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The impact of race and ethnicity on acute telestroke care: A multistate experience

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Abstract

Introduction: Previous analyses suggest that ethnic and racial differences exist in acute stroke care including thrombolytic treatment rates. The current study evaluates ethnic or racial differences in acute stroke treatment within a multistate telestroke program.

Methods: Acute telestroke consultations seen in the Emergency Department in 203 facilities and 23 states were extracted from the Telecare by TeleSpecialists™ database. Cases were reviewed for age, race, ethnicity, sex, last known normal time, arrival time, treatment with thrombolytic therapy, door-to-needle (DTN) time, and baseline National Institutes of Health Stroke Scale score. Race was defined as Black, White, or Other; ethnicity was defined as Hispanic or non-Hispanic.

Results: The current study included 13,221 acute telestroke consultations consisting of 9890 White, 2048 Black, and 1283 patients classified as Other. A total of 934 patients were Hispanic and 12,287 patients were non-Hispanic. There were no statistically significant differences noted in thrombolytic treatment rates when comparing White (7.9%) patients with non-White patients (7.4%), $p = 0.36$, or comparing Black (8.1%) with non-Black patients (7.8%), $p = 0.59$. In addition, there were no statistically significant differences in treatment rates comparing Hispanic (6.3%) with non-Hispanic (7.9%) patients, $p = 0.072$. We noted no measurable differences in DTN times by race or ethnicity.

Conclusions: Contrary to previous reports, we failed to detect any significant differences in thrombolytic treatment rates and DTN times by race or ethnicity among stroke patients in a multistate telestroke program. These findings support the hypothesis that telestroke may mitigate racial and ethnic disparities which may be attributable to local variability in stroke procedures or access to healthcare.

Keywords

Telecare, telemedicine, teleneurology, telehealth, stroke services, equity

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Introduction

Previous research suggests ethnic and racial differences in thrombolytic treatment that is associated with increased morbidity and mortality.[1–5] Specifically, the studies have demonstrated decreased thrombolytic treatment rates and longer door-to-needle (DTN) times in Black compared to White patients.[2,3,6] Hispanic patients are also less likely to receive thrombolytics and have increased DTN times compared to non-Hispanic White patients.[3,5]

Although there are many variables underlying the racial and ethnicity disparities in acute stroke care, differences in access to healthcare appear to be a significant contributing factor.[7–12] Past studies have shown that Black and Hispanic patients are treated in higher proportion at hospitals with lower performance on quality metrics.[8,9] Other research has shown that Black and Hispanic stroke patients are less likely to be evaluated by a neurologist in the Emergency Department.[10–12]

Multihospital telestroke programs, particularly ones that improve the quality of in-hospital acute stroke procedures

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and optimize access to experienced neurologists, have the potential to mitigate racial and ethnic disparities attributable to access to care. Previous research exploring the impact of statewide telestroke programs on such disparities has yielded conflicting results.[13–15] Some statewide telestroke programs have found racial differences in treatment rates, while others have found no ethnic and racial disparities in treatment.[13–15] This study seeks to evaluate ethnic or racial differences in acute stroke treatment within a multistate telestroke program.

Methods

The study was reviewed by the WCG Institutional Review Board and determined to be exempt from a full board review. Data from acute telestroke consultations seen in the emergency department in 203 facilities located in 23 states between January 1, 2021, to April 30, 2021, were extracted from the Telecare by TeleSpecialists™ database. Acute telestroke consultations are initiated when the hospital calls a stroke alert and notifies the telestroke call center. These consultations are initiated for all patients displaying stroke symptoms that started within the last 24 h. Neurologists are then dispatched directly on screen for all patients without a prescreening phone call, prescreening evaluation by Emergency Medicine physician, or preevaluation neuroimaging. Each of the 203 hospitals is supported by a quality management system focused on education and implementation of best practices.

