RACIAL/ETHNIC DIFFERENCES IN STROKE MORTALITY IN VETERANS

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Objective: We examined racial-ethnic differences in all-cause mortality after stroke in a cohort of veterans living in the southeastern United States.

Methods: Data on a cohort of 4115 veterans with a diagnosis of stroke were analyzed. The cohort included veterans who classified themselves as non-Hispanic White, non-Hispanic Black, or Other. All veterans had a diagnosis of ischemic or hemorrhagic stroke. All subjects were seen in Veterans Affairs facilities in the Charleston, South Carolina area and were followed from January 1, 2000 to December 31, 2006. Cox proportional hazards regression models were used to compare survival times by race/ethnicity, adjusting for relevant covariates.

Results: In 38 months of follow-up, 1232 veterans in the cohort died. Compared with non-Hispanic White veterans, Black veterans were ≈20% more likely to die, and other ethnicities were ≈20% less likely to die in the unadjusted model. In the adjusted model, the White-Black disparity increased somewhat, and the disparity between Whites and other ethnicities was somewhat attenuated. Age, coronary heart disease, cancer, and Charlson co-morbidity index >2 were also associated with higher mortality.

Conclusions: Non-Hispanic Black veterans with a history of stroke in the southeastern United States had significantly higher mortality than did Non-Hispanic White veterans and veterans of other ethnicities, even after adjusting for relevant covariates. (*Ethn Dis*. 2009;19: 161–165)

Key Words: Stroke, Mortality, Race/Ethnicity, Veterans

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INTRODUCTION

Stroke is the third leading cause of death in the United States, after heart disease and cancer.[1] National statistics indicate that racial/ethnic minorities have almost twice the risk of stroke[2] and are more likely to die of stroke at a younger age.[2,3] In 2004, the stroke death rate was 73.9 per 100,000 of the US population for Black men and 64.9 for Black women, substantially higher than the rates for White men (48.1) and White women (47.4).[1] A review of studies of stroke deaths in the US population indicates that Blacks consistently have higher stroke mortality than do Whites.[4–10] Further, excess stroke-related death has been reported among Blacks (aged 35–64 years) living in the southeastern region of the United States.[3]

Distinctly different and unexplained racial/ethnic differences in death rates for stroke and other chronic conditions have emerged in the Veterans Healthcare System.[11–15] Several recent studies of poststroke death in Veterans Affairs (VA) facilities report that Blacks are less likely to die after stroke than are Whites, which suggests better outcomes among Blacks.[12–14,16,17] Equal access to care in VA facilities has emerged as the primary explanation for lower post-stroke death rates among Blacks, whereas higher death rates are more common in the non-veteran population.[13,14]

Despite the promising observation of lower mortality among Black veterans, the conclusions of previously reported studies of stroke and other chronic conditions are limited by the possibility of unmeasured or unmeasurable confounders.[15] Overall illness severity, admission practices, and patient choice of VA vs non-VA facility are among those variables that are not abstracted from VA administrative datasets. Therefore, it is unclear if recently reported studies of poststroke mortality in the VA are representative of regions of the United States where stroke incidences are higher or regions where Black veterans are more likely to rely on VA facilities for stroke-related care. To determine whether prior findings of lower stroke mortality among Blacks would hold in a VA population with a higher proportion of African Americans and higher incidence of stroke death, we examined racial/ethnic differences in stroke mortality among veterans in the southeastern United States.

The aim of this study was to examine racial/ethnic differences in all-cause mortality among veterans residing in the state of South Carolina and in the heart of the "stroke belt."[18–20] South Carolina has the distinction of being the "buckle" of the stroke belt because it has the highest stroke-related death rates in the United States.[1] Additionally, 40% of the population of South Carolina is Black, which suggests more reliance on VA facilities among Black veterans since VA facilities serve a higher proportion of underrepresented minorities than exists in the United States overall.[21] We hypothesized that, since the percentage of Black South Carolinians was significantly higher than the US population overall and more Black veterans were more likely to use VA facilities, post-stroke mortality would be higher in Blacks than in Whites, in keeping with findings from non-VA studies.

