Association of Hispanic Ethnicity with Acute Ischemic Stroke Care Processes and Outcomes

William P. Neil, MD; Rema Raman, PhD;
Thomas M. Hemmen, MD, PhD; Karin Ernstrom, MS;
Brett C. Meyer, MD; Dawn M. Meyer, PhD;
Bruce Ovbiagele, MD, MSc, MAS

Background: Few studies have examined the actual hospital arrival mode, emergency department (ED) care processes, and early outcomes in Hispanic vs non-Hispanic acute ischemic stroke (AIS) patients. We evaluated processes and prognosis by Hispanic ethnicity among AIS patients encountered in urban setting.

Methods: We retrospectively reviewed prospectively-collected data on 1,117 AIS patients presenting within 12 hours of ictus to five hospitals in a tertiary–level stroke center network in San Diego, California. Variables of interest included pre-hospital factors, ED care processes, and favorable outcome (day-90 modified Rankin Scale [mRS] score of 0–1); all of which were adjusted for pre-specified covariates in a multivariable logistic regression model.

Results: There were 192 Hispanic AIS patients (17.2% of cohort) encountered from June 2004 to March 2011. Hispanic patients were significantly more likely to be younger, female, and diabetic. Hispanic patients arrived by ambulance (vs other arrival modes) less frequently (adjusted OR .56; 95% CI: .38–.81), trended toward a longer time of stroke onset to treatment decision (351.6 vs. 320.02 minutes, P=.07), and experienced a favorable day-90 outcome less often (adjusted OR .52, CI: .28–.96). However, for the day-90 outcome, there was no interaction between ambulance arrival and Hispanic ethnicity (P= .5614).

Discussion: Hispanic AIS patients in this study were less likely to arrive at the hospital by ambulance, and experienced half the odds of a favorable outcome compared to others. Strategies to boost ambulance utilization among Hispanic AIS patients and identify contributors to this worrisome outcome disparity are needed. (*Ethn Dis.* 2015;25[1]:19–23)

Key Words: Stroke Race-Ethnic, Emergency Medical Services, Hispanic, Prognosis, Outcome, Thrombolysis, Prognosis, Health Services, Ambulance, Disparities

INTRODUCTION

Bridging racial-ethnic disparities in health care is a top public health priority.[1,2] The Hispanic population of the United States, its fastest growing ethnic segment,[3,4] is expected to double by 2050 to 132.8 million people, or 30.2% of the nation's total population.[4] This rapid growth is forecasted to have important public health implications given the less favorable health status of Hispanics compared to non-Hispanic Whites. Indeed, stroke outcomes in Hispanics appear to be worse than in non-Hispanic Whites (NHWs), especially at younger ages.[5] While some of this difference can be attributed to traditional stroke risk factors such as a higher incidence of diabetes among Hispanics, access to, and use of medical care may also be contributors,[1,5,6] since a telephone survey of a bi-ethnic community in Texas suggested that Hispanics would be less likely to call 911 for stroke symptoms, possibly leading to unnecessary delays in acute stroke treatment.[7,8]

Few studies have specifically compared hospital arrival mode and emergency department (ED) care processes, as well as day-90 outcome (the most common timing of final assessment in phase 3 clinical trials) among Hispanic and non-Hispanic acute ischemic stroke (AIS) patients. The objective of our study was to compare ambulance arrival, ED processes of care, and 3-month functional outcomes by Hispanic ethnicity among AIS patients encountered in an urban setting.

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METHODS

We reviewed all code stroke calls from June 1, 2004 to March 31 2011, who were prospectively entered into an academic/tertiary stroke center database with an admission diagnosis of ischemic stroke. The database allows for collection of treatment times, sociodemographic, clinical, discharge and day-90 outcomes data on AIS patients presenting within 12 hours of ictus at six San Diego emergency departments for acute

stroke. Of the six hospitals, two are academic facilities, one is a veteran's hospital and three are community/private. Five of the six hospitals are The Joint Commission certified Primary Stroke Centers. Patients were excluded from this analysis if they were transferred from another hospital, had a stroke while in the hospital, or had a hemorrhagic stroke.

