it includes primary self-reported racial/ethnic identity with racial/ethnic categories for the 5 major racial/ethnic groups in Hawai'i. Previous research has used the BRFSS with the HHIC data providing comparative results for other types of preventable hospitalizations (15, 16).

Statistical Analysis

Characteristics of patients with a CHF preventable hospitalization were summarized by descriptive statistics for each racial/ethnic subgroup and compared among subgroups using Chi-squared tests or Fisher's exact tests (for categorical variables) and analysis of variance (ANOVA) or non-parametric Kruskal-Wallis tests, if the normality assumption was not satisfied (for continuous variables). Unadjusted patient-level annual rates of CHF preventable hospitalization among racial/ethnic groups were calculated by age group and gender using population totals. Unadjusted patient-level rate ratios (RRs) and their 95% confidence intervals for CHF hospitalizations were then calculated by dividing the unadjusted rate for each racial/ethnic group by the unadjusted rate for Whites. A possible subgroup disparity relative to Whites is represented as RR over 1.0. Finally, multivariable negative binomial models were developed to estimate patient-level CHF preventable hospitalization rates adjusting not only for gender, age group, and race/ethnicity but also for other explanatory factors that may predict hospitalization, i.e., co-morbidity, residence in Oahu, continuous age, substance abuse, and insurer type. The percentage of public insurance

(Medicare and Medicaid), median CCI, mean age, and percentage of substance use for each race/gender combination were calculated and used for rate estimation. Data were modeled using negative binomial regression models adjusting for possible overdispersion (26). Multivariable adjusted rate ratios (aRRs) and their 95% confidence intervals for patients with CHF preventable hospitalizations were derived from the final models for each racial/ethnic group, age group, and gender combination compared with Whites of the same age group/gender combination. All data analyses were performed in SAS 9.3 (Cary, N.C., 2011). A two-tailed p-value of less than or equal to 0.05 was regarded as statistically significant. The study was deemed exempt by the University of Hawai'i Institutional Review Committee under federal exemption 4.

RESULTS

Descriptive analysis results are summarized by race/ethnicity in Table 1. A total of 10,165 CHF preventable hospitalizations by 6,528 unique individuals were seen. An important difference was seen by age group across racial ethnic groups. While 71.5% (4,665) of individuals with CHF preventable hospitalizations overall were 65 or older, this percentage varied dramatically by racial/ethnic group. For Native Hawaiians, only 49.9% of CHF hospitalizations were by those who were over 65 compared to 68.1% of Filipinos, 75.4% of Whites, 85.0% of Japanese, and 88.7% of Chinese. Similarly, considering average age, Native Hawaiians with CHF preventable hospitalizations were the youngest (63.4 years; SD: 15), followed Filipinos (69.8; SD: 16), Whites (73.7; SD: 14), and Japanese (78.3; SD: 13) and Chinese (78.8; SD: 12) (p-value<0.001).

These age trends were echoed in the percent of CHF preventable hospitalizations by payer, which also varied significantly across racial/ethnic group. Native Hawaiians had the highest percentage paid by Medicaid (18.4%) while Japanese had the lowest (2.1%). Chinese had the highest percent paid by Medicare (88.7%), while Native Hawaiians had the lowest (58.7%) (p-value<0.001). Though percentages varied, Medicare paid for over half of CHF hospitalizations in all racial/ethnic groups.

Significant differences were also seen across race/ethnicity groups in comorbidity scores, substance abuse, living on Oahu, and gender. Native Hawaiians were more likely than any other group to also have co-morbid substance abuse (10.6%) and also had the highest average comorbidity score (3.9).

