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Texas Stroke System of Care Report, 2019

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I. EXECUTIVE SUMMARY

In 2016, stroke was the third leading cause of death among Texans, causing 44.1 deaths per 100,000 people. (1) Stroke mortality varied by race/ethnicity. Deaths due to stroke were more common among blacks (62.7 deaths per 100,000 people) compared with whites (44.2 deaths per 100,000 people) or Hispanics (37.2 deaths per 100,000). In 2017, the prevalence of stroke among Texans ages 18 years and older was 3.5%. (2)

In 2017, about 25 hospitalizations occurred due to stroke for every 10,000 Texans. (3) The total charges for stroke hospitalizations in 2017 were more than $5.3 billion. Medicaid beneficiaries accounted for over $308 million of the total charges. (3)

In order to advance stroke reduction efforts, it is important to analyze the system of care by collecting and analyzing data. During the 83rd Regular Texas Legislative Session, funds were appropriated to advance heart attack and stroke reduction efforts throughout Texas. To inform such efforts, the Texas Department of State Health Services (DSHS) launched a heart attack and stroke data collection initiative.

To evaluate the care of patients diagnosed with a stroke, DSHS assessed elements within the stroke system of care for timeliness and appropriateness. DSHS analyzed data collected from the hospitals that agreed to participate in this data collection initiative. The data are collected in the "Get With The Guidelines®"-Stroke database using the Quintiles PMT® system, and reflect hospital care from the first quarter of 2008 through the fourth quarter of 2018, unless otherwise stated.

Substantial stroke system of care findings, 2008-2018:

- From 2008-2018, the number of hospitals providing data on individual episodes of stroke has ranged from 21-50 hospitals, with 47 located in urban counties and 4 in rural counties (Pg. 10). Note: One hospital system reports four hospitals in aggregate; these cases cannot be analyzed individually by hospital, so these four hospitals are counted as a single hospital.
  - For 2018, 46 hospitals/hospital systems participated in the data collection.
- In total, 132,036 episodes of care have been reported. Out of these, 126,758 episodes of stroke care were considered eligible for analyses in this report (Pg. 10 - Pg. 13).
- Overall, about four out of 10 stroke cases (39.2%) arrived at the hospital by private vehicle (Pg. 15). For the most recent 5 years (2014-2018), the arrival methods of stroke cases have remained similar (Pg. 17).
  - Among rural hospitals, 46.3% cases arrived to the hospital by private vehicle, vs. 38.7% among urban hospitals (Pg. 15);
  - Females were more likely than males to arrive via ambulance (46.5% vs. 43.6%), while males were more likely than females to arrive via private vehicle (40.0% vs. 38.4%) (Pg. 15).

- Overall, Emergency Medical Services (EMS) gave advance notification to the receiving hospital in 53.0% of stroke cases transported by EMS from home or scene (Pg. 18).
  - Advance notification occurred for 73.0% of adult stroke cases in rural hospitals, as compared with 57.8% among urban hospitals (Pg. 18);
  - In 2018, advance notification was provided for over half (51.8%) of the EMS transported adult stroke cases (Pg. 19).
- For the most recent 5 years (2014-2018), the National Institutes of Health Stroke Scale (NIHSS) was reported for over 91% of adult ischemic stroke and stroke not otherwise specified (NOS) cases (Pg. 21).
  - For the last 7 years (2012-2018), the median NIHSS score has remained the same: NIHSS score of 4 - Minor stroke.
- Overall, almost half of all adult stroke cases (48.0%) received initial brain imaging within 15 minutes of hospital arrival. The median door-to-imaging time was 16 minutes (Pg. 22).
  - The median door-to-imaging time was 14 minutes for arrival by EMS and 20 minutes for arrival by private vehicle (Pg. 22);
  - Having a door-to-imaging ≤ 25 minutes varied by arrival method: 73.6% who arrived by EMS and 61.0% who arrived by private vehicle (Pg. 22).
- Overall, three out of 10 stroke cases (31.7%) received Tissue plasminogen activator (tPA) within 45 minutes of hospital arrival, and six out of 10 (64.7%) received tPA within 60 minutes of hospital arrival (Pg. 24).
- The door-to-tPA times and percentage of cases treated varied by method of arrival (Pg. 24 - 26).
  - 67.1% of cases arriving by EMS, vs. 60.4% arriving by private transport, had a door-to-tPA time ≤ 60 minutes (Pg. 24);
  - Over time, the median door-to-tPA time has decreased by almost half, from 90 minutes in 2008 to 47 minutes in 2017 (Pg. 26).
- In 2018, three in 100 (3.3%) adult stroke cases treated with any type of thrombolytic therapy experienced bleeding complications post thrombolytic therapy (Pg. 34).
- Of the eligible adult ischemic stroke and Transient Ischemic Attack (TIA) cases, two-thirds (68.3%) were prescribed a qualifying high-intensity statin at hospital discharge (Pg. 35).
- For the last 8 years, 97.9% or more of adult ischemic stroke and TIA cases were prescribed an antithrombotic at hospital discharge (Pg. 37).
- From 2008-2018, 98.2% of eligible adult stroke cases were assessed for rehabilitative services (Pg. 40).
- The percentage of eligible adult stroke cases who received all of the stroke education materials has increased, from a low of 50.6% in 2008 to a high of 97.7% in 2016, and 96.4% in 2018 (Pg. 42).
- From 2011-2018, four in 10 (40.6%) adult stroke cases had a Modified Rankin Scale score (mRS) documented at discharge (Pg. 43).

II. INTRODUCTION

A stroke occurs when a blood vessel that carries oxygen and nutrients to the brain is blocked by a clot or ruptures, leading to death of brain cells. (4) The two most common types of stroke are ischemic stroke and hemorrhagic stroke. An ischemic stroke is caused by a clot in a brain blood vessel which prevents blood and oxygen flow to the area. A hemorrhagic stroke is caused when a brain blood vessel ruptures, leaking blood into the surrounding brain area. An additional type of stroke, transient ischemic attack (TIA), also called a "mini stroke", is caused by a temporary clot in a brain blood vessel. (4)

III. BACKGROUND

In order to advance stroke reduction efforts, it is important to assess the system of care by collecting and analyzing data. During the 83rd Regular Texas Legislative Session, funds were appropriated to advance heart attack and stroke reduction efforts throughout Texas. To inform such efforts, the Texas Department of State Health Services (DSHS) launched a Heart Attack and Stroke Data Collection initiative. The data collection initiative focuses on pre-hospital and hospital data elements. This report includes de-identified, aggregate data for hospitals who have agreed to share "Get With The Guidelines®" (GWTG) Stroke data with DSHS. All data is protected under Health Insurance Portability Accountability Act (HIPAA) guidelines. No hospital level data will be distributed, nor will any hospital name be identified in the report. This aggregate data is intended to inform stakeholders about opportunities for collaboration and system improvement.

