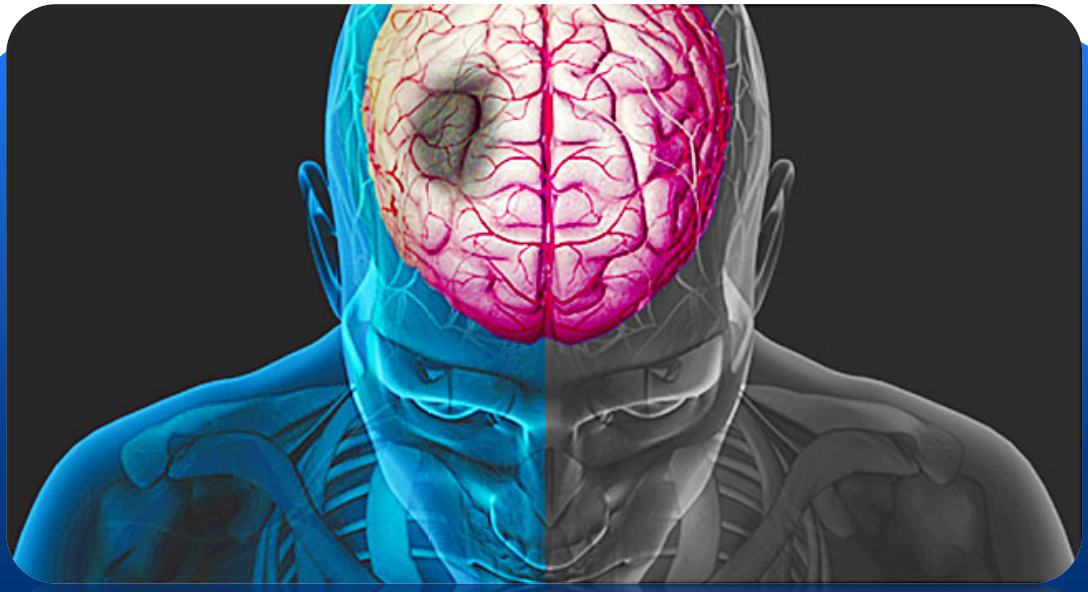

Tennessee Annual Stroke Registry 2020

TN Department of Health

COLLEGE of PUBLIC HEALTH
EAST TENNESSEE STATE UNIVERSITY

American Heart Association | American Stroke Association
life is why

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EXECUTIVE SUMMARY

The Tennessee Stroke Registry (TSR) was created in 2009 through the Tennessee Stroke Registry Act of 2008. In July 2017, the legislation was updated with Tennessee House Bill 123, requiring all certified comprehensive and primary stroke centers in Tennessee to share their data with the TSR in order to improve stroke care in the state. The bill requires data to be provided from hospitals on a quarterly basis through the American Heart Association's Patient Management Tool™, provided by the Quintiles Real World & Late Phase Research. This report provides a summary of the TSR data, obtained through Quintiles software, for January through December 2020. Analyzed in this report are aggregate data from the 39 hospitals that reported to the Tennessee Stroke Registry during 2020, along with observations on 2019 data.

List of Certified Stroke Centers by Certification

Joint Commission Certified Hospitals

Certification	Organization Name	City
Acute Stroke Ready Hospital	Claiborne Medical Center	Tazewell
	Campbell County HMA, LLC	La Follette
Acute Stroke Ready Hospital	Ballad Health- Franklin Woods Hospital	Johnson City
	Ballad Health -Sycamore Shoals Hospital	Elizabethton
Acute Stroke Ready Hospital	Metro Knoxville HMA LLC	Powell
	Jefferson County HMA, LLC	Jefferson City
Acute Stroke Ready Hospital	Tennova Newport Medical Center	Newport
	TriStar Skyline Medical Center	Nashville
Advanced Comprehensive Stroke Center	Ballad Health- Johnson City Medical Center	Johnson City
	Fort Sanders Regional Medical Center	Knoxville
Advanced Comprehensive Stroke Center	Saint Thomas West Hospital	Nashville
	Vanderbilt University Medical Center	Nashville
Advanced Comprehensive Stroke Center	The University of Tennessee Medical Center	Knoxville
Advanced Primary Stroke Center	LeConte Medical Center	Sevierville
Advanced Primary Stroke Center	Jackson-Madison County General Hospital	Jackson
Advanced Primary Stroke Center	TriStar Hendersonville Medical Center	Hendersonville
Advanced Primary Stroke Center	Vanderbilt Wilson County Hospital	Lebanon
Advanced Primary Stroke Center	Sumner Regional Medical Center, LLC	Gallatin
Advanced Primary Stroke Center	Roane Medical Center	Harriman
Advanced Primary Stroke Center	Ballad Health-Bristol Regional Medical Center	Bristol
Advanced Primary Stroke Center	TriStar Summit Medical Center	Hermitage
Advanced Primary Stroke Center	Memorial Health Care System, Inc.	Chattanooga
Advanced Primary Stroke Center	Parkridge Medical Center, Inc.	Chattanooga
Advanced Primary Stroke Center	Maury Regional Hospital	Columbia
Advanced Primary Stroke Center	Cookeville Regional Medical Center	Cookeville
Advanced Primary Stroke Center	Cumberland Medical Center	Crossville
Advanced Primary Stroke Center	Fort Loudon Medical Center	Lenoir City
Advanced Primary Stroke Center	Blount Memorial Hospital, Inc.	Maryville

Advanced Primary Stroke Center	Baptist Memorial Hospital - Memphis	Memphis
Advanced Primary Stroke Center	Morristown-Hamblen Hospital Association	Morristown
Advanced Primary Stroke Center	Saint Thomas Rutherford Hospital	Murfreesboro
Advanced Primary Stroke Center	Saint Thomas Midtown Hospital	Nashville
Advanced Primary Stroke Center	Methodist Medical Center of Oak Ridge	Oak Ridge
Advanced Primary Stroke Center	NorthCrest Medical Center	Springfield
Advanced Primary Stroke Center	Parkwest Medical Center	Knoxville
Advanced Primary Stroke Center	Metro Knoxville HMA LLC	Powell
Advanced Primary Stroke Center	Ballad Health - Holston Valley	Kingsport
Advanced Primary Stroke Center	TriStar Centennial Medical Center	Nashville
Advanced Primary Stroke Center	TriStar Southern Hills Medical Center	Nashville
Advanced Primary Stroke Center	TriStar Horizon Medical Center	Dickson
Advanced Primary Stroke Center	TriStar StoneCrest Medical Center	Smyrna
Advanced Primary Stroke Center	Saint Francis Hospital - Bartlett	Bartlett
Advanced Thrombectomy Capable Stroke Ctr	Saint Francis Hospital-Memphis	Memphis
Stroke Rehabilitation	Siskin Hospital for Physical Rehabilitation	Chattanooga
Stroke Rehabilitation	Encompass Health Rehabilitation Hospital of Kingsport, LLC	Kingsport
Stroke Rehabilitation	Rebound, LLC	Chattanooga
Stroke Rehabilitation	TriStar Horizon Medical Center	Dickson
Stroke Rehabilitation	Encompass Health Rehabilitation Hospital of Memphis	Memphis
Stroke Rehabilitation	Encompass Health Corporation	Nashville
Stroke Rehabilitation	Encompass Health Methodist Rehabilitation Hospital, LP	Memphis
Stroke Rehabilitation	West Tennessee Rehabilitation Hospital, LLC	Martin
Stroke Rehabilitation	West Tennessee Rehabilitation Hospital, LLC	Jackson
Stroke Rehabilitation	Encompass Health Rehabilitation Hospital of Franklin, LLC	Franklin
Stroke Rehabilitation	Quillen Rehabilitation Hospital of Johnson City, LLC	Johnson City

*This list was last updated on April 7, 2020. The most up-to-date listing of certified stroke centers can be found on The Joint Commission website or American Heart/American Stroke

Association website. **Includes Ballad Health, Johnson City Medical Center and Ballad Health Holston Valley Medical Center.

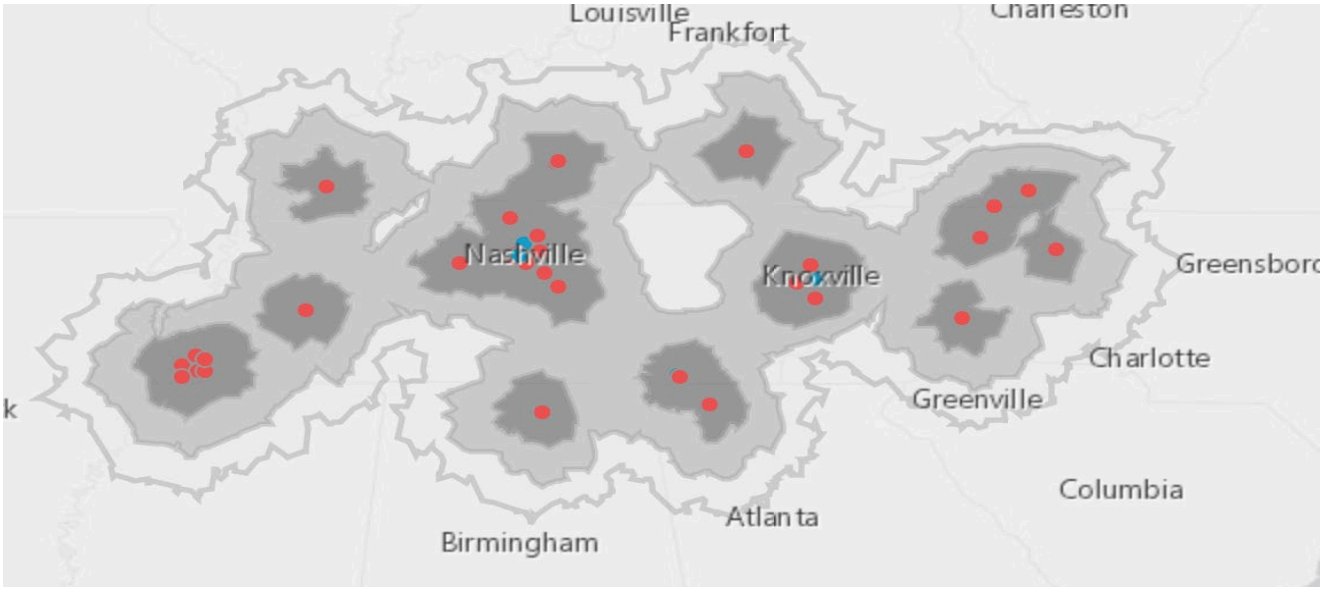
DNV-GL Certified Hospitals

Organization Name	City	County	Certification program
Erlanger Health System	Chattanooga	Hamilton	Advanced Comprehensive Stroke Center
Methodist Le Bonheur	Germantown	Shelby	Advanced Primary Stroke Center
Methodist Medical Center, North	Memphis	Shelby	Advanced Primary Stroke Center
Methodist Medical Center, South	Memphis	Shelby	Advanced Primary Stroke Center
Methodist University Hospital	Memphis	Shelby	Advanced Comprehensive Stroke Center

*This list was last updated on April 26, 2020. The most up-to-date listing of stroke certification of these hospitals can be found on the Methodist Le Bonheur Healthcare website: https://www.methodisthealth.org/healthcare-services/neurology-neurosurgery/stroke-center/.

