Racial and Ethnic Disparities in Hospital Mortality among Ischemic Stroke Patients in Hawaii

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Background: We evaluated disparities in in-hospital mortality rates among whites, Native Hawaiians and other Pacific Islanders (NHOPI), Filipinos, and other Asian groups in Hawaii who were hospitalized for acute ischemic stroke. *Materials and Methods:* Using a statewide hospital claims database, we performed a retrospective study including sequential acute ischemic stroke patients between 2010 and 2015. We compared in-hospital mortality rates among whites, NHOPI, Filipinos, other Asian groups excluding Filipinos, and other races (Blacks, Hispanics, Native Americans, mixed race). *Results:* A total of 13,030 patient discharges were included in this study. The mean (±SD) age in years at the time of stroke was 63.5 ± 14.3 for NHOPI, 69.6 ± 14.4 for Filipinos, 67.8 ± 14.2 for other race, 71.4 ± 13.8 for whites, and 76.1 ± 13.5 for other Asians ($P < .001$). NHOPI patients had higher rates of diabetes (48.8%), obesity (18.4%), and tobacco use (31.3%) compared with patients in other racial-ethnic categories. Filipino patients had the highest rate of hemorrhagic transformation (9.7%). Age-adjusted stroke mortality rates were highest among Filipinos (15.9%; 95% confidence interval [CI] = 14.3%-17.6%), followed by other Asian groups (15.1%; 95% CI = 14.0%-16.2%), NHOPI (14.8%; 95% CI = 12.8%-16.8%), other race (14.4%; 95% CI = 11.3%-17.4%), and lowest among whites (12.8%; 11.5%-14.2%). After adjusting for other confounding variables, Filipinos had higher mortality (odds ratio = 1.22, 95% CI = 1.03-1.45), whereas other Asian groups, NHOPI, and other race patients had mortality rates that were similar to whites. *Conclusion:* In Hawaii, Filipino ethnicity is an independent risk factor for higher in-hospital stroke mortality compared with whites. **Key Words:** Ischemic stroke—ethnic disparities—mortality—stroke treatment—Asian—Native Hawaiian.

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Introduction

Stroke is the fifth leading cause of death in the United States and accounts for nearly 129,000 deaths annually. This health burden disproportionately affects racial-ethnic minorities who have higher stroke-related death rates than their white counterparts.[1-4] Most studies demonstrating ethnic disparities in stroke outcomes have focused on blacks and Hispanics. Disparities in stroke-related mortality among a multiethnic population in Hawaii have not been adequately studied.

Hawaii has a unique and ethnically diverse population that includes Native Hawaiian, Marshallese, Fijian, Tongan, Chamorro, and Samoan groups collectively known as Native Hawaiians and other Pacific islanders (NHOPI).[5] Native Hawaiians have higher rates of cardiovascular risk

factors and a lower mean age of cardiovascular-related death than their white counterparts.[6,7] Native Hawaiians with ischemic or hemorrhagic stroke also tend to be younger and have more characteristics of the metabolic syndrome than their white counterparts.[8-10] Age-adjusted stroke mortality rates are reported to be 3-fold higher among Native Hawaiians compared with whites and Asians, according to vital statistics from the Hawaii State Department of Health.[11]

Filipinos represent the most common Asian ethnic group in Hawaii. Filipino-Americans have a higher reported incidence of cardiovascular risk factors[12-15] and higher cardiovascular mortality[16] compared with whites and other Asian-American groups. Despite these differences, Filipinos have historically been aggregated with other Asian ethnic groups in previous stroke studies. We hypothesized that NHOPI and Filipinos have higher in-hospital stroke mortality rates compared with whites after adjusting for confounders.

