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Patient Awareness and Perception of Stroke Symptoms and the Use of 911

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Abstract

Background—Response to stroke symptoms and the use of 911 can vary by race/ethnicity. The quickness with which a patient responds to such symptoms has implications for the outcome and treatment. We sought to examine a sample of patients receiving a REACH (Remote Evaluation of Acute isCHemic stroke) telestroke consult in South Carolina regarding their awareness and perception of stroke symptoms related to the use of 911, and to assess possible racial/ethnic disparities.

Methods—As of September 2013, 2,325 REACH telestroke consults were conducted in thirteen centers throughout South Carolina. Telephone surveys assessing use of 911 were administered from March 2012–January 2013 among 197 patients receiving REACH consults. Univariate and multivariable logistic regression was performed to assess factors associated with use of 911.

Results—Most participants (73%) were Caucasian (27% were African-American) and male (54%). The mean age was 66 + 14.3 years. Factors associated with use of 911 included National Institutes of Health Stroke Scale scores >4 (OR=5.4, 95% CI: 2.63, 11.25); unknown insurance, self-pay, or not charged (OR=2.90, 95% CI: 1.15, 7.28); and perception of stroke-like symptoms as an emergency (OR=4.58, 95% CI: 1.65, 12.67). African-Americans were significantly more likely than Caucasians to call 911 (62% vs. 43%, $p=0.02$).

Conclusions—African-Americans used 911 at a significantly higher rate. Use of 911 may be related to access to transportation, lack of insurance, or proximity to the hospital although this information was not available. Interventions are needed to improve patient arrival times to telemedicine equipped emergency departments after stroke.

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Keywords

stroke; emergency medical services; 911; perception

INTRODUCTION

Stroke is a leading cause of death nationally and internationally [1, 2] and is associated with enormous public health burden, reductions in quality of life, increased health care costs, and a loss in economic productivity. Stroke is the 4th leading cause of death in the U.S. [3]. In South Carolina, stroke was the 3rd leading cause of death and ranked 8th among other states in 2006 [4]. Disparities related to stroke morbidity and mortality exist in South Carolina [5] as young African-Americans (aged 45–65 years) are more likely to have a stroke than Caucasians [6]. Over the past decade, mortality rates for stroke have decreased in South Carolina but remain 53% higher among African-Americans [5].

In 2009, stroke hospitalizations alone cost South Carolina nearly \$560 million and the associated economic costs were approximately 40% higher among African-Americans (approximately \$8,500 more per patient) compared to Caucasians [5]. Rural counties have also experienced an increase (10%) in stroke hospitalization rates between 2008–2009, due possibly to issues related to access to care [5].

REACH MUSC telemedicine program

The REACH (**R**emote **E**valuation of **A**cute **i**schemic Stroke) MUSC (Medical University of South Carolina) telemedicine program was created in 2008 as a web-based outreach for the evaluation and treatment of stroke at thirteen outlying hospitals in South Carolina. After virtually examining patients and brain images, the MUSC stroke team provides urgent consultations via the web. Patients may also be transferred to MUSC for additional diagnostic procedures and treatment, as needed. To date, over 3,500 consultations have been performed.

Benefits of the use of emergency medical services, such as 911

Use of emergency medical services (EMS) such as 911, a central number to call for help and emergency transport to the hospital, is vital in the event of a stroke as nearly 50% of stroke deaths occur prior to arrival at the emergency department (ED) [7]. In addition, the benefits of using EMS include the potential for alerting the hospital and stroke team in advance, significantly shorter door to needle time for tissue plasminogen activator (tPA) administration, and earlier brain imaging [8–12]. It is well known that the majority of stroke patients delay going to the ED after symptom onset [8, 13–20]. The delay in ED arrival is mediated by the use of EMS, such as 911 [8, 10–12, 21–24], with prior studies showing EMS use among acute stroke patients as approximately 50% [25–28]. Earlier arrival is important as it results in early institution of therapy which has been associated with reduced morbidity, mortality, and disability related to stroke [10, 29–33]. Stroke-related disability is related to the size of the infarct, which can increase with delay in treatment [31, 33, 34]. As administration of tPA is currently very low (1%–5%) among patients with ischemic strokes

due to the time sensitive nature of treatment [11, 19, 35, 36], an increase in administration would be expected following reductions in delays from symptom onset to the ED.

