Disparities in Acute Stroke Care: Role of Race and Insurance Status

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Abstract: *Background*: Minorities constitute groups with higher risk of stroke and stroke severity. Disparities in stroke care may result from greater prevalence of risk factors, barriers to medical care, and lower utilization of preventive therapies. Insurance status may be one limiting factor in access to care and preventive measures.

Purpose: We hypothesize that vascular risk factors differ between racial groups and that insurance status may affect stroke treatment, secondary prevention measures, stroke severity, and outcomes.

Methods: We included 1061 consecutive patients with ischemic stroke (2005-2008) in our local Get-With-The-Guidelines (GWTG) database. Multivariate logistic regression analysis was used to evaluate the relation of race and insurance status to risk factors, intravenous thrombolytic therapy (IV-tPA) use, stroke severity (National Institute of Health Stroke Scale [NIHSS]), hospital complications, and ambulatory status at discharge.

Results: Whites were older than Non-Whites (mean age 65 vs 62 years, $p<0.001$), and had higher prevalence of atrial fibrillation, coronary artery disease, and carotid stenosis ($p<0.01$). Non-whites were more likely to have hypertension and diabetes ($p<0.01$), peripheral arterial disease ($p<0.05$), and be uninsured ($p<0.001$). More IV-tPA was used in insured patients (24 vs 2). Blacks and other groups were more likely to be discharged on antihypertensive treatment (OR 1.9, 95% CI 1.0-3.6, and OR 3.8, 95% CI 1.1-13.4 respectively, $p=0.04$). Blacks were more likely to be discharged on lipid lowering treatment than Whites (OR 3.5, 95% CI 1.4-8.6, $p=0.02$). There were no significant differences on hospital complications, ambulatory status on discharge or discharge location.

Conclusion: Data at this safety-net hospital suggests racial disparities in stroke risk factors and insurance status, both of which are potential targets for prevention of stroke. Follow up studies are required to clarify the role of universal insurance coverage in reduction of stroke risk and its complications.

Keywords: Stroke, racial disparities, GWTG.

INTRODUCTION

Stroke is a heterogeneous disorder and wide-ranging factors affect its incidence, severity and outcomes. Previous studies suggest that disparate stroke measures between racial groups play a role in this heterogeneity [1]. More minorities suffer stroke, at a younger age, and with greater severity [1-3]. These disparities may be the result of biological differences that predispose certain racial groups to high blood pressure, greater disease severity, and higher mortality related to diseases overlapping with stroke [4,5], and/or sociocultural factors that lead to lower utilization of preventive measures and stroke therapies [6-8]. Among the available treatments for acute ischemic stroke, the use of intravenous thrombolytic therapy (IV-tPA) is pivotal in improving functional outcomes [9]. Previous studies suggest disparate acute stroke care, with minorities less likely to receive IV-tPA treatment [10]. Although post-stroke mortality is similar among patients across racial groups, low income patients and minorities have longer hospital stays [11]. In this context, insurance status may be an important factor limiting access to stroke care and prevention measures, and a potential reason for the low use of IV-tPA observed in minorities [12].

Previous studies suggest disparities related to insurance status - in particular higher initial stroke severity, mortality, and length of stay for uninsured patients. The increase in length of stay has been attributed to the inability to transfer uninsured patients and that disparities in insurance status may drive observed racial disparities [13-15].

We hypothesize that disparate insurance status in minorities may affect acute stroke treatments (i.e. IV-tPA utilization), prevention measures, stroke severity, and outcomes. Further characterization of such differences across racial and socioeconomic groups will help to identify targets for interventions at public health level, with measures directed to specific sectors

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of the population and/or health policy changes to improve health care access to minorities.

METHODS

Study Sample

Boston Medical Center (BMC) has been a collaborator in the Get-With-The-Guidelines (GWTG) Stroke project with the American Heart Association (AHA) since August 2005. GWTG has been previously described [16]. Participating hospitals enter data for each stroke patient directly into a central de-identified databank via a password protected portal managed by Quintile. Only BMC data was used for this study with each stroke patient entered tracked from the ER until discharge. This study included a sample of 1,061 patients with ischemic stroke or transient ischemic attack (TIA) from August 1, 2005 through December 31, 2008. This dataset was approved by the Boston University IRB for research purposes as well as for quality assurance.