OVERVIEW OF CERTIFIED STROKE CENTERS

Stroke Centers by Tennessee Department of Health (TDH) Region and Metro Counties



Map of TDH Regions

Northeast and Sullivan Metro:
- **Ballad Health**
- **Bristol Regional Medical Center**
- **Holston Valley Medical Center**
- **Johnson City Medical Center**
- **Sycamore Shoals Hospital**

East and Knox Metro:
- **Blount Memorial Hospital**
- **Campbell County HMA, LLC**
- **Fort Sanders Regional Medical Center**
- **Fort Loudon Medical Center**
- **Jefferson County HMA, LLC**
- **Parkwest Medical Center**
- **LeConte Medical Center**
- **Methodist Medical Center Oak Ridge**
- **Newport Medical Center**
- **North Knoxville Medical Center (Tennova)**
- **Turkey Creek Medical (Tennova)**
- **University of Tennessee Medical Center**

Southeast and Hamilton Metro:
- **Erlanger Health System**
- **Memorial Healthcare System**
- **Parkridge Medical Center**

South-Central:
- **Maury Regional Hospital**

Southwest, and Shelby and Madison Metro:
- **Baptist Memorial Hospital**
- **Jackson-Madison County General Hospital**
- **Methodist University Hospitals**
- **Saint Francis Hospital Bartlett**
- **Saint Francis Hospital Memphis**

Mid-Cumberland and Davidson Metro:
- **NorthCrest Medical Center**
- **Morristown-Hamblen Hospital Association**
- **Roane Medical Center**
- **Southern Hills Medical Center**
- **St. Thomas Midtown Hospital**
- **St. Thomas Rutherford Hospital**
- **St. Thomas West**
- **StoneCrest Medical Center**
- **Sumner Regional Medical Center**
- **Tennova Healthcare-Lebanon**
- **TriStar Centennial Medical Center**
- **TriStar Hendersonville Medical Center**
- **TriStar Horizon Medical Center**
- **Tristar Skyline Medical Center**
- **TriStar Summit Medical Center**
- **Vanderbilt University Medical Center**

Upper-Cumberland:
- **Cookeville Regional Medical Center**

2020 TENNESSEE STROKE REGISTRY DATA AND INTERPRETATION

The following charts and tables represent aggregate data from the 39 hospitals reporting to the Tennessee Stroke Registry in 2019 and in 2020 with data from January to December of each year. All cases of strokes are reported including transient ischemic attack (TIA) patients, unless otherwise stated. Data were obtained from Quintiles on July 8, 2021. Illustrations are made on similarities and differences between 2019 and 2020 data.

Variable Descriptions

Measure	Numerator	Denominator
Age	Patients in specific age groups	Patients with a diagnosis of Ischemic stroke, TIA, Subarachnoid hemorrhage, or Intracerebral hemorrhage
Co-morbidities	Patients with co-morbidity	All patients
Transportation times	Patients arriving in time interval	Patients with a diagnosis of Ischemic stroke, TIA, Subarachnoid hemorrhage, Intracerebral hemorrhage, or Stroke not otherwise specified
NIHSS reported	NIH Stroke scale performed as part of initial evaluation AND Total Score is reported	Patients with a diagnosis of Ischemic stroke or Stroke not otherwise specified
Time to Intravenous Thrombolytic Therapy	Patients in time intervals based on time from patient arrival at the ED to time of administration of IV t-PA	Patients with a primary stroke diagnosis of ischemic stroke who received IV t-PA at my hospital
Reasons for no IV-rtPA	Patients in exclusion criteria group	Patients with a primary stroke diagnosis of ischemic stroke who arrived at the ED <270 minutes after the onset of stroke symptoms and had reason(s) why IV t-PA was not started at my hospital
Reasons for no IV-rtPA beyond 60 min	Patients grouped by reason	Patients with a primary stroke diagnosis of ischemic stroke in whom IV tPA was initiated greater than 60 minutes after hospital arrival
Modified Rankin Scale at discharge	Patients in each Modified Rankin Scale at discharge value	Patients with a diagnosis of Ischemic Stroke or Subarachnoid Hemorrhage or Intracerebral Hemorrhage or Stroke not otherwise specified
Complication types	Patients in each of the 4 combination groups (therapy received versus complication experienced)	Patients with a primary stroke diagnosis of ischemic stroke who received IV t-PA or intra-arterial thrombolytic therapy at my hospital

Initial exam findings	Patients grouped by exam finding	Patients with a diagnosis of Ischemic Stroke or TIA or Subarachnoid Hemorrhage or Intracerebral Hemorrhage or Stroke not otherwise specified
Length of stay	Patients grouped by stroke type	All patients
GWTG/PAA Defect Free	All patients which were included in the numerator for all of the measures that they were not excluded from	All patients which are included in the denominator for at least one of these measures: • IV rt-PA 2 Hour • Early Antithrombotics • VTE Prophylaxis (for patients discharged on or after 4/7/2012) • DVT Prophylaxis (GWTG Historic) (for patients discharged before 4/7/2012) • Antithrombotics* • Anticoag for AF* • LDL 100 or ND-Statin * • Smoking Cessation
CDC/COV Defect Free	All patients which were included in the numerator for all of the measures that they were not excluded from	All patients which are included in the denominator for at least one of these measures: • IV rt-PA 2 Hour • Early Antithrombotics • VTE Prophylaxis • Antithrombotics • Anticoag for AF • LDL 100 or ND • Smoking Cessation • Dysphagia Screen • Stroke Education • Rehabilitation Considered

*Percentages in graphs are based on the number of cases per year, unless otherwise specified.

Diagnosis

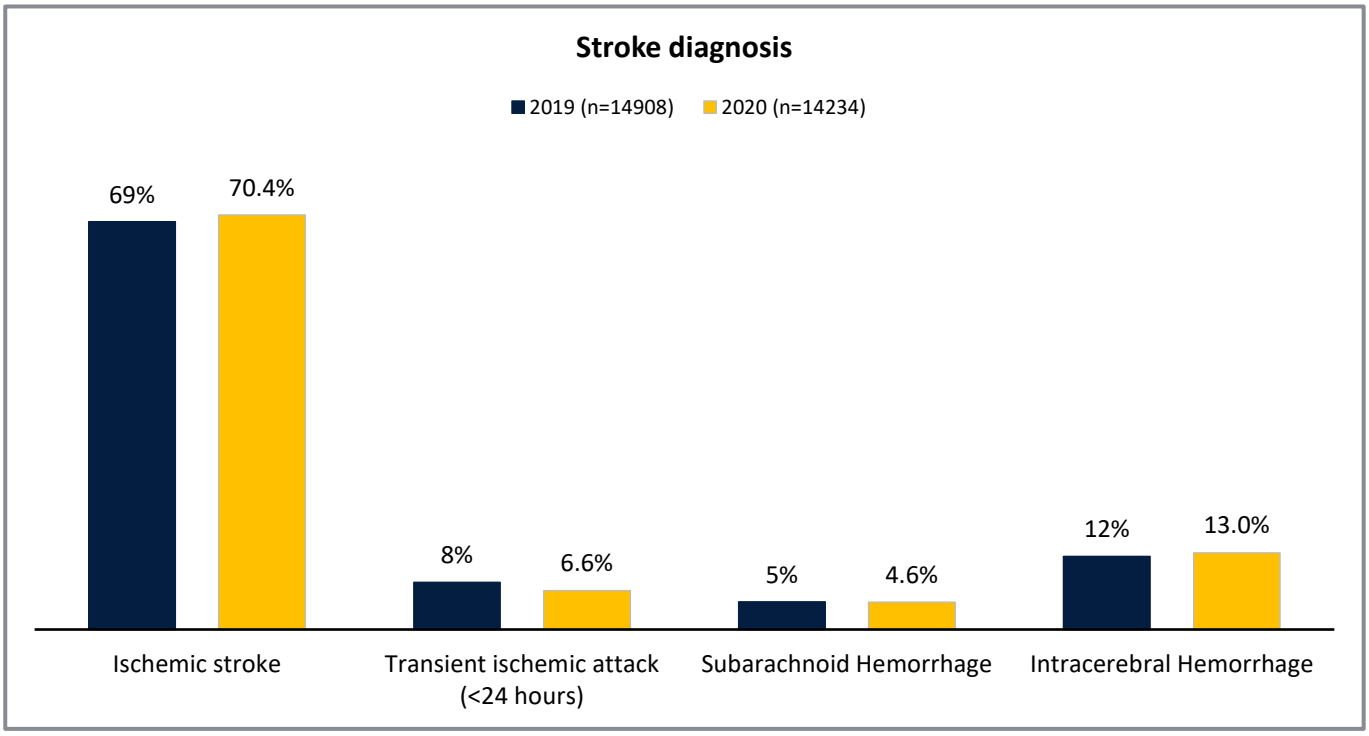


Figure 1. *Distribution of stroke diagnosis in 2020.*

Overall, the patterns and distributions for 2020 are similar to what was seen in previous years. The total number of stroke cases reported for 2020 was 14,234. The most common cases were ischemic strokes at 10,014 (70%) of strokes reported to the registry. Hemorrhagic strokes, which include subarachnoid hemorrhage (SAH), and intracerebral hemorrhage (ICH) together composed 18% of cases (2,515). There were 1,854 ICH, 661 SAH, and 937 transient ischemic attacks reported.

