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Stroke Quality Measures in Mexican Americans and Non-Hispanic Whites

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ABSTRACT

Mexican Americans (MAs) have been shown to have worse outcomes after stroke than non-Hispanic Whites (NHWs), but it is unknown if ethnic differences in stroke quality of care may contribute to these worse outcomes. We investigated ethnic differences in the quality of inpatient stroke care between MAs and NHWs within the population-based prospective Brain Attack Surveillance in Corpus Christi (BASIC) Project (February 2009- June 2012). Quality measures for inpatient stroke care, based on the 2008 Joint Commission Primary Stroke Center definitions were assessed from the medical record by a trained abstractor. Two summary measure of overall quality were also created (binary measure of defect-free care and the proportion of measures achieved for which the patient was eligible). 757 individuals were included (480 MAs and 277 NHWs). MAs were younger, more likely to have hypertension and diabetes, and less likely to have atrial fibrillation than NHWs. MAs were less likely than NHWs to receive tPA (RR: 0.72, 95% confidence interval (CI) 0.52, 0.98), and MAs with atrial fibrillation were less likely to receive anticoagulant medications at discharge than NHWs (RR 0.73, 95% CI 0.58, 0.94). There were no ethnic differences in the other individual quality measures, or in the two summary measures assessing overall quality. In conclusion, there were no ethnic differences in the overall quality of stroke care between MAs and NHWs, though ethnic differences were seen in the proportion of patients who received tPA and anticoagulant at discharge for atrial fibrillation.

Keywords: Stroke; Quality of Health Care; Mexican Americans; Thrombolysis; Anticoagulants

INTRODUCTION

Hispanics are now the largest minority population in the United States, with Mexican Americans (MAs) making up the largest sub-population.(United States Census Bureau, 2013) MAs have a higher risk of incident and recurrent stroke compared with non-Hispanic Whites (NHWs), and also have worse functional outcomes after stroke.(Lisabeth et al., 2014; Lisabeth et al., 2006; Morgenstern et al., 2013) Racial and ethnic disparities in stroke quality measures have been previously reported, though most studies have focused on differences involving African Americans, with relatively few studies specifically focused on Hispanic/Latino populations.(Cruz-Flores et al., 2011; Jacobs et al., 2006; Kelly, Hellkamp, Olson, Smith, & Schwamm, 2012; Reeves et al., 2010; Schwamm et al., 2010) One study based on the Get with the Guidelines (GWTG) database that did separately analyze Hispanics from other race-ethnic groups found few overall differences in stroke quality of care between Hispanics and non-Hispanic whites (NHWs), though Hispanics were less likely to have counseling for smoking cessation and discharge anti-thrombotics when adjusted for patient and hospital characteristics.(Schwamm et al., 2010) However, it is unknown if these findings are consistent in other health systems that do not participate in GWTG, within specific Hispanic sub-populations, or when addressed in a community-based study.

Investigation of potential ethnic differences in quality of care specifically between MAs and NHWs is warranted to determine if the observed ethnic differences in outcomes may be due to ethnic disparities in quality of stroke care. We investigated ethnic differences in the quality of inpatient stroke care in a population-based study in a bi-ethnic community without an academic medical center.

METHODS

Study population and case identification

This study was a pre-planned cross-sectional analysis from the prospective Brain Attack Surveillance in Corpus Christi (BASIC) Project. Detailed study methods have been previously reported.(Morgenstern et al., 2013) Briefly, active and passive surveillance were used to identify cases of stroke >44 years old presenting to one of six hospitals in Nueces County, Texas. This is a predominantly urban, bi-ethnic, non-immigrant community where the majority (62%) of residents are of MA descent(United States Census Bureau, 2014) and are second or third generation US residents. The six acute care hospitals (median bed size 154, range 72-345) in the community all have CT, MRI and neurology services. Two of the hospitals were certified by the Joint Commission as Primary Stroke Centers (one in January 2009 and the other in December 2010). Stroke diagnosis was validated by study physicians using source documentation blinded to ethnicity and age. Eligibility criteria for the current study included individuals with ischemic stroke presenting between February, 2009 and June, 2012. Ethnicity was determined from the medical record as we have previously reported high agreement between medical record and self-report in this community.(Morgenstern et al., 2004) Only individuals of NHW or MA ethnicity were included due to low numbers of individuals in other race-ethnic groups. If an individual had multiple events during the study period, only the first ischemic stroke was included. This study was approved by the Institutional Review Board of the University of Michigan (approval number HUM00041536) as well as the local Corpus Christi hospital systems. Screening the medical record for stroke cases was approved under a waiver of informed consent, with written consent obtained for detailed medical record review and interviews.