Objective

The aim of the current study was to assess awareness and perception of stroke symptoms associated with the use of 911 related to the ED visit that resulted in the REACH telestroke consult.

METHODS

Survey Design

A sample of patients receiving REACH consults was surveyed to assess awareness and perception of stroke symptoms as they related to 911 use. The survey was adapted from two previously validated medical questionnaires (Stroke Education and Prevention - South Carolina [STEP-SC] and the 2009 Behavior Risk Factor Surveillance System [BRFSS] Module 8: Heart Attack and Stroke). Alpha pilot testing was conducted in-person among randomly selected patients (n=4) by a trained stroke care nurse during the three week post-stroke follow-up clinical visit. The study was approved by the Institutional Review Board of MUSC and the Department of Defense (DoD) Telemedicine and Advanced Technology Research Center (TATRC). A multidisciplinary team designed the questionnaire and pilot tested the survey in a similar stroke population.

A random sample (n=640, 28%) of 2,264 patients receiving REACH consults between May 2008-September 2012 was selected (every third patient) to be contacted between March 2012-January 2013 to participate in a telephone survey. One county was oversampled due to an ongoing EMS study (n=71). Surveys were administered by phone by trained interviewers, and information regarding the stroke symptoms that led to the consult, how and when patients arrived at the ED, knowledge and use of 911, and any associated comorbidities such as hypertension or diabetes were obtained.

640 patients were contacted, of which 57 were deceased, letters were returned to sender for 49, and the address was inaccurate or unavailable for three patients resulting in 531 eligible patients. A total of 334 individuals did not participate for the following reasons: unsuccessful after ten attempts (n=57), refused (n=57), disconnected phone (n=138), wrong number (n=51), did not have a phone number (n=27), or resided in a nursing home or assisted living facility (n=4). Thus, of the 531 eligible patients, a total of 197 patients (37%) agreed to participate in the survey.

Four individuals were under the age of eighteen. Proxies were permitted to complete the survey on behalf of patients who were unable to do so on their own and for deceased patients with no record of death, and included spouses, family members, or other (a nurse and significant other) (n=61; 31%). Race was characterized as African-American or Caucasian. Time from onset of symptoms to the ED door was evaluated as 270 minutes and >270 minutes.

The National Institutes of Health (NIH) Stroke Scale (NIHSS) score, which is used by physicians and health care professionals to measure the level of stroke impairment and to determine whether tPA may be administered, was available through the REACH database. NIHSS scores were compared among participants and non-responders. NIHSS scores range from 0 to 42, with 42 indicating the most severe impairment. In 1999, Adams et al. characterized NIHSS scores ≤ 4 as mild impairment and NIHSS scores >4 as moderate or severe impairment [37].

Statistical Analysis

REDCap (Research Electronic Data Capture) electronic data capture tool was used for the collection and management of study data [38]. Descriptive statistics including t-tests, chi-square tests, and the Mann-Whitney U test were performed comparing demographic characteristics among those who completed the survey (participants) compared to those who did not complete the survey (non-responders). Characteristics of the overall REACH cohort were summarized. Descriptive statistics were also used to examine survey responses among the main outcome of interest, use of 911. Univariate logistic regression was performed to identify factors independently associated with the outcome. Backwards multivariate logistic regression was performed and nonsignificant terms removed to determine the most parsimonious model for the outcome of interest. Interaction terms were assessed and excluded as no significant effects were found. The final model included three significant terms. Statistical Package for the Social Sciences (SPSS) version 21 was used to conduct all statistical analyses (IBM, Chicago) [39].