RESEARCH DESIGN AND METHODS

Study Sample

We created a cohort of veterans with a diagnosis of stroke at a VA facility in the southeastern United States (Charles-

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ton, South Carolina) by using multiple patient and administrative files from the Veterans Health Administration (VHA) Decision Support System files linked by Social Security number. Social Security numbers were stripped after creating the database. The VHA Decision Support System is a management information system that integrates data from clinical and financial systems for both inpatient and outpatient care.[22] Patients with a diagnosis of stroke were identified on the basis of International Classification of Diseases (ICD), Ninth Revision, codes for stroke (430–438) in either outpatient or inpatient files and having ≥2 visits each year since diagnosis based on a previously validated algorithim.[23] The cohort was followed from January 1, 2000, to December 31, 2006, which was the end of data collection. The final cohort included 4115 veterans who had had a stroke. The study was approved by the Medical University of South Carolina institutional review board and local VA research and development committees.

Measures

The primary outcome measure was all-cause mortality. Death was ascertained through the Beneficiary Identification and Record Location files, a national database of veterans or their families who applied for death benefits, which is 95% complete.[22] The endpoint for this study was death from all causes. Follow-up time was calculated from time of entry into the study to time of death, loss to follow-up, or end of the study (December 31, 2006).

Age was treated as a continuous variable. Race/ethnicity was based on self-report and defined as non-Hispanic White, non-Hispanic Black, and all others (included those with missing race/ethnicity data).

Co-morbidity was based on the International Classification of Diseases, Ninth Revision (ICD-9). We used a previously validated enhanced algorithm to identify hypertension (codes 401–405), coronary heart disease (410–414), diabetes (250), cancer (140–208), and depression (296.2, 296.3, 296.5, 300.4, 309.4, 311).[24] We also calculated a summary Charlson co-morbidity index.

Statistical Analysis

We compared baseline values for demographic and clinical variables by using pooled t-test or one way ANOVA for continuous variables and χ^2 tests for categorical variables. We used Cox proportional hazards regression models to compare survival times for patients by race/ethnicity. We developed 2 multivariate models: a minimal, unadjusted model contained only effects of age and sex. A full multivariable model included age, sex, and confounding co-morbidities that were likely to be mediators of the relationship between race/ethnicity and mortality. Comorbidities included: hypertension, coronary heart disease, diabetes, cancer, depression, and the Charlson comorbidity index (categorized as <2 vs. 2 or more comorbidities). Parameter estimates and the 95% confidence interval (CI) of the hazard ratio (HR) were used to describe the unadjusted and adjusted effect of race/ethnicity on mortality. The assumption of proportionality of hazard was satisfied for the racial/ethnic groups and each study covariate. All statistical tests used a 2-tailed $\alpha = .05$ level of significance and were conducted by using SAS statistical software version 9.1.3 (SAS Institute Inc, Cary, NC).

RESULTS

In this representative sample of 4115 veterans followed for an average of 38 months, 1232 (29.9 %) died. A larger proportion of the sample were men, White, and aged ≥65 years and had a history of hypertension and coronary heart disease (Table 1).

In the unadjusted minimal model, non-Hispanic Black veterans were significantly more likely to die (HR 1.21, 95% CI 1.07–1.37) than were non-Hispanic White veterans, and veterans of other ethnicities were less likely to die (HR .78, 95% CI .67–.91).

After adjusting for co-morbid conditions, the likelihood of death remained higher for non-Hispanic Black veterans. Similarly, the likelihood of death among other ethnicities remained lower than that for Whites. Other factors associated with increased risk of death were increasing age, coronary heart disease, hypertension, cancer, and Charlson co-morbidity index >2.

Figure 1 shows Kaplan-Meier curves of unadjusted survival times for veterans by racial/ethnic groups (non-Hispanic Whites, non-Hispanic Blacks and "all others") during the period of follow-up. Non-Hispanic Blacks had higher mortality compared to, Non-Hispanic Whites while "All Others" had lower mortality compared to Non-Hispanic Whites.

DISCUSSION

In this study of veterans in the southeastern United States, we found that non-Hispanic Black ethnicity was associated with increased mortality when compared with non-Hispanic Whites. In contrast, veterans of other ethnicities had lower mortality. Our results also indicate that older age, the presence of coronary heart disease or cancer, and a Charlson co-morbity index >2 are also associated with an increased risk of death.