Medical record review and quality measures

Trained abstractors reviewed the medical record for key clinical characteristics. Initial National Institutes of Health Stroke Scale (NIHSS) was determined from the medical record or abstracted from the chart based on a previously validated method.(L. S. Williams, Yilmaz, & Lopez-Yunez, 2000) Highest level of education was assessed based on interview with the patient or proxy, as was pre-stroke disability (based on a published structured interview for the Modified Rankin Scale.(Wilson et al., 2002)) Health insurance status was determined from medical record review. The number of comorbid conditions was determined from the medical record and summed to create a comorbidity index for each patient (range 0-15).

Stroke quality measures were determined from the medical record by a trained abstractor, adapted from the 2008 Joint Commission Primary Stroke Center definitions. Data were collected on the following measures: 1) deep vein thrombosis prophylaxis; 2) discharged on antithrombotic therapy; 3) patients with atrial fibrillation receiving anticoagulation therapy at discharge; 4) thrombolytic therapy administered; 5) antithrombotic therapy by the end of hospital day 2; 6) discharged on cholesterol reducing medication; and 7) assessed for rehabilitation. Transferred patients had the quality measure attributed to the discharging hospital. Two summary measures of the overall quality of care were used.(Peterson et al., 2010) A composite opportunity score was created by dividing the number of performance measures that a patient met by the number of measures they were eligible for, such that the final score ranged from 0 to 1. A binary defect-free care variable was defined as a patient meeting all of the eligible performance measures. A reliability study of the individual quality measures was performed by having a second abstractor review a sample of 29 cases as described in the Appendix. The mean percent agreement was 92% (range 83-100%) for determination of inclusion/exclusion in the denominators and 97% (range 88% to 100%) for determination of inclusion/exclusion in the numerators.

Statistical Analysis

Descriptive statistics were calculated for all variables; differences by ethnicity were assessed using chi-square tests for categorical and Kruskal-Wallis tests for continuous variables. To examine ethnic differences in quality of care measures, we fit a Poisson model (unadjusted) with robust standard errors to report relative risk for the binary outcomes and a linear model (unadjusted) with robust standard errors for the continuous composite score. To account for hospital clustering, we then used generalized estimating equations (GEE) with a log link function for the binary outcomes (Lu & Tilley, 2001) and GEE with the identity link function for the continuous outcome, and robust standard errors were additionally corrected for the small number of clusters used (n=6 hospitals).(Mancl & DeRouen, 2001) Adjustment for hospital clustering was not performed for the tPA and anticoagulant for atrial fibrillation measures due to small numbers of eligible participants for these measures at some of the hospitals. In order to assess the effect of potential confounders of any observed ethnic differences in the quality measures, we sequentially added covariates to the regression models for each of the individual and overall quality measures, beginning with an unadjusted model including ethnicity alone (model 1), next adding in hospital clustering (model 2, except for tPA and atrial fibrillation measures as noted above), and then demographics including age and sex (model 3). To avoid overfitting the model, no additional adjustment was performed for the individual quality indicators due to the low number of outcome events per variable.(Peduzzi, Concato, Kemper, Holford, & Feinstein, 1996) However, for the two overall quality measures where there were a larger number of outcome events per variable, a final fully adjusted model (model 4) was developed to additionally adjust for education, insurance, pre-stroke disability (Modified Rankin 0-2 versus 3-5), NIHSS, and

comorbidity index. To estimate the impact of hospital system on quality, the absolute values for the intraclass correlation coefficients (ICC) were calculated from the hierarchical models (i.e., model 2) for the two overall quality outcomes. The functional form of continuous covariates (age, NIHSS) was assessed. Due to non-linear associations with outcome, age was modeled with quadratic term for the composite opportunity score and NIHSS was log transformed and modeled with a quadratic term for both overall quality measures.