RESULTS

Demographic and clinical characteristics for survey participants and non-responders are displayed in Table 1. Those who completed the survey were significantly more likely to be Caucasian than African-American (73% vs. 27%, $p=0.01$) and ≥ 65 years of age (60% vs 40%, $p=0.02$). Compared to non-responders, participants had less severe strokes as indicated by lower NIHSS scores [median (range): 3 (0–21) vs. 4 (0–32), $p<0.01$]. Upon the REACH telestroke consult, 46% of participants and non-responders were diagnosed with ischemic strokes. No significant differences were found among participants and non-responders with regard to arrival to the ED in ≤ 270 minutes or recommendation and administration of tPA. A comparison of survey participants to the overall REACH patient database found age and sex were similar; however, a greater proportion of Caucasians participated in the survey. Participants were also more likely to have private insurance compared to the overall REACH patient database.

An overall summary of the survey responses are presented in Table 2. Over two-thirds (69%) of surveys were completed by patients while the remainder were completed by a proxy on behalf of a patient. Nearly three-quarters (73%) of participants were at home when they experienced stroke symptoms and a similar proportion were not alone (74%). Participants reported presence of one or more of the following symptoms (referred to as ‘changes’ in the survey) that led to the REACH consult: talking (44%), moving (40%), other (40%), facial (22%), breathing (9%), and behavior (7%). Other symptoms involved:

weakness, seizure, paralysis, off balance, passing out, falling, numbness, nauseous, dizziness, and blurred vision, etc. Symptoms were reported as occurring all of a sudden 62%–85% of the time, depending on the symptom. The majority of the time (72%) patients (rather than someone with them) were the first to notice the symptoms.

The main outcome of interest examined was use of 911. Although 77% of participants thought the stroke symptoms were an emergency and 55% of patients or someone with them thought it might be a stroke, only 48% ($n=94$) called 911. Of the 94 participants who called 911, 43% called someone else in addition to 911; however, 55% reported calling 911 first. The large majority of participants who called 911 did so in less than 30 minutes (86%).

Of participants who did not call 911 ($n=103$), 34% called someone else and 84% did so in less than 30 minutes. Most individuals who did not call 911 arrived at the hospital by a spouse (52%) or family member (32%). Nearly all participants were aware of the availability of 911 for medical emergencies.

Additional characteristics of participants with regard to use of 911 are given in Table 3. Those who called 911 were significantly more likely to think it was an emergency (91%, $p=0.002$), have a moderate/severe stroke (NIHSS >4) (57%, $p=0.000$), and not be transferred to MUSC (61%, $p=0.005$) compared to those who did not call 911.

Results of the univariate regression and multivariate backwards logistic regression models for the outcome of interest are shown in Table 4. With respect to use of 911, the univariate models showed that African-Americans, those with an NIHSS score >4 (vs. ≤ 4); those with unknown insurance, self-pay, or who weren't charged; and those who "thought it was an emergency" were more likely to call 911. In the multivariate model, NIHSS >4 (OR=5.44, 95% CI: 2.63, 11.25, $p=0.000$); unknown insurance, self-pay, or not charged (OR=2.90, 95% CI: 1.15, 7.28, $p=0.02$); and "thought it was an emergency" (OR=4.58, 95% CI: 1.65, 12.67, $p=0.003$) were found to be significant predictors of calling 911.

The use of 911 was further explored by race as previous studies have reported racial/ethnic differences in the use of 911. In our study, African-Americans were significantly more likely to call 911 compared to Caucasians ($p=0.02$) (see Table 5). Although a significant difference was not found, African-Americans (91%) were more likely than Caucasians (78%) to think the stroke symptoms were an emergency while Caucasians (77%) were more likely (than African-Americans [67%]) to think it might be a stroke. Caucasians were significantly more likely to have private insurance, Medicare, or Medicaid compared to African-Americans ($p=0.009$). Delay in the time from symptom onset to ED door of >270 minutes was similar for both races and ranged from 15%–18%. Mode of transport to ED door was also examined and found African-Americans were more likely than Caucasians to arrive by ambulance (58% vs. 44%, respectively), a family member (21% vs. 16%), or a friend/other (8% vs. 7%). Caucasians (33%) more often were driven by a spouse than African-Americans (14%).