A multivariable logistic regression analysis was performed to control for multiple observed confounding factors. Discharge destination was compared between sexes using the Fisher's Exact test. A good outcome at hospital discharge was defined as discharge to home or acute and subacute rehabilitation facility. A poor outcome at discharge was defined as discharge to skilled nursing facility, death, and other (hospice).

For this study, specific variables of interest included self-reported ethnicity (Hispanic vs non-Hispanic), hospital arrival mode (ambulance vs other), time from stroke onset to ED arrival, time from stroke onset to head CT, time from stroke onset to treatment decision, t-PA use and day-90 modified Rankin Scale (mRS) score. The mRS is a simple clinician-reported measure of global disability that defines 7 clinically discrete patient disability categories including 6 levels of disability and 1 for death,[9] and has been shown valid and reliable.[7] Wilcoxon Rank-Sum test was used for comparisons of continuous variables and Fisher's Exact test was used for categorical variables. Favorable outcome was defined as day-90 modified Rankin Scale (mRS) score of 0–1.

Variables were considered to be confounders and included as covariates in the multivariable logistic regression models if found to be associated with Hispanic ethnicity ($P<.1$) based on univariate analysis or previously known (published data) to be associated with stroke outcomes. Covariates included in the arrival mode multivariable model were ethnicity, age, sex, National Insti-

tutes of Health Stroke Scale score (NIHSSS), which grades severity of an index stroke on a 42-point scale,[8] and t-PA-use. Covariates included in the day-90 outcome multivariable model were ethnicity, arrival mode, t-PA-use and the pre-specified covariates (ie, age, history of diabetes, baseline NIHSS, history of hypertension and smoking). All analyses were done with the statistical software R 2.1.1.

RESULTS

Over the study period, 2685 code stroke alerts were registered, of which a total of 1117 patients had an ED admitting diagnosis of AIS with a decision regarding t-PA and were included in this analysis. Among the patients included there were 192 Hispanic (17.2% of the cohort) and 925 non-Hispanic AIS patients. Hispanic patients differed from non-Hispanic patients in age (65.6 ± 17.3 vs 70.9 ± 14.8 years, $P=.0002$), female sex (57.8% vs 44%, $P=.0006$), and diabetes (37.5% vs 20%, $P<.0001$). Five-hundred and twenty-five participants (47%% of the cohort) received day-90 functional status assessment, but there were no significant differences in baseline characteristics between those who received vs did not receive day-90 assessment.

Median NIHSS at arrival was 7 for both Hispanic and non-Hispanics (mean 11.16 vs. 10.02 $P=.079$). Baseline mRS was 0–1 in 143 (74.48%) of Hispanics and in 695 (75.22%) of non-Hispanics ($P=.86$) (Table 1).

Hispanic patients arrived by ambulance (vs other arrival modes) less frequently than others (73.4% vs. 83.0%, adjusted OR .56; 95% CI: .38–.82, $P=.0025$) (Table 2). Time from stroke onset to emergency department arrival, arrival to head CT, and time from stroke onset to treatment decision did not differ significantly between groups (Table 1). Those arriv-

ing by ambulance trended toward being more likely to receive IV thrombolysis (OR 1.43 CI .99–2.05 $P=.053$).

Median hospital length of stay was 4 days for each group, with mean (SD) 5.63 (7.54) days for Hispanics and 5.32 (6.96) for non-Hispanics ($P=.92$). Discharge to home occurred in 90/186 (48.39%) of Hispanics and 393/911(43.14%) of non-Hispanics (adjusted OR 1.38 CI .94–2.03, $P=.095$).

Ninety day functional outcome data was available for 84 Hispanics and 441 non-Hispanics. Favorable outcome (mRS 0–1) was seen in 28.6% of Hispanic and 40.1% of non-Hispanic AIS patients (OR .53, CI .29–.97, $P=.0377$) (Table 3).