Table 1. Characteristics of 4115 veterans with a history of stroke, Charleston, South Carolina, 2000–2006

	Race/Ethnicity			
	Non-Hispanic White ($n = 2004$ [48.7%])	Non-Hispanic Black ($n = 1079$ [26.2%])	All Others ($n = 1032$ [25.1%])	*P* Value
Mean age (SD), years	71.7 (10.7)	70.0 (12.3)	71.8 (11.6)	<.01
Mean (SD) months of followup	41.2 (26.2)	39.5 (27.4)	34.1 (23.9)	<.01
% in each age group				<.01
<50 years	2.1	4.5	3.6	
50–64 years	25.5	31.1	23.6	
≥65 years	72.4	64.3	72.8	
% men	97.4	97.8	97.5	.77
% died	31.6	35.5	20.9	<.01
% with hypertension	85.5	90.5	80.2	<.01
% with coronary heart disease	57.8	47.3	43.6	<.01
% with diabetes	42.9	47.5	36.4	<.01
% with cancer	30.2	22.9	21.6	<.01
% with depression	37.6	24.2	27.2	<.01
Charlson co-morbidity index				<.01
0	12.4	11.1	23.5	
1	18.4	16.9	22.2	
2	18.0	15.3	18.9	
≥3	51.2	56.7	35.3	

Our findings of increased risk of death after stroke among non-Hispanic Blacks are consistent with previous reports in the non-veteran population.[4–10] These findings are inconsistent with recent studies of the veteran population that report lower stroke-related death among non-Hispanic Black veterans.[12–14,16,17] For example, among >55,000 veterans who were discharged from VA Medical Centers nationwide from 1990 through 1997, the odds of death after stroke among White veterans was 6% higher than among Black veterans.[14] Similarly, in a second study of the effect of diabetes on post-ischemic stroke mortality in a cohort of ≈49,000 veterans, the odds of death were 7% higher among White veterans than among Black veterans.[16] In a third study of the effect of depression and other mental health diagnoses on death after ischemic stroke, using a national cohort of over 51,000 veterans, the odds of death were 7% higher among White veterans than among Black veterans.[12]

Table 2. Adjusted likelihood of death among 4115 veterans with a history of stroke, Charleston, South Carolina, 2000–2006

	HR (95% CI)	P Value
Non-Hispanic Black (White = reference)	1.25 (1.10–1.43)	.01
All other ethnicities (White = reference)	.84 (.72–.98)	.03
Age (years)	1.02 (1.02–1.03)	<.01
Women (men = reference)	.69 (.42–1.13)	.14
Coronary heart disease	1.13 (1.01–1.28)	.03
Hypertension	.54 (.46–.64)	<.01
Cancer	1.30 (1.15–1.48)	<.01
Depression	.92 (.81–1.05)	.20
Diabetes	.95 (.84–1.07)	.39
Charlson co-morbidity index > 2 (≤2=reference)	1.69 (1.47–1.94)	<.01

One explanation for the lack of consistent observation of higher post-stroke mortality among non-Hispanic Blacks and other racial/ethnic minorities has been attributed to the differences that emerge when examining mortality in national vs region-specific or state-level data. When considering the equal access to care afforded to veterans, it would be expected that racial/ethnic disparities would not emerge in the VA system, or at a minimum they would consistently occur among the same racial/ethnic group. However, analyses of national data cannot adequately capture the unique regional differences and heterogeneity of racial/ethnic minority groups in those regions.[25] Thus, even though understanding national patterns are critical to determining nationwide healthcare approaches, they may not be reliable for local public health approaches or adequately represent regional health patterns.[26]

Conclusions regarding potential differences between the influences of national and regional data appear to be supported by the findings of this study. The higher observed odds of death among non-Hispanic Black veterans may be primarily a reflection of region-specific death rates in the southeastern United States and in particular the state of South Carolina. Thus, one might hypothesize that equal access to care may not be substantial enough to counter baseline racial/ethnic disparities in the health-related profiles of veterans in South Carolina. For example, South Carolina is one of several southeastern states that make up the stroke belt, which is known for substantially more stroke-related deaths.[18–20] Additionally, South Carolina is a predominantly rural and poor state; 40%–50% of the population live in rural areas, and ≈24% of the population live below the poverty line.[27] Further, even though the profile of confounding co-morbid conditions (coronary heart disease, hypertension, cancer) and overall mortality risk (Charlson index) were generally