Gender Distributions

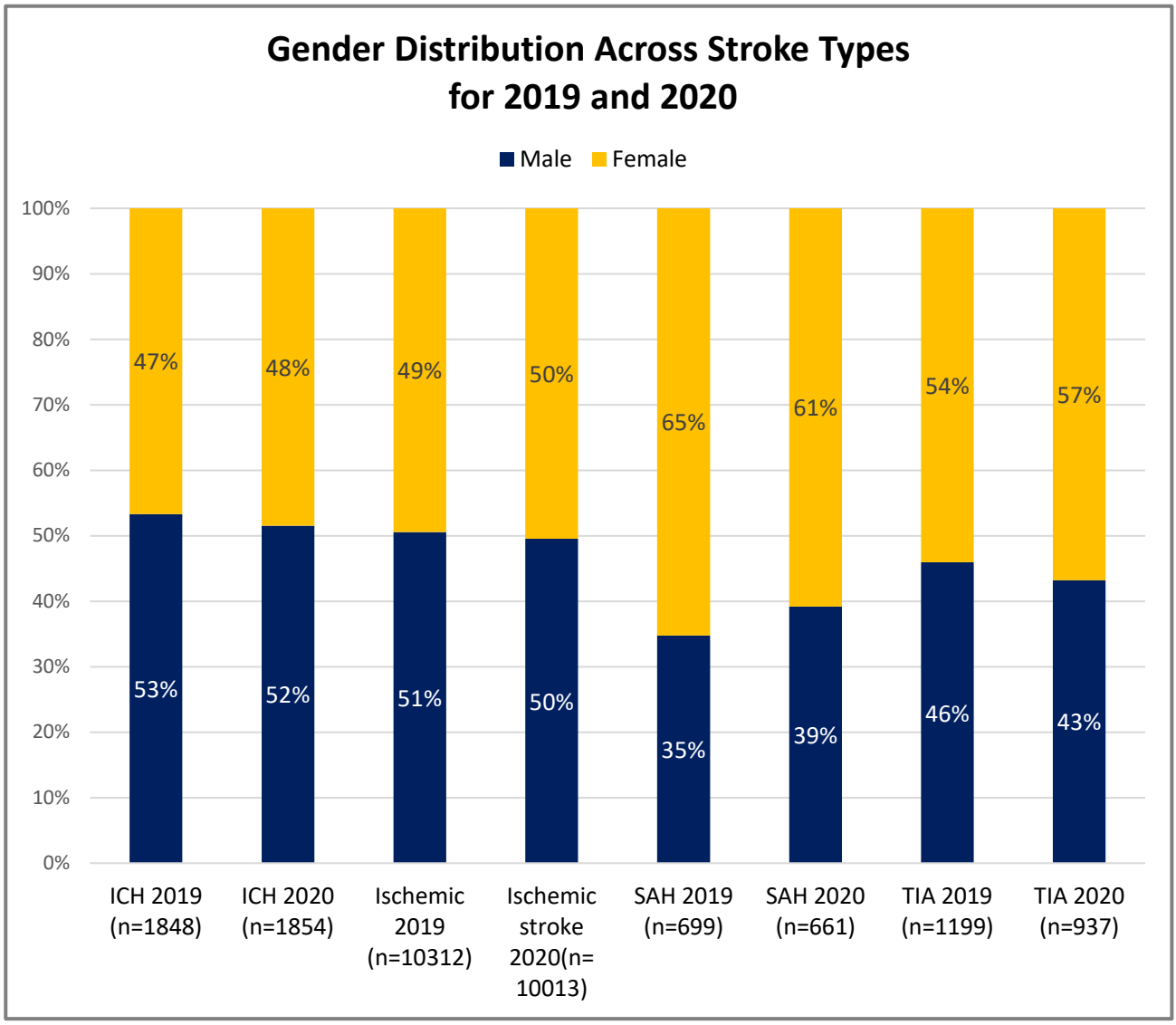


Figure 3. Distribution of stroke by gender in 2019 and 2020.

Gender distributions were consistent with data from 2019, with similar percentages of male and female cases for ischemic stroke, and slightly higher percentages of female cases for TIA (54% versus 46%) and similar proportions of male and female cases of ICH (53% versus 47%). The gender differences in strokes were more pronounced for subarachnoid hemorrhage than they were in 2019, but the difference between 2019 and 2020 was not significant.

Age Distributions

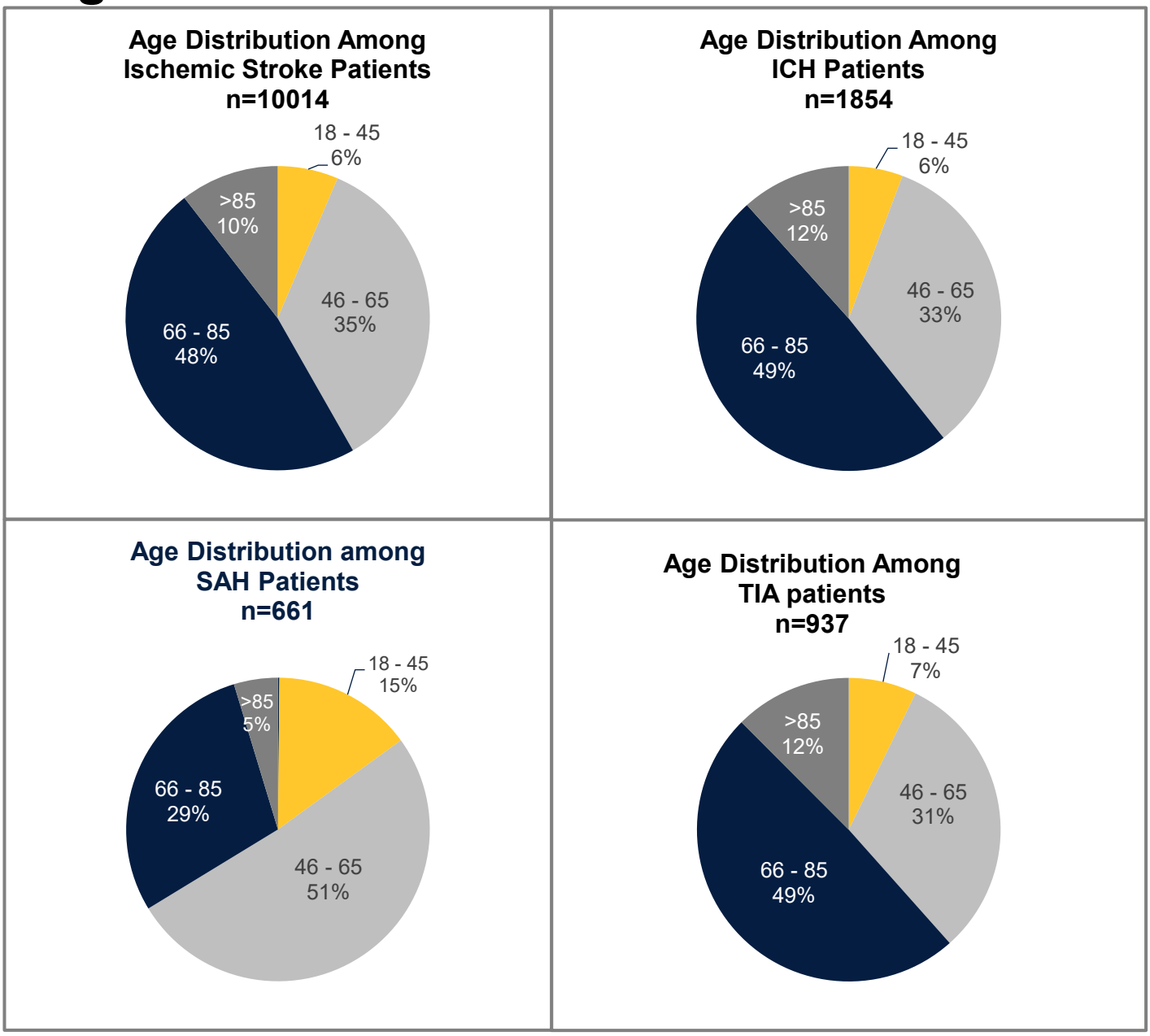


Figure 4. **Age distribution for all stroke types in 2020.**

Race

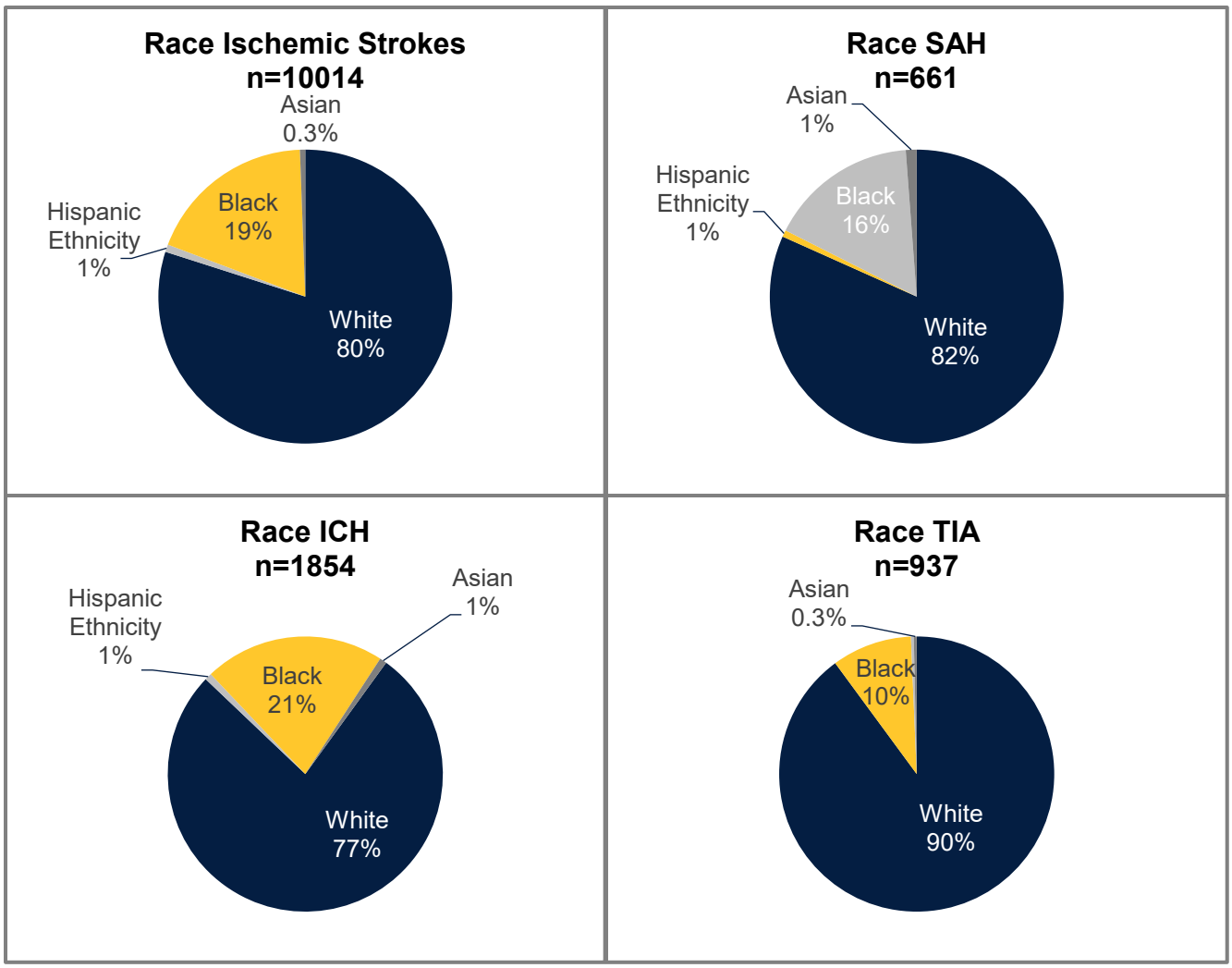


Figure 6. Race distribution of stroke patients aged 18 and older for all stroke types in 2020.