The objectives of the data collection are: 1) to gain an understanding of the stroke systems of care in Texas; and 2) to evaluate pre-hospital and hospital care components, and treatment of stroke patients. The findings will be used to assess the practices regarding delivery of care across the state and identify areas of opportunity for quality improvement.

IV. STROKE IN TEXAS

In 2017, the prevalence of stroke among Texans 18 years of age and older was 3.5% (95% CI: 2.8-4.2). (2) The unadjusted prevalence of stroke for each year (2011-2017), overall and by race-ethnicity, is displayed in Table 1.

TABLE 1. ESTIMATED NUMBER AND UNADJUSTED PREVALENCE OF STROKE, ADULTS AGES 18 YEARS AND OLDER, BY RACE/ETHNICITY, 2011-2017

			Race/Ethnicity			
Year	Number	% (95% CI)	White only % (95% CI)	Black only % (95% CI)	Hispanic % (95% CI)	Other % (95% CI)
2011	487,039	2.7 (2.3-3.0)	2.7 (2.2-3.1)	5.2 (3.2-7.2)	1.8 (1.1-2.4)	--
2012	513,211	2.7 (2.3-3.1)	3.2 (2.6-3.8)	4.2 (2.6-5.8)	1.5 (0.9-2.0)	--
2013	487,955	2.5 (2.1-2.9)	3.0 (2.5-3.6)	3.7 (2.1-5.3)	1.6 (1.0-2.2)	--
2014	587,304	3.0 (2.5-3.4)	3.1 (2.6-3.7)	5.8 (3.9-8.6)	1.9 (1.4-2.6)	--
2015	608,538	3.0 (2.5-3.5)	3.1 (2.6-3.5)	4.7 (2.6-6.9)	2.3 (1.5-3.2)	--
2016	532,088	2.6 (2.1-3.1)	2.9 (2.3-3.7)	2.7 (1.6-4.4)	2.0 (1.2-3.3)	--
2017	732,484	3.5 (2.8-4.2)	4.2 (3.2-5.4)	5.8 (3.6-9.4)	2.1 (1.5-3.1)	--

Abbreviations: CI, confidence interval.
-- indicates data is not reportable due to small sample size.

According to the 2013 Texas Behavioral Risk Factor Surveillance System (BRFSS) survey, an estimated 86.9% of adults in Texas said they would call 911 if they thought someone was having a heart attack or stroke. The remaining 13.1% of adults said they would take other action, such as take the person to the hospital, tell the person to call their doctor, call a spouse or family member, or do something else.

HOSPITALIZATIONS

Table 2 displays annual (2010-2017) age-adjusted hospitalization rates (per 10,000 individuals) for stroke among Texans of all ages. In 2017, for every 10,000 people, about 25 hospitalizations occurred due to stroke (25.0; 95% Confidence Interval [CI]: 24.8-25.2). (3) The annual age-adjusted hospitalization rate for stroke (per 10,000) increased by 15.2% from 2010 to 2017.

TABLE 2. AGE-ADJUSTED STROKE HOSPITALIZATION RATES PER 10,000 INDIVIDUALS, ALL AGES, BY RACE/ETHNICITY, TEXAS, 2010-2017

Year	Number	Age-Adjusted Hospitalization Rate (95% CI)	Race/Ethnicity			
			White only (95% CI)	Black only (95% CI)	Hispanic only (95% CI)	Other (95% CI)
2010	47,588	21.7 (21.5-21.9)	20.6 (20.3-20.8)	28.9 (28.1-29.6)	19.0 (18.6-19.4)	38.4 (36.9-39.9)
2011	49,224	21.7 (21.5-21.9)	20.4 (20.2-20.7)	30.7 (29.9-31.4)	17.9 (17.6-18.3)	32.7 (31.5-33.8)
2012	49,738	21.1 (20.9-21.2)	18.8 (18.6-19.0)	26.4 (25.8-27.1)	16.8 (16.4-17.1)	56.3 (54.8-57.8)
2013	50,500	20.7 (20.5-20.9)	19.4 (19.2-19.6)	27.5 (26.9-28.2)	17.0 (16.6-17.3)	34.9 (33.8-36.1)
2014	50,933	20.3 (20.1-20.4)	19.1 (18.9-19.3)	27.4 (26.7-28.0)	17.3 (17.0-17.7)	32.9 (31.7-34.0)
2015	57,113	22.0 (21.8-22.1)	20.9 (20.6-21.1)	30.2 (29.5-30.9)	19.3 (18.9-19.6)	30.0 (29.0-31.1)
2016	68,327	25.3 (25.1-25.5)	23.4 (23.2-23.7)	33.4 (32.7-34.1)	21.7 (21.3-22.1)	48.1 (46.8-49.4)
2017	69,764	25.0 (24.8-25.2)	22.1 (21.9-22.3)	32.5 (31.8-33.2)	24.8 (24.4-25.2)	43.7 (42.5-44.9)

Abbreviations: CI, confidence interval.

In 2017, the total charges for hospitalizations due to stroke were more than $5 billion (Table 3). (3) Medicare beneficiaries accounted for 60% of hospital discharges and nearly $3 billion in total charges. Total charges for Medicaid beneficiaries were over $300 million.

TABLE 3. STROKE HOSPITAL DISCHARGES AND TOTAL CHARGES BY PRIMARY PAYMENT SOURCE, TEXAS, 2017

Payer Source	Hospital Discharges		Total Charges
Total	N=69,764	%	$5,334,502,977
Medicaid	2,756	4.0	$308,409,930
Medicare	43,367	62.2	$3,048,880,938
Private Insurance	16,293	23.4	$1,303,080,956
Uninsured	6,147	8.8	$574,154,533
Other	1,201	1.7	$99,976,619

MORTALITY

In 2016, stroke was the third leading cause of death among Texans of all ages, accounting for 44.1 deaths per 100,000 people. (1) When stratified by race/ethnicity, the age-adjusted stroke mortality was significantly higher among blacks (62.7 per 100,000) than among whites (44.2 per 100,000) or Hispanics (37.2 per 100,000).

From 2011-2016, the average age-adjusted stroke mortality rate was 43.0 deaths per 100,000 Texans of all ages. Among race-ethnicity groups, deaths due to stroke were more common among blacks (61.2 per 100,000) than among whites (42.7 per 100,000) or Hispanics (36.8 per 100,000).

The map below displays the geographic distribution of the 6-year (2011-2016) age-adjusted stroke mortality rate per 100,000 Texans. The highest mortality rates emerge across north, east, and central Texas.

For every 100,000 people, an average of 43.0 Texans died of a stroke each year from 2011-2016.

FIGURE 1. AGE-ADJUSTED STROKE MORTALITY RATE, PER 100,000 PEOPLE, ALL AGES, BY COUNTY, TEXAS, 2011-2016

V. EVALUATING HOSPITAL CARE FOR STROKE IN TEXAS

In an ideal system of care, all patients should receive proper care with minimal delays to treatment. To evaluate the care of patients diagnosed with a stroke, elements of care were assessed for timeliness and appropriateness.