CHF Hospitalization Rates for Women

Table 2 shows the unadjusted and adjusted RR of CHF hospitalizations for women by age group. In unadjusted models, compared to Whites, CHF hospitalization rates are higher for both working age and elderly Filipino and Native Hawaiian women and also for elderly Chinese women. Rates are lower for working-age Chinese women compared to Whites. In multivariable-adjusted analyses, these differences remain. Filipino and Native Hawaiian women, both working age and elderly, had significantly higher rates of CHF hospitalizations than Whites. CHF rates among women were highest for Native Hawaiian females <65 (aRR: 5.59 [4.08-7.65]), followed by Native Hawaiian females 65+ (aRR: 2.61 [1.76-3.87]), Filipino females 65+ (RR: 2.28 [1.66-3.13]), and Filipino females <65 (aRR: 2.13

[1.47-3.09]). Chinese women 65+ also had significantly higher rates (aRR: 1.52 [1.14-2.04]) than Whites, but Chinese women <65 had significantly lower rates (aRR: 0.43 [0.19-0.95]).

CHF Hospitalization Rates for Men

Table 3 shows the unadjusted and adjusted RR of CHF hospitalizations for men by age group. Similar to findings seen among women, in unadjusted models, CHF rates were higher for both working age and elderly Filipino and Native Hawaiian men compared to Whites. Unlike trends seen in women, rates were not significantly lower for working-age Chinese men compared to Whites. In multivariable-adjusted analyses, Filipino and Native Hawaiian men, both working age and elderly, had significantly higher rates of preventable CHF hospitalizations than Whites. CHF hospitalization rates were highest for Native Hawaiian males <65 (aRR: 4.05 [3.00-5.47]), followed by Filipino males 65+ (aRR: 3.01 [2.52-3.60]), Native Hawaiian males 65+ (aRR: 2.25 [1.58-3.21]), and Filipino males <65 (aRR: 1.93 [1.20-3.11]). No significant differences were seen for Chinese men of either age groups compared to Whites (as was seen in women), though higher rates at marginal significance (p-values<0.10) were seen for Chinese (aRR: 1.34 [0.95-1.90]) and Japanese men (aRR: 1.38 [0.98-1.96]) aged 65+.

DISCUSSION

As hypothesized, this study demonstrates significant disparities in potentially preventable CHF hospitalizations for some Asian and Pacific Islander populations, particularly Filipinos and Native Hawaiians of all ages and genders, and, unexpectedly, for elderly Chinese women. Even in multivariable-adjusted analyses, Filipino and Native Hawaiians of all age and gender combinations had significantly higher rates of CHF hospitalizations than Whites. Rate disparities were highest for Native Hawaiian females <65 (aRR: 5.59 [4.08-7.65]) and Native Hawaiian males <65 (aRR: 4.05 [3.00-5.47]), but were at least 1.9 times higher in all tested groups of Native Hawaiians and Filipinos. These are notable disparities, particularly as they are seen after accounting for insurer, co-morbidity, age, gender, location of residence, and substance abuse.

Our results show that this issue is also coupled with another important health disparity. For Native Hawaiians and Filipinos, not only are rates of CHF preventable hospitalizations considerably higher than rates seen in Whites, but preventable CHF hospitalizations occur at significantly younger ages. Preventable CHF hospitalizations seen most often in other racial/ethnic groups among the elderly are seen in substantial numbers among working-age Native Hawaiian and Filipino populations. In the Chinese and Japanese populations, only 11.3% and 15.0% of CHF hospitalizations respectively were by those under 65 years while among Native Hawaiians more than half (50.1%) of CHF hospitalizations were by those under 65 as were 31.9% of CHF hospitalizations among Filipinos. Hospitalizations are extremely expensive, burdensome, and challenging to both employment and family life (27). Disproportionate and significant numbers of preventable CHF hospitalizations among the working-age member of certain ethnic groups could have critical population-level social and economic implications.