All cases were reviewed for age, race, ethnicity, sex, last known normal (LKN) time, arrival time, arrival-to-notification time, treatment with thrombolytic therapy, DTN time, reasons for not treating with thrombolytic therapy, baseline National Institutes of Health Stroke Scale (NIHSS) score, and premorbid modified Rankin Score (p-mRS). Race was defined as Black, White, or Other. Ethnicity was defined as Hispanic or non-Hispanic. Race and ethnicity were documented by the neurologist involved in the patient's care during the acute stroke consultation in the Telecare by TeleSpecialists™ database.

Patient demographics including age, race, ethnicity, sex, and clinical characteristics including LKN time, arrival time, treatment with thrombolytic therapy, DTN time, reasons for not treating with thrombolytic therapy, baseline NIH Stroke Scale score, and p-mRS were expressed using descriptive statistics for both categorical and continuous variables. Comparisons across race/ethnic variables were conducted using parametric and nonparametric statistics (t difference in means, and the median test for differences) for continuous variables. For categorical variables, the use of Mantel–Haenszel Chi-Square test and generation of odds ratios (ORs) and 95% confidence limits for comparisons were conducted. All statistical analyses were generated using SPSS, version 27 or 28 (IBM, 2021).

Data availability

Anonymized data not published within this article will be made available by request from any qualified investigator.

Results

A total of 13,221 patients were included in the study with 2048 patients Black, 9890 White, and 1283 patients classified as Other. A total of 934 patients were Hispanic and 12,287 patients were non-Hispanic.

White patients were older, had lower NIHSS scores, and had lower p-mRS scores compared to non-White patients in our cohort (Table 1). Similarly, Black patients were younger, had higher NIHSS scores, and had higher p-mRS scores compared to non-Black patients (Table 2). Hispanic patients were younger compared to non-Hispanic patients (Table 3).

With respect to stroke care metrics by race, Black patients had longer LKN-to-arrival times and longer arrival-to-notification times compared to non-Black patients (Table 2). Arrival-to-notification times did not differ when stratified by mode of transportation: 9.4 min (Black) compared to 9 min (non-Black) in patients arriving through Emergency Medical Services, and 15 min (Black) vs 11.5 min

Table 1. Characteristics and stroke care metrics in White versus non-White patients.

Variables	White ($n = 9890$)	Non-White ($n = 3331$)	p values
Age, years, mean (SD)	65 (16)	67.4 (17)	**<0.001**
NIHSS score, median (IQR)	2(5)	2 (4)	**<0.001**
pmRS, median (IQR)	0 (3)	0 (3)	**<0.001**
LKN-to-arrival time, min, median (IQR)	163 (516)	198 (536)	**0.001**
Arrival-to-notification time, min, median (IQR)	10 (16)	12 (18)	**<0.001**
Screen time, min, median (IQR)	20 (13)	20 (15)	0.072
Thrombolytics treatment rates, %	7.9%	7.4%	0.36
DTN times median (IQR)	40 (23)	43 (26)	0.061

Bold values indicate a significance at $p < 0.05$.

SD: standard deviation; Min: minutes; IQR: interquartile range; NIHSS: National Institute of Health Stroke Scale; pmRS: premorbid Modified Rankin Scale; LKN: last known normal; DTN: door-to-needle.

Table 2. Characteristics and stroke care metrics in Black versus non-Black patients.

Variables	Black ($n = 2048$)	Non-Black ($n = 11,173$)	p values
Age, years, mean (SD)	60.5 (16)	67.2 (16)	**<0.001**
NIHSS score, median (IQR)	3 (5)	2 (5)	**<0.01**
pmRS, median (IQR)	0 (3)	0 (3)	**<0.01**
LKN-to-arrival time, min, median (IQR)	194 (523)	166 (521)	**0.044**
Arrival-to-notification time, min, median (IQR)	12 (19)	10 (16)	**<0.001**
Screen time, min, median (IQR)	20 (15)	20 (13)	0.216
Thrombolytics treatment rates, %	8.1%	7.8%	0.59
DTN times median (IQR)	42 (27)	40 (23)	0.142

Bold values indicate a significance at $p < 0.05$.
SD: standard deviation; Min: minutes; IQR: interquartile range; NIHSS: National Institute of Health Stroke Scale; pmRS: premorbid Modified Rankin Scale; LKN: last known normal; DTN: door-to-needle.