Co-morbidities

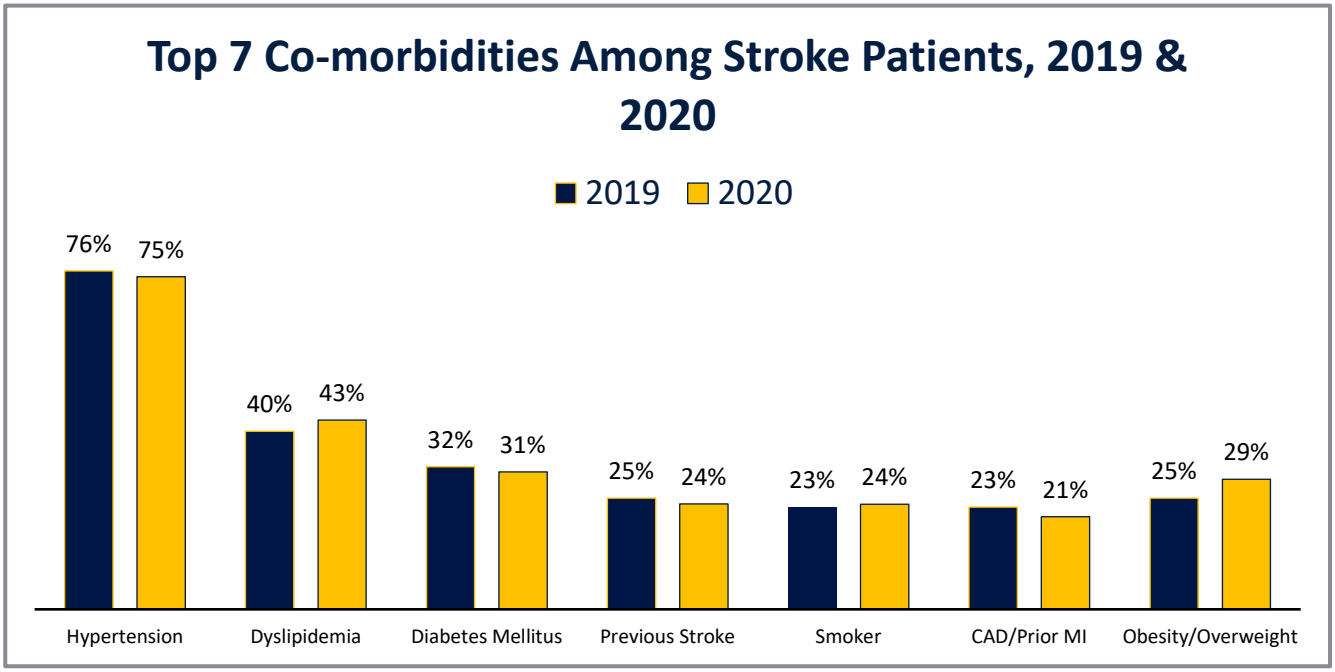


Figure 7. Most common comorbidities for all stroke types in from 2019-2020.

The top three co-morbidities among stroke patients in 2020 were hypertension (75%), dyslipidemia (43%), and diabetes mellitus (31%). More patients had a medical history of obesity in 2020 than in previous years, with a prevalence rate of 29% in reported cases in 2020 compared to 25% in 2019.

Arrival Mode

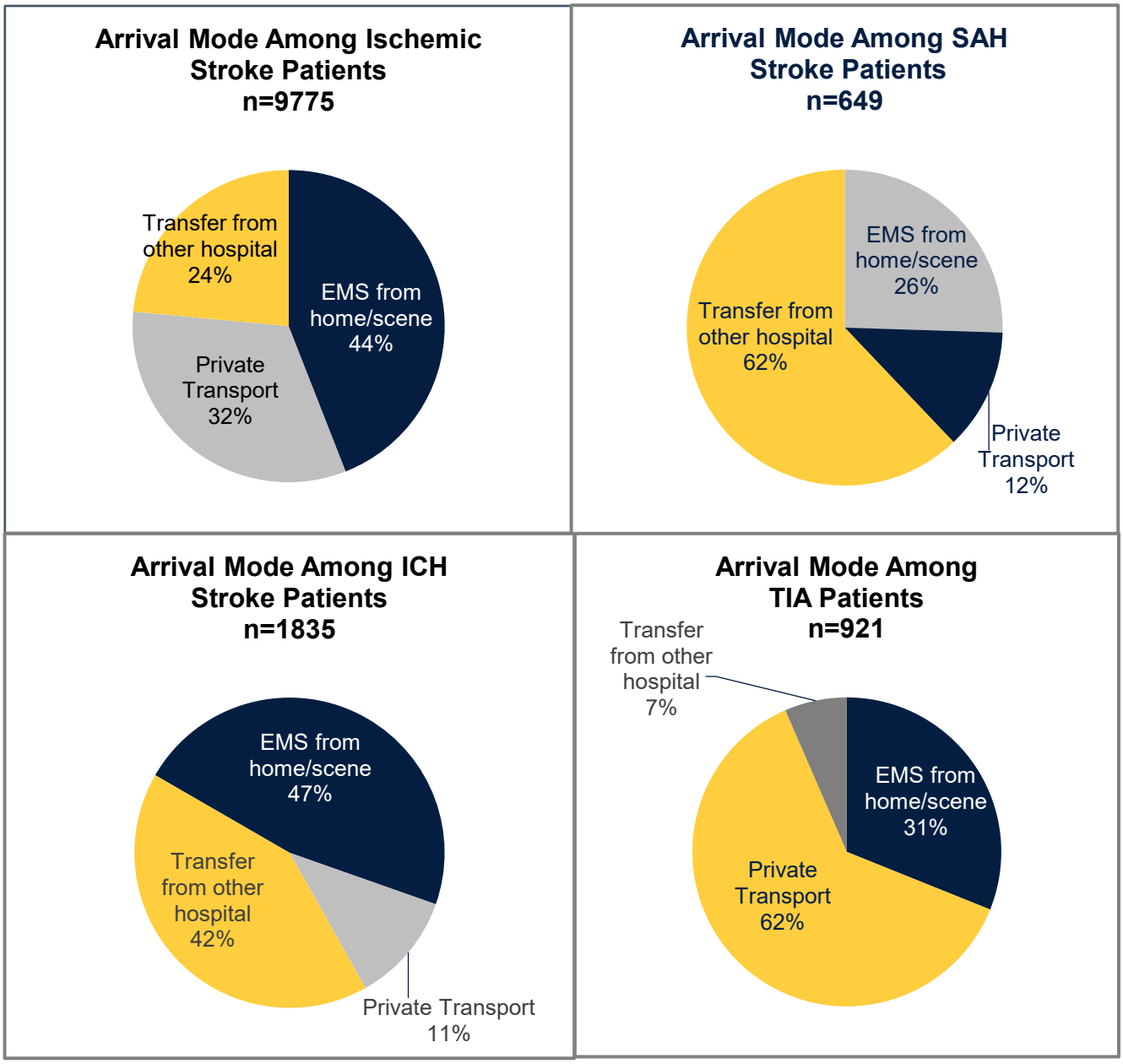


Figure 8. Arrival mode for all stroke types in 2020.

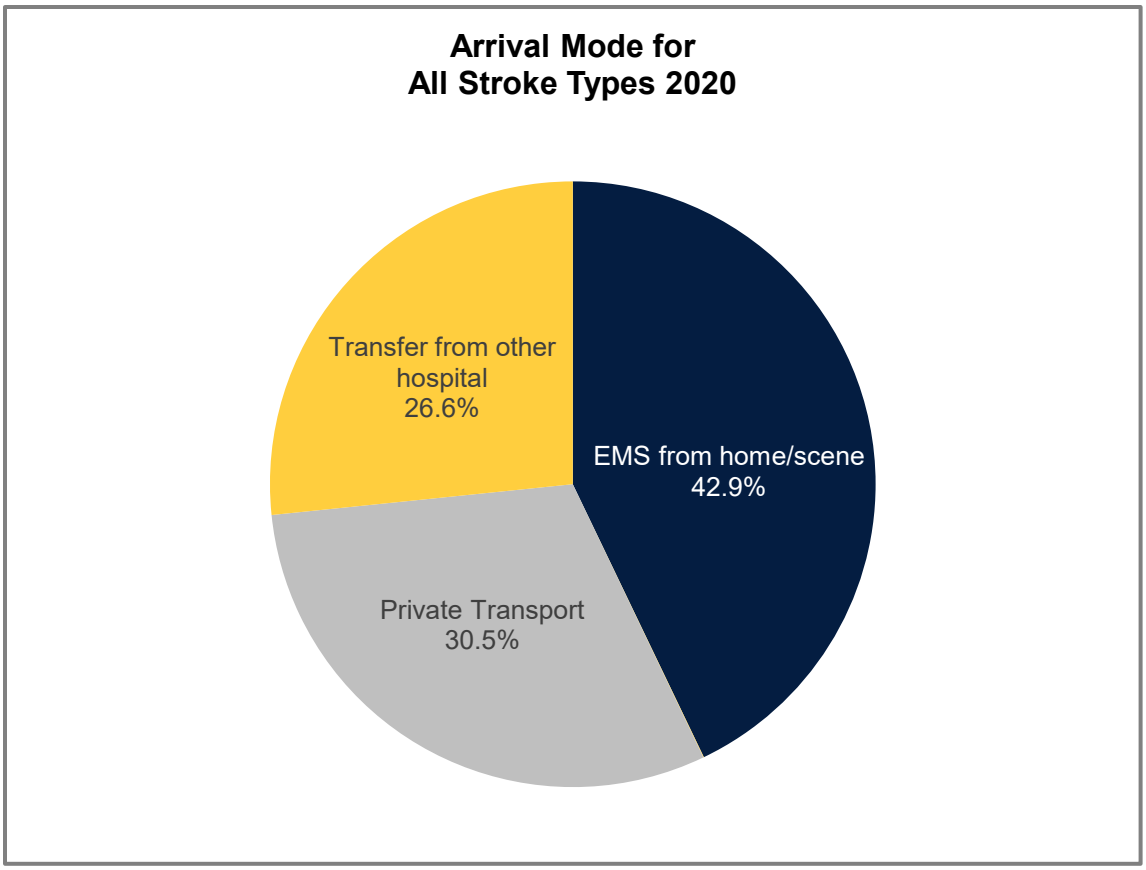


Figure 9. Arrival mode for all stroke types in 2019.

The most common mode of arrival for all strokes in 2019 was via Emergency Medical Services (EMS) transport, with 42.9% of patients arriving in this manner. This was the same for 2020 as well. There was a slightly different distribution of arrival mode among the stroke types, with the majority of TIA patients (26.6%) arriving via private transport and the majority of hemorrhagic stroke patients arriving from another hospital.

Last Known Well to Arrival times

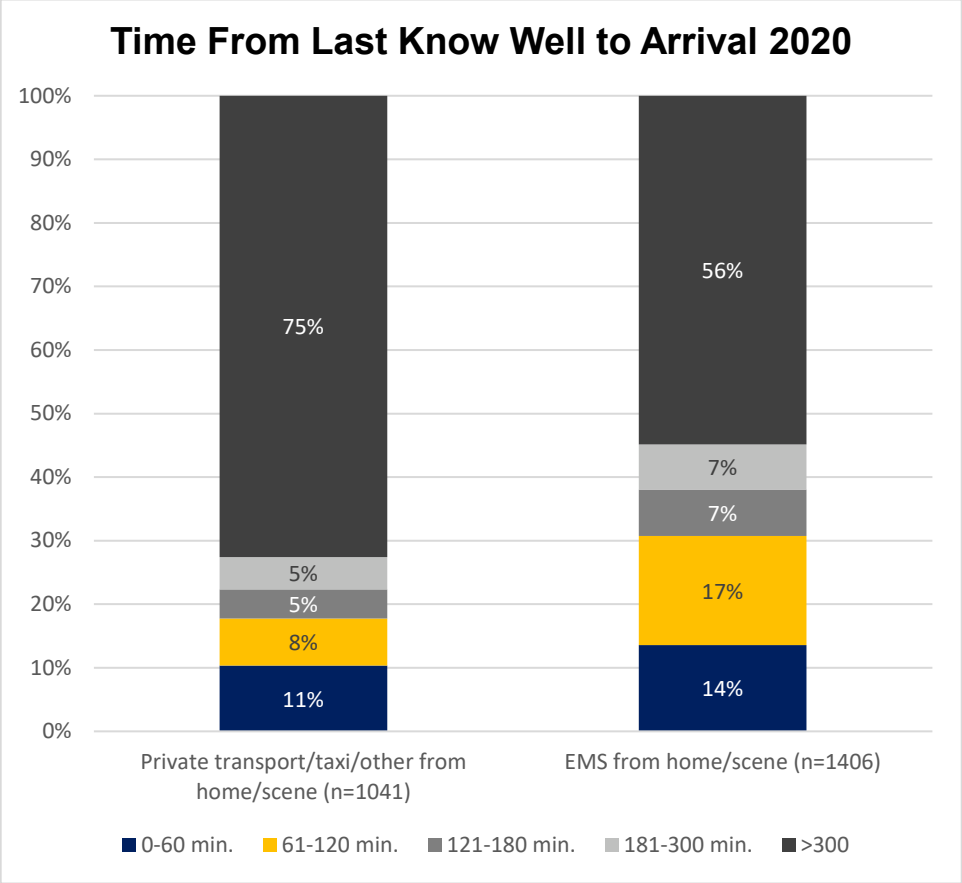


Figure 10. Last Known Well (LKW) to arrival times for all stroke types in 2020. LKW to arrival time is defined as the amount of time between when the patient first began experiencing stroke symptoms and their arrival at the hospital.