STUDY MEASUREMENTS

Race

Based on self-report on hospital admission or from existing medical records, following the U.S. census model and standard definitions outlined in Directive 15 [17]. Upon registration, patients are asked: (1) Hispanic/Spanish origin? (no/yes), and (2) best racial? (White; Black or African-American; Eskimo or Aleutian (Alaskan native); Asian or Pacific Islander; other [specify]). For the present study, ethnicity (i.e. Hispanic/Spanish origin) was unavailable. Race group of the patients was classified following their report as White, Black, or Other.

Outcome Measures

Three areas were evaluated: 1) stroke severity and functional disability, 2) hospital acute treatments and stroke care, and 3) discharge medical therapies.

Stroke severity was measured by the admission National Institute of Health stroke scale (NIHSS). Discharge functional status was determined by ambulatory status categorized as independent, ambulatory with assistance, or unable to walk. Discharge location included: home with self care, home with in-home care, acute rehabilitation center, subacute nursing facility, or death.

Evaluated areas of stroke care during hospitalization were: IV-tPA use, care provided for medical complications, and length of hospital stay. The three medical complications reviewed were: urinary tract infection (UTI) defined as positive urine culture and signs of infection, deep venous thrombosis (DVT) confirmed by duplex ultrasound, and pneumonia defined by positive chest X-ray and signs of infection. Length of hospital stay was defined as the number of hospital days from admission to discharge from the stroke unit.

Last, discharge medical therapies included secondary stroke prevention treatments such as statins, antihypertensive and diabetic medications, antiplatelet therapy, and warfarin.

Statistical Analysis

Descriptive statistics of the sample were obtained. Multivariable logistic regression analyses were done to relate race and insurance status categories to pertinent dichotomous outcomes. For each outcome, a crude model with race alone was run first, then a second model was run including race, insurance and their interaction; the interaction term was dropped if not significant. Finally, multivariable adjusted models were then run with race group and insurance status as main predictors. Covariates in each model included baseline patient characteristics related to the outcomes in prior or current study: age, sex, cardiovascular risk factors (atrial fibrillation, previous stroke/TIA, coronary artery disease or prior myocardial infarction, carotid stenosis, diabetes, peripheral vascular disease, hypertension, dyslipidemia, smoking) and stroke severity on admission by NIHSS score. To analyze functional outcomes and discharge location, additional adjustment was done for medical complications during hospitalization.

All analyses were determined a priori. A two-sided p-value <0.05 was considered statistically significant. Analyses were performed using SAS Version 9.13 (SAS Institute, Cary, NC).

RESULTS

The study sample included 1,061 patients, 84% with ischemic stroke and 16% with TIA. Baseline sample characteristics are shown in Table **1**. The overall race distribution was 39% White (n=412), 43% Black (n=458), 18%, others (n=191). Whites (mean age 65 years) were older than Blacks and other racial groups (both had mean age of 62 years), $p<0.001$. Whites had greater prevalence of atrial fibrillation, coronary artery disease and carotid stenosis ($p<0.01$), whereas Blacks

and other groups had higher prevalence of hypertension and diabetes (p<0.01). Peripheral arterial disease was less frequent in Blacks (p<0.05). Smoking history and history of cerebrovascular events were similar among the groups.

The overall distribution according to insurance status was 11% uninsured (n=117), 89% insured (n=944). We observed significant disparities between groups in terms of insurance status. Blacks and other groups were more likely to be uninsured (p<0.001). Stroke severity measured by NIHSS scores did not differ among the groups (Table **1**).

IV-tPA was used in 2.4% of all patients (N=26). More IV-tPA was used in insured patients (24 [2.6%] vs 2 [1.7%], p=0.58). The most frequent reasons for not giving IV-tPA within 3 hours were late arrival to ER (54.1% insured, 50% uninsured), and rapid improvement of symptoms (21% insured, 26% uninsured).

Medical complications during hospitalization varied across racial groups and insurance status, but differences were not statistically significant. Deep venous thrombosis occurred more frequently in Blacks, and insured patients had lower rates of pneumonia (Tables **2** and **3**). There were no differences on ambulatory status on discharge or discharge location.