Table 3. Characteristics and stroke care metrics in Hispanic versus non-Hispanic patients.

Variables	Hispanic ($n = 934$)	Non-Hispanic ($n = 12,287$)	p values
Age, years, mean (SD)	64.1 (17)	66.3 (16)	**<0.001**
NIHSS score, median (IQR)	2 (5)	2 (6)	**<0.001**
pmRS, median (IQR)	0 (2)	0 (3)	**<0.001**
LKN-to-arrival time, min, median (IQR)	198 (525)	168 (522)	0.133
Arrival-to-notification time, min, median (IQR)	12 (17)	10 (17)	**<0.001**
Screen time, min, median (IQR)	20 (13)	20 (13)	0.956
Thrombolytics treatment rates, %	6.3%	7.9%	0.0719
DTN times median (IQR)	46 (26)	40 (24)	0.123

Bold values indicate a significance at $p < 0.05$.
SD: standard deviation; Min: minutes; IQR: interquartile range; NIHSS: National Institute of Health Stroke Scale; pmRS: premorbid Modified Rankin Scale; LKN: last known normal; DTN: door-to-needle.

(non-Black) in patients arriving through private transportation. White patients had shorter LKN-to-arrival times and shorter arrival-to-notification times compared to non-White patients (Table 1). Thrombolytic treatment rates did not significantly differ between White (7.9%) versus non-White patients (7.4%), $p = 0.36$ (Table 1, Figure 1), or Black (8.1%) versus non-Black patients (7.8%), $p = 0.59$ (Table 2, Figure 1). DTN times did not differ between Black versus non-Black patients, $p = 0.142$ (Table 2, Figure 2.), or in White patients vs non-White patients, $p = 0.061$ (Table 1, Figure 2).

For stroke metrics by ethnicity, no significant differences in LKN-to-arrival times, arrival-to-notification times, or screen times were observed. There was no statistically significant difference in treatment rates between Hispanic (6.3%) versus non-Hispanic (7.9%) patients (OR 0.78, 95% CI 0.59–1.02, $p = 0.0719$) (Table 3, Figure 2). DTN times did not differ between Hispanic (46 min) versus non-Hispanic patients (40 min), $p = 0.123$ (Table 3, Figure 2).

Discussion

The current study explores whether a multistate telestroke program has any impact on reducing ethnic and racial differences in acute stroke treatment. Despite racial differences in LKN-to-arrival times and arrival-to-notification times, we found no significant difference in thrombolytic treatment by race or ethnicity. This demonstrates that a systematic approach to acute stroke consultations within a multistate telestroke program along with limiting barriers to the neurologist evaluation can negate local variability in care.

Similar to a study by Reddy et al., evaluating a statewide telestroke program in Texas, we found no significant racial differences in thrombolytic treatment.[14] In contrast to our findings, a recent study by Ajinkja et al., assessing a telestroke program in South Carolina found that White patients were significantly more likely to receive thrombolytics as well as achieve DTN $\leq$ 45 min.[15] Compared to our range of thrombolytic treatment rates of 6.3–8.1%, the range of treatment rates in the South Carolina study was 21.9–23.8%.[15] This large discrepancy is likely due to differences in the process for assessing patients with on-screen telestroke consultation. Many telestroke programs utilize a screening protocol and only proceed to a telestroke consultation after a screening process is performed, often by an Emergency Medicine physician, to eliminate those not eligible for treatment and limit overutilization of the neurologist. In our