DISCUSSION

Our study aimed to determine the factors associated with use of 911. African-Americans, individuals with higher NIHSS scores (>4 vs. ≤ 4), and those who perceived the stroke

symptoms as an emergency were more likely to call 911, univariately. A higher NIHSS score and perception of stroke symptoms as an emergency remained significant independent predictors of calling 911 in addition to lack of health insurance. Examination of the use of 911 by race found that African-Americans were significantly more likely to call 911 compared to Caucasians. African-Americans were also more likely to think stroke symptoms were an emergency and less likely to think it might be a stroke, although this was not statistically significant. Use of 911 may be related to access to transportation (e.g. having a car or someone who can drive you to the hospital), lack of insurance, or proximity to the hospital (as shown by delay from the onset of symptoms to ED door); although this was unmeasured.

Previous Research

A number of studies have been conducted to assess stroke knowledge and awareness and the use of EMS through personal interview or survey administration. Overall, studies have varied by population characteristics such as age, race, geographic area, inclusion of previous/current stroke patients or individuals from the general public, and by sample size. A recent study assessing EMS use among Get With the Guidelines-Stroke participating hospitals found that 63.7% of the 204,591 admitted stroke patients used EMS to arrive at the ED [12]. EMS use was more common among those with severe strokes, Medicare and Medicaid, and the elderly [12]. EMS was less likely to be used by those living in rural communities and those of racial minority groups [12].

Prior U.S. studies have reported differences in the use of EMS in the event of a stroke ranging from <50% [40] to >70% among Caucasians and African-Americans indicating they would go to the ED for stroke symptoms [41] to 75% [42] and 80% among a sample of Hispanic males (in the event of a stroke or heart attack) [43]. In 2009, Ellis et al. found that 88% of participants from the 2003 BRFSS survey would call 911 if someone were having a stroke [44]. Another study involving the BRFSS reported 81% of respondents would call 911 in the presence of a stroke or heart attack [45]. However, a study in New York did not find significant racial/ethnic differences for the use of 911, although women were more likely to call 911 than men (OR=0.50, 95% CI: 0.30, 0.80) [46]. Racial/ethnic differences in arrival time to the ED in Texas were assessed, and found that 18% of Hispanics, 28% of African-Americans, 34% of Caucasians, and 26% of females arrived within the three-hour window after onset of stroke [47].

Stroke warning signs and symptoms have also been examined in relation to the use of 911, although the proportion indicating they would use 911 has generally been lower. One study provided participants with three stroke symptom scenarios and found that only 14% would use 911 for any of the three scenarios, while 17.6% would call 911 in the event of all three scenarios and in the context of high stroke warning sign awareness [48]. The BRFSS was similarly used to evaluate the proportion that would call 911 for a stroke upon recognition of all six stroke symptoms. Results varied by state, ranging from 5.9% – 21.7%, with an overall average of 17.2% [45]. No difference was found by sex but similar to Jones et al.'s review, persons of minority groups, lower education levels, smokers, younger ages, and the elderly were found to have poorer knowledge of stroke symptoms and awareness of when to use

911 services [45]. As demonstrated by previous studies, increased knowledge of stroke symptoms does not appear to decrease the delay in care seeking [48].