RESULTS

A total of 844 individuals with ischemic stroke were identified during the study period, with 79 cases excluded for race-ethnicity other than MA or NHW, 5 excluded as not eligible for any quality measure, and 3 excluded due to missing covariates (2 for education and 1 for comorbidity index), leaving a total of 757 individuals available for analysis. Descriptive characteristics and stroke risk factors by ethnicity are shown in Table 1. MAs were younger, more likely to have hypertension and diabetes, and less likely to have atrial fibrillation than NHWs. Education and insurance were also different by ethnicity. There were no ethnic differences in the initial NIHSS, comorbidity index, or in-hospital mortality.

Table 1: Descriptive characteristics of the population overall and by ethnicity

Characteristic	**Non-Hispanic White N=277 (% unless specified)**	**Mexican American N=480 (% unless specified)**
Median Age (Q1, Q3)	72 (60, 82)	66 (57,78)
Female Sex	52.3	51.3
Hypertension	75.1	85.8
Diabetes	28.2	59.8
Prior stroke or TIA	30.7	33.5
High cholesterol	49.5	45.6
Atrial fibrillation	21.7	11.0
CAD or MI	30.0	34.8
Smoker	45.8	29.0
Median Comorbidity index (Q1, Q3)	3 (2, 5)	3 (2, 5)
Median NIHSS (Q1, Q3)	4 (2,10)	4 (2,9)
Baseline MRS 0-2	76.5	75.2
In-hospital death	3.6	3.1
Education		
Less than High school	13.7	52.7
High school	31.4	26.0
Vocational/some college	27.8	13.3
College or more	27.1	7.9
Insurance		
Self pay	12.3	16.9
Medicare, Medicaid and Medicare, or Veterans Affairs	15.9	24.4

Medicaid	1.4	3.3
Private, Private and Medicare	70.4	55.4

MA indicates Mexican American; NHW, non-Hispanic white; mRS, modified Rankin scale; TIA, transient ischemic attack; CAD, coronary artery disease; MI, myocardial infarction; and NIHSS, National Institute for Health Stroke Scale.

A descriptive summary for the individual quality measures and the two summary quality measures by ethnicity are reported in Table 2. Most of the individual measures were met in 80% or more of cases; exceptions included DVT prophylaxis (79.0% overall) anticoagulant at discharge for atrial fibrillation (70.1% overall), and acute stroke therapy with tPA administered (62.2% overall).

Table 2: Quality indicators, overall and by ethnicity

Quality indicator	**Non-Hispanic White (N=277)**		**Mexican American (N=480)**	
	N/D or median	**% or Q1, Q3**	**N/D or median**	**% or Q1, Q3**
Deep vein thrombosis prophylaxis at 48 hours	154/195	79.0	261/330	79.1
Discharged on antithrombotic	211/249	84.7	377/435	86.7
Anticoagulant at discharge for atrial fibrillation	53/66	80.3	36/61	59.0
tPA administered	27/36	75.0	29/54	53.7
Antithrombotic at 48 hours	228/241	94.6	405/434	93.3
Cholesterol medication at discharge	149/193	77.2	273/331	82.5
Rehabilitation evaluation	223/229	97.4	389/407	95.6
Summary measures				
Defect Free Care	161/277	58.1	284/480	59.2
Median composite score (Q1, Q3)	1.0	(0.8,1.0)	1	(0.8,1.0)

*N/D indicates Numerator/Denominator, e.g. number of patients attaining the quality measure over the number of patients eligible for the quality measure.

The regression models investigating ethnic differences in the individual indicators are shown in Table 3. Most of the individual measures did not show differences by ethnicity. However, MAs were less likely than NHWs to receive tPA (relative risk (RR) 0.72, 95% confidence interval (CI) 0.52, 0.98). Similarly, MAs with atrial fibrillation were less likely to receive anticoagulant medications at discharge when compared with NHWs (RR 0.73, 95% CI 0.58, 0.94). There were no ethnic differences in any of the other individual quality indicators. Note that the sequential model building (adding adjustment for hospital clustering when appropriate and then age and

sex) did not result in any meaningful changes in the magnitude of the association between ethnicity and any of the quality measures.