Additional analyses did not show an association between favorable 90-day outcome and the interaction between Hispanic ethnicity and arrival by ambulance. Nor was there a significant association between 90-day outcome and the interaction of Hispanic ethnicity and diabetes.

DISCUSSION

In this retrospective analysis of AIS patients encountered within a tertiary stroke center network in San Diego, California, we found disparities by Hispanic ethnicity in hospital arrival mode and day-90 outcome, even after adjusting for major confounders. Specifically, compared to their non-Hispanic counterparts, Hispanic AIS patients were about half as likely to arrive at the ED using an ambulance, and had approximately half the odds of a favorable functional outcome at 3 months post-ictus.

In comparison to previously published reports in which ambulance arrival to the hospital in the setting of AIS was only as high as 65%,[10,15,16] we observed ambulance arrival ranging from 73% to 83% in our cohort. The noted lower utilization of emergency medical services (EMS) by Hispanics vs

Table 1. Baseline sociodemographic and clinical characteristics of Hispanic vs. non-Hispanic acute ischemic stroke patients

Variable	Hispanic, N=192 n (%)	Not Hispanic, N=925 n (%)	P
Female	111 (57.8%)	407 (44%)	.0006
Diabetes	72 (37.5%)	185 (20%)	<.0001
Hypertension	132 (68.8%)	628 (67.9%)	.8651
Smoking history	67 (34.9%)	322 (34.8%)	>.9999
Pre-stroke mRS Score 0–1	143 (74.5%)	695 (75.22%)	.8546
	Mean ± SD, median	Mean ± SD, median	
Age	65.6 ± 17.3	70.9 ± 14.8	.0002
Baseline NIHSS	11.16 ± 9.31, 7	10.02 ± 9, 7	.0790
Stroke onset to arrival time, minutes	279.5 ± 554.1, 114	252.7 ± 485.8, 95	.4028
ED arrival to head CT, minutes	49.85 ± 45.46, 40	48.62 ± 46.25, 39	.8868
Stroke onset to treatment decision, minutes	351.6 ± 552.6, 193	320.0 ± 488.6, 160	.0741

t-PA, tissue plasminogen activator; NIHSSS, National Institutes of Health Stroke Scale Score; ED, emergency department.

non-Hispanics in our study is in accord with some prior investigations,[11,12] but in conflict with others,[10,13,14] that did not show any difference. Causes for less EMS use among Hispanics may be due to lack of awareness of stroke symptoms. Hispanic ethnicity has been associated with lower recognition of stroke symptoms and the need to call 911 compared with non-Hispanic Whites.[17,18] Also, our cohort may have included a proportion of undocumented Hispanic immigrants, who may be more reluctant than non-Hispanic Whites to use health services including EMS.[6,18] Finally, a lack of insurance may have also been another potential barrier among Hispan-

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ics,[6,12] though this issue was not specifically examined in our study.

Interestingly, despite the lesser EMS use among Hispanics, we found that there was no difference in time from stroke onset to ED presentation between Hispanics and non-Hispanics, which is not consistent with prior data that showed EMS use differences by ethnicity as well as corresponding distinctions in time from stroke onset to ED presentation.[11,15] This discrepancy between EMS use and onset to presentation by Hispanic ethnicity in our study may have been due to the rather wide range of arrival times seen in our cohort. Furthermore, methodological differences may have also occurred, as we did not formally compare arrival times of those using EMS to those arriving by other means such as private car.

