HHS Public Access

Author manuscript

J Aging Health. Author manuscript; available in PMC 2021 May 05.

Published in final edited form as:

J Aging Health. 2020 December ; 32(10): 1579–1590. doi:10.1177/0898264320945177.

Hospital Disparities Between Native Hawaiian and Other Pacific Islanders and non-Hispanic Whites with Alzheimer's Disease and Related Dementias

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Abstract

Objective: To compare important indicators of quality of care between Native Hawaiians and other Pacific Islanders (NHOPIs) and non-Hispanic Whites (NHWs) with Alzheimer's disease and related dementias (ADRD).

Methods: We used the Health Care Cost and Utilization Project, Hawaii State Inpatient Databases, 2010–2014. They included 10,645 inpatient encounters from 7,145 NHOPI or NHW patients age ≥50 years, residing in Hawaii, and with at least one ADRD diagnosis in the discharge record. Outcome variables were inpatient mortality, length of hospital stay, and hospital readmission.

Results: NHOPIs with ADRD had, on average, a hospital stay of 0.94 days less than NHWs with ADRD, but were 1.16 times more likely than NHWs to be readmitted.

Discussion: These patterns have important clinical care implications for NHOPIs and NHWs with ADRD as they are important indicators of quality of care. Future studies should consider specific contributors to these differences in order to develop appropriate interventions.

Keywords

ADRD; Disparities; Native Hawaiian; Pacific Islander; Hospitalization

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This study was approved by the Institutional Review Boards at the University of Hawaii at Manoa and Washington State University.

INTRODUCTION

Alzheimer's disease and related dementias (ADRD) are one of the costliest chronic diseases, both in financial and human resources, in the US and the world (El-Hayek et al., 2019). The financial cost of caring for patients with ADRD in 2018 was estimated to be $277 billion in the US (Association, 2018; Hurd, Martorell, Delavande, Mullen, & Langa, 2013; Kelley, McGarry, Gorges, & Skinner, 2015). These costs are due, in large part, to the frequency of hospitalizations among patients with ADRD, particularly during the last 2 years of life, when the intensity and necessity of health services escalate (Ornstein et al., 2018). Indeed, the vast majority of patients with ADRD are hospitalized following their diagnosis, with approximately 5.2 hospitalizations over the course of their disease (Ornstein et al., 2018). There are also indirect and intangible human costs that are not usually measured, such as the impact on caregivers (e.g., inability to maintain employment) and reduced quality of life for both caregivers and patients (El-Hayek et al., 2019).

The burden of ADRD is not shared equitably across racial and ethnic groups (Husaini, Gudlavalleti, Cain, Levine, & Moonis, 2015). For example, the cost of care is higher for Blacks with ADRD compared to non-Hispanic Whites (NHWs) due to more frequent inpatient care and greater illness severity (Gilligan, Malone, Warholak, & Armstrong, 2013; Husaini et al., 2015). Similarly, Native Hawaiians and Other Pacific Islanders (NHOPIs) are more likely to be hospitalized with dementia at an earlier age than NHW, Chinese, Filipino, and Japanese individuals (Sentell et al., 2015). Only one study examined racial differences in hospitalization rates among individuals with dementia in Hawaii, but important indicators of quality of care like inpatient mortality, length of stay, and readmissions in the hospital (Lingsma et al., 2018) were not examined. High-quality care for all individuals, including individuals hospitalized with ADRD, is necessary for better health outcomes, decreased likelihood of potentially preventable readmissions, reduced health care costs, and fewer complications related to other chronic conditions (Jennings et al., 2016).

Chronic health conditions like cardiovascular and cerebrovascular diseases (CVD) and their vascular-related risk factors are strongly associated with ADRD (Corriveau et al., 2016; Corriveau et al., 2017; Santos et al., 2017; Snyder et al., 2015). NHOPIs have a higher prevalence of hypertension, obesity, diabetes, and dyslipidemia than many other racial/ethnic groups in Hawaii and the US (Aluli et al., 2009; Aluli et al., 2010; Grandinetti et al., 2007; Johnson, Oyama, LeMarchand, & Wilkens, 2004; Mau, Sinclair, Saito, Baumhofer, & Kaholokula, 2009; Nakagawa, Koenig, Seto, Asai, & Chang, 2012; Nguyen & Salvail, 2013; Schiller, Lucas, & Peregoy, 2012; Uchima, Wu, Browne, & Braun, 2019). The higher prevalence of CVD and its risk factors increase the possibility that NHOPIs with ADRD, similar to Blacks and Hispanics with ADRD, are at higher risk for adverse outcomes and/or lower quality of care when hospitalized than NHWs with ADRD (Boltz et al., 2018). These adverse outcomes may include higher rates of ADRD-related hospitalizations and in-hospital deaths, longer lengths of stay, and more early readmissions (Boltz et al., 2018). However, there have been no studies estimating possible racial/ethnic disparities in hospital-related adverse outcomes that included NHOPIs with ADRD.

