Examining Physical Access to Acute Ischemic Stroke Care and the Implications of TeleStroke in the Southeastern US: Findings from the 2020 Release of the American Hospital Association Database

Submitted in partial completion for the Bachelor of Science Degree in Management with a Concentration in Health Analytics at The University of Alabama

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There have been advancements in the treatment of acute ischemic stroke that have deemed to be highly effective if administered quickly after the onset of symptoms (1). An ischemic stroke, which accounts for most strokes in the US, occurs when a blood vessel to the brain becomes blocked (2). Intravenous recombinant tissue-type plasminogen activator (r-tPA) is a FDA approved therapy to treat patients affected acute ischemic stroke (3). Despite the cost effectiveness of r-tPA (4), the use of this treatment after stroke does not occur at a rate comparable to strokes in the US (5). Part of this may be due to the time 2-3 hour window by which r-tPA is deemed effective after the onset of acute ischemic stroke symptoms (6). Though helicopters can be an effective and quick form of transportation, it is very expensive, and some emergency response organizations are reluctant to use that mode of transportation under circumstances where automobile transportation is feasible (7).

The US Deep South, especially the Black Belt and Mississippi Delta regions has witness historical challenges in many health disparities including access to care (8). With respect to care for stroke victims, TeleStroke is a service made available to provide increased access to neurological care for patients unable to go to medical facilities with on-site services in a timely manner (9, 10). There is evidence suggesting that TeleStroke is effective promoting improved outcomes among patients after acute ischemic stroke has occurred (11). Though findings are mixed with respect to whether TeleStroke is equally effective as neurological services received in a comprehensive stroke center, outcomes are usually better when compared to patients who did not receive such services.

The objective of this analysis is to examine the impact that TeleStroke has on physical access to care among populations in the states of Alabama, Georgia, Mississippi, and Tennessee. This will involve comparing travel times with and without the inclusion of TeleStroke sites. The report

will conclude with a brief discussion on areas that could benefit by participating in the TeleStroke program.

Methods

The dataset used in this analysis to identify hospitals with neurological services, TeleStroke services, and general telehealth services was provided by the American Hospital Association (AHA) (12). Population estimates and neighborhood characteristics at the census tract level came from the US Census Bureau American Community Survey 5-year estimates (13). In this report, we operationalized physical access to hospitals as estimated personal automobile travel time between each census tract centroid and each respective hospital in the nation. Travel time estimates were produced by a faculty mentor using GIS software (14). The rurality status of each neighborhood was operationalized using the US Health Resources and Services Administration rural health areas criteria (15). Socioeconomic deprivation was operationalized using the area deprivation index (16).

Using T-SQL programming language, we generated queries using SQL Server Management Studio © and Azure Data Studio ©. Thereafter, we used Tableau © to examine maps to interpret findings. A faculty mentor assisted in re-generating maps using ArcGIS Pro © so that maps would have the appropriate cartographic projections for the US Deep South Region. More details about the database schema can be found here: https://bit.ly/3eMbEei.