In addition, several international studies have evaluated the use of EMS, such as 911 or a similar number, during a stroke or in the presence of stroke symptoms or signs with results ranging widely by country. In the event of a stroke, the proportion of participants who would contact EMS included 20% in China (in the presence of a stroke or myocardial infarction) [49], 53% in Ireland [50]; 69% in Germany [51]; 82% in Denmark (7% would call their general practitioner, and 10% would access the ED) [52]; and 88% in France (6% would call their physician, 6% would go to the ED, and the remainder were unsure of what to do) [53]. An Australian study found that 90% would either go to the ED or call EMS in the case of a stroke [54]. Nearly $\frac{3}{4}$ (71%) of participants in an Indian study would drive to the ED if they (or a family member) were having a stroke [55]. Compared to those 65 years of age in Ireland, younger participants were significantly more likely to call EMS (71.5% vs. 37.6%, respectively), as were those with higher educational levels characterized by having a degree following high school (64.2%) [50]. Signs and symptoms of stroke have also been assessed internationally. In the presence of more than 50% of stroke symptoms, 18% of participants from the Czech Republic would call EMS [56]. During signs of stroke, 31% of respondents in Croatia would go to a neurologist or call EMS while 37% would contact a general practitioner; those with higher educational levels were more likely to use EMS or visit a neurologist (40.9% vs. 12.9%, respectively) [57]. A Brazilian study found that 51.4% of participants would contact EMS if a relative had stroke symptoms, while 40% would drive them to the ED [58]. A survey of Nigerian hospital workers reported 90% would go to the hospital for stroke symptoms; this was especially true for those with higher educational levels ($p<0.001$) [59]. In the event of stroke symptoms, predictors of visiting an ED or using EMS in an Australian study included history of hyperlipidemia, angina, being married, older age, and a native [54]; while higher education was found to be a significant predictor of using EMS (OR=1.5, 95% CI: 1.02, 2.2) in Brazil [58].

Previous studies have demonstrated low awareness of stroke symptoms or warning signs, especially among certain ethnic/racial and age groups at highest risk. Moreover, the delay in access to EMS has been attributed to the general lack of knowledge of stroke warning signs. A prospective study nested within the multicenter clinical trial, Asymptomatic Carotid Atherosclerotic Study (ACAS), followed patients with clinically asymptomatic cerebrovascular disease for up to five years for the development of stroke [60]. After receiving stroke and TIA education related to warning symptoms, recognition, and reporting, symptoms were reported by only 29.9% of stroke patients and 19.1% of TIA patients within the first 24 hours, and by 44.9% and 32.2%, respectively, within three days [60]. In 2010, Jones et al. reviewed 39 studies conducted between 1966 and 2008 investigating awareness and knowledge of stroke and found through closed questioning that 95% to 100% of respondents were able to report one stroke symptom; however, upon open-ended questioning the proportion declined to 25%–72%, depending on symptoms [61]. Of concern is that the proportion indicating they would call EMS in the instance of a stroke ranged widely from 53% to 98%, with nearly half stating they would not call EMS [61]. However, of note is the important role of bystanders in the identification of stroke symptoms

and the greater likelihood of calling 911 than the victim himself/herself [27, 62, 63]. Knowledge of stroke has been reported as obtained from friends and family, and those with a poorer knowledge base included individuals with lower educational levels, of minority groups, and the elderly [61]. Several other studies have also confirmed the significance of friends and family as sources of stroke information [64, 65].

In summary, several studies have conducted telephone interviews or administered questionnaires among patients and the general public to assess knowledge of stroke and the use of emergency services, with specific risk factors mentioned by some but not all studies. The proportion indicating they would call 911 or use EMS if they were having a stroke has varied; however, additional factors should be examined (e.g. age, race, socioeconomic status). Our initial survey was a general assessment which confirmed some knowledge of the stroke as an emergent condition and some knowledge (and response) to stroke warning signs, but these attitudes and responses varied by geography and demographics. These findings are consistent with other studies referenced. This variation in responses and wide assessment did not allow us to identify the factors associated with the knowledge gaps. The results of this assessment will be used to design interventions (community education) focused on: 1) stroke warning signs; 2) emergent reaction to stroke signs; and 3) the use of 911. The interventions will be strategically implemented in order to assess the impact of the education intervention and attribute changes to the specific education message.