Thus, the purpose of this study was to compare in-hospital mortality risk, length of stay, and readmissions between NHOPIs and NHWs with ADRD (Rockville, 2002). Although Hawaii is a multi-ethnic community where there is no one racial or ethnic group that comprises the majority (Okamura, 2008), NHOPIs as a group are among the most likely to be economically disadvantaged whereas NHWs are among the least likely to be economically disadvantaged. Also, NHWs are the standard comparison group in health disparities and ADRD research, so using NHWs as the comparison group in this study will help to situate our findings in the rest of the literature on racial/ethnic disparities in ADRD. We hypothesized that NHOPIs with ADRD would have higher in-hospital mortality risk, longer lengths of stay, and more early readmissions than NHWs with ADRD when hospitalized, after adjusting for sociodemographic and medical factors that could attenuate any observed differences.

METHODS

We used the Agency for Healthcare Research and Quality, Health Care Cost and Utilization Project (HCUP), Hawaii State Inpatient Databases, which include inpatient discharge data for all Hawaii community hospitals for the years 2010–2014 (Rockville, 2002). Detailed, patient-level information was available on principal and secondary International Classification of Diseases – 9th revision – Clinical Modification (ICD-9) codes, race/ethnicity, age range, sex, county of residence, discharge year, median household income by state quartile for patient zip code, primary payer, comorbidities, and discharge disposition. For this analysis, the study population was limited to inpatient visits of NHOPI and NHW persons who resided in Hawaii, were 50 years of age or older, and had at least one ICD-9 diagnosis of ADRD (Services., 2019). Fourteen specific racial subgroups that were included in the NHOPI category. NHOPI patients were identified as individuals whose primary self-reported racial group was reported as Native Hawaiian, Part Native Hawaiian, Guamanian or Chamorro, Other Micronesian, Maori, Samoan, Tongan, Melanesian, Other Pacific Islander, Fijian, Marshallese, Tahitian, or Tokelauan. NHW patients were identified as individuals whose primary self-reported racial group is White or Caucasian.

ADRD definitions

We identified NHOPI and NHW patients with ADRD by the presence of a principal or secondary ICD-9 diagnostic code of ADRD, using the set of ICD-9 codes recommended by the Chronic Conditions Data Warehouse of the Centers for Medicare and Medicaid Services (Table 1; (Lyketsos, Sheppard, & Rabins, 2000; Sentell et al., 2015; Services., 2019; Zuliani et al., 2012).

Demographic and health characteristics

The demographic and health characteristics included in the HCUP Hawaii State Inpatient Databases were: age, sex, county of residence, median household income, primary payer, discharge disposition, primary diagnosis, whether one or more surgical procedures were performed during the inpatient encounter, and presence of comorbid conditions at the time of admission. Age was categorized in 5-year groups, so the midpoint in each 5-year age group was used to adjust for age. Individuals ≥50 years of age were included in the analysis

because NHOPIs are more likely to have early-onset Alzheimer's disease (Panegyres, Chen, & Diseases, 2014) and more likely to be hospitalized at an earlier age than the other major racial groups in Hawaii (Sentell et al., 2015). Sex was defined as male or female. County of residence was determined from Federal Information Processing System (FIPS) Codes for States and Counties. A state quartile classification of median household income was provided for each patient's zip code, which varied across years. Primary payer indicated whether Medicare, Medicaid, Private or Health Maintenance Organization, self-pay, or other (including Worker's Compensation, Civilian Health and Medical Program of the Uniformed Services, Civilian Health and Medical Program of the Department of Veterans Affairs, Title V, and other government Programs) were responsible for charges. HCUP created discharge disposition categories following the inpatient encounter that included routine discharge to home or self-care, transfer to a short-term hospital (e.g., cancer center and federal health care facility), transfer to another facility (e.g., skilled nursing or intermediate care facility, hospice, other institution not defined elsewhere), home health care, against medical advice, and died during hospitalization. Primary ICD-9 diagnosis code was grouped into 15 broad categories using the International Statistical Classification of Diseases and Related Health Problems (ICD-9; ("List of ICD-9 codes," 2019). We identified encounters that included surgical procedures from ICD-9-CM procedural codes using an external database created by HCUP (HCUP, 2019). HCUP defines a surgical procedure as an invasive therapeutic or diagnostic procedure involving incision, excision, manipulation, or suturing of tissue that penetrates or breaks the skin or enters a body cavity through an existing orifice; typically requires use of an operating room; and also typically requires regional anesthesia, general anesthesia, or sedation to control pain. This includes percutaneous procedures, endoscopic procedures, and all "open" surgical procedures, regardless of therapeutic or diagnostic purpose.

Co-morbidity measures were predefined in the HCUP State Inpatient Databases, and were identified as coexisting medical conditions that were not directly related to the primary diagnosis, or the main reason for admission. Comorbidities were identified using ICD-9-CM diagnoses and the Diagnosis Related Group (DRG) in effect on the discharge date. We selected cardiovascular and cerebrovascular risk factors associated with ADRD, including uncomplicated diabetes or diabetes with chronic complications, uncomplicated or complicated hypertension, and obesity and peripheral vascular disorders. The final co-morbidity score was defined as the number of selected comorbid conditions present at each hospital discharge; possible values ranged from 0 to 4 conditions.