Regarding care delays, we did not find that Hispanic ethnicity was associated with any delays once the patients

were in the ED. Prior research has shown that Hispanic stroke patients were more likely to wait over 15 minutes to see a physician than non-Hispanic Whites,[11,15] but more recent data, using the National Hospital Ambulatory Medical Care Survey for years 1997–2000 and 2003–2005 showed similar ED waiting times between Hispanics and non-Hispanic Whites.[16] Similar to our study, a biethnic population-based study in Corpus Christi, Texas, found that Mexican Americans were younger, more likely to have diabetes, less likely to have atrial fibrillation, and in spite of less frequent arrival by EMS, had similar rates of t-PA use to non-Hispanic Whites.[5]

A unique aspect of our study was the assessment of AIS functional outcome at 90 days, which as far as we are aware has not been previously evaluated between Hispanics and non-Hispanic AIS patients. Published studies have generally

Table 2. Multivariate logistic regression data for the outcome of ambulance arrival between Hispanic and non-Hispanic acute ischemic stroke patients[a]

Variable	Odds Ratio (95% CI)	P
Hispanic ethnicity	.56 (.38–.82)	.0029
Age	1.02 (1.01–1.03)	.0025
Male	.86 (.63–1.19)	.3660
Admission NIHSS	1.03 (1.01–1.05)	.0032
t-PA Use	1.43 (.99–2.05)	.0533

t-PA, tissue plasminogen activator; NIHSSS, National Institutes of Health Stroke Scale Score.
[a] Includes all variables entered in the multivariable model.

Table 3. Multivariate logistic regression data for favorable day-90 functional status (Modified Rankin Scale ≤1) between Hispanic and non-Hispanic acute ischemic stroke patients[a]

Variable	Odds ratio (95% CI)	*P*
Hispanic ethnicity	.53 (.29–.97)	.0406
Age	.98 (.96–.99)	.0011
Diabetes	.65 (.38–1.09)	.0991
Hypertension	.54 (.35–.85)	.008
Tobacco use	1.17 (.74–1.83)	.505
Admission NIHSS	.85 (.82–.89)	<.001
t – PA use	1.15 (.73–1.8)	.548

t-PA, tissue plasminogen activator; NIHSSS, National Institutes of Health Stroke Scale Score.
[a] Includes all variables entered in the multivariable model.

been limited to hospital discharge outcomes (which may not necessarily be a reliable indicator of final status), or have not included endpoints like functional status which are important to patient and caregivers.[5,12,19–22] We noted that Hispanic AIS patients had a worse functional outcome at 90 days compared with non-Hispanics. This disparity cannot be explained by utilization of rehabilitation services since we found similar rates of discharge to rehabilitation between Hispanics and non-Hispanics. Another consideration is that cultural factors may have influenced perception of mRS. Hispanics have been shown to have stronger family support compared with non-Hispanic Whites. More reliance upon family members may have artificially increased perceived mRS among Hispanics. This effect has been shown among Maori population in New Zealand, but not among Hispanics.[23] To further investigate other explanations for the outcome disparity observed we tested for interaction effects between hospital arrival mode vs Hispanic ethnicity, and diabetes vs Hispanic ethnicity.

Our study has limitations. Not all code stroke patients received a 90-day evaluation and although there were no significant baseline difference between those who received this evaluation and those who did not, bias may have been introduced into our outcome analysis. We also cannot readily generalize our findings to other acute stroke popula-

tions or within or beyond San Diego. Although there were patterns suggesting Hispanics who did not arrive by ambulance or were diabetic had higher odds of a poor outcome, these interactions did not reach statistical significance. While our database does not contain elements related to health literacy, access to health care, financial or insurance status, length of rehabilitation stay, it is conceivable that one or more of these elements, in addition to more subtle effects of lower EMS use and diabetes, may have contributed to the worse day-90 functional outcomes seen among the Hispanic AIS patients. Lastly, we did not have specific information on the actual timing of initiation of intravenous thrombolysis. The study is strengthened by its modestly large size, prospective data collection, inclusion of various hospital types, and stroke severity/outcomes assessment by certified investigators unaware of the goals of the study at the time of the assessments.

In summary, Hispanic AIS patients encountered in this San Diego Stroke Center Network used EMS less frequently and had poorer 3-month functional outcomes than non-Hispanics. The reasons for these disparities are not clear, and based on our analysis are not directly related. Additional prospective investigation is needed to identify the precise factors contributing to these disparities and develop strategies to bridge them.

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