Materials and Methods

Data Source

The study was approved by the Institutional Review Board for retrospective human subject research. Hawaii Health Information Corporation (HHIC) inpatient data from January 2010 to June 2015 were utilized to investigate racial-ethnic disparities in mortality among stroke patients. The HHIC claims database consists of discharge data from all nonfederal acute care hospitals in Hawaii, including age, sex, race-ethnicity, insurance type, *International Classification of Diseases, Ninth Revision, Clinical Modification* (ICD-9) primary and secondary diagnosis and procedure codes (up to 25 diagnosis and 25 procedure codes), and Medicare Severity Diagnosis Related Groups.

We identified 14,450 discharges for patients who were hospitalized with acute ischemic stroke. Acute ischemic stroke was identified with the ICD-9 codes 430.01, 433.11, 433.21, 433.31, 433.81, 434.91, 434.01, 434.11, 434.91, and 536 or Medicare Severity Diagnosis Related Groups between 61 and 68. Transferred records between hospitals were combined (n = 139). We excluded stroke that was not present on admission (n = 142), non-Hawaii residents (n = 728), patients with no race-ethnicity data (n = 215), and Tripler Army Medical Center discharges (n = 196). A total of 13,030 patient discharges were included in the final analysis.

Measurements

The HHIC database includes self-reported race-ethnicity at hospital admission. We classified race-ethnicity into 5 groups. Whites, NHOPI, Filipinos, and other Asian groups (excluding Filipinos) accounted for 90% of the population. Blacks, Hispanics, Native Americans, and mixed-race individuals were aggregated as "other race." Filipinos and other Asian groups were analyzed separately because stroke risk factors and mortality rates differ between these populations.[15,16] Whites were the reference group for the comparative analyses.

As explanatory variables that may be associated with race-ethnicity, we considered the following patient characteristics: sex, age, insurance type (Medicare, Medicaid, private insurance, and other), residential location, hypertension (ICD-9 code 401-405), hypercholesterolemia (ICD-9 code 272), diabetes (ICD-9 code 250), obesity (ICD-9 code 278), tobacco use (ICD-9 code 305.1, V15.82), atrial fibrillation or flutter (ICD-9 code 427.31, 427.32), and Charlson's comorbidity index (CCI). Residential area was classified as urban (island of Oahu) and rural (other Hawaiian islands).

As potential factors related to stroke mortality, we considered patient and hospital characteristics. Patient characteristics included sex, age, insurance type, residential location, and CCI. Hospital characteristics included average annual number of stroke discharges, hospital bed number, and hospital location (urban versus rural). To characterize the volume of stroke discharges, hospitals were classified into 3 groups: low volume (<100 discharges), medium volume (100-300 discharges), and high volume (>300 discharges). Hospital bed number was determined by State Health Planning & Development Agency (SHPDA) health-care utilization report (SHPDA, 2010) and U.S. News & Health if it was unavailable in the SHPDA report. We classified hospitals into 3 groups: small (<100 beds), medium (100-300 beds), and large (>300 beds). Discharge year was included to examine temporal changes during the study period.

The following were considered potential confounders that may increase mortality: hemorrhagic transformation of ischemic stroke and utilization of intravenous recombinant tissue plasminogen activator. Hemorrhagic transformation was estimated based on one of the following in-hospital codes that were not present on admission: intracerebral hemorrhage (ICD-9 code 431), subarachnoid hemorrhage (ICD-9 code 430), iatrogenic cerebral hemorrhage (ICD-9 code 997.02), and adverse effect of fibrinolysis-affecting drugs (ICD-9 code E934.4). Utilization of intravenous tissue plasminogen activator was identified using ICD-9 procedure code 99.10.

The primary outcome variable was mortality. Mortality was limited to in-hospital mortality or discharge to hospice because the HHIC database does not include longitudinal data such as postdischarge mortality. Besides in-hospital mortality, discharge disposition was also investigated and categorized as death (in-hospital morality or discharge to hospice); discharge to skilled nursing facility, including long-term care hospitals or intermediate care facilities; discharge to rehabilitation facility; discharge to home; and other.