Outcome variables

Outcome variables were inpatient mortality, length of hospital stay, and hospital readmission within the same or next calendar month. Inpatient mortality was defined by HCUP as death during hospitalization and was derived from the discharge disposition of the patient. Length of stay was the number of consecutive days a patient was hospitalized during their stay, calculated by subtracting the admission date from the discharge date. Same-day admission and discharge stays were coded as 0. Hospital readmission was defined as patients who were readmitted within the same month of discharge or the month after. A variable for

readmission within 30 days could not be constructed because HCUP only includes month and year of admission.

Statistical analyses

Descriptive statistics were presented as frequency and percent for categorical variables and mean and standard deviation for continuous variables. Separate Poisson regression models were used to estimate the association between race/ethnicity and inpatient mortality and readmission. Linear regression was used to estimate the association between race/ethnicity and length of stay. Regression analyses used the sandwich variance estimator to account for multiple encounters within patient. However, the HCUP Hawaii state inpatient database did not track the same patient across multiple hospitals, and we were unable to account for that in the analysis. To provide context for the interpretation of our findings, we fitted multiple regression models that progressively adjust for additional covariates. Model 1 adjusted for demographic variables only: age, sex, and year of discharge (2010–2014). Model 2 additionally adjusted for socio-economic, health, and procedural variables: county of residence, median household income, primary payer, primary diagnosis, the number of comorbid conditions, an indicator that a surgical procedure was performed, and discharge disposition (length of stay and readmission only). Fitting multiple models allowed observation of differential confounding effects of demographic compared to socio-economic and health variables. Results were presented as prevalence ratios (PR) for Poisson regression or differences in means for linear regression with 95% confidence intervals. All analyses were conducted using Stata 15.1 (StataCorp, 2017).

RESULTS

Our sample included 10,645 inpatient encounters from 7,145 NHOPI or NHW patients ≥50 years of age, residing in Hawaii, with at least one diagnosis of ADRD in the discharge record. Table 1 presents the descriptive statistics of ADRD-related ICD-9 codes in NHOPI and NHW individuals with at least 1 ADRD diagnosis who were hospitalized. The frequency of ADRD ICD-9 codes was relatively similar between NHOPIs and NHWs. Unspecified dementia without behavioral disturbance was slightly more common among NHOPIs than NHWs. The ordering of the top 6 ADRD diagnoses was the same for NHOPIs and NHW individuals who were hospitalized.

Table 2 shows the demographic characteristics (i.e., age group, sex, county of residence, median household income group, primary payer, primary diagnosis, surgical procedure during the encounter, co-morbidity summary score, discharge disposition) and primary outcomes (i.e., inpatient mortality, inpatient length of stay, readmission) of the individuals with an ADRD ICD-9 diagnostic code stratified by NHOPI or NHW. NHOPIs (15%) with ADRD were younger (50–69 years old) than NHWs (8%) with ADRD, and NHOPIs (71%) were more likely to reside in Honolulu county than NHWs (63%). NHOPIs (9%) were somewhat less likely to have a primary diagnosis of injury or poisoning than NHWs (14%). NHOPIs (42%) were more likely to have two or more comorbidities compared to NHWs (23%). NHWs (28%) were also more likely to have no comorbid diagnoses than NHOPIs

(15%). There were also more routine discharges for NHOPIs (52%) than NHWs (44%) and more transfers to other facilities for NHWs (35%) than NHOPIs (25%).

NHOPIs with an ADRD diagnosis had approximately the same risk of inpatient mortality as NHWs with ADRD (PR=1.02; 95% CI= 0.86, 1.20) after controlling for age, sex, county of residence, median household income, primary payer, primary diagnosis, surgical procedure, and co-morbidity summary score (Table 3). However, NHOPIs with an ADRD diagnosis had, on average, a stay in the hospital 0.94 days less (difference in means= −0.94; 95% CI= −1.61, −0.27) than NHWs with an ADRD diagnosis after controlling for the same covariates and discharge disposition (Table 4). Further investigation showed that primary diagnosis and discharge disposition were the most substantial confounders for this association (data not shown). Further, NHOPIs with an ADRD diagnosis were 1.16 times (95% CI= 1.04, 1.28) more likely than NHWs with an ADRD diagnosis to be readmitted within the same month or the month after (Table 5).

DISCUSSION

The purpose of this study was to determine whether racial disparities exist in ADRD hospitalizations between NHOPIs – an understudied but high-risk racial population – and NHWs. This is the first study to examine differences in-hospital mortality, length of stay, and early readmission between NHOPI and NHW individuals hospitalized with ADRD, which represents a key step to determining which systemic-, provider- and/or patient-level factors may contribute to any observed disparities (Giglia et al., 2017). For example, misalignment between the expectations of providers and patients about hospital care or variations in social support, financial resources, trust and engagement may impact these outcomes (Giglia et al., 2017). We found that NHOPI individuals hospitalized with ADRD were discharged approximately a day earlier and were more likely to be readmitted early than NHWs with ADRD.