DSHS analyzed data collected from a group of hospitals that voluntarily agreed to participate in this data collection initiative. The data are collected in the GWTG®-Stroke database using the Quintiles PMT® system. This report reflects hospital care from January 1, 2008 through December 31, 2018.

HOSPITAL PARTICIPATION

A total of 132,036 cases of stroke were reported from 2008 through 2018. From 2008 through 2018, 51 hospitals have participated, after accounting for hospitals' participation and withdrawal across this time. Of 46* hospitals participating in 2018, 43 were located in an urban setting, and 3 in a rural setting.

The number of patient beds among participating hospitals ranged from 43 to 817 beds per hospital. About 1/3 of the participating hospitals (n=26; 34%) had 100 to 299 bed capacity. Roughly eight in 100 stroke cases (7.8%) were treated at hospitals with less than 100 beds. About three in 10 stroke cases (32.1%) were treated at hospitals with 500 or more beds.

TABLE 4. NUMBER OF CASES AND HOSPITAL PARTICIPATION, BY YEAR, BY PATIENT BEDS, AND BY SETTING, 2008-2018

	Total Reported Cases	Participating Hospitals *
	N=132,036 (%)	N
Year		
2008	4,845 (3.7)	21
2009	6,321 (4.8)	27
2010	8,329 (6.3)	33
2011	9,357 (7.1)	36
2012	10,431 (7.9)	40
2013	12,498 (9.5)	44
2014	14,051 (10.6)	49
2015	16,669 (12.6)	49
2016	16,778 (12.7)	50
2017	16,896 (12.8)	49
2018	15,861 (12.0)	46
Patient Beds		
<100	10,292 (7.8)	8
100-299	45,025 (34.1)	26
300-499	34,406 (26.1)	11
≥500	42,313 (32.1)	6
Setting		
Urban	125,072 (94.7)	47
Rural	6,965 (5.3)	4

***** One hospital presents aggregate data for four of their hospitals; since data from these four hospitals cannot be analyzed by individual hospital, they are counted as a single hospital in this report.

FINAL STROKE DIAGNOSIS

Table 5 and Figure 2 display the descriptive characteristics of each type of the final stroke diagnoses, 2008 through 2018.

From 2008-2018, ischemic stroke accounted for 66.8% of all reported cases. Among the other stroke subtypes reported, 13.2% were transient ischemic attack (TIA), 10.9% were intracerebral hemorrhage (ICH), 3.7% were subarachnoid hemorrhage (SAH), and 1.4% were stroke not otherwise specified (NOS).

TABLE 5. STROKE TYPE, BY DEMOGRAPHIC AND OTHER SELECT FACTORS, 2008-2018

Final Stroke Diagnosis	**Total Reported Cases**		**LOS** (days)	**Gender** (Female)	**Age** (years)	**Race** (White)	**Insurance** (yes)	**County** (Rural)
	N=132,036	**%**	Median	%	Median	%	%	%
Ischemic Stroke	88,192	66.8	4	49.7	68	74.1	84.7	4.2
TIA (<24hrs)	17,363	13.2	2	56.8	69	80.4	90.5	10.4
Intracerebral Hemorrhage	14,445	10.9	5	45.3	65	71.4	78.5	3.6
Subarachnoid Hemorrhage	4,891	3.7	8	61.4	58	72.5	73.5	1.9
Stroke NOS	1,867	1.4	3	50.1	70	68.9	88.0	20.0
Elective Carotid Intervention only	3,308	2.5	1	42.5	71	88.8	95.4	8.4
No stroke related diagnosis	1,589	1.2	2	50.4	66	72.3	88.3	12.2
Missing	381	0.3	3	--	--	**--**	**--**	**--**

Abbreviations: LOS=Length of Stay

From 2008-2018, the overall median length of hospital stay (LOS) for stroke patients was 4 days. LOS varied by final stroke diagnosis. Of stroke patients, those with TIA had the shortest LOS (median 2 days) while hemorrhagic stroke patients had the longest: median 5 days for intracerebral, median 8 days for subarachnoid. The median LOS for Elective Carotid Intervention was 1 day. Figure 2 shows the 2018 median LOS by stroke type.

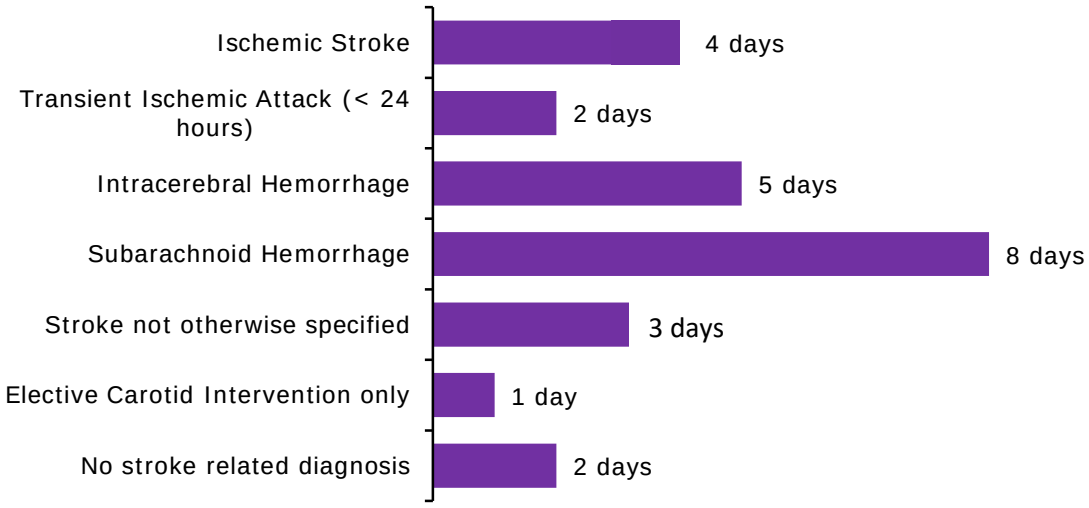


FIGURE 2. MEDIAN LENGTH OF STAY, BY FINAL STROKE DIAGNOSIS, 2018

Note: While Table 5 and Figure 2 include cases of "elective carotid intervention only" and "no stroke related diagnosis", these cases are not included in any further analyses unless otherwise stated.

PATIENT DEMOGRAPHICS

Table 6 displays the demographic characteristics of the 126,758 stroke cases reported from 2008 to 2018.