Discharge medical therapies did not vary by insurance, but there were differences by race (Tables **3** and **4**). Blacks and other groups were more likely to be discharged on antihypertensive treatment (OR 1.9, 95% CI 1.0-3.6, and OR 3.8, 95% CI 1.1-13.4 respectively, p=0.04). Blacks were more likely to be discharged on lipid lowering treatment than Whites (OR

Table 1: Baseline Characteristics of Patients (N=1.061)

		White(n=412)n (%)	Black(n=458)n (%)	Other(n=191)n (%)	P-value
Clinical characteristics					
Age, mean (SD)		65.3 (15.4)	61.5 (15.4)	61.6 (15.7)	0.0005
Sex, Male		188 (45.6)	207 (45.2)	104 (54.5)	0.0757
No medical history		54 (13.1)	35 (7.6)	15 (7.9)	0.0156
Atrial fibrillation		58 (14.1)	33 (7.2)	19 (9.9)	0.0040
Coronary artery disease		79 (19.2)	59 (12.9)	20 (10.5)	0.0056
Carotid stenosis		10 (2.4)	1 (0.2)	3 (1.6)	0.0162
Diabetes Mellitus		119 (28.9)	185 (40.4)	74 (38.7)	0.0012
Dyslipidemia		154 (37.4)	163 (35.6)	87 (45.5)	0.0547
Hypertension		277 (67.2)	361 (78.8)	145 (75.9)	0.0004
Previous stroke/TIA		113 (27.4)	119 (26.0)	57 (29.8)	0.5988
Peripheral vascular disease		16 (3.9)	6 (1.3)	7 (3.7)	0.0459
Smoking		70 (17.0)	79 (17.2)	36 (18.8)	0.8468
Stroke severity					
NIHSS, mean(SD)		4.6 (5.8)	4.3 (4.8)	4.2 (5.1)	0.6893
Admission NIHSS	0-8	192 (80.7)	258 (83.5)	98 (86.7)	0.3531
	9+	46 (19.3)	51 (16.5)	15 (13.3)	
Admission NIHSS	0-3	150 (63.0)	182 (58.9)	67 (59.3)	0.1687
	4-8	42 (17.6)	76 (24.6)	31 (27.4)	
	9+	46 (19.3)	51 (16.5)	15 (13.3)	
Insurance Measures*					
Insurance coverage	Medicare	198 (48.1)	189 (41.3)	64 (33.7)	<0.0001
	Other private	178 (43.2)	196 (42.8)	76 (40.0)	
	Medicaid/None	36 (8.7)	73 (15.9)	50 (26.3)	
Insurance status	Insured	381 (92.5)	408 (89.1)	154 (81.1)	0.0002
	Uninsured	31 (7.5)	50 (10.9)	36 (18.9)	

NIHSS= National Institute of Health Stroke Scale. * Chi square.

Table 2: Frequency of Medical Complications during Hospitalization

		Insured, n (%)				Uninsured, n (%)			
		White	**Black**	**Other**	**All**	**White**	**Black**	**Other**	**All**
Deep vein thrombosis	No	287 (79.5)	286 (73.5)	115 (78.2)	688 (76.7)	20 (64.5)	29 (59.2)	28 (80.0)	77 (67.0)
	Yes	74 (20.5)	103 (26.5)	32 (21.8)	209 (23.3)	11 (35.5)	20 (40.8)	7 (20.0)	38 (33.0)
Urinary tract infection	No	113 (97.4)	132 (96.4)	44 (97.8)	289 (97.0)	5 (100.0)	14 (100.0)	13 (100.0)	32 (100.0)
	Yes	3 (2.6)	5 (3.6)	1 (2.2)	9 (3.0)	0	0	0	0
Pneumonia	No	315 (96.3)	347 (99.1)	130 (98.5)	792 (97.9)	26 (96.3)	39 (90.7)	30 (100.0)	95 (95.0)
	Yes	12 (3.7)	3 (0.9)	2 (1.5)	17 (2.1)	1 (3.7)	4 (9.3)	0	5 (5.0)