Reducing delays in access to care in the presence of stroke symptoms has been an area of ongoing interest and effort as delay in the time from onset of symptoms to ED door is known to play a significant role in the outcome of stroke patients. In addition, it is recognized that the physical effects of stroke may also impact the delay to access care [20]. However, the American Heart Association (AHA) and others have carried out a number of educational campaigns to increase awareness and knowledge of stroke warning signs and risk factors as well as to promote the FAST protocol (face, arms, speech, and time), which advises calling 9-1-1 in the event of signs of a stroke to get to the hospital as quickly as possible [56].

Limitations

The study involved patients receiving a REACH telestroke consult and excluded those who arrived at the ED without the use REACH services. The survey was administered several months after participants experienced stroke symptoms leading to the REACH telestroke consult. Several individuals may have been excluded due to administration of the survey by phone, residence in assisted care facilities, or death. Thus, the responders may be disproportionately healthy stroke survivors and not necessarily representative of the entire stroke population. Through exclusion of patients not using REACH services, the results may underestimate the numbers not using 911 and not recognizing and reporting stroke symptoms early. Although insurance status was available, we did not have access to other socioeconomic status variables such as educational level and income. Residential address was not obtained by the survey or readily available in the REACH database although it would have been interesting to evaluate proximity of residences to hospitals. At present, we are unable to verify use of 911 or mode of arrival to ED through EMS run sheets associated

with the REACH consult, and mode of arrival is self-reported. As our exploratory approach involved a small sample size, replication is needed in a larger sample to confirm these findings.

CONCLUSIONS

While stroke care systems of care, emergency response technologies and treatment modalities have developed exponentially to reduce the adverse outcomes of cerebrovascular events, suboptimal utilization remains in the population. The results of this assessment identified both stroke recognition and the emergently reporting of the event as issues for the stroke population. These delayed and absent reactions were evident for all race-sex groups and age strata. Further, the ongoing community education programs appear to have been adequate in affecting the reaction and awareness of stroke systems, emergent nature of a stroke, and the use of '911'. The community-based education programs associated with REACH site communities have been modified to focus and emphasize the acute signs of a stroke; onset of stroke symptoms as critical and emergent condition; and the '911' response as the appropriate response. The reassessment of REACH stroke patients will be completed after the implementation of the community education programs.

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Table 1

Demographic and Clinical Characteristics for Survey Participants and Non-Responders (May 2008–September 2012)

Characteristic	Total (n=531) n (%)	Participants (n=197) n (%)	Non-responders (n=334) n (%)	<i>p</i>
African-American	178 (34)	52 (27)	126 (38)	0.01
Male	265 (50)	107 (54)	158 (47)	0.12
Age, <65 years	247 (47)	79 (40)	168 (50)	0.02
Insurance status ^a				
Private	137 (26)	64 (33)	73 (23)	0.03
Medicare/Medicaid	282 (53)	94 (49)	188 (58)	
Unknown insurance, self-pay, or not charged	97 (18)	36 (19)	61 (19)	
Missing	15 (3)			
NIHSS, median (range: 0–34)	3 (0–32)	3 (0–21)	4 (0–32)	0.01
NIHSS, 4	282 (53)	117 (63)	165 (55)	0.07
>4	206 (39)	69 (37)	137 (45)	
Missing	43 (8)			
Consult diagnosis				
Ischemic stroke	243 (46)	94 (60)	149 (61)	0.62
Hemorrhagic stroke	12 (2)	4 (3)	8 (3)	
TIA	66 (12)	30 (19)	36 (15)	
Other ^b	82 (15)	29 (19)	53 (22)	
Missing	128 (24)			
Time from symptom onset to ED door ^c				
270 minutes	372 (70)	134 (83)	238 (86)	0.37
>270 minutes	67 (13)	28 (17)	39 (14)	
Missing	92 (17)			
tPA recommended ^d	85 (35)	32 (34)	53 (36)	0.75
tPA administered ^d	75 (31)	29 (31)	46 (31)	0.94
Transfer to MUSC	132 (25)	58 (29)	74 (22)	0.08

Abbreviations: sd, standard deviation; NIHSS, NIH Stroke Scale; intracerebral hemorrhage; TIA, transient ischemic attack; ED, emergency department; tPA, tissue plasminogen activator; REACH, Remote Evaluation of Acute isCHemic stroke.