TABLE 6. DEMOGRAPHIC CHARACTERISTICS AMONG REPORTED CASES, 2008-2018

Demographics	Total reported stroke cases		LOS (days)*
	N=126,758*	%	Median
Gender			
Female	64,108	50.6	4
Male	62,588	49.4	4
Unknown	17	<0.1	4
Age (years)			
< 18	41	<0.1	9
18 – 30	1,239	1.0	4
31 - 45	8,518	6.7	4
46 – 65	47,204	37.2	4
66 – 85	55,360	43.7	4
> 85	14,396	11.4	4
Race			
White	94,272	74.5	3
Black or African American	21,803	17.2	4
Asian	1,744	1.4	4
American Indian/Alaskan Native	243	0.2	3
Native Hawaiian/Pacific Islander	121	0.1	4
Unable to determine (UTD)	8,283	6.6	4
Other	--	--	--
Ethnicity			
Hispanic	30,269	23.9	4
Non-Hispanic	96,352	76.1	3
Health Insurance Status			
Health insurance	85,170	67.2	4
Without health insurance	15,711	12.4	4
Missing	25,877	20.4	3

***** Totals for each grouping may not add up to table total due to missing data.

Note: While Table 6 includes stroke cases of all ages, the remaining tables and figures report only on stroke cases among patients ages 18 years and older.

Females accounted for half (50.6%) of the patient population. The median age was 68 years, with patients aged 66 to 85 years accounting for 43.7% of the total patients. About three out of four patients were white (74.4%) and non-Hispanic (76.1%). More than two-thirds (76.1%) of patients had some form of health insurance. The median LOS among the demographic categories rarely deviated from the overall, 4 days, except for patients age < 18 years (median 9 days).

VI. HOSPITAL STROKE PERFORMANCE MEASURES

The following tables and figures display the data for specific reporting, quality, and achievement measures for effective care of stroke patients. Annual percent trends for the period of 2008 – 2018 are also included for each of the measures of effective care for stroke patients. Additional information, including data sources, can be found in the Appendix. Because the measures listed here have different inclusion/exclusion criteria, the number of cases reported for measures differ, and totals for the measures may not add up to the total number of cases reported in Table 6.

This report includes the following hospital performance measures for stroke:

1. Hospital Arrival Method
2. Advance Notification
3. National Institutes of Health Stroke Scale (NIHSS) Reported
4. Time to Initial Brain Imaging
5. Time to Intravenous Thrombolytic Therapy – 45 Minutes
6. Time to Intravenous Thrombolytic Therapy – 60 Minutes
7. IV tPA Arrive by 2 Hours, Treat by 3 Hours
8. IV tPA Arrive by 3.5 Hours, Treat by 4.5 Hours
9. Drip-and-Ship
10. Early Antithrombotics
11. Thrombolytic Therapies
12. Thrombolytic Complications
13. Intensive Statin Therapy
14. Antithrombotic Prescribed at Discharge
15. Anti-hypertensives Prescribed at Discharge
16. Rehabilitation Considered
17. Stroke Education
18. Modified Rankin Scale at Discharge
19. Discharge Disposition

HOSPITAL ARRIVAL METHOD

Time to treatment can have a significant effect on stroke patient survival rate and potential disability. For this reason, it is important to evaluate the method of arrival for stroke patients. Transport protocols should be in place for Emergency Medical Services (EMS) transport to take suspected stroke patients to the hospital with the

appropriate level of stroke care, whereas patients who arrive by private vehicle may be taken to a hospital that does not meet their medical and treatment needs. (5)

Figure 3, below, displays the percentage of stroke patients' mode of hospital arrival overall, and by setting (rural and urban hospitals).

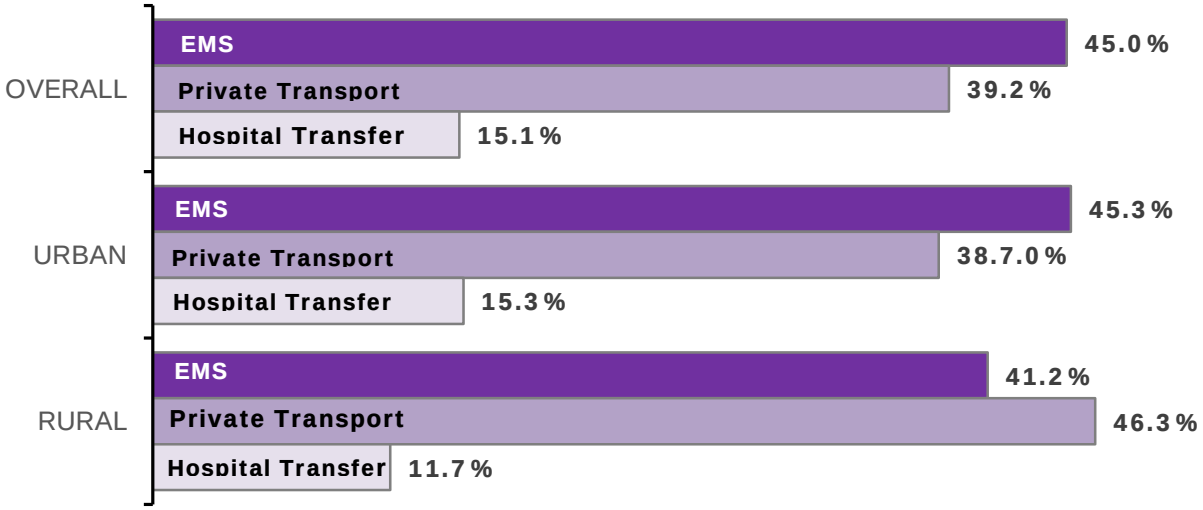


FIGURE 3. STROKE CASES BY METHOD OF HOSPITAL ARRIVAL: OVERALL, AND SETTING URBAN/RURAL, 2008-2018

Note: Missing and unknown categories are not displayed in Figure 3 so the total may not add up to 100% for each category.

From 2008-2018, the most common mode of hospital arrival among stroke cases was EMS from home or scene (45.0%, n=52,535), followed by private transport from home or scene (39.2%, n=45,647), and transferred from other hospital (15.1%, n=17,555).

Forty-six out of 100 stroke cases treated at rural hospitals (46.3%, n=3,118) arrived via private transport, compared with 39 out of 100 stroke cases treated at urban hospitals (38.7%; n=45,317).