An unexpected finding is that NHOPIs stayed in the hospital for just over a day less than NHWs. The relationship between race/ethnicity and length of stay may be confounded by the primary diagnosis as NHWs (14%) had a higher prevalence of admission due to injury/poisoning than NHOPIs (9%). This relationship may also be confounded by discharge disposition as evidenced by a reduction in the prevalence ratio for NHOPIs from −1.49 to −0.94 days in the hospital (Table 4). In this sample, NHOPIs (52%) were more likely to be discharged home than NHWs (44%), and NHWs (35%) were more likely to be transferred to another facility, such as a skilled nursing facility, intermediate care facility, or hospice facility than NHOPIs (25%). Eight percent of households in Hawaii are multigenerational because of the high costs of living and limited number of houses (Lofquist, 2012). NHOPIs may be more likely to have available family and community support locally. NHOPIs comprise the highest proportion (18%) of people, compared to only 5% of NHWs, who live in multigenerational households (Lofquist, 2012). A shorter average length of stay for NHOPIs may be due to the availability of support from family members at home. In contrast, NHWs may have more family support on the continental US and thus more likely to be transferred to a skilled nursing facility for example, which requires a longer discharge process.

The notion that NHOPIs versus NHWs are more likely to be discharged to the home is supported by previous research showing that White caregivers are more likely than African American caregivers to place care recipients with dementia into nursing home settings (Hargrave, 2006). NHOPIs may also be less likely to be discharged to a nursing facility because of the cost and cultural practices. A study with Native Hawaiian elders about their aging and care preferences in later life identified concerns about the high cost of care and care that is incompatible with their Native Hawaiian values and beliefs (e.g., great respect for aging, elders identified as the keepers of knowledge and culture, mistrust of service providers and the healthcare system due to experiences with perceived discrimination (Browne et al., 2014). Insurance status may also impact whether NHOPIs are discharged to a nursing facility as it could impact the financial costs of nursing homes for family and loved ones. Specifically, 66.9% of NHOPIs compared to 75.4% of NHWs used private health insurance in 2017. Also in 2017, 8.3% of NHOPIs compared to 5.9% of NHWs were uninsured (US Deparmtent of Health and Human Services, 2019). The lower number of NHOPIs with private insurance and the high number of uninsured may impact access to skilled nursing care homes. Future studies should consider whether shorter lengths of stay among NHOPI individuals with ADRD are related to these concerns.

Counterintuitive to a shorter length of stay in the hospital is the higher number of comorbid cardiovascular and cerebrovascular conditions among NHOPIs compared to NHWs. Although NHOPIs may be “sicker” than NHWs, their perceived health status may be better. A previous study that examined the subjective physical wellbeing of Native Hawaiians compared to other major racial and ethnic groups in Hawaii found no significant differences in perceived health-related quality of life between NHWs and Native Hawaiians, despite the latter having significantly more co-morbid conditions (Kaholokula, Braun, Kanaiaupuni, Grandinetti, & Chang, 2006; Kaholokula, Hermosura, & Antonio, 2019). This may be explained by a phenomenon observed in other indigenous populations like Native Americans called “tolerated illness,” or the incongruence between subjective and objective health measures in chronically ill patients (Moss, 2005). The potential consequences of “tolerated illness” include premature discharges, divergent patient and provider goals, or missed opportunities of care (Moss, 2005). Additional information is necessary to better understand the reasons for earlier discharges among NHOPIs.

NHOPIs with an ADRD diagnosis were more likely to be readmitted within 60 days after discharge than NHWs with an ADRD diagnosis. In Hawaii, 16.1% of individuals with ADRD on Medicare who were hospitalized in 2015 were readmitted within 30 days (Association, 2018). Higher readmission rates among NHOPIs aligns with research that shows other minority populations are more likely than NHWs to be readmitted within 30 days for chronic conditions like diabetes, congestive heart failure, and ADRD (Ash & Brandt, 2006; Jiang, Andrews, Stryer, & Friedman, 2005; Rathore et al., 2003). Unnecessary hospital readmissions for Medicare beneficiaries may be due in part to poor discharge transitions and may result in reimbursement penalties for hospitals (Daiello, Gardner, Epstein-Lubow, Butterfield, & Gravenstein, 2012). Medicare beneficiaries comprised 88% of the sample for both NHOPI and White who were hospitalized in this study, so higher rates of readmissions may come with substantial financial costs. Identifying effective interventions to reduce preventable hospital readmissions is necessary to reducing healthcare

costs and decreasing the unnecessary burden on patients, their families and caregivers, and even healthcare systems.

There were no differences in inpatient mortality risk between NHOPIs and NHWs. It was unexpected that NHOPIs with an ADRD diagnosis had approximately the same risk of mortality during a hospitalization as NHWs. Interestingly, this finding is similar to those of other studies that examined post-dementia or Alzheimer's disease diagnosis survival by racial group (Mayeda et al., 2017; Mehta et al., 2008). Asian Americans, Latinos, African Americans, and American Indians or Alaska Natives had lower mortality than NHWs after controlling for different factors (e.g., comorbidities, age, sex; (Mayeda et al., 2017) (Mehta et al., 2008). In these studies, NHOPIs were aggregated with Asians or not included because of their small sample size (Mayeda et al., 2017; Mehta et al., 2008). Potential reasons for the lower mortality rates among these minority groups with dementia or Alzheimer's disease include differences in care or more support after diagnosis, slower disease progression, and later timing of diagnosis in relation to the underlying neuropathological disease process (Babulal et al., 2019; Mayeda et al., 2017). For example, other studies found that Latino or African American individuals with dementia are less likely to be placed in nursing homes, which increases the likelihood of survival post-diagnosis (Mausbach et al., 2004; Schulz et al., 2004; Yaffe et al., 2002). However, no other studies have examined whether these mortality patterns or potential reasons for them are similar for NHOPIs or NHWs with ADRD (Mayeda et al., 2017).