P-values compared characteristics between participants and non-responders.

The Mann Whitney U test was used to compare medians.

Chi-squared tests were completed on a test by test basis and the missing row indicates the number excluded from the test.

Note: All cells do not add up to the total, as some variables had missing values.

^a Private insurance includes: BlueCross BlueShield and Cigna. Unknown insurance includes: Veteran's Administration and New England Insurance Company, etc.

^b Other consult diagnoses included: migraine, seizure, acute confusional state, alcohol intoxication, Bell's palsy, conversion disorder, and brain metastasis, etc.

^c Time from symptom onset to ED door referent group was ≤270 minutes.

^dRecommendation and administration of tPA applied only to patients diagnosed with an ischemic stroke.

Table 2

Overall Survey Responses

Survey question	Yes, n (% of total)	Total Responses, n
Who completed the survey?	197 (100)	197
Patient	136 (69)	-
Proxy	61 (31)	61
Spouse	41 (67)	-
Family member	17 (28)	-
Other	2 (3)	-
Where were you when you had stroke symptoms? (Home)	144 (73)	197
Were you alone when you had event/stroke symptoms? (No) ^a	146 (74)	197
If not, who was with you? Spouse	78 (53)	146
Family Member	38 (26)	-
Friend	6 (4)	-
Other ^b	21 (14)	-
What were the changes at the time of event/stroke? (check all that apply)		197
Facial	44 (22)	-
Behavior	13 (7)	-
Talking	87 (44)	-
Breathing	18 (9)	-
Moving	79 (40)	-
Other ^c	79 (40)	-
Did the changes happen all of a sudden? (Yes)		
Facial	33 (75)	44
Behavior	8 (62)	13
Talking	67 (77)	87
Breathing	12 (67)	18
Moving	67 (85)	79
Other	58 (73)	79
Who noticed these changes? (patient)	141 (72)	197
At the time, did you think it was an emergency?	151 (77)	197
Did you/someone with you think it might be a stroke?	108 (55)	197
Did you call 911?	94 (48)	197

Abbreviations: sd, standard deviation.

- = indicates the same total follows in rows below.

^aOf the 146 who were not alone at time of event/stroke, one did not know whether he/she was alone and two did not know who was with them.

^bOther included: co-workers, significant other, doctor, church members, neighbor, hospital/assisted living center staff, and strangers at a public place.

^cOther changes or symptoms involved: weakness, seizure, paralysis, off balance, passing out, falling, numbness, nauseous, dizziness, and blurred vision, etc.

Table 3

Characteristics of Participants by 911 Usage

Characteristic	Total n=197 n (%)	Was 911 called? (n=197) n (%)		p
		Yes n=94 (48) n (%)	No n=103 (52) n (%)	
Male	107 (54)	55 (59)	52 (50)	0.26
African-American	52 (27)	32 (35)	20 (20)	0.02
Age, <65 years	79 (40)	40 (43)	39 (38)	0.51
Patient completed survey, not proxy				
Yes	136 (69)	61 (65)	75 (73)	0.23
No	61 (31)	33 (35)	28 (27)	
Thought was an emergency				
Yes	151 (77)	80 (91)	71 (73)	0.002
No	34 (17)	8 (9)	26 (27)	
Missing	12 (6)			
Thought it might be a stroke				
Yes	108 (55)	55 (74)	53 (60)	0.06
No	54 (27)	19 (26)	35 (40)	
Missing	35 (18)			
Presence of symptoms				
Yes	125 (63)	61 (65)	64 (62)	0.69
No	72 (37)	33 (35)	39 (38)	
NIHSS, median (range)	3 (0–21)	5 (0–21)	2 (0–20)	<0.001
NIHSS				
4	117 (59)	38 (43)	79 (81)	<0.001
>4	69 (35)	50 (57)	19 (19)	
Missing	11 (6)			
Consult diagnosis				
Ischemic stroke	94 (48)	53 (67)	41 (53)	0.02
Hemorrhagic stroke	4 (2)	4 (5)	-	
TIA	30 (15)	13 (17)	17 (22)	
Other ^a	29 (15)	9 (11)	20 (26)	
Missing	40 (20)			
Time from symptom onset to ED				
270 minutes	134 (68)	10 (13)	18 (21)	0.17
>270 minutes	28 (14)	67 (87)	67 (79)	
Missing	35 (18)			
tPA recommended				
Yes	32 (16)	22 (42)	10 (24)	0.08
No	165 (84)	72 (77)	93 (90)	
tPA administered				