Preventable hospitalizations can be used to assess health care quality and are the focus of many large quality improvement efforts (4-6, 28). In efforts to improve quality, there may be unmeasured factors that influence 'performance.' These factors need to be better understood, which is only possible by first identifying patterns. For instance, the younger age and higher rates of substance abuse among Native Hawaiian and Filipino groups with CHF hospitalizations suggest that there may be an entirely different mechanism of disease that is poorly characterized and understood. Besides showing an important health disparity, the age difference for preventable CHF hospitalizations by race/ethnicity also suggests that clinical care during CHF hospitalizations for Native Hawaiians and Filipinos might need to include factors that address the needs of younger individuals while different factors may be needed for Chinese and Japanese patients, who are primarily elderly. Targeted interventions might be ideally coupled with a consideration of cultural preferences (29). Many interventions that have shown success in reducing CHF hospitalizations, such as primary care-based strategies of disease management, self-care, or patient education (2, 30-31), could include cultural tailoring (32-33). However, there is currently limited effectiveness research on racial/ethnic specific interventions for preventable hospitalizations (32).

While Chinese women <65 had significantly lower rates of CHF hospitalizations (aRR: 0.43 [0.19-0.95]) than Whites, Chinese women 65+ had significantly higher rates (aRR: 1.52 [1.14-2.04]). Chinese immigrants and those who do not speak English well may be particularly vulnerable groups for preventable hospitalizations (34). Yet, as presumably access to care would be improved among all groups at age 65 due to Medicare, and the health status of Chinese women in Hawai'i tend to be strong (35), our finding are somewhat surprising and deserve further consideration. Future work could identify relevant changes at age 65 that might result in this difference, such as an unmet need for caregiving (36), and focused interventions to meet the unique needs of this population.

While this work has clear relevance for improving health care quality and equity in Hawai'i, findings are also useful and important to other locations as the state's multicultural context represents the future of much of the US. Hawai'i's unique demographic composition offers a timely window into the utilization patterns of understudied groups while these populations are increasing in other locations. Findings from Hawai'i can provide benchmarks for locations where subgroups analyses will not be currently possible without extremely large samples. Findings about Chinese and Filipino populations may be especially relevant to other locations as these represent the first and second largest Asian ethnic groups, respectively, in the US (37). Results may be particularly useful for states, such as California and New York (37), and for specific communities, such as New York City, San Diego, and Houston, with large and growing Asian and/or Pacific Islander populations (38). Finally, our findings highlight the importance of disaggregating heterogeneous Asian and Pacific Islander populations, which is generalizable not just to other locations, but also to Hispanics, Blacks, Native Americans and other racial ethnic groups that may often be aggregated in ways that mask underlying differences and disparities.

Our findings should also be of particular interest to public payers. Overall, more than 75% of CHF hospitalizations in every racial/ethnic group were paid by public sources. And, while the percentages varied, Medicare paid for over half of CHF hospitalizations in all racial/

ethnic groups. As the total costs of Medicare of preventable hospitalizations is considerable, this is an important area of policy and clinical intervention within Medicare (38). Evidence suggests that not only are there effective methods to reduce preventable hospitalizations for heart failure (2, 30-33), but that significant costs savings are possible if these reductions are accomplished (39).

This study also has some limitations. For rates, our estimates are dependent on the accuracy of our denominators, yet the population-level estimates from the BRFSS may not fully capture the population due to sampling methods (40). Racial/ethnic categorizations from the numerator and denominator may not match perfectly due to differences in the BRFSS survey vs. hospital administrative data collection protocols. Also, our data includes only one state and may not be representative of other areas. Hawai'i has some unique characteristics that might impact CHF hospitalizations, including a high managed care participation among Medicaid enrollees, high insurance coverage generally, notable longevity across many populations, and the previously mentioned unique cultural context (41). Managed care participation, for instance, is known to impact avoidable hospitalizations (42). As the large majority of Medicaid recipients in Hawai'i are in managed care, this may make our findings less generalizable to locations, such as West Virginia, where few Medicaid enrollees are in managed care (43).

Finally, our analyses are based on administrative data, which has some general limitations (44) and lacks some variables that would have been useful, such as education, modifiable risk factors, or quality of care. We share these limitations with many studies on this topic as the AHRQ metrics are designed to use administrative data. We also used these administrative data to characterize the control variables (e.g., comborbidity, substance abuse, continuous age) for each racial/ethnic/gender/age group in calculating adjusted CHF hospitalization rates. Adjustment is thus derived from hospitalized patients only and may not represent the population-level characteristics of these groups.