Overall, private transport observes longer transportation times from home/scene in comparison to Emergency Medical Services (EMS) transport. Most patients arrived at the hospital in over 300 minutes via private transportation (75%), while only 56% of patients via EMS services arrived in that time frame. Meanwhile, 14% of patients arrive to the hospital via EMS services in less than 60 minutes. All of these percentages are very similar to 2019.

Insurance status

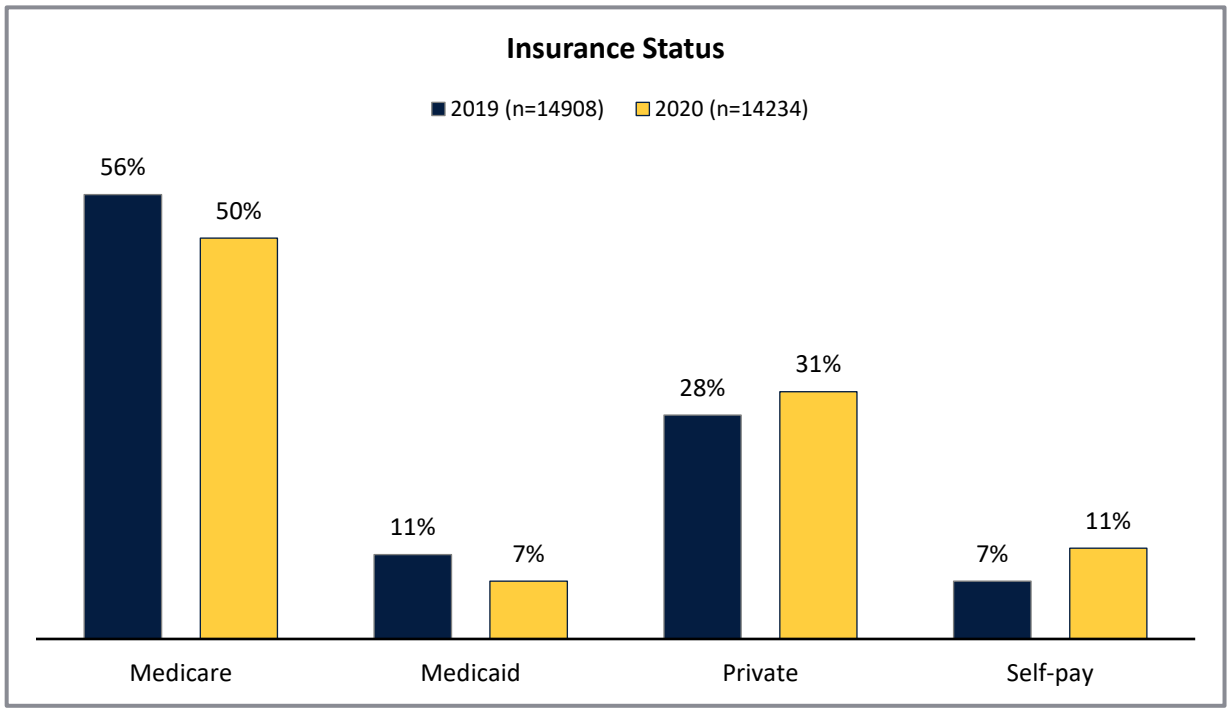


Figure 13. Insurance status of patients in 2020.

The majority of stroke patients had Medicare, with 56% of patients paying with Medicare in 2019 compared with 50% in 2020. This reflects that the most common age group experiencing strokes are those from ages 66-85, the group most likely to have Medicare insurance.

Quality Measures

The GWTG-Stroke program requires the following consensus measure. Descriptions are from the Patient Management Tool program, Quintiles.

- **Dysphagia Screen:** Percent of stroke patients who undergo screening for dysphagia with an evidence-based bedside testing protocol approved by the hospital before being given any food, fluids, or medication by mouth.
- **Stroke Education:** Percent of patients with stroke or TIA or their caregivers who were given education and/or educational materials during the hospital stay addressing ALL of the following: personal risk factors for stroke, warning signs for stroke, activation of emergency medical system, need for follow-up after discharge, and medications prescribed.
- **Rehabilitation Considered:** Percent of patients with stroke who were assessed for rehabilitation services.
- **Time to Intravenous Thrombolytic Therapy - 60 min:** Percent of acute ischemic stroke patients receiving intravenous tissue plasminogen activator (tPA) therapy during the hospital stay who have a time from hospital arrival to initiation of thrombolytic therapy administration (door-to-needle time) of 60 minutes or less.
- **LDL Documented:** Percent of ischemic stroke or TIA patients with a documented Lipid profile.
- **Intensive Statin Therapy:** Percent of Ischemic stroke and TIA patients who are discharged with Intensive Statin Therapy.
- **IV rt-PA Arrive by 3.5 Hours, Treat by 4.5 Hours:** Percent of acute ischemic stroke patients who arrive at the hospital within 210 minutes (3.5 hours) of time last known well and for whom IV t-PA was initiated at this hospital within 270 minutes (4.5 hours) of time last known well.
- **NIHSS Reported:** Percent of ischemic stroke and stroke not otherwise specified patients with a score reported for NIH Stroke Scale (Initial)

Quality measure	2019	2020
Dysphagia screen	86.00%	88.00%
Intensive statin therapy	89.50%	90.00%
IV rt-PA arrive by 3.5 hour, treat by 4.5 hour	91.70%	92.60%
LDL documented	94.80%	94.80%
NIHSS reported	95.40%	95.90%
Rehabilitation considered	99.40%	99.00%
Stroke education	95.00%	94.80%
Time to intravenous thrombolytic therapy - 60 min	88.80%	89.00%

Table 1. Percent of patients receiving quality measure in 2019 & 2020.

There was not much difference in the quality measures from the year 2019 to 2020. In IV r-tPA treatment, there were more patients who arrived by 3.5 hours and were treated by 4.5 hours in 2019 than in previous years, with 92.6% of patients in 2020. There was a slight decrease in patients with rehabilitation considered, this occurred in 99.40% of patients in 2019 and 99% of patients in 2020.

Time to Intravenous Thrombolytic Therapy

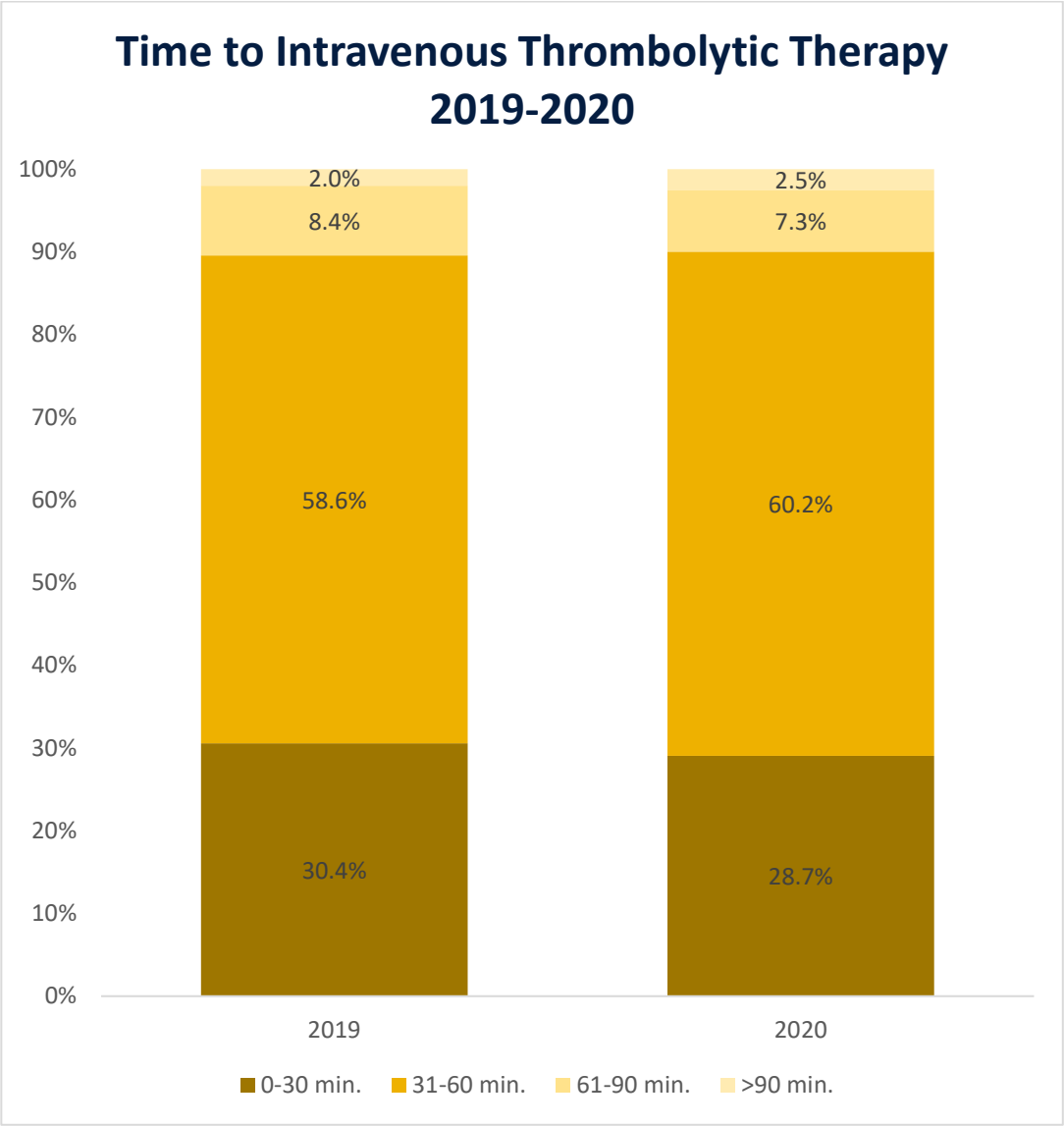


Figure 14. Time to intravenous thrombolytic therapy from 2019-2020.