The shorter length of stay, higher rates of earlier readmissions, and similar risk for mortality experienced by NHOPIs hospitalized with ADRD compared to NHWs hospitalized with ADRD may also be due to larger societal and systemic issues of racism that contribute to racial biases among healthcare providers and within healthcare systems (Nelson, 2002). In fact, a review of different studies indicated that healthcare professionals had low to moderate levels of implicit pro-White or light-skin and anti-Black, Hispanic, Native American or dark-skin biases, rates that are similar to the general population (Hall et al., 2015). No one, not even healthcare providers, is immune to racial biases. Although the results on the impact of higher implicit racial biases among healthcare providers have been mixed, the most consistent finding is that higher levels of implicit racial biases are associated with poorer provider-patient communication in real world settings (Maina, Belton, Ginzberg, Singh, & Johnson, 2018). Poorer provider-patient communication may lead to misalignment between the expectations of providers and patients about patient care in the hospital and post-discharge. To date, there have not been any published studies examining the role of implicit racial biases towards NHOPIs compared to Whites in healthcare in Hawaii. It will be critical to examine the possible role that implicit biases toward NHOPIs with ADRD compared to NHWs with ADRD plays in these disparities.

The strengths of this study include the use of secondary data for analysis which is both cost- and time-efficient with a large sample of an understudied population, and the ability to identify factors that could shed light on potential reasons for disparities in length of stay and readmissions observed among NHOPIs compared to NHWs. A limitation of this study is the use of administrative data, which can suffer from a number of issues, such as poor data quality and data misclassification, reliance on diagnostic codes, and common use of

diagnostic codes like dementia, unspecified (Goodman et al., 2017; Lee & Yoon, 2017). For example, due to the limitations of the databases, we used zip code household income as the best proxy variable, but this may be a poor proxy variable for household income at the individual level becuase of the large geographic area that is covered and significant socioeconomic differences between areas within the same zip code. Residual confounding due to socioeconomic differences in NHOPIs and NHWs may contribute to the observed differences in the outcome variables. However, the large size and comprehensive nature of the data represent a substantial strength that allows for more generalizable results to the NHOPI population, and to Native Hawaiians in particular, than have been available in previous research. In fact, 83% of this NHOPI sample identifed as Native Hawaiian (26%) or part Native Hawaiian (57%). The next largest group was Samoans (9%). Another limitation to this study is the inability to understand the influence of factors like the presence or absence of caregivers on the differences observed or the relationship between shorter lengths of stay and readmission rates. Nonetheless, our results emphasize that future research is needed for studies to examine these factors further and indicates that there are differences between these two racial groups.

Studies on NHOPI individuals who were hospitalized with ADRD are extremely limited so this study addresses a substantial gap in the scientific literature. This is the first study to examine inpatient mortality, length of stay, and readmissions among NHOPI and NHW individuals hospitalized with ADRD. Although the limitations of a large administrative dataset did not allow for more granularity, it did allow for the identification of patterns in the outcomes of interest between NHOPIs and NHWs with ADRD. Additional studies that examine hospital, provider, and patient factors (e.g., experiences of adversity and discrimination) that may increase an individual's risk for adverse hospital outcomes are necessary to achieve health equity, especially for vulnerable racial groups like NHOPIs (Gaugler, James, Johnson, Marin, & Weuve, 2019). Focusing on health disparities in Hawaii is important because it is often believed that Hawaii is a "melting pot" of people of various races and ethnicities who live in harmony and are very healthy (Okamura, 2008). However, the fact that racial/ethnic disparities exist in Hawaii and that racial minority groups like NHOPIs are sicker at younger ages (Sentell et al., 2015) suggest the presence of systemic racism in Hawaii that ultimately impacts the care of individuals with ADRD in the hospital and post-discharge. Future studies are necessary to better understand the reasons that patterns of racial/ethnic disparities among NHOPIs with ADRD compared to NHWs with ADRD in Hawaii are similar to those that are experienced by other racial/ethnic minority groups with ADRD in the US.

Our findings suggest different policy implications. Specifically, the quality of care among NHOPIs with ADRD may be enhanced by increasing access to care for individuals with ADRD in ambulatory care settings and requiring training for healthcare providers and staff on person-centered care as well as culturally safe care for racial/ethnic minorities with ADRD. Managing symptoms earlier on in a lower level of care may also improve outcomes in hospital settings. In addition, these findings reinforce the need to disaggregate NHOPIs to better and more accurately understand health disparities between between groups in Hawaii and the US.