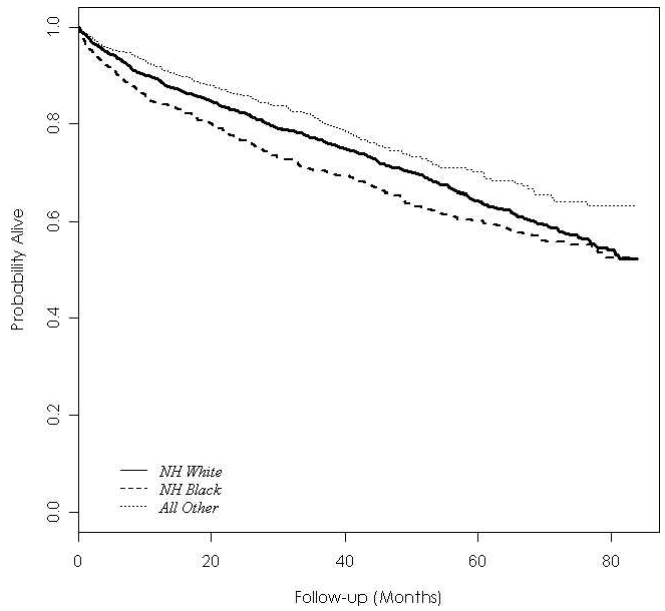

Fig 1. Estimated probability of survival for veterans in the Charleston, SC Stroke Cohort 2000–2006 by race/ethnicity

similar between the 3 groups, the specific effect on the death rates of each racial/ethnic group could not be accurately determined. Therefore, the findings of this study may be a reflection of unique regional characteristics of this veteran cohort rather than general veteran population nationwide.

A second consideration related to regional differences in mortality outcomes may be the close proximity between high socioeconomic urban areas and impoverished rural areas of the study region. More specifically, the results of this study could have been influenced by a rural-urban disparity because of the socioeconomic characteristics of the study region. Even though specific data related to the socioeconomic characteristics of the veterans included in this study were not collected, socioeconomic characteristics of patients and communities are believed to influence poststroke mortality.[28–30] A higher death rate after stroke has been observed in Blacks compared with Whites when both are from low socioeconomic backgrounds and receiving care in healthcare systems that offer universal access to care.[28] Future studies of veterans and mortality after stroke should be designed to address these issues.

Our results also indicate that older age, the presence of coronary heart disease or cancer, and a Charlson comorbity index >2 are also associated with an increased risk of death.

We recognize a number of limitations of this study. First, we found significantly lower odds of death among veterans of "Other" ethnicities. Unfortunately, this category included veterans with missing race/ethnicity data. We cannot say whether the ≈1000 veterans in this category would have contributed to the higher odds of death among non-Hispanic Black veterans or the lower odds among non-Hispanic White veterans. In the absence of specific race/ethnicity data, we cannot delineate those factors that may have contributed to the lower odds of death. It will be critical in future studies to minimize the number of missing reports of race/ethnicity to ensure that the most accurate depiction of mortality after stroke is obtained. Second, the influence of confounding variables could not fully be accounted for in this study. As noted previously, there are several potential explanatory variables (socioeconomic status, educational level, income level, presence of usual source of care, insurance status, social support, health behaviors, medication adherence) that were not available in our administrative datasets. These explanatory variables would need to be examined in future studies. Third, we did not have data related to stroke severity to determine its effects on mortality.

In spite of these limitations, the findings of this study offer new information related to racial/ethnic differences in death rates among veterans after stroke. Future studies in the veteran population should be designed to fully consider national death rates among veterans after stroke and potential regional differences. Similarly, full consideration must be given to sociodemographic and behavioral factors that can influence death rates among veterans after stroke, even in the presence of equal access to care.

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AUTHOR CONTRIBUTIONS

Design concept of study: Ellis, Egede
Acquisition of data: Ellis, Egede
Data analysis and interpretation: Zhao, Egede
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