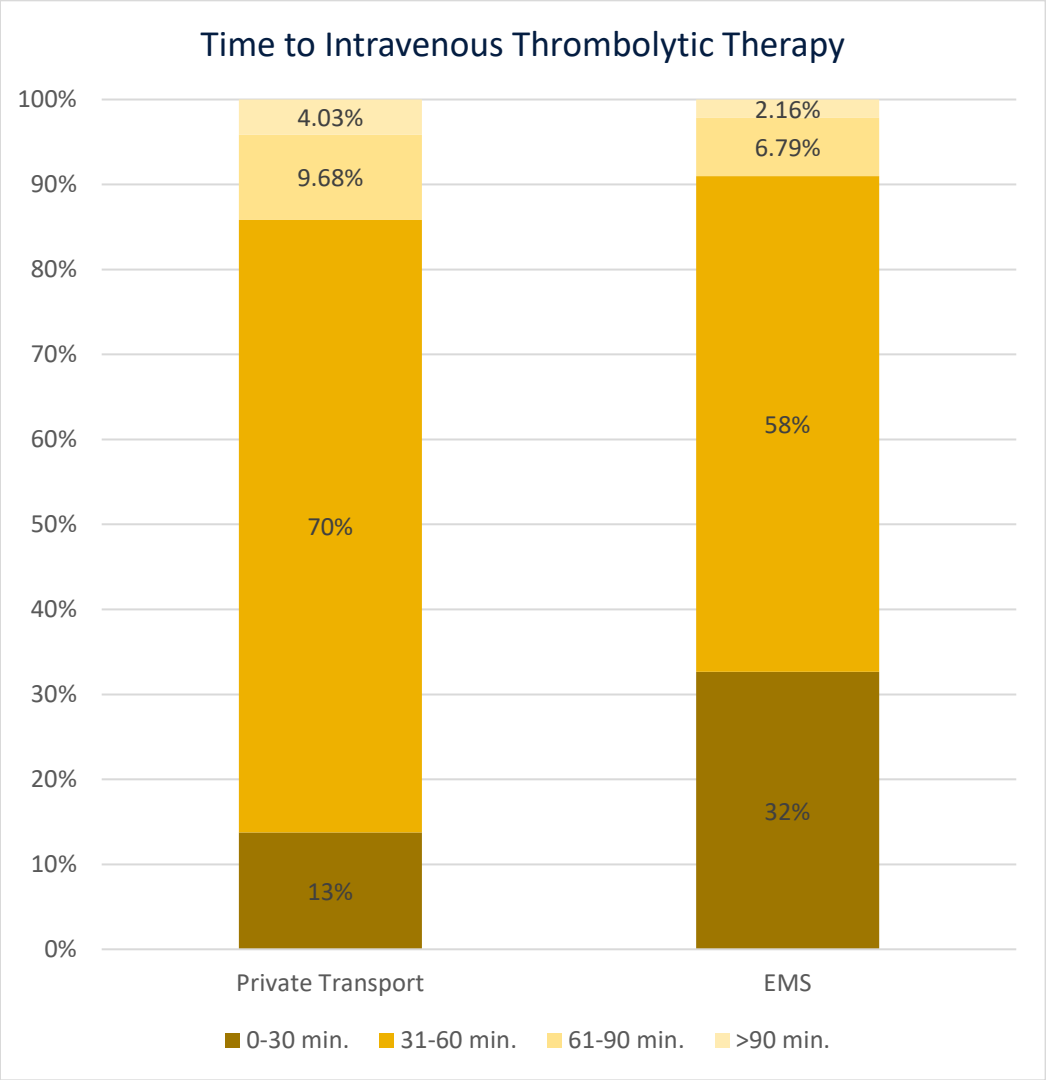


Figure 15. Comparison of times to intravenous thrombolytic therapy by transportation type in 2020.

IV t-PA was initiated within 60 minutes in 2020, at 93%. Compared to transport via EMS services, arriving via private transport experience slightly slower times with 87% of patients receiving treatment in an hour versus 94.2% who arrived via EMS.

Reasons for no IV rt-PA

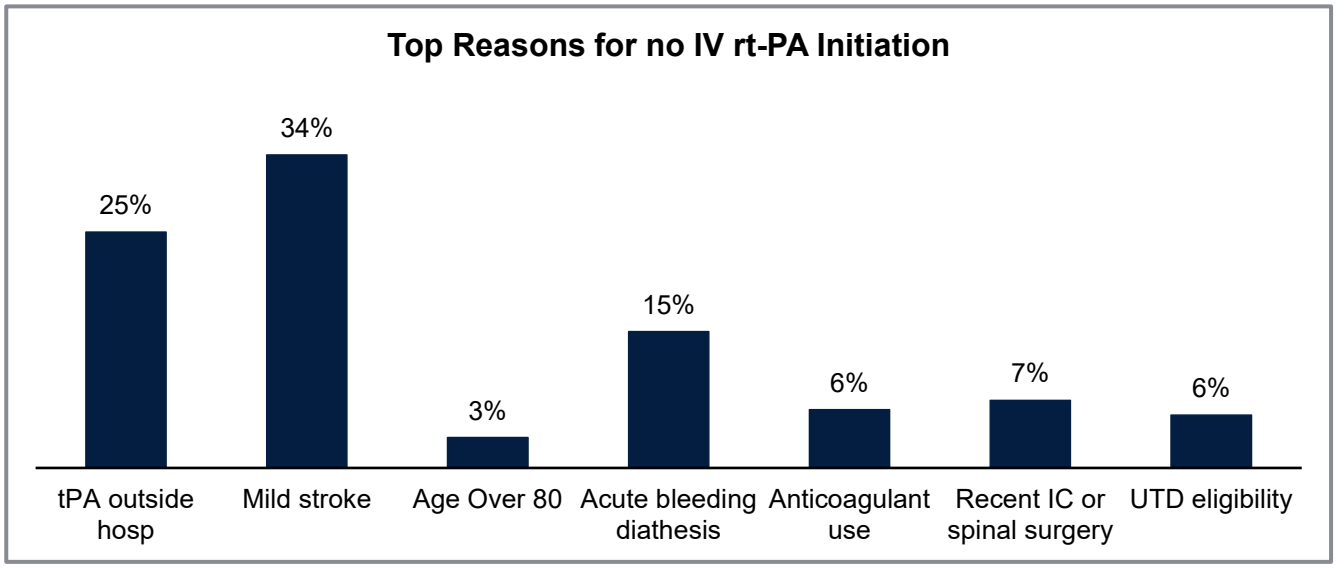


Figure 16. Top seven reasons in 2020 for no IV rt-PA initiation.

The percentages in the chart above represent the number of times the reason was listed as to why IV rt-PA was not initiated, out of patients with a primary stroke diagnosis of ischemic stroke who arrived at the ED <270 minutes after the onset of stroke symptoms and had reason(s) why IV t-PA was not started. The top reasons for no IV rt-PA initiation in 2020, in order of highest proportion of patients to lowest, were because the stroke was too mild, IV or IA tPA was given outside the hospital, acute bleeding diathesis, UTD eligibility, Recent IC or spinal surgery, and age over 80 and anticoagulant use.

Reasons for Delay of IV rt-PA Beyond 60 Minutes

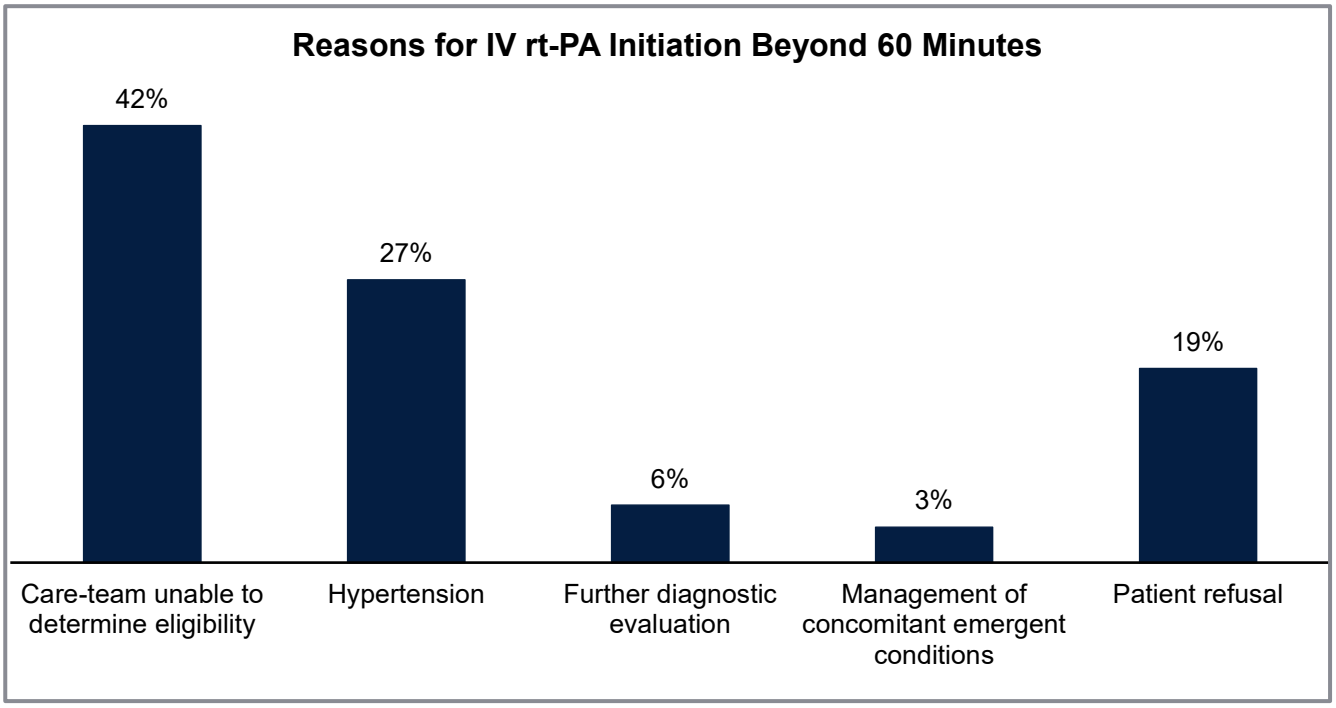


Figure 17. Top four reasons in 2020 for IV rt-PA initiation beyond 60 mins.

The percentages above represent patients with a primary stroke diagnosis of ischemic stroke in whom IV tPA was initiated greater than 60 minutes after hospital arrival The most common reason for delay in IV rt-PA beyond 60 minutes was that care-team was unable to determine the eligibility of the patient, composing 42% of delays in 2020, compared to 38% in 2019.