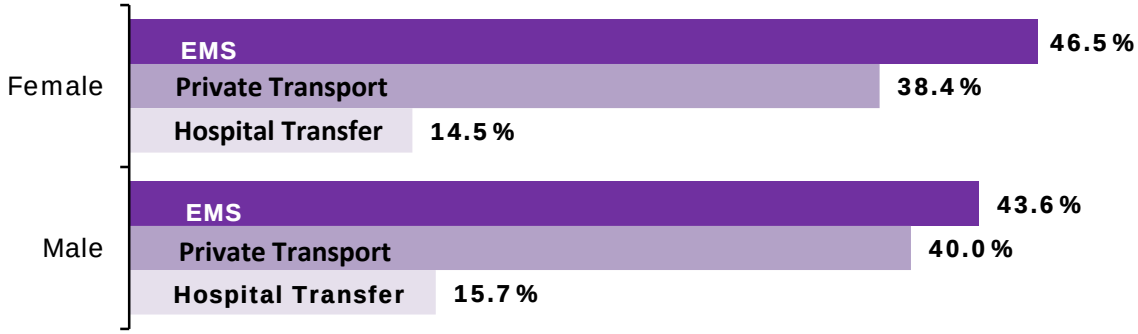


FIGURE 4. STROKE CASES BY METHOD OF HOSPITAL ARRIVAL, BY SEX, 2008-2018

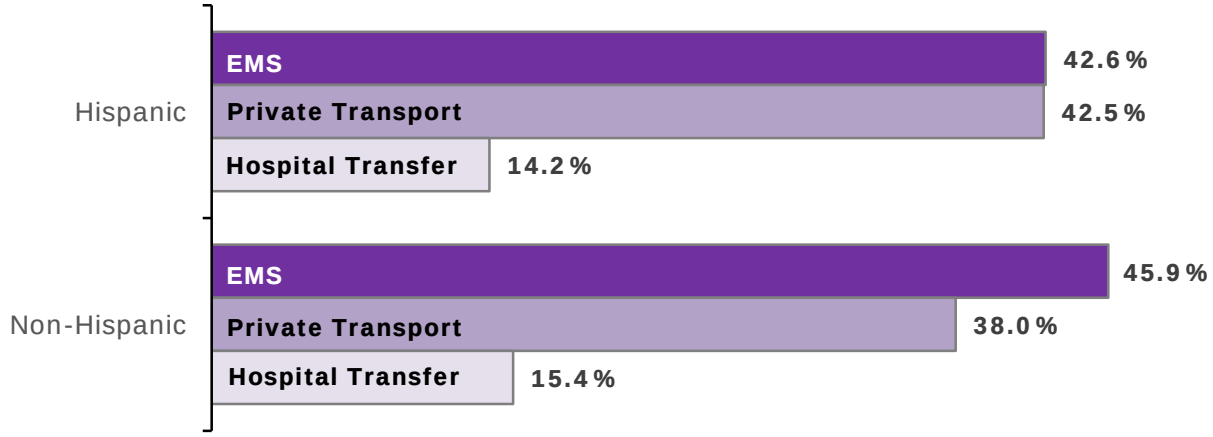


FIGURE 5. STROKE CASES BY METHOD OF HOSPITAL ARRIVAL, BY ETHNICITY, 2008-2018

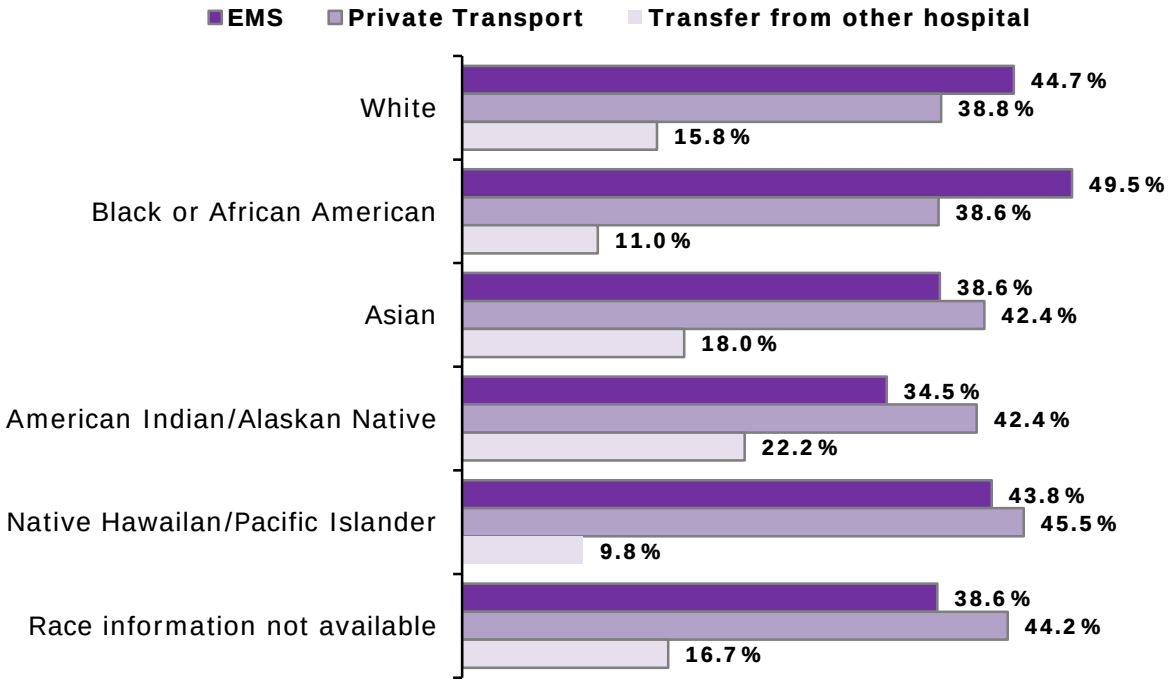


FIGURE 6. STROKE CASES BY METHOD OF HOSPITAL ARRIVAL, BY RACE, 2008-2018

The arrival method patterns were similar between females and males, and Hispanic and Non-Hispanic cases during 2008-2018 (Figures 4 and 5). Whites and Black or African Americans used EMS more frequently than private transportation and hospital transfer, while private transportation was used more frequently than EMS among other races (Figure 6).

Arrival Method, by Year

Figure 7 and Table 7 provide information regarding hospital arrival methods among stroke cases by reporting year.