Acknowledgments

Partial support was provided by The Queen's Health System. The views expressed in written materials or publications do not necessarily reflect the official policies of The Queen's Health Systems, nor does mention of trade names, commercial practices, or organizations imply endorsement by The Queen's Health Systems. Partial support was also provided by the Department of Native Hawaiian Health in the University of Hawaii, John A. Burns School of Medicine. In addition, funding for this research were also provided by the National Institute of Health National Institute on Aging (Grant # P30AG059295). The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

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Table 1.

Prevalence of Alzheimer's Disease and Related Dementia (ADRD) subtypes among inpatient hospital admissions with at least 1 ADRD ICD-9 diagnostic code; Hawaii Healthcare Cost and Utilization Project Inpatient Database 2010–14.

		Native Hawaiians and Other Pacific Islanders[1] (n=3719)		Non-Hispanic Whites (n=6926)	
ICD-9 code		**Frequency**	**Percent**	**Frequency**	**Percent**
294.20	Dementia, unspecified, without behavioral disturbance	1248	33.6	2051	29.6
294.8	Other specified senile psychotic conditions; dementia	892	24.0	1709	24.7
331.0	Alzheimer's disease	795	21.4	1567	22.6
294.10	Dementia in conditions classified elsewhere without behavioral disturbance	629	16.9	1287	18.6
290.40	Vascular dementia, uncomplicated	361	9.7	585	8.5
294.11	Dementia in conditions classified elsewhere w/behavioral disturbance	159	4.3	370	5.3
290.0	Senile dementia NOS or Senile dementia uncomplicated	133	3.6	363	5.2
294.21	Dementia unspecified w/behavioral disturbance	128	3.4	206	3.0
797	Senility without mention of psychosis	44	1.2	160	2.3
290.41	Vascular dementia with delirium	43	1.2	84	1.2
290.3	Senile dementia with delirium and/or confusion	32	0.9	115	1.7
290.43	Vascular dementia with depressed mood	19	0.5	28	0.4
	Combined Other[2]	24	0.7	95	1.4

NOTE. Percentages may add to >100% due to multiple diagnoses per admission

[1]Native Hawaiian or Pacific Islander: Native Hawaiian, Part Native Hawaiian, Maori, Samoan, Guamanian/Chamorro, Tongan, Melanesian, Fijian, Marshallese, Tahitian, Tokelauan, Other Pacific Islander, or Other Micronesian.

[2]Combined Other includes ICD-9 codes of 290.42, 290.10, 290.11, 290.12, 290.13, 290.20, 290.21, 294.0, 331.11, 331.19, 331.2, and 331.7. All of these codes had cell sizes of 0 or <11 for NHOPIs.

Table 2:

Demographics and primary outcomes among inpatient hospital admissions with at least 1 Alzheimer's Disease and Related Dementias ICD-9 diagnostic code; Hawaii Healthcare Cost and Utilization Project Inpatient Database 2010–14.

	Native Hawaiians and Other Pacific Islanders[1] (n=3719)	Non-Hispanic Whites (n=6926)
Age	*Frequency (%)*	*Frequency (%)*
50–59	120 (3)	116 (2)
60–69	434 (12)	441 (6)
70–79	1169 (31)	1399 (20)
80–89	1581 (43)	3405 (49)
90+	415 (11)	1565 (23)
Sex		
Male	1659 (45)	3070 (44)
Female	2060 (55)	3856 (56)
Discharge year		
2010	651 (18)	1481 (21)
2011	756 (20)	1480 (21)
2012	799 (21)	1353 (20)
2013	749 (20)	1262 (18)
2014	764 (21)	1350 (19)
County of residence		
Hawaii county	611 (16)	1367 (20)
Honolulu county	2657 (71)	4381 (63)
Kauai county	95 (3)	392 (6)
Maui county	356 (10)	786 (11)
Median household income, state quartile for patient ZIP code		
1	1129 (31)	1871 (28)
2	784 (22)	1528 (23)
3	907 (25)	1349 (20)
4	819 (23)	2010 (30)
Primary payer		
Medicare	3292 (89)	6132 (89)
Medicaid	188 (5)	88 (1)
Private/HMO	165 (4)	387 (6)
Self-pay	12 (<1)	32 (<1)
Other[2]	62 (2)	287 (4)
Primary diagnosis		
Infectious and parasitic diseases	553 (15)	875 (13)
Neoplasms	81 (2)	150 (2)
Endocrine, nutritional and metabolic diseases, and immunity disorders	182 (5)	263 (4)