Modified Rankin Scale at Discharge

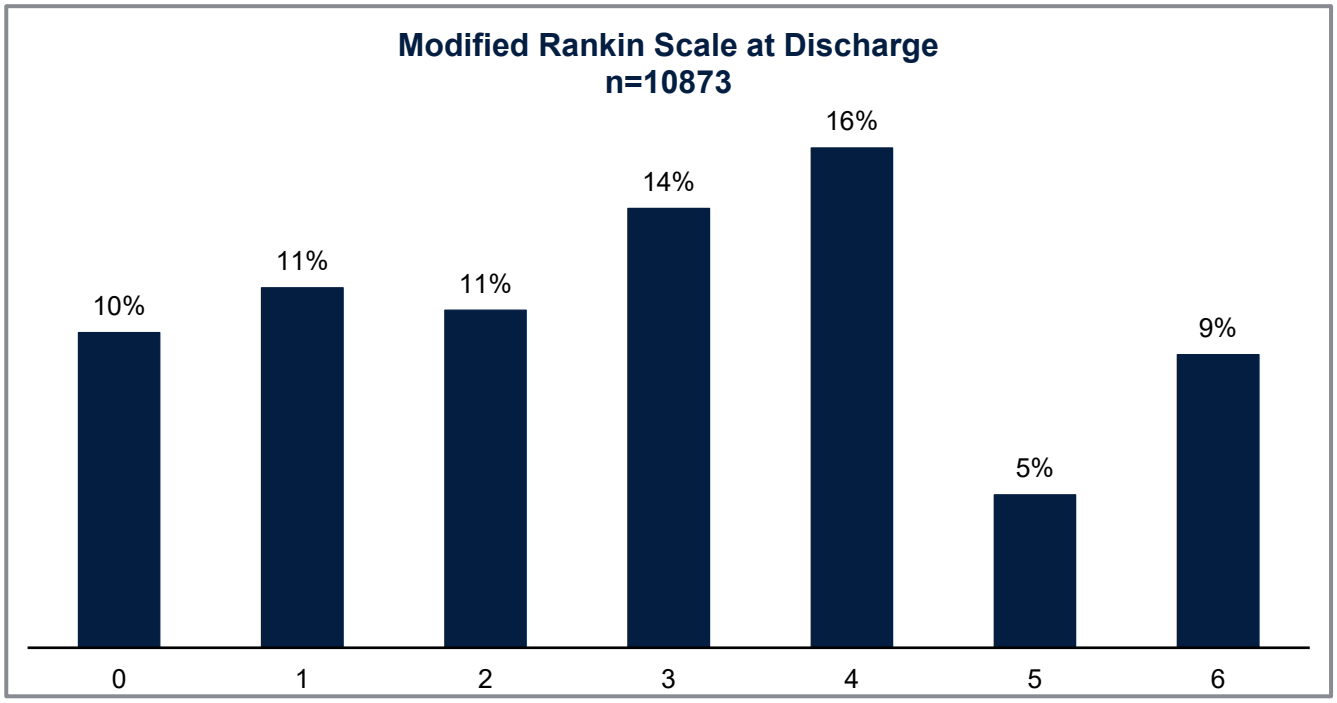


Figure 18. Modified Rankin Scale at Discharge 2020.

75% of patients had their Modified Rankin Scale at discharge documented in 2020, an increase from previous years (see figure 19). The Modified Rankin Scale ranges from 0-6, with the following designations for values:

- 0 - No symptoms at all
- 1 - No significant disability despite symptoms: Able to carry out all usual activities
- 2 - Slight disability
- 3 - Moderate disability: Requiring some help but able to walk without assistance
- 4 - Moderate to severe disability: Unable to walk without assistance and unable to attend to own bodily needs without assistance
- 5 - Severe disability: Bedridden, incontinent and requiring constant nursing care and attention
- 6 - Death

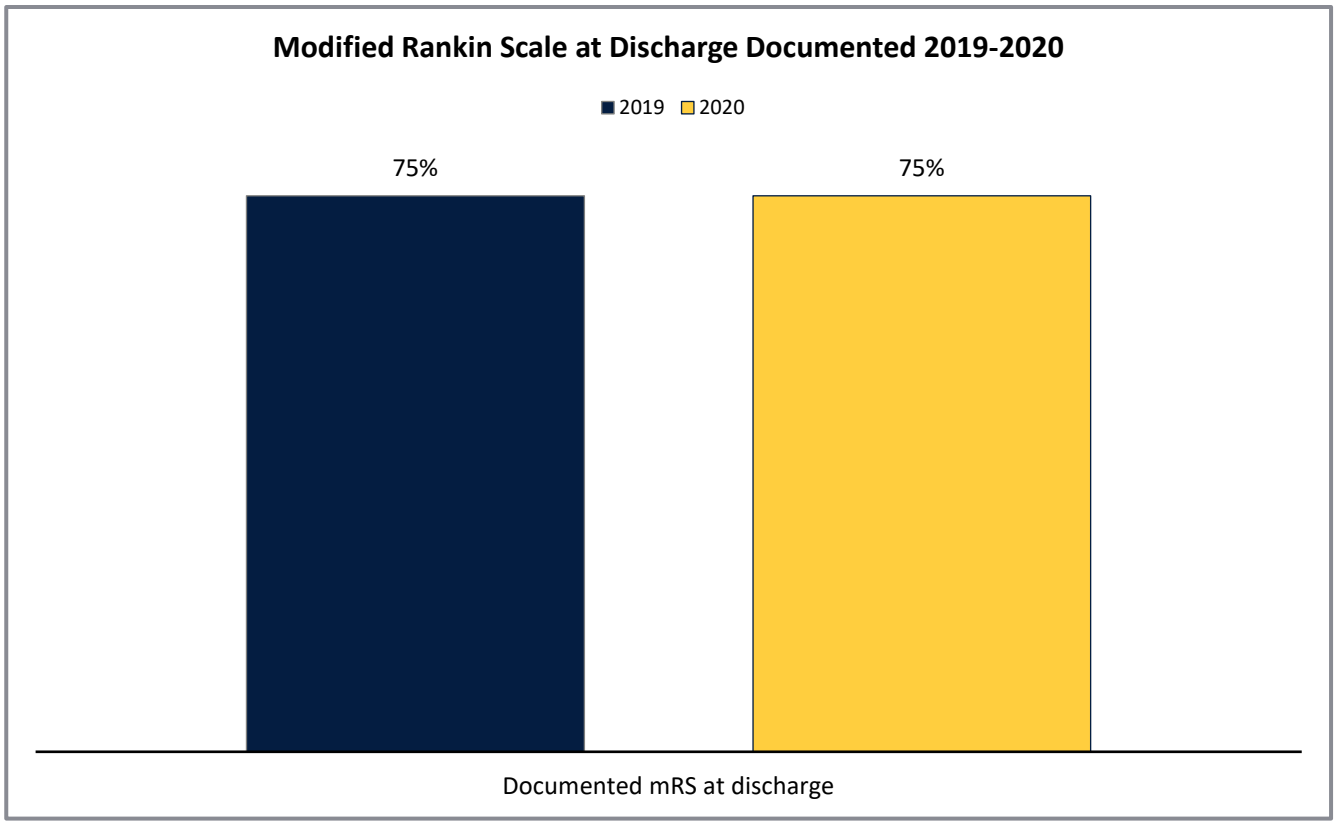


Figure 19. Percentage of patients with Modified Rankin Scale documented from 2019-2020.

Complication Types

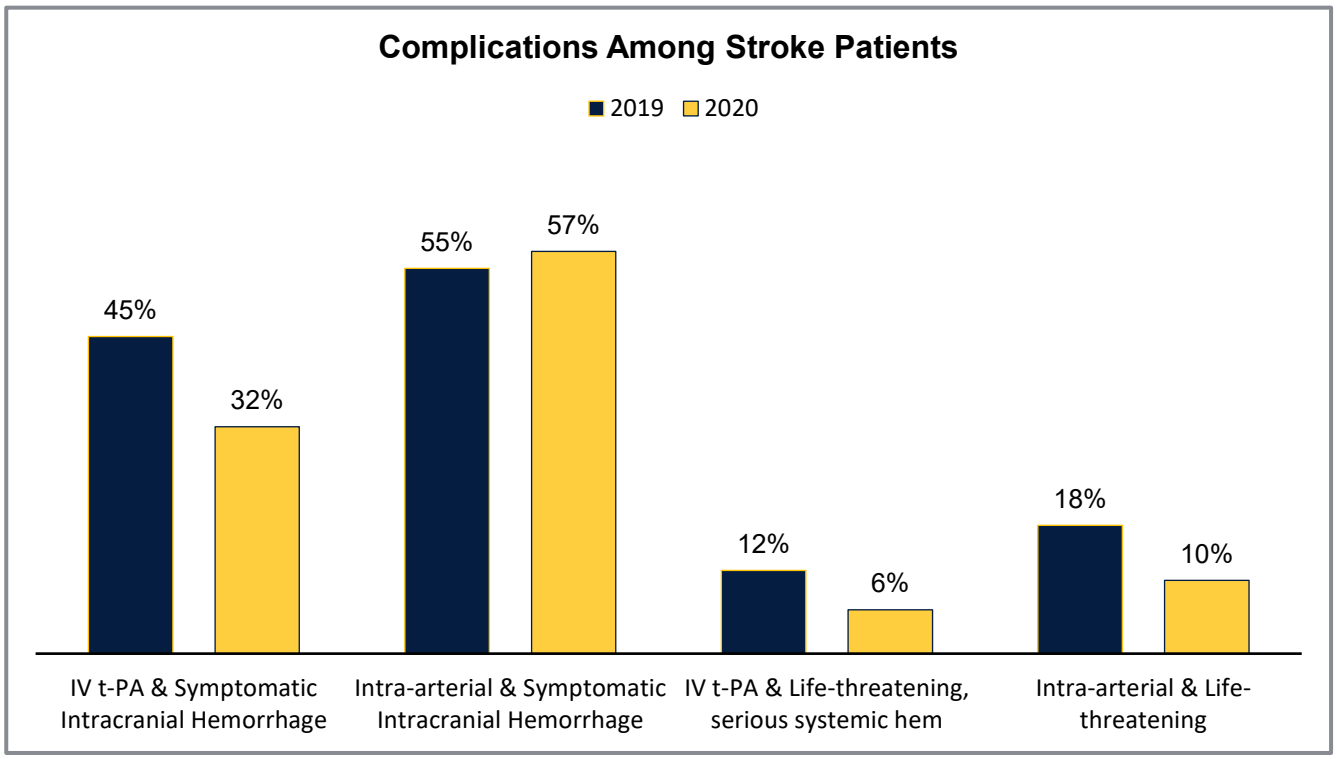


Figure 20. Complications found in IV rt-PA from 2019-2020.

The most common type of complication for IV-tPA in 2020 was Intra-arterial and Symptomatic Intracranial Hemorrhage at 57%. This means that out of all patients with a primary stroke diagnosis of ischemic stroke who received IV t-PA or intra-arterial thrombolytic therapy, most complications were an Intra-arterial and Symptomatic Intracranial Hemorrhage. There is no increase in this type of complication from 2019 to 2020.