Table 3: Association of Mexican American ethnicity with individual quality indicators

Quality indicator	**Model 1: Unadjusted**	**Model 2: Add hospital clustering**	**Model 3: Add age* and sex**
	RR for MA[†] (95%CI)	RR for MA[†] (95% CI)	RR for MA[†] (95% CI)
Deep vein thrombosis prophylaxis at 48 hours	1.00 (0.91, 1.10)	1.00 (0.90,1.11)	1.00 (0.94, 1.06)
Discharged on antithrombotic	1.02 (0.96, 1.09)	1.02 (0.88, 1.19)	1.01 (0.89, 1.15)
Anticoagulant at discharge for atrial fibrillation[‡]	0.73 (0.58, 0.94)	-	0.74 (0.58, 0.94)
tPA administered[‡]	0.72 (0.52, 0.98)	-	0.70 (0.51, 0.96)
Antithrombotic at 48 hours	0.99 (0.95, 1.03)	0.99 (0.96, 1.01)	0.98 (0.94, 1.02)
Cholesterol medication at discharge	1.07 (0.98, 1.17)	1.06 (0.99, 1.13)	1.05 (0.97, 1.13)
Rehabilitation evaluation	0.98 (0.95, 1.01)	0.97 (0.88, 1.07)	0.97 (0.88, 1.08)

MA indicates Mexican American; RR, Relative Risk; and CI, confidence interval
*Age was modeled as a linear term.
[†]Reference group for Mexican American was non-Hispanic white.
[‡]Unable to adjust for hospital clustering due to small sample size for these quality measures, therefore model 3 includes only age, ethnicity, and sex as covariates.

The findings for the regression models for the two overall summary indicators are shown in Table 4. The absolute values for ICC for the hospital effect were < 0.01 for both the composite score and defect-free care, suggesting that there was little difference in quality across hospitals. For the composite quality score, ethnicity was not associated with quality in the unadjusted or adjusted models. Factors significantly associated with better quality of care in the fully-adjusted composite model included younger age, male sex, insurance, education, baseline modified Rankin of 0-2, and stroke severity. For the defect-free care measure, there was also no ethnic difference in quality in either the unadjusted or fully adjusted models. Factors associated with defect free care in the fully-adjusted model included younger age, male sex, lower comorbidity index, insurance, education, and stroke severity.

Table 4: Overall quality of care measures by ethnicity

	Model 1*	**Model 2[†]**	**Model 3[‡]**	**Model 4[§]**
	Estimate or RR (95%CI)	**Estimate or RR (95%CI)**	**Estimate or RR (95%CI)**	**Estimate or RR (95%CI)**
Composite Quality Score				

Estimate for MA	-0.004 (-0.034, 0.026)	-0.003 (-0.034, 0.028)	-0.01 (-0.026, 0.005)	-0.016 (-0.064, 0.032)
Defect Free Care				
RR for MA	1.01 (0.94, 1.09)	1.02 (0.82, 1.27)	0.99 (0.90, 1.10)	0.97 (0.86, 1.09)

MA indicates Mexican American; RR, Relative Risk; and CI, confidence interval.
Reference group for Mexican American was non-Hispanic white.
*Model 1: Unadjusted (ethnicity alone)
†Model 2: Add hospital clustering
‡Model 3: Add in age (linear term for the defect free and quadratic term for the composite score), and sex
§Model 4: Add education, insurance, pre-stroke disability (Modified Rankin 0-2 versus 3-5), National Institutes of Health Stroke Scale (log transformed and quadratic), and comorbidity index

DISCUSSION

We found no difference in the overall quality of stroke care provided between MAs and NHWs in this community using a measure of defect free care and a composite quality score. However, there were differences in some of the individual quality indictors, with MAs less likely than NHWs to receive intravenous tPA and to receive anticoagulant medications at discharge in the setting of atrial fibrillation. While the lack of difference in overall quality is reassuring, it is concerning that the magnitude of the ethnic differences seen in the tPA and discharge anticoagulant measures was quite large, with MAs about 30% less likely than NHWs to meet these measures. While the differences in tPA and discharge anticoagulant are potentially important and could contribute to health disparities between MAs and NHWs,(Lisabeth et al., 2014; Lisabeth et al., 2006) it seems unlikely that these two quality measures would entirely explain the observed ethnic differences in functional outcome and stroke recurrence, as less than 20% of patients were eligible for each of these measures.