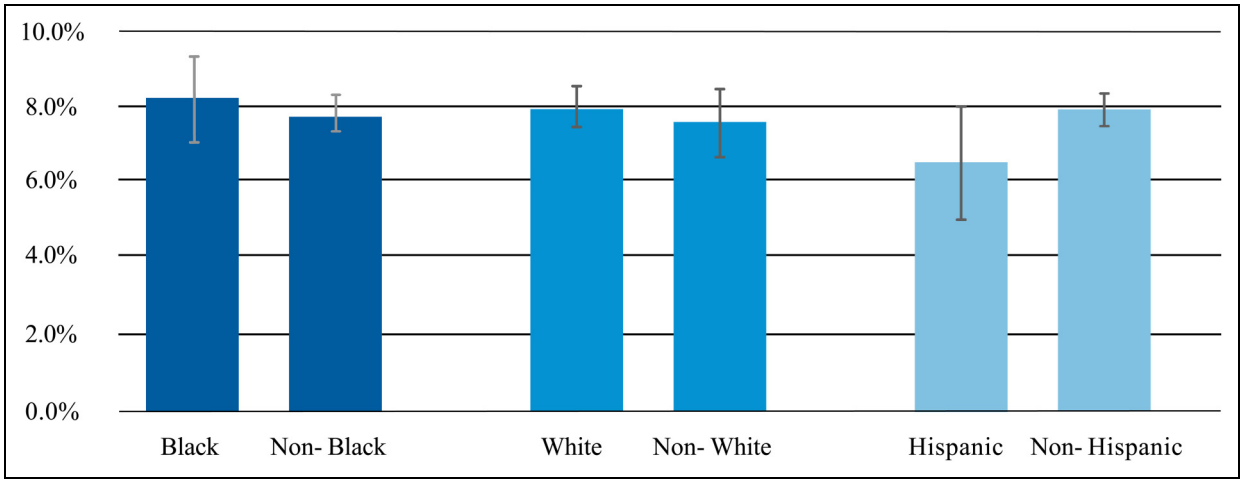

Figure 1. Thrombolytic treatment rates by race and ethnicity. Comparison of thrombolytic treatment percentages between Black versus Non-Black, White versus Non-White, and Hispanic versus Non-Hispanic patients. Error bars indicate the 95% confidence intervals.