Initial Exam findings

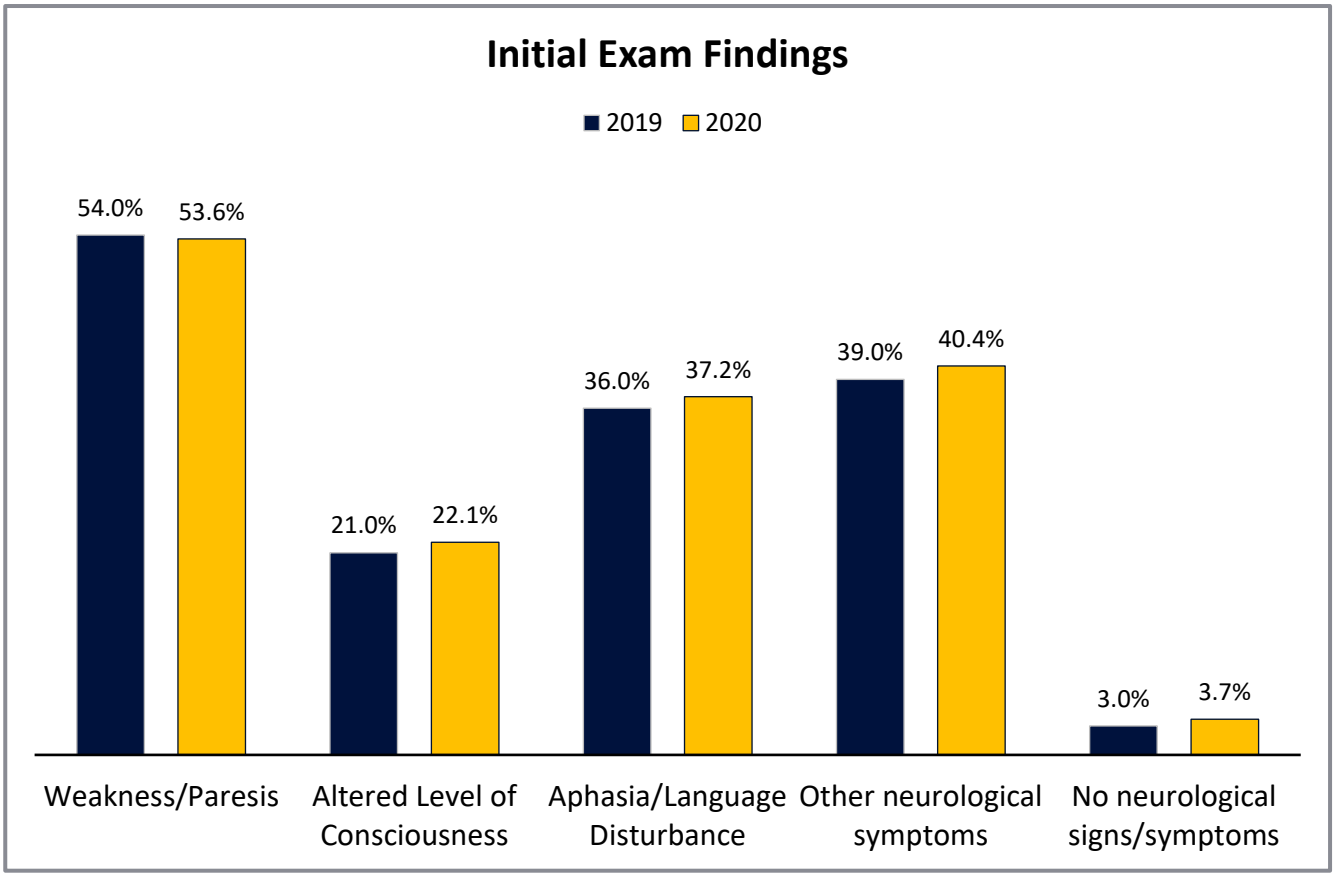


Figure 21. Initial exam findings in 2020.

The two most common findings in initial exam of patients in 2020 were weakness/paresis (54%) and neurological symptoms other than altered level of consciousness and aphasia (40%). These are both very similar to 2019.

Average Length of Stay

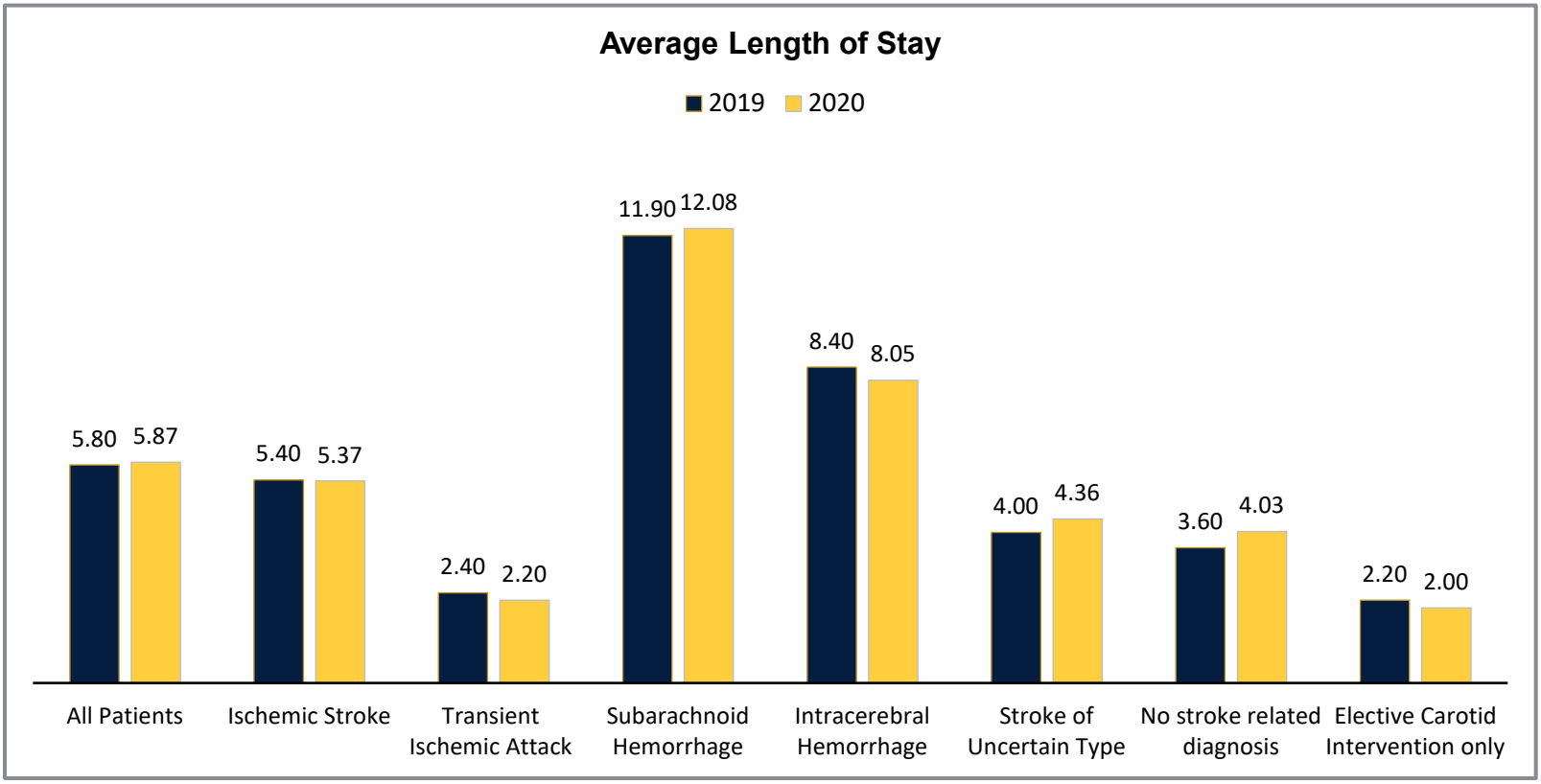


Figure 22. Average length of stay in 2020.

The type of stroke with the longest length of hospital stay (LOS) was SAH at about 12 days, and the shortest LOS was TIA at about 2 and a half days. This was true for both 2019 and 2020.

GTWTG/PAA Defect Free

Figure 23. Percent of patients who received defect-free care according to GWTG standards.

CDC/COV Defect Free

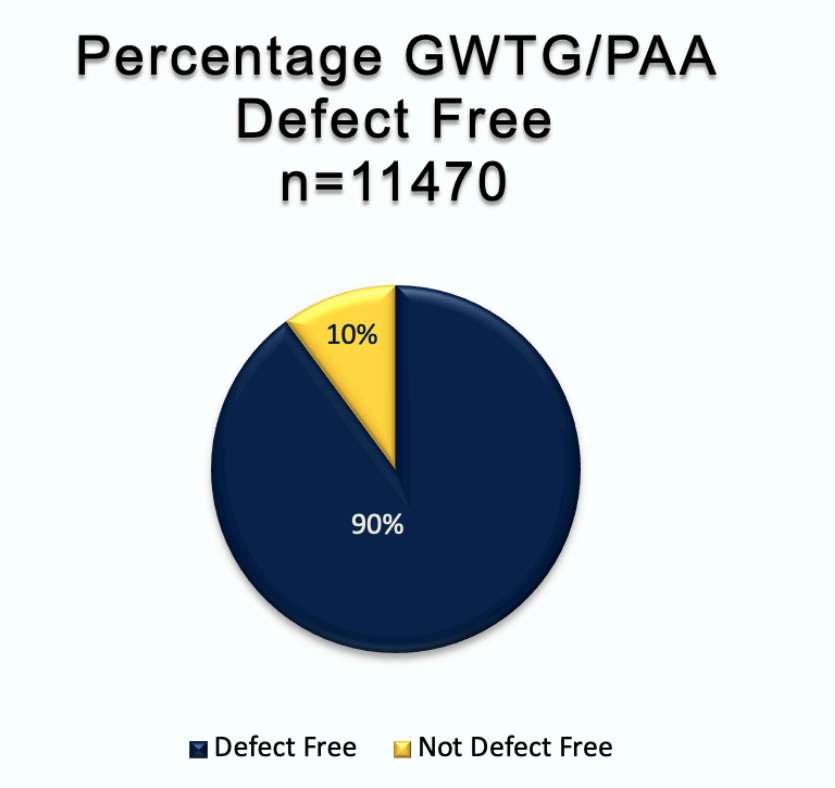


Figure 24. Percent of patients who received defect-free care according to Center for Disease Control (CDC) standards.

LIMITATIONS TO DATA PRESENTED IN THIS REPORT

Data reported are based on the data provided to the Tennessee Stroke Registry from reporting hospitals and may not be inclusive of all strokes in the state of Tennessee. Data are combined for all hospitals and are reported in aggregate.

HOW TO PARTICIPATE IN GWTG-STROKE

According to Tennessee House Bill 123, all certified comprehensive and primary stroke centers in Tennessee are required to submit their data to the TSR in order to improve stroke care in the state. The bill requires data to be provided from hospitals on a quarterly basis. Additional information is available on the TSR website, as well as the Hospital Participation form and the Amendment to Hospital Participation Form: https://www.etsu.edu/cph/biostat_epidemiology/tnstroke.php.

The local GWTG contact is Kayley Pelton, who can assist hospitals in enrolling in GWTG-Stroke and the Tennessee Stroke Registry.

Local GWTG Representative:

Kaley Pelton, MPH, RT(R)
Director, Quality & Systems Improvement, Greater Southeast Affiliate
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Contact Information for TSR:

Megan Quinn, DrPH, MSc.
Tennessee Stroke Registry Manager
Email (preferred): strokeregistry@etsu.edu
Phone: (423) 439-4427

REFERENCES

1. The Type of Treatment Depends on the Type of Stroke. Am Stroke Assoc. *http://www.strokeassociation.org/STROKEORG/AboutStroke/Treatment/Stroke-Treatment_UCM_492017_SubHomePage.jsp*