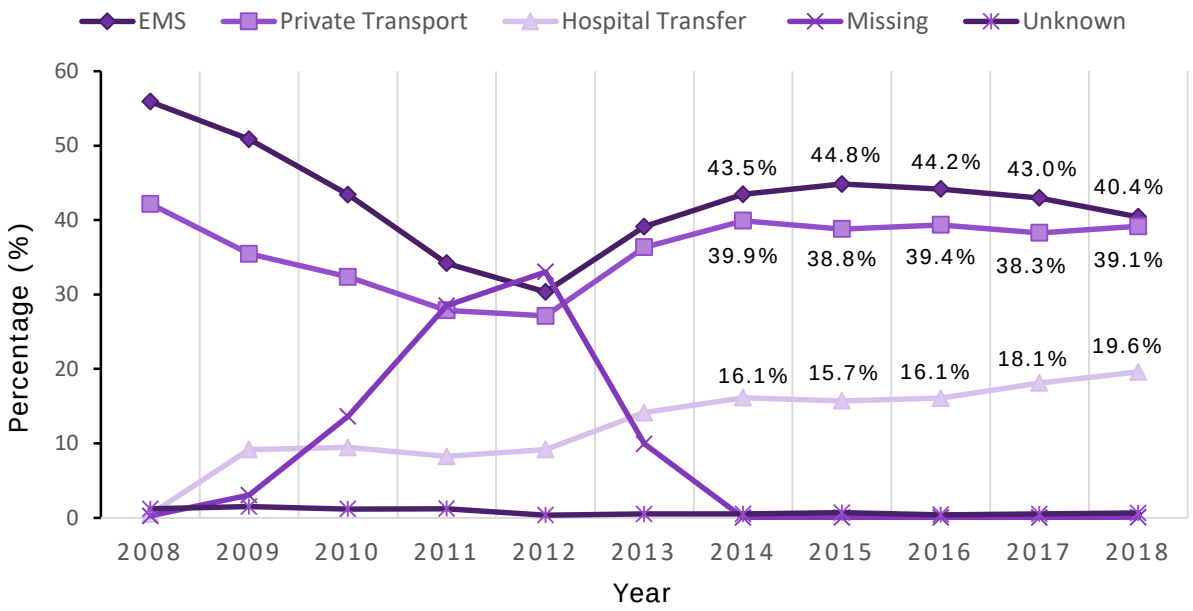


FIGURE 7. PERCENTAGE OF STROKE CASES, BY HOSPITAL ARRIVAL MODE, BY YEAR, 2008-2018

TABLE 7. STROKE CASES, BY HOSPITAL ARRIVAL MODE, BY YEAR, 2008-2018

Year	Stroke cases	EMS from home/scene	Private Transportation	Hospital Transfer	Missing	Unknown	Reporting Hospitals
	N=125,001 (%)	n=52,535 (42.0%)	n=45,647 (36.5%)	n=17,555 (14.0%)	n=8,413 (6.7%)	n=854 (0.7%)	N
2008	4,817	2,692 (55.9)	2,032 (42.2)	23 (0.5)	12 (0.3)	58 (1.2)	21
2009	6,262	3,182 (50.8)	2,220 (35.5)	577 (9.2)	190 (3.0)	93 (1.5)	27
2010	8,118	3,523 (43.4)	2,628 (32.4)	766 (9.4)	1,106 (13.6)	95 (1.2)	33
2011	9,086	3,109 (34.2)	2,530 (27.9)	749 (8.2)	2,588 (28.5)	110 (1.2)	35
2012	10,052	3,033 (30.2)	2,706 (26.9)	914 (9.1)	3,364 (33.5)	35 (0.4)	40
2013	11,415	4,466 (39.1)	4,146 (36.3)	1,613 (14.1)	1,132 (9.9)	58 (0.5)	44
2014	12,769	5,549 (43.5)	5,094 (39.9)	2,061 (16.1)	1 (<0.1)	64 (0.5)	49
2015	15,155	6,797 (44.9)	5,878 (38.8)	2,377 (15.7)	2 (<0.1)	101 (0.7)	49
2016	15,765	6,965 (44.2)	6,204 (39.4)	2,531 (16.1)	3 (<0.1)	62 (0.4)	50
2017	16,208	6,988 (43.1)	6,199 (38.3)	2,936 (18.1)	4 (<0.1)	81 (0.5)	49
2018	15,357	6,231 (40.6)	6,010 (39.1)	3,008 (19.6)	11 (0.1)	97 (0.6)	46

The annual percentage of stroke cases arriving by EMS ranged from a high of 55.9% in 2008 to a low of 30.2% in 2012. This rose to 44.9% in 2015, and has slowly declined, dropping to 40.6% in 2018. Arrival by private transportation had a similar trend as EMS, ranging from 42.2% in 2008 to 26.9% in 2012. This rose to 39.9% in 2014 and has remained relatively stable since. Percentage of cases transferred from another hospital has increased gradually and substantially, from 0.5% in 2008, to 19.6% in 2018.

Between 2008 and 2017, the number of participating hospitals reporting on arrival method increased each year, from 21 in 2008 to 50 in 2016 and 46 in 2018. An opportunity exists to explore why Texans continue to rely heavily on private transportation (see Table 7).

ADVANCE NOTIFICATION

A stroke alert protocol should be in place that requires EMS technicians to alert the receiving hospital of suspected stroke patients. EMS act as the point of first contact, providing critical time information, such as symptom onset and time last known well (LKW), potentially improving time from hospital arrival to treatment.

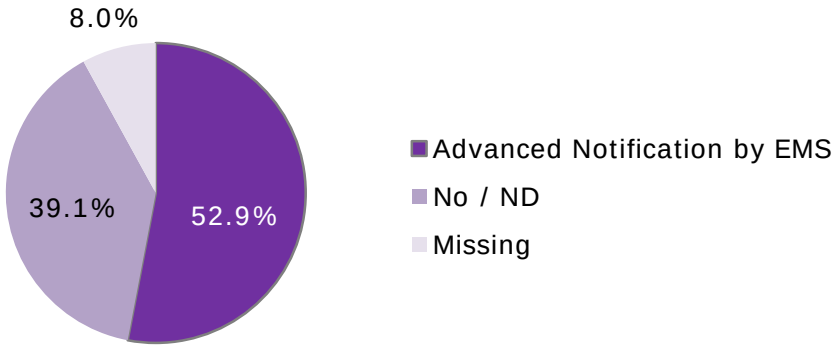


FIGURE 8. EMS ADVANCE NOTIFICATION TO HOSPITAL, 2008-2018

From 2008-2018, 52,583 stroke patients were transported by EMS from home or scene. Advance notification occurred in 52.9% of these arrivals while 39.1% had no advance notification or had no documentation. Data were missing for 8.0% of cases (Figure 8).

Among rural hospitals' eligible stroke cases (n=2,414), advance notification occurred for 72.9% (n=1,759) of cases. Among urban hospitals' eligible stroke cases (n=45,966), advance notification occurred for 56.7% (n=26,079) of cases. This excludes missing data.

Advance notification varied by stroke diagnosis. The highest percentage was seen among stroke NOS patients (64.4%, n=465) and the lowest percentage was seen among hemorrhagic stroke patients (Subarachnoid 50.8%, n=762; Intracerebral 55.8%, n=3,691).

Advance Notification by EMS, by Year

Figure 9 and Table 8 display percentages of advance notification provided prior to Emergency Department (ED) arrival among adult stroke cases arriving by EMS from home/scene.