	Native Hawaiians and Other Pacific Islanders[1] (n=3719)	Non-Hispanic Whites (n=6926)
Diseases of the blood and blood-forming organs	29 (1)	63 (1)
Mental disorders	76 (2)	244 (4)
Diseases of the nervous system and sense organs	131 (4)	245 (4)
Diseases of the circulatory system	926 (25)	1433 (21)
Diseases of the respiratory system	507 (14)	998 (14)
Diseases of the digestive system	272 (7)	492 (7)
Diseases of the genitourinary system	263 (7)	578 (8)
Diseases of the skin and subcutaneous tissue	122 (3)	171 (2)
Diseases of the musculoskeletal system and connective tissue	59 (2)	156 (2)
Symptoms, signs, and ill-defined conditions	174 (5)	281 (4)
Injury and poisoning, external causes of injury and supplemental classification[3]	334 (9)	962 (14)
Surgical procedure during inpatient encounter		
Yes	623 (17)	1297 (19)
No	3096 (83)	5629 (81)
Co-morbidity summary score[4]		
0	567 (15)	1889 (28)
1	1576 (42)	3401 (49)
2	1156 (31)	1410 (20)
3–4[3]	420 (11)	226 (3)
Discharge disposition[5]		
Routine	1943 (52)	3053 (44)
Transfer to short-term hospital	48 (1)	107 (2)
Transfer to other facility[4]	942 (25)	2406 (35)
Home health care	540 (15)	881 (13)
Against medical advice	20 (1)	30 (<1)
Died	225 (6)	448 (6)
Primary outcomes[6]		
Inpatient length of stay, *mean (SD)*	8 (15)	9 (16)
Readmission (2 months)	659 (18)	977 (14)

NOTE. Percentages may not add up to 100% based on rounded estimates.

[1]Native Hawaiian or Pacific Islander: Native Hawaiian, Part Native Hawaiian, Maori, Samoan, Guamanian/Chamorro, Tongan, Melanesian, Fijian, Marshallese, Tahitian, Tokelauan, Other Pacific Islander, or Other Micronesian.

[2]Other includes Worker's Compensation, CHAMPUS, CHAMPVA, Title V, and other government programs

[3]Combined categories due to cell size < 11

[4]Sum of present comorbidities (diabetes, hypertension, obesity, and peripheral vascular disorders).

[5]Skilled nursing facility, intermediate care facility, hospice facility, inpatient rehabilitation facility, long-term care hospital, psychiatric hospital, other facility not defined elsewhere

[6] Inpatient mortality presented in discharge disposition (died)

Table 3.

Association between race and inpatient mortality in individuals with an Alzheimer's Disease and Related Dementias ICD-9 diagnostic code[1]; Hawaii Healthcare Cost and Utilization Project Inpatient Database 2010–14. 3

	Inpatient mortality			
	Model 1 (n=10645)		Model 2 (n=10397)[2]	
	PR	95% CI	PR	95% CI
NHOPI[3]	1.03	0.88, 1.21	1.02	0.86, 1.20
Age group	1.14	1.08, 1.20	1.13	1.08, 1.19
Sex, female	0.86	0.74, 1.00	0.89	0.77, 1.03
Discharge year[4]				
2011	0.82	0.66, 1.03	0.82	0.66, 1.03
2012	0.92	0.74, 1.14	0.86	0.69, 1.07
2013	0.70	0.55, 0.90	0.64	0.51, 0.82
2014	0.86	0.69, 1.08	0.79	0.63, 1.00
County of residence[5]				
Hawaii county	-	-	1.16	0.93, 1.45
Kauai county	-	-	2.11	1.60, 2.79
Maui county	-	-	1.48	1.14, 1.90
Median household income[6]				
Quartile 2	-	-	1.04	0.83, 1.30
Quartile 3	-	-	1.06	0.85, 1.31
Quartile 4	-	-	0.85	0.67, 1.07
Primary payer[7]				
Medicaid	-	-	1.75	1.09, 2.82
Private/HMO	-	-	1.14	0.82, 1.58
Self-pay	-	-	0.81	0.12, 5.60
Other[8]	-	-	0.76	0.49, 1.18
Surgical procedure	-	-	0.96	0.76, 1.21
Co-morbidity summary score[9]	-	-	0.91	0.83, 1.00

NOTE.

[1] At least one ADRD ICD-9 code diagnosis.

[2] Model 2 also adjusts for categorized primary diagnosis, results not shown

[3] Native Hawaiian or Pacific Islander; Reference group=Non-Hispanic Whites

[4] Reference group=2010

[5] Reference group=Honolulu county

[6] Median household income, state quartile for patient ZIP code. Reference group=quartile 1 (lowest median income).

[7] Reference group=Medicare.

[8] Other includes Worker's Compensation, CHAMPUS, CHAMPVA, Title V, and other government programs

[9] Sum of present comorbidities (diabetes, hypertension, obesity, and peripheral vascular disorders).

PR=prevalence ratio. CI=confidence interval. Differences in model n due to missing household income.

Table 4.

Association between race and inpatient length of stay (days) in individuals with an Alzheimer's Disease and Related Dementias ICD-9 diagnostic code[1]. Hawaii Healthcare Cost and Utilization Project Inpatient Database 2010–14.