Results

Figure 1. Hospital location and identification of telehealth services

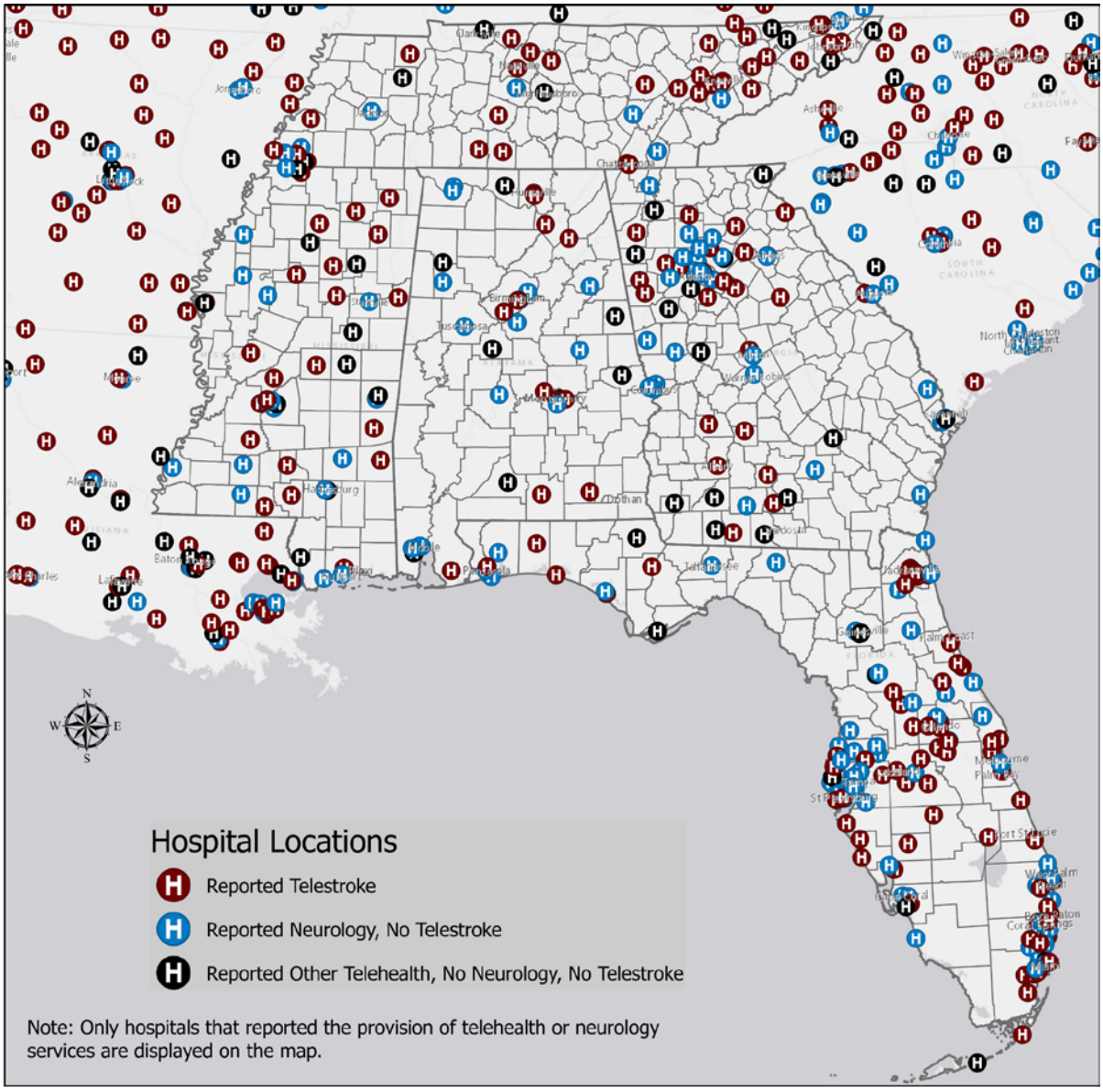


Table 1. Statistics on TeleStroke services

State Name	Total Hospitals	TeleStroke Hospitals	% TeleStroke Statewide	Urban Hospitals	TeleStroke Urban	Rural Hospitals	TeleStroke Rural
Alabama	116	14	12.07%	68	9	48	5
Florida	253	68	26.88%	231	64	22	4
Georgia	172	27	15.70%	105	18	67	9
Mississippi	112	23	20.54%	36	6	76	17
Tennessee	133	33	24.81%	79	22	54	11

Figure 2. Percent of hospitals within each state that have TeleStroke services

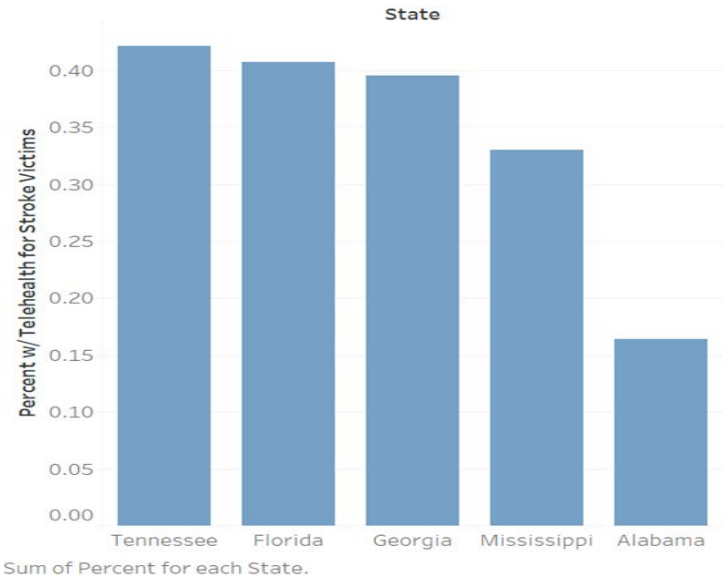


Table 2. Median Travel Time With and Without TeleStroke (Minutes)