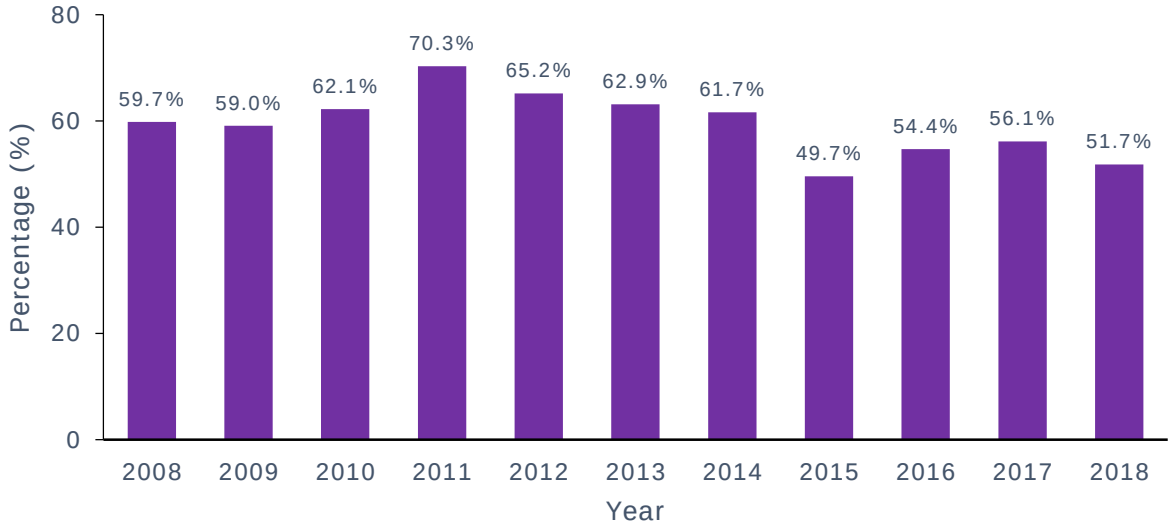


FIGURE 9. ADVANCE NOTIFICATION BY EMS, BY YEAR, 2008-2018

TABLE 8. ADVANCE NOTIFICATION BY EMS, BY YEAR, 2008-2018

Year	Eligible cases arriving via EMS	Advance Notification		Reporting Hospitals
	N=48,380	n=27,838	57.5%	N
2008	2,320	1,385	59.7	19
2009	2,788	1,645	59.0	27
2010	3,141	1,951	62.1	32
2011	2,844	1,998	70.3	30
2012	2,655	1,731	65.2	34
2013	3,221	2,026	62.9	44
2014	5,109	3,152	61.7	49
2015	6,368	3,163	49.7	49
2016	6,873	3,738	54.4	50
2017	6,971	3,901	56.0	49
2018	6,090	3,147	51.7	46

The yearly percentage of advance notification varied, ranging from a low of 49.7% in 2015 to a high of 70.3% in 2011.

In 2018, advance notification was provided by EMS for just over half (51.7%, n=3,147) of the EMS transported patients.

Over time, the number of participating hospitals reporting on this measure has increased, from the low of 19 in 2008 to 46-50 during 2014-2018. The lack of advance notification by EMS prior to hospital arrival is a missed opportunity and indicates a gap in the stroke system of care, regardless of geographic differences. Identifying the cause of under-utilization and potential barriers to use of pre-notification by EMS is needed. An opportunity exists to standardize the use of EMS stroke alert protocol across all hospital systems.

NATIONAL INSTITUTES OF HEALTH STROKE SCALE (NIHSS) REPORTED

When a suspected stroke patient arrives at a hospital, an initial neurological examination should be conducted as a component of determining diagnosis of stroke and further care. The NIHSS is a standardized neurologic examination tool used to evaluate and document a patient's status. The NIHSS allows healthcare providers to easily quantify the degree and severity of neurological deficits, and to identify the most appropriate treatment and level of care. (5)

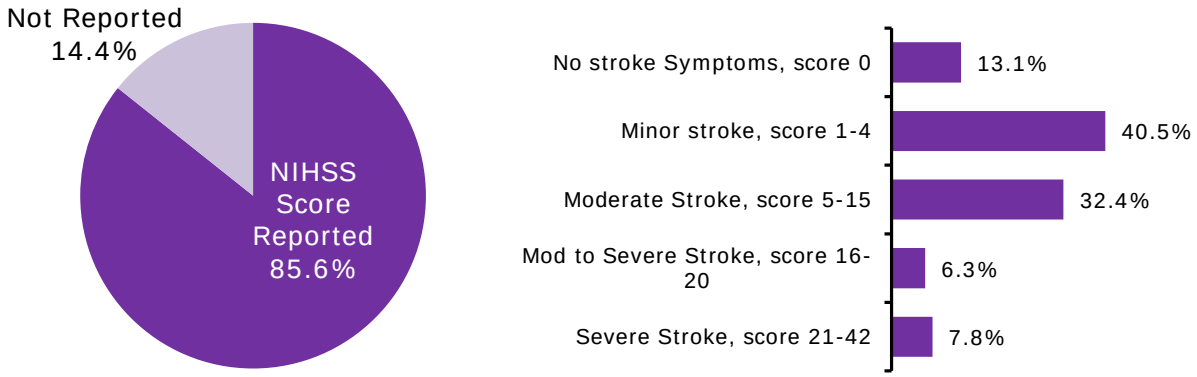


FIGURE 10. INITIAL NATIONAL INSTITUTES OF HEALTH STROKE (NIHHS) SCORES AMONG ADULT ISCHEMIC STROKE OR STROKE NOT OTHERWISE SPECIFIED CASES, 2008-2018

From 2008-2018, the NIHSS was performed as part of the initial examination in 85.6% (n=71,339) of eligible cases (n=83,341). Alternatively, 14.4% (n=12,001) of cases with a diagnosis of ischemic stroke or stroke NOS did not have an NIHSS evaluation performed and/or initial score reported (Figure 10). Data on this measure were missing for n=126 cases.

Of the 71,339 cases listed as having an NIHSS performed, actual NIHSS scores were available for 71,116 cases (99.7%). From 2008-2018, four in 10 cases had a NIHSS score of 1-4, qualifying as a minor stroke (40.5%, n=28,768), and three in 10 (32.4%, n=23,056) had a score of 5-15, qualifying as a moderate stroke. Over all reporting years, the overall median NIHSS score was 4.

NIHSS Reported, by Year

Figure 11 and Table 9 display the percentages of eligible adult ischemic and stroke NOS cases with an NIHSS score reported, by year.