	Inpatient length of stay (days)			
	Model 1 (n=10640)		Model 2 (n=10390)[2]	
	B	95% CI	β	95% CI
NHOPI[3]	−1.49	−2,17, −0.81	−0.94	−1.61, −0.27
Age group	−1.26	−1.52, −0.99	−0.94	−1.19, −0.68
Sex, female	−0.41	−1.04, 0.22	−0.17	−0.80, 0.46
Discharge year[4]				
2011	0.03	−0.83, 0.88	0.25	−0.60, 1.10
2012	0.11	−0.77, 0.99	0.07	−0.79, 0.94
2013	−0.05	−0.95, 0.85	−0.17	−1.04, 0.71
2014	0.28	−0.66, 1.22	−0.03	−0.94, 0.88
County of residence[5]				
Hawaii county	-	-	−0.86	−1.87, 0.16
Kauai county	-	-	−1.77	−2.67, −0.87
Maui county	-	-	1.87	0.66, 3.08
Median household income[6]				
Quartile 2	-	-	−0.35	−1.33, 0.62
Quartile 3	-	-	0.03	−0.92, 0.99
Quartile 4	-	-	−1.04	−1.91, −0.17
Primary payer[7]				
Medicaid	-	-	5.46	1.28, 9.65
Private/HMO	-	-	0.03	−1.49, 1.55
Self-pay	-	-	5.25	−6.27, 16.8
Other[8]	-	-	2.58	0.45, 4.71
Surgical procedure	-	-	5.23	4.23, 6.23
Co-morbidity summary score[9]	-	-	−0.11	−0.47, 0.24
Discharge disposition[10]				
Transfer to short-term hospital	-	-	1.16	−1.80, 4.12
Transfer to other facility	-	-	4.00	3.21, 4.78
Home health care	-	-	2.14	1.48, 2.80
Against medical advice	-	-	6.19	−7.80, 20.2
Died	-	-	3.16	1.88, 4.45

NOTE.

[1] At least one ADRD ICD-9 code diagnosis.

[2]Model 2 also adjusts for categorized primary diagnosis, results not shown

[3]Native Hawaiian or Pacific Islander; Reference group=Non-Hispanic Whites.

[4]Reference group=2010.

[5]Reference group=Honolulu county

[6]Median household income, state quartile for patient ZIP code. Reference group=quartile 1 (lowest median income).

[7]Reference group=Medicare.

[8]Other includes Worker's Compensation, CHAMPUS, CHAMPVA, Title V, and other government programs

[9]Sum of present comorbidities (diabetes, hypertension, obesity, and peripheral vascular disorders).

[10]Reference group=routine discharge

β = difference in length of stay compared to the reference group or for a 1-unit increase in age group or co-morbidity score. CI = confidence interval. Differences in model n due to missing household income and discharge disposition.

Table 5.

Association between race and inpatient readmission (2 months) in individuals with an Alzheimer's Disease and Related Dementias ICD-9 diagnostic code[1]. Hawaii Healthcare Cost and Utilization Project Inpatient Database 2010–14

	Inpatient readmission (2 months)			
	Model 1 (n=10639)		Model 2 (n=10749)[2]	
	PR	95% CI	PR	95% CI
NHOPI[3]	1.20	1.08, 1.33	1.16	1.04, 1.28
Age group	0.94	0.92, 0.97	0.95	0.92, 0.97
Sex, female	0.88	0.80, 0.98	0.90	0.81, 0.99
Discharge year[4]				
2011	1.01	0.87, 1.17	1.00	0.86, 1.16
2012	1.03	0.89, 1.20	1.01	0.87, 1.18
2013	0.85	0.72, 1.00	0.86	0.73, 1.01
2014	0.97	0.83, 1.13	0.96	0.82, 1.12
County of residence[5]				
Hawaii county	-	-	0.94	0.81, 1.08
Kauai county	-	-	0.91	0.71, 1.16
Maui county	-	-	1.08	0.92, 1.28
Median household income[6]				
Quartile 2	-	-	0.93	0.81, 1.07
Quartile 3	-	-	0.91	0.79, 1.06
Quartile 4	-	-	0.93	0.80, 1.08
Primary payer[7]				
Medicaid	-	-	1.11	0.83, 1.47
Private/HMO	-	-	1.33	1.10, 1.60
Self-pay	-	-	0.99	0.48, 2.03
Other[8]	-	-	1.13	0.86, 1.47
Surgical procedure	-	-	0.77	0.67, 0.89
Co-morbidity summary score[9]	-	-	1.11	1.05, 1.17
Discharge disposition[10]				
Transfer to short-term hospital	-	-	0.72	0.46, 1.13
Transfer to other facility	-	-	1.09	0.97, 1.22
Home health care	-	-	1.28	1.12, 1.47
Against medical advice	-	-	1.02	0.60, 1.73
Died	-	-	1.30	1.08, 1.55

NOTE.

[1] At least one ADRD ICD-9 code diagnosis.

[2]Model 2 also adjusts for categorized primary diagnosis, results not shown

[3]Native Hawaiian or Pacific Islander; Reference group=Non-Hispanic Whites

[4]Reference group=2010.

[5]Reference group=Honolulu county

[6]Median household income, state quartile for patient ZIP code. Reference group=quartile 1 (lowest median income).

[7]Reference group=Medicare.

[8]Other includes Worker's Compensation, CHAMPUS, CHAMPVA, Title V, and other government programs

[9]Sum of present comorbidities (diabetes, hypertension, obesity, and peripheral vascular disorders).

[10]Reference group=routine discharge

PR=prevalence ratio. CI=confidence interval. Differences in model n due to missing household income and discharge disposition.