Table 3: Multivariable Analysis of Outcomes by Race and Insurance Status

Outcome (R=reference group)	**Race**				**Insurance Status**		
	Black	**Other**	**White(R)**	**p-value**	**Insured**	**Not insured(R)**	**p-value**
	OR (95%CI)	**OR (95%CI)**	**OR (95%CI)**		**OR (95%CI)**	**OR (95%CI)**	
IV t-PA given**	0.9 (0.4, 2.2)	1.3 (0.5, 3.6)	1.0 (--)	0.78	1.5 (0.4, 6.5)	1.0 (--)	0.58
Medical complications							
Deep Venous Thrombosis	1.5 (0.9, 2.2)	1.4 (0.8, 2.5)	1.0 (--)	0.19	0.8 (0.5, 1.4)	1.0 (--)	0.42
Pneumonia**	0.5 (0.2, 1.2)	0.3 (0.1, 1.5)	1.0 (--)	0.15	-	-	-
Urinary tract infection **					0.4 (0.1, 1.1)	1.0 (--)	0.08
Discharge medications							
Antithrombotics	1.5 (0.8, 2.6)	0.9 (0.5, 1.9)	1.0 (--)	0.35	0.9 (0.4, 2.0)	1.0 (--)	0.85
Anticoagulants	1.1 (0.7, 1.8)	1.4 (0.7, 2.5)	1.0 (--)	0.63	0.8 (0.4, 1.7)	1.0 (--)	0.60
Smoking cessation counseling	0.7 (0.2, 2.5)	0.5 (0.1, 2.1)	1.0 (--)	0.63	2.3 (0.7, 7.6)	1.0 (--)	0.18
At discharge							
Independent ambulatory status at discharge*	1.1 (0.6, 2.1)	0.7 (0.3, 1.6)	1.0 (--)	0.46	1.1 (0.4, 2.6)	1.0 (--)	0.90
Home (self care) discharge location*	1.8 (1.0, 3.2)	1.3 (0.6, 2.6)	1.0 (--)	0.13	0.9 (0.4, 1.9)	1.0 (--)	0.73

Models include both race and insurance status. Adjusted for age, sex, cardiovascular risk factors (hypertension, diabetes, dyslipidemia, smoking, prior stroke or TIA, length of hospital stay, and NIHSS. *Additionally adjusted for medical complications (deep venous thrombosis, urinary tract infection, pneumonia). **Crude models only due to small sample size, race and insurance status separately.

3.5, 95% CI 1.4-8.6, p=0.02). There were no differences on ambulatory status on discharge or discharge location.

DISCUSSION

Our study results showed significant racial differences in the prevalence of key stroke risk factors and insurance status, with minorities less likely to be insured. Despite these differences among racial groups, we did not observe significant differences in stroke severity, in-hospital complications, functional status at time of discharge, and discharge location. Medication prescribed at discharge did differ significantly among racial groups.

Differences in the prevalence of stroke risk factors between Whites and Blacks have previously been reported in population studies [18]. Risk factors such as cardiac disease and atrial fibrillation have been shown to occur more in Whites [19], and hypertension and diabetes more in Blacks [20]. Although Whites were slightly older than Non-whites in this study, and the

Table 4: Use of Secondary Prevention Treatments on Discharge

		Insured, n (%)				Uninsured, n (%)			
		White	**Black**	**Other**	**All**	**White**	**Black**	**Other**	**All**
Antithrombotics	No	79 (20.8)	71 (17.4)	24 (15.6)	174 (18.5)	8 (25.8)	6 (12.0)	6 (16.7)	20 (17.1)
	Yes	301 (79.2)	337 (82.6)	130 (84.4)	768 (81.5)	23 (74.2)	44 (88.0)	30 (83.3)	97 (82.9)
Anticoagulants*	No	324 (85.3)	353 (86.5)	127 (82.5)	804 (85.4)	28 (90.3)	44 (88.0)	29 (80.6)	101 (86.3)
	Yes	56 (14.7)	55 (13.5)	27 (17.5)	138 (14.6)	3 (9.7)	6 (12.0)	7 (19.4)	16 (13.7)
Antihypertensives*	No	118 (31.0)	82 (20.1)	38 (24.7)	238 (25.2)	9 (29.0)	9 (18.0)	9 (25.0)	27 (23.1)
	Yes	263 (69.0)	326 (79.9)	116 (75.3)	705 (74.8)	22 (71.0)	41 (82.0)	27 (75.0)	90 (76.9)
Lipid lowering therapy*	No	137 (36.0)	134 (32.8)	49 (31.8)	320 (33.9)	12 (38.7)	14 (28.0)	9 (25.0)	35 (29.9)
	Yes	244 (64.0)	274 (67.2)	105 (68.2)	623 (66.1)	19 (61.3)	36 (72.0)	27 (75.0)	82 (70.1)
Diabetic treatment*	No	269 (70.6)	244 (59.8)	97 (63.0)	610 (64.7)	22 (71.0)	35 (70.0)	20 (55.6)	77 (65.8)
	Yes	112 (29.4)	164 (40.2)	57 (37.0)	333 (35.3)	9 (29.0)	15 (30.0)	16 (44.4)	40 (34.2)
Smoking cessation counseling*	No	210 (78.1)	216 (78.0)	84 (78.5)	510 (78.1)	20 (74.1)	28 (68.3)	17 (63.0)	65 (68.4)
	Yes	59 (21.9)	61 (22.0)	23 (21.5)	143 (21.9)	7 (25.9)	13 (31.7)	10 (37.0)	30 (31.6)