This study also has a number of important strengths, including four years of all payer, state-level hospitalization data in a diverse population. By using patient-level information, we were also able to ensure that multiple visits by unique patients within racial/ethnic groups were not responsible for CHF hospitalization disparities across groups, an acknowledged weakness in many previous studies on this topic (20). However, particularly in light of our finding that Native Hawaiians had a higher than number of hospitalizations per patient compared to other groups, CHF rehospitalizations among Asian Americans and Pacific Islanders will be a critical focal area for future research and policy solutions.

CONCLUSIONS

This study identified over 10,000 hospital visits in a four-year period in Hawai'i potentially avoided with better primary care. The burden falls heavily on some Asian American and Pacific Islander subgroups, particularly Native Hawaiians and Filipinos, who were also hospitalized for CHF at younger ages, as well as elderly Chinese women. This indicates an important area for improvement in clinical care and health care delivery.

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Table 1

Descriptive Results for those with a Preventable Hospitalization for Heart Failure Hospitalization in Hawai'i from December 2006-December 2010 by Race/Ethnicity from Hawai'i Health Information Corporation Inpatient Data

		Chinese	Filipino	Native Hawaiian	Japanese	White	Total	
# of patients		415	1296	1514	1748	1555	6,528	
# of hospitalizations		589	2060	2596	2578	2342	10,165	
		n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	p-value*
Female		201 (48.43)	522 (40.28)	715 (47.23)	833 (47.65)	663 (42.64)	2,934 (44.94)	<0.001
Payer								
	Medicaid	15 (3.61)	91 (7.02)	278 (18.36)	36 (2.06)	113 (7.27)	533 (8.16)	<0.001
	Medicare	368 (88.67)	901 (69.52)	888 (58.65)	1472 (84.21)	1165 (74.92)	4,794 (73.44)	<0.001
	Private	28 (6.75)	262 (20.22)	314 (20.74)	213 (12.19)	247 (15.88)	1,064 (16.30)	<0.001
	Other	4 (0.96)	42 (3.24)	34 (2.25)	27 (1.54)	30 (1.93)	137 (2.10)	0.008
Lives on Oahu		391 (94.22)	985 (76.00)	974 (64.33)	1345 (76.95)	923 (59.36)	4,618 (70.74)	<0.001
Substance Abuse		9(2.17)	95 (7.33)	161 (10.63)	67 (3.83)	109 (7.01)	441 (6.76)	<0.001
Age Group								
	<65	47 (11.33)	413 (31.87)	759 (50.13)	262 (14.99)	382 (24.57)	1863 (28.54)	<0.001
	65+	368 (88.67)	883 (68.13)	755 (49.87)	1486 (85.01)	1173 (75.43)	4665 (71.46)	
		Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	
Continuous age (years)		78.80 (11.82)	69.84 (15.62)	63.36 (14.69)	78.30 (12.78)	73.73 (13.61)	72.10 (15.09)	<0.001
Charlson comorbidity index		3.65 (2.25)	3.63 (2.01)	3.88 (2.15)	3.34 (2.05)	3.29 (2.03)	3.53 (2.09)	<0.001
# of hospitalizations per patient		1.42 (1.01)	1.59 (1.36)	1.71 (1.62)	1.47 (1.02)	1.51 (1.15)	1.56 (1.28)	<0.001

*P-values based on Chi-squared tests (or Fisher's exact tests) for categorical variables and one-way ANOVA for continuous variables except for number of hospitalizations per patient, for which Kruskal-Wallis test was used because of the non-normality of the data.