State Name	Median Closest Travel Time With TeleStroke Statewide	Median Closest Travel Time Without TeleStroke Statewide	Median Closest Travel Time With TeleStroke Urban	Median Closest Travel Time Without TeleStroke Urban	Median Closest Travel Time With TeleStroke Rural	Median Closest Travel Time Without TeleStroke Rural
Alabama	20.33	30.38	14.67	19.62	35.19	53.57
Florida	12.05	16.31	11.63	15.70	36.83	51.13
Georgia	15.69	20.62	13.69	16.94	33.73	47.02
Mississippi	17.07	31.28	13.22	16.89	20.70	42.10
Tennessee	17.00	35.74	14.04	29.45	36.80	58.19

Figure 3. Travel time to closest hospital that can service stroke patients when Telestroke is included

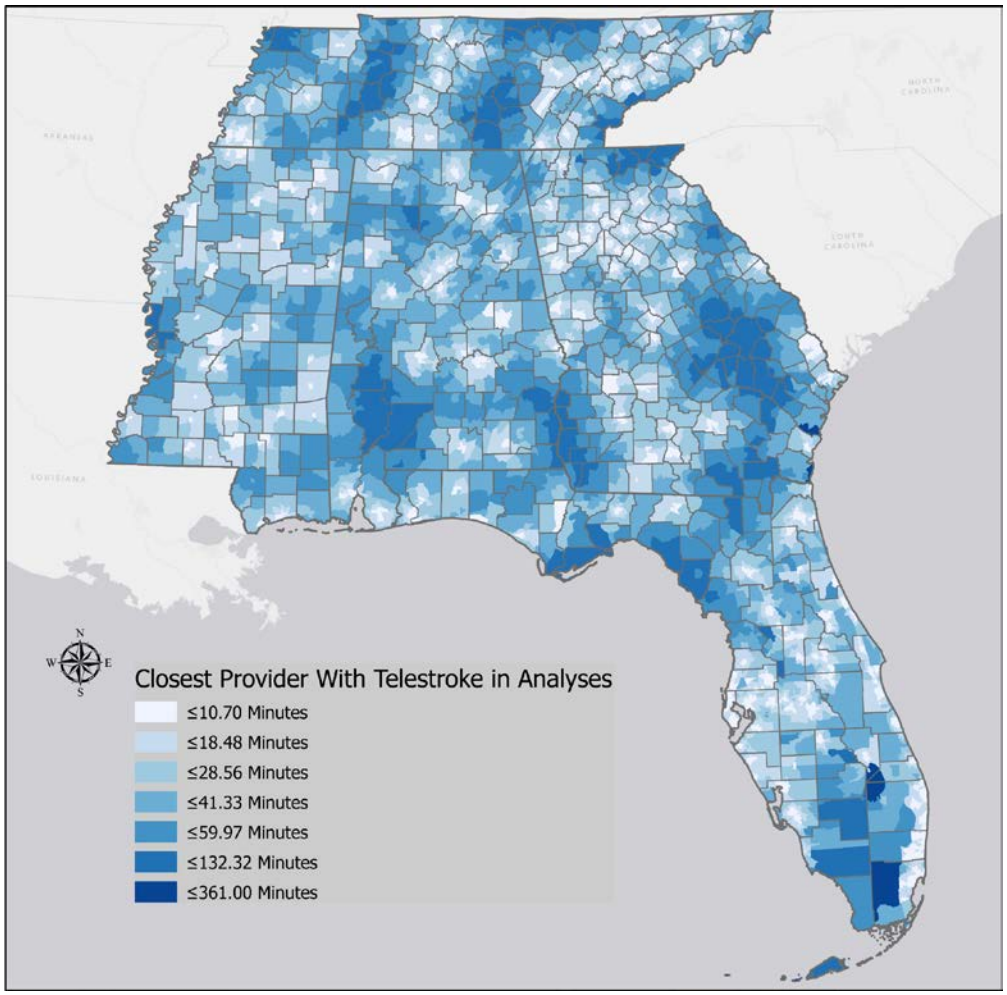
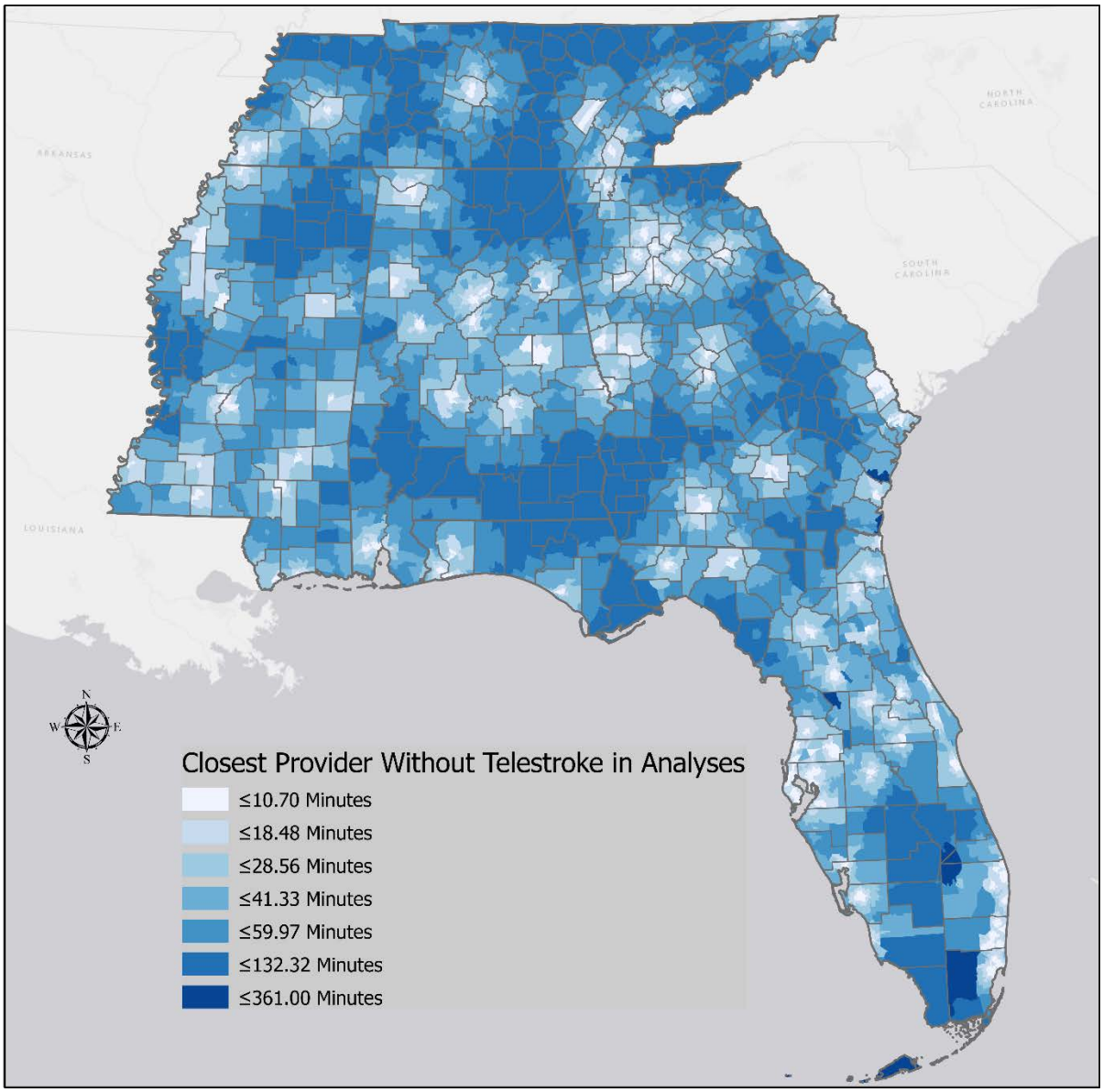


Figure 4. Travel time to closest hospital that can service stroke patients when Telestroke is excluded



Conclusion

As our analysis shows, Alabama in comparison to its neighboring states is far behind the curve. This means that it is a lot harder for stroke victims to receive adequate, specialized help in Alabama when compared to its neighbors. Our analysis also shows that the more rural you go in all of the states, the harder it is to get to a healthcare facility with TeleStroke services. To improve upon the inadequacies in Alabama, we suggest setting up more TeleStroke services in other hospitals. To help bridge the gap between the urban and rural hospitals, we suggest setting up TeleStroke services in smaller clinics and doctors' offices. When you have a stroke, time is of the essence and getting the help at a smaller facility first and then being transferred once the patient is stable could save a lot of lives. It will also make it easier for people in rural areas to get the help they need. Telehealth mobile units can also be of use to reach more rural locations. They are able to get to patients quickly and have a neurologist connected to make decisions on the spot. "Time is brain" when it comes to strokes and saving these crucial minutes and sometimes even hours for rural locations can be the difference between life and death.

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