There are a limited number of prior studies that have investigated the quality of stroke care among Hispanics.(Cruz-Flores et al., 2011) The largest study that specifically compared quality of care between Hispanics and NHWs was based on the GWTG data.(Schwamm et al., 2010) Our study differs from the in the GWTG dataset as it is a population-based sample from a community with a large, non-immigrant MA population. Similar to our study, the GWTG investigators found no difference in the overall quality of care between Hispanics and NHWs using a defect-free care measure. They did identify some statistically significant, but small absolute ethnic differences in individual quality indicators, with Hispanics less likely to receive discharge antithrombotics and smoking cessation counseling, but no differences were seen in other measures including tPA and anticoagulation for atrial fibrillation.(Schwamm et al., 2010) Our study adds to this prior work by specifically focusing on MAs, the largest sub-population of Hispanics, and identifies several areas of potentially large ethnic disparities in quality of stroke care in this community.

Examining the issue of discharge anticoagulant for atrial fibrillation in more detail, a prior study of nursing home residents found that Hispanics with stroke and an indication for anticoagulation were less likely than NHWs to receive warfarin, though this difference was attenuated when adjusting for demographics and other risk factors.(Christian, Lapane, & Toppa, 2003) In BASIC, we have previously reported that MAs are more likely than NHWs to have a recurrent stroke in the setting of atrial fibrillation, and that the recurrent strokes tended to be more severe among MAs.(Simpson et al., 2010) This prior analysis did not identify any ethnic difference in the proportion of patients discharged on warfarin, though the use of warfarin at discharge was low in both ethnic groups (<40%). The prior analysis was based on an earlier time

period (2000-2008) and had other minor methodological differences that complicate a direct comparison of results, though these two analyses suggest a worrisome pattern of disparities in the care of MA stroke patients with atrial fibrillation. This disparity is likely to be of increasing importance given the growing population of older MAs.(Vincent & Velkoff, 2010)

Our findings on the tPA and discharge anticoagulant measures should be interpreted with a degree of caution, as these two indicators had the smallest number of eligible individuals (90 for tPA and 127 for discharge anticoagulant) compared with other quality indicators, and therefore our ability to adjust for confounders was limited. Since these quality measures are designed by definition to identify only individuals eligible for the particular therapy, the unadjusted result is arguably the more important finding than the adjusted result, and it is the unadjusted raw proportion that is subject to public reporting of hospital outcomes. Therefore, identifying potential confounders of the ethnicity-quality relationship is useful to explain the reason for the disparity, but does not diminish the importance of the observed unadjusted ethnic difference in quality. Still, given the relatively small sample, further confirmation of these findings in other populations is warranted.

Other studies have suggested that hospital differences may be an important determinant of variability in quality of care.(Reeves et al., 2010; Schwamm et al., 2010) We found no evidence of an effect of hospital-level differences in quality of care in this community, as the hospital level ICC was quite small for the two overall quality measures. It is worth noting that the majority of cases in this study came from a single hospital, which may have limited our ability to detect hospital-level differences. Additionally, this is a smaller community relative to other reports (6 hospitals), and therefore quality may be more homogenous within the community. Two of the six hospitals in this community are certified as primary stroke centers, with one obtaining certification in January 2009 and the other in December 2010. Since our data collection started in February 2009, we did not formally investigate the effect of stroke center certification on quality due to low number of pre-certification cases available in these hospitals.

This study has limitations. While the quality measures were based on 2008 JC measures, minor adaptations to the quality measures were needed for the current study. As with any process measure, we cannot be certain if these differences are due to a true difference in treatment versus simply an artifact of differences in documentation of care. However, accurate documentation is one important dimension of quality, especially now with public reporting of stroke quality measures.

CONCLUSION

MAs were less likely than NHWs to receive certain recommended stroke treatments including intravenous tPA and anticoagulant medication at discharge for atrial fibrillation. While there was no ethnic difference in the overall quality of care provided, further investigation of these particular measures where larger differences were identified is warranted in order to design interventions to eliminate these disparities.