*Treatments provided to applicable patients.

prevalence of atrial fibrillation increases with age, we doubt the age gap between groups was sufficient to explain the difference in atrial fibrillation prevalence. In a separate report using the REGARD observational study data, researchers found that Blacks are more likely to experience undiagnosed or untreated atrial fibrillation as well as other key stroke risk factors. Perhaps genetic factors [21] might also explain some of the difference.

The role of insurance status in stroke care has not been clearly defined. The lack of insurance may significantly inhibit medical care, as patients are more reluctant to seek medical attention because of cost, and delay medical care because of longer hospital processing time. Studies have shown that Mexican-Americans and Blacks have more difficulties in accessing medical care in general than Whites [22]. Perhaps the lack of adequate insurance plays a part. Furthermore, this same set of patients who avoid tertiary care may also avoid preventive care. While the differences in cardiovascular risk factor and insurance status observed did not show a significant effect on the outcomes evaluated, we believe that a more robust outcome evaluation tool such as modified rankin scale (mRS) and longer follow up periods may better be able to define the effects. Insurance status is an important factor to evaluate in view of the recent mandate for obligatory health insurance. A follow-up study post mandatory health coverage may shed more light in the role of insurance coverage.

The use of IV-tPA for the treatment of acute ischemic stroke has remained low [23]. Our rates reflect the infrequent use of IV-tPA in an urban setting. The most common reasons we observed were improving symptoms and late arrival to ER, both of which are potential targets for intervention. The decision to withhold IV-tPA for acute ischemic stroke in patients with mild deficits has been brought into question by recent studies suggesting that its use may be justified in patients with partial improvement in symptoms, as disabling deficits may persist [24]. Furthermore, late arrival to the ER is a factor that can be altered through educational efforts targeting minorities at the community level [25]. Our study cannot infer any aspects of the role of insurance on IV-tPA use, but raises a question for this relation.

Regarding occurrences of medical complications during hospitalization, we observed DVT more frequently in Blacks. Although the difference did not reach statistical significance, prior studies suggest higher incidence of venous thromboembolism in Blacks compared with Whites and Hispanics [26]. The reasons for such disparities are unclear, but offer possible medical intervention and care improvement opportunities to increase awareness, prevention, and aggressive DVT prophylaxis in this higher risk group. The observation of lower pneumonia rates in Whites is intriguing. One potential explanation, provided by previous reports, suggests significantly higher rates of vaccination in Whites compared to Blacks [27].

However, this is unlikely to be the sole explanation. Similar complications may explain the increased risk for readmission in elderly Black patients, after hospitalization for myocardial infarction and pneumonia [28].

The use of medications for secondary stroke prevention at the time of discharge varied across the groups but this is likely related to higher diagnosis of hypertension and hyperlipidemia in Blacks and other groups when compared to Whites.

There are three major limitations to this study. First, while this study attempts to evaluate the role of race and insurance status in acute stroke care, we were not able to ascertain a more thorough characterization of 'race', and ethnic group was not determined. Constrained by the intake format of this information (based on U.S. Census), we cannot clearly stratify our population by factors such as birth country. As a result, the three groups analyzed do not fully represent the diverse patient population in our community. Secondly, the study design limits generalization of results. As with any convenient sampling studies, it comes with inherent bias. The study's results provide points of interest pertaining to the experience of one urban hospital, but a multi-center and community study would be needed to provide generalizable results. Lastly, in order to evaluate use of IV-tPA and in-hospital complications within this framework (given the very small use of tPA nationally), a larger sample is needed.

CONCLUSION

This study evaluated an urban safety-net hospital serving a catchment heavily populated by minorities. The primary results showed significant race differences in the prevalence of key stroke risk factors, and disparities in insurance status among the racial groups, with minorities less likely to be insured. The results are preliminary, but suggest potential targets for intervention at the individual and community level to reduce stroke risk in minorities. Whether current health policies to promote universal insurance coverage result in changes in vascular risk factors, stroke risk and severity and use of preventive and therapeutic measures in minorities, need follow up studies.

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CONFLICTS OF INTERESTS

None declared.

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