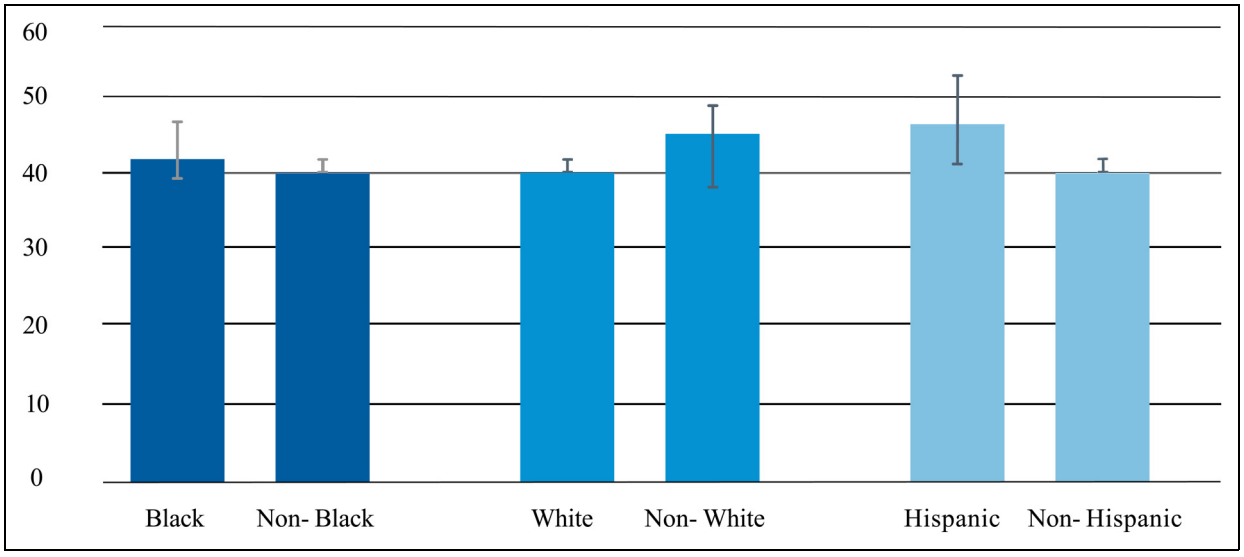

Figure 2. Door-to-needle times by race and ethnicity. Comparison of the median door-to-needle times in minutes between Black versus Non-Black, White versus Non-White, and Hispanic versus Non-Hispanic patients. Error bars indicate the 95% confidence intervals.

telestroke network, every patient determined to have neurological symptoms within 24 h of hospital arrival is seen on screen in a telestroke consult. With this process, there is a potential for reduced bias as all patients are being evaluated by a neurologist. Such an explanation is supported by the finding that the median door-to-telestroke page time was 5 min longer in non-White versus White patients in the South Carolina study compared to a 2 min difference in arrival-to-notification time in our study.

In our study, White patients were older, had lower NIHSS scores, and had lower p-mRS scores compared to non-White patients. The median LKN-to-arrival interval was 35 min longer for non-White patients as compared to White patients, which are consistent with other studies exploring racial differences in acute stroke care.[1,16] Despite this difference, treatment rates and DTN times did not significantly differ between White and non-White patients and Black and non-Black patients in our study.

Thrombolytic treatment rates for Hispanic patients were 6.3% compared to 7.9% in non-Hispanic patients ($p = 0.072$). The presence of only 934 Hispanic patients in our cohort is a significant limitation and may have impacted our power to detect a difference in treatment rates. Regarding DTN times, there was no significant difference

or even a notable trend when comparing Hispanic (46 min) to non-Hispanic patients (40 min) ($p = 0.123$). This is consistent with the Texas telestroke study that found no ethnic disparity in time to thrombolytic treatment.[14]

Multihospital telestroke programs can improve the quality of in-hospital acute stroke procedures and provide more timely access to experienced neurologists.[17] Previous research has identified differences in average patient volumes and quality performance scores in hospitals that see a higher proportion of racial and ethnic minority patients.[12] Thus, decreasing the variability in the quality of acute stroke procedures and access to stroke specialists may explain our finding of reduced disparity in stroke treatment. Telestroke programs are an excellent way to bring consistent care across hospital systems that are focused on quality.[18]

The current study only evaluates the impact of telemedicine on in-hospital stroke care at facilities with the resources and technology to support telemedicine. Racial and ethnic differences in access to broadband connectivity, particularly in the home or prehospital setting, are well-established and limit the benefit of telemedicine with respect to healthcare equity.[19,20] In fact, as telemedicine becomes more prevalent, it has the potential to worsen racial and ethnic disparities in care without commensurate efforts to bridge the "digital divide" and improve access to the infrastructure that supports telehealth.[19,20] Facilitating equitable access should be the target for future studies with evidence that it can reduce disparities in the care itself.

One limitation of our study is that the race categories included were: White, Black, and Other. The NIH recommends the use of five race categories including: American Indian or Alaska Native, Asian, Black or African American, White, and Native Hawaiian or Other Pacific Islander. The current findings may not generalize to patients in Asian, American Indian, or the Pacific Islander race categories.

To our knowledge, this is the first study to explore the impact of an extensive, multi-state telestroke program on racial and ethnic differences in acute stroke treatment. With over 13,000 patients from 23 states, this is also the largest study assessing the relationship between telestroke and variability in care by race or ethnicity at the time it was performed. Our findings suggest that a telestroke program focused on improving in-hospital acute stroke protocols and optimizing access to experienced neurologists can mitigate the effect on racial and ethnic disparities as compared with more traditional acute stroke care. Further research is needed to explore whether variability in the preselection process of telestroke patients contributes to the racial disparities observed in some multicenter telestroke programs.

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Declaration of conflicting interests

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