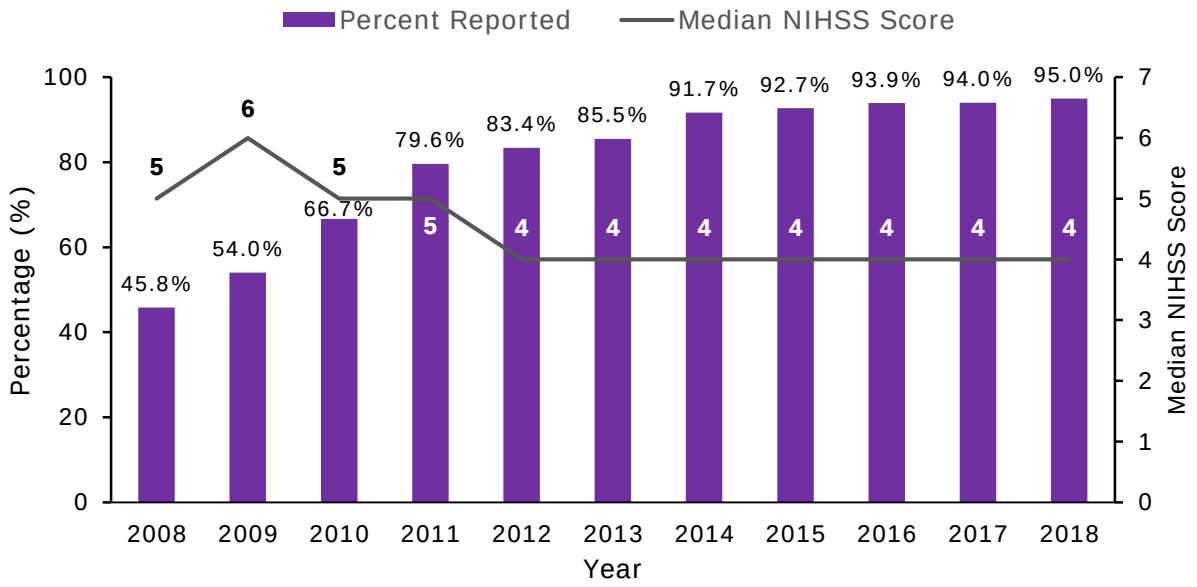


FIGURE 11. ADULT ISCHEMIC AND STROKE NOT OTHERWISE SPECIFIED CASES WITH AN INITIAL NIHSS SCORE, BY YEAR, 2008-2018

TABLE 9. ADULT ISCHEMIC AND STROKE NOT OTHERWISE SPECIFIED CASES WITH AN INITIAL NIHSS SCORE, BY YEAR, 2008-2018

	Ischemic & Stroke NOS cases	**NIHSS score reported**		**Reporting Hospitals**
Year	N=83,340	n=71,339	85.6%	N
2008	3,103	1,420	45.8	20
2009	3,821	2,065	54.0	26
2010	5,490	3,660	66.7	33
2011	6,267	4,990	79.6	35
2012	6,709	5,591	83.4	40
2013	7,430	6,349	85.5	42
2014	8,558	7,846	91.7	49
2015	10,001	9,271	92.7	48
2016	10,530	9,890	93.9	50
2017	10,766	10,123	94.0	49
2018	10,665	10,131	95.0	46

The percentage of eligible cases receiving an initial NIHSS evaluation has more than doubled over time, from 45.8% in 2008 to 95.0% in 2018. For the five most recent years (2014-2018), the NIHSS score was reported in over 90% of eligible ischemic stroke and stroke NOS cases. For the last 7 years (2012-2018), the median NIHSS score has remained the same (minor stroke, score 4).

Between 2008 and 2018, the number of participating hospitals reporting on this measure has increased annually, from 20 in 2008 to 46-50 in 2014-2018. Opportunities exist for improving the standardization of NIHSS use and score reporting across all hospital systems.

TIME TO INITIAL BRAIN IMAGING

Brain imaging, or computerized tomography (CT) scan, is used to identify the type and acuity of a stroke, and to locate the blockage or clot. (4) A timely initial CT scan is vital to providing effective treatment for a stroke patient. A CT scan should be performed within 25 minutes of hospital arrival and interpreted within 45 minutes of arrival. (5)

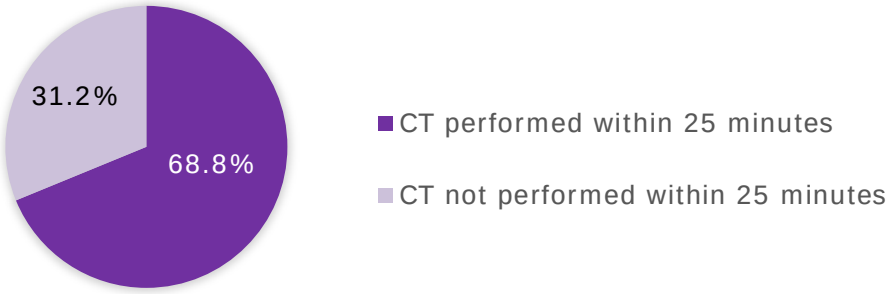


FIGURE 12. ADULT STROKE CASES ARRIVING AT HOSPITAL WITHIN 3 HOURS OF TIME LAST KNOWN WELL, WITH DOOR-TO-CT TIME WITHIN 25 MINUTES OF HOSPITAL ARRIVAL, 2008-2018

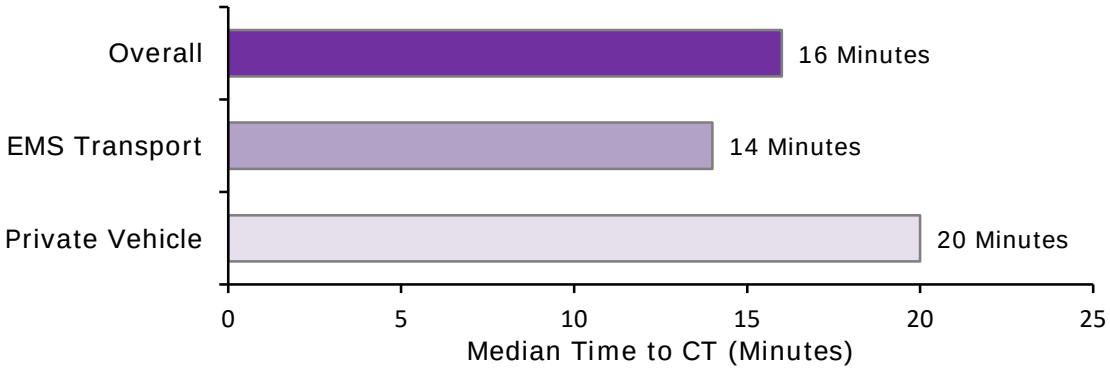


FIGURE 13. MEDIAN DOOR-TO-CT TIMES OF ADULT STROKE CASES ARRIVING AT HOSPITAL WITHIN 3 HOURS OF TIME LAST KNOWN WELL, OVERALL AND BY MODE OF TRANSPORT, 2008-2018

Among eligible stroke cases arriving to the hospital within 3 hours of time LKW (n=22,784), seven in 10 cases (68.8%, n=15,673) received an initial CT scan within 25 minutes of hospital arrival (Figure 12). Almost half of eligible cases (48.0%, n=10,933) had an initial CT performed within 15 minutes of hospital arrival. Overall, the median door-to-initial CT time was 16 minutes.

Door-to-CT imaging performed within 25 minutes varied by arrival method: 73.6% of patients who arrived by EMS vs. 61.0% who arrived by private vehicle. The median door-to-CT imaging time was 14 minutes for patients arriving by EMS and 20 minutes for those arriving by private vehicle (Figure 13).

Door-to-CT Imaging ≤ 25 Minutes