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APPENDIX: RELIABILITY OF QUALITY MEASURES

A random sample of thirty stroke cases for the time period 2011-2012 was selected for the reliability study. One case was ineligible due to a change in validation status leaving 29 cases eligible for the reliability study. Data elements for all quality measures were re-abstracted from the medical record by a second abstractor blinded to the prior assessment and compared to the original data. Reliability was considered in two ways following methods previously published for assessing the reliability of standardized performance measures.(S. C. Williams, Watt, Schmaltz, Koss, & Loeb, 2006) First, agreement was assessed for determination of whether a patient was included or excluded from the denominator for each quality measure (i.e., the quality measure population). Second, agreement was assessed for determination of whether a patient was included or excluded from the numerator for each quality measure, given that both raters included the patient in the denominator for that measure. Agreement was calculated as percent agreement, percent positive agreement, and percent negative agreement using the formulas outlined below.(Cicchetti & Feinstein, 1990) Kappa was not calculated given the imbalance in the marginal totals of the two by two tables for the quality measures which has been shown to result in artificially low estimates of kappa despite high agreement.(Cicchetti & Feinstein, 1990)

Proportion of positive agreement	2*a/(N+a-d)
Proportion of negative agreement	2*d/(N-a+d)
Proportion of observed agreement	(a+d)/N

In 2X2 table, a, b, c, d represent frequency of each cell

a	b
c	d

N = a+b+c+d

Results of the reliability study are included in Appendix Table 1 (denominators) and Appendix Table 2 (numerators). Percent agreement for determination of whether patients were included/excluded from the denominator for the quality measures ranged from 83% for deep vein thrombosis (DVT) prophylaxis to 100% for thrombolytic therapy administered (tPA). Percent agreement for determination of whether patients were included/excluded from the numerator for the quality measures ranged from 88% for antithrombotic at discharger to 100% for several of the measures (DVT prophylaxis, discharged on cholesterol reducing medication, patients with atrial fibrillation receiving anticoagulation therapy at discharge, tPA).

Appendix Table 1: Comparison of originally abstracted and re-abstracted data for determination of inclusion/exclusion in the denominator of the quality measure.

		Re-abstracted data				
Quality measure	**Original data**	**Yes**	**No**	**Observed proportion of agreement**	**Proportion of positive agreement**	**Proportion of negative agreement**
DVT prophylaxis at 48 hours	Yes	20	5	0.83	0.89	0.62
	No	0	4			
Discharged on antithrombotic	Yes	24	1	0.90	0.94	0.57
	No	2	2			
Anticoagulant at discharge for afib	Yes	4	0	0.97	0.89	0.98
	No	1	24			
tPA administered	Yes	4	0	1.00	1.00	1.00
	No	0	25			
Antithrombotic at 48 hours	Yes	26	2	0.93	0.96	0.50
	No	0	1			
Cholesterol medication at discharge	Yes	16	1	0.93	0.94	0.92
	No	1	11			
Rehabilitation evaluation	Yes	24	3	0.90	0.94	0.57
	No	0	2			

Appendix Table 2: Comparison of originally abstracted and re-abstracted data for determination of inclusion/exclusion in the numerator* of the quality measure.

		Re-abstracted data				
Quality measure	**Original data**	**Yes**	**No**	**Observed proportion of agreement**	**Proportion of positive agreement**	**Proportion of negative agreement**
DVT prophylaxis at 48 hours	Yes	18	0	1.00	1.00	1.00
	No	0	2			
Discharged on antithrombotic	Yes	18	1	0.96	0.97	0.91
	No	0	5			
Anticoagulant at discharge for afib	Yes	4	0	1.00	1.00	0.00
	No	0	0			
tPA administered	Yes	4	0	1.00	1.00	0.00
	No	0	0			
Antithrombotic at 48 hours	Yes	21	2	0.88	0.93	0.57
	No	1	2			
Cholesterol medication at discharge	Yes	15	0	1.00	1.00	1.00
	No	0	1			
Rehabilitation evaluation	Yes	23	1	0.96	0.98	0.00
	No	0	0			

*Agreement statistics for numerator were calculated when both raters included the record in the indicator population.