Characteristic	Total n=197 n (%)	Was 911 called? (n=197) n (%)		p
		Yes n=94 (48) n (%)	No n=103 (52) n (%)	
Yes	29 (15)	19 (36)	10 (24)	0.23
No	168 (85)	75 (80)	82 (89)	
Transfer to MUSC				
Yes	58 (29)	37 (39)	21 (21)	0.005
No	136 (69)	57 (61)	79 (79)	
Missing	3 (2)			
Insurance Status				
Private, Medicare, or Medicaid	158 (80)	70 (75)	88 (88)	0.03
Unknown insurance, self-pay, or not charged	36 (18)	23 (25)	13 (13)	
Missing	5 (3)			

Abbreviations: sd, standard deviation; NIHSS, National Institutes of Health stroke scale; ED, emergency department; tPA, tissue plasminogen activator.

P-values compare characteristics between those who called 911 and those who did not call 911.

Chi-squared tests were completed on a test by test basis and the missing row indicates the number excluded from the test.

^aOther consult diagnosis included: migraine, seizure, acute confusional state, alcohol intoxication, Bell's palsy, conversion disorder, and brain metastasis, etc.

Table 4

Univariate Logistic and Multivariate Backwards Logistic Regression Models

Variable	Called 911			
	Univariate		Multivariate ^a	
	OR	95% CI	OR	95% CI
Age 65 vs. <65	0.83	0.47, 1.46	--	--
Female vs. Male	0.72	0.41, 1.27	--	--
African-American vs. Caucasian	2.13	1.11, 4.09	--	--
NIHSS >4 vs. 4	5.47	2.84, 10.53	5.44	2.63, 11.25
Symptoms vs. none	1.13	0.63, 2.01	--	--
Self-pay, unknown insurance, or not charged vs. private insurance, Medicare, Medicaid ^b	2.22	1.05, 4.70	2.90	1.15, 7.28
Thought it was an emergency	3.66	1.56, 8.61	4.58	1.65, 12.67
Thought it might be a stroke	1.91	0.97, 3.75	--	--

Abbreviations: OR, odds ratio; CI, confidence interval; No., number; NIHSS, National Institutes of Health stroke scale; ED, emergency department; vs., versus; n/a, not applicable.

^aMost parsimonious model.

Table 5

Racial Difference in Use of 911

Characteristic	African-American n=52 n (%)	Caucasian n=140 n (%)	<i>p</i>
Did not call 911	20 (38)	80 (57)	0.02
Thought it was an emergency ^a	43 (91)	104 (78)	0.26
Thought it might be a stroke ^b	16 (67)	37 (77)	0.34
Self-pay, unknown insurance, or not charged ^b	15 (29)	18 (13)	<0.01
Time from symptom onset to ED door >270 minutes	6 (15)	21 (18)	0.63
How did you get to the hospital?			
Ambulance	30 (58)	61 (44)	0.06
Spouse	7 (14)	46 (33)	
Family member	11 (21)	23 (16)	
Friend or Other ^c	4 (8)	10 (7)	

Note: All cells do not add up to the total, as some variables had missing values

^aThe total n for 'Did you think it was an emergency' was 47 for African-Americans and 135 for Caucasians.

^bThe total n for 'Did you think it might be a stroke' was 42 for African-Americans and 115 for Caucasians.

^cOther included: self, co-worker, ex-wife, partner, helicopter, or already at hospital.