Table 2

Rate Ratios and Adjusted Rate Ratios of Preventable Hospitalizations (PH) for Heart Failure (HF) by Patient in Hawai'i from December 2006-December 2010, Women

	Pop. Totals[2]	# HF PH[3]	# of unique individuals with HF PH[4]	Unadjusted annual rate by pop. x 10,000 per patient	Unadjusted rate ratio per patient by pop. totals, compared to Whites with 95%CI	Adjusted Rate ratio by pop., compared to White with 95% CI[5]	p-value
<65							
Chinese	21386	10	10	1.15	0.51 [0.27, 0.96]	0.43 [0.19, 0.95]	0.037
Filipino	71323	185	114	3.91	1.74 [1.38, 2.20]	2.13 [1.47, 3.09]	<0.0001
NH	59968	474	294	12.01	5.34 [4.43, 6.42]	5.59 [4.08, 7.65]	<0.0001
Japanese	79289	108	79	2.44	1.08 [0.83, 1.41]	1.40 [0.87, 2.26]	0.17
White	118856	180	109	2.25	1.00	ref[6]	ref
65+							
Chinese	7726	267	191	60.54	1.47 [1.25, 1.74]	1.52 [1.14, 2.04]	0.005
Filipino	11700	662	408	85.40	2.08 [1.83, 2.36]	2.28 [1.66, 3.13]	<0.0001
NH	10560	694	421	97.63	2.37 [2.09, 2.70]	2.61 [1.76, 3.87]	<0.0001
Japanese	40186	1074	754	45.95	1.12 [1.00, 1.25]	1.12 [0.86, 1.45]	0.41
White	33005	796	554	41.11	1.00	ref	ref

[2] From Hawai'i BRFSS; pop.=population

[3] From Hawai'i Health Information Corporation analysis

[4] From Hawai'i Health Information Corporation analysis

[5] Based on multivariable model adjusting for age group, gender, race/ethnicity, gender, median Charlson Comorbidity Index, percentage of public insurer, percentage of substance use, mean age and location of residence; age group, gender and race/ethnicity were significant at p value < 0.05.

[6] Ref= reference group

Table 3

Rate Ratios and Adjusted Rate Ratios of Preventable Hospitalizations (PH) for Heart Failure (HF) by Patient in Hawai'i from December 2006-December 2010, Men

	Pop. Totals[7]	#HFPH[8]	# of unique individuals with HF PH[9]	Unadjusted annual rate by pop. x 10,000 per patient	Unadjusted rate ratio per patient by pop. totals, compared to Whites with 95%CI	Adjusted Rate ratio by pop., compared to White with 95% CI[10]	p-value
<65							
Chinese	24048	57	37	3.77	0.77 [0.54, 1.08]	0.96 [0.57, 1.63]	0.88
Filipino	70467	502	299	10.39	2.11 [1.79, 2.49]	1.93 [1.20, 3.11]	0.008
NH	53937	859	465	21.11	4.29 [3.70, 4.98]	4.05 [3.00, 5.47]	<0.0001
Japanese	82551	266	183	5.43	1.10 [0.92, 1.33]	1.21 [0.77, 1.90]	0.40
White	135936	392	273	4.92	1.00	ref[11]	ref
65+							
Chinese	6893	255	177	62.89	1.22 [1.03, 1.44]	1.34 [0.95, 1.90]	0.099
Filipino	8381	711	475	138.80	2.69 [2.39, 3.03]	3.01 [2.52, 3.60]	<0.0001
NH	7063	569	334	115.81	2.24 [1.96, 2.56]	2.25 [1.58, 3.21]	<0.0001
Japanese	25393	1130	732	70.60	1.37 [1.23, 1.52]	1.38 [0.98, 1.96]	0.069
White	29366	974	619	51.62	1.00	ref	ref

[7] From Hawai'i BRFSS; pop.=population

[8] From Hawai'i Health Information Corporation analysis

[9] From Hawai'i Health Information Corporation analysis

[10] Based on multivariable model adjusting for age group, gender, race/ethnicity, gender, median Charlson Comorbidity Index, percentage of public insurer, percentage of substance use, mean age and location of residence; age group, gender and race/ethnicity were significant at p value < 0.05.

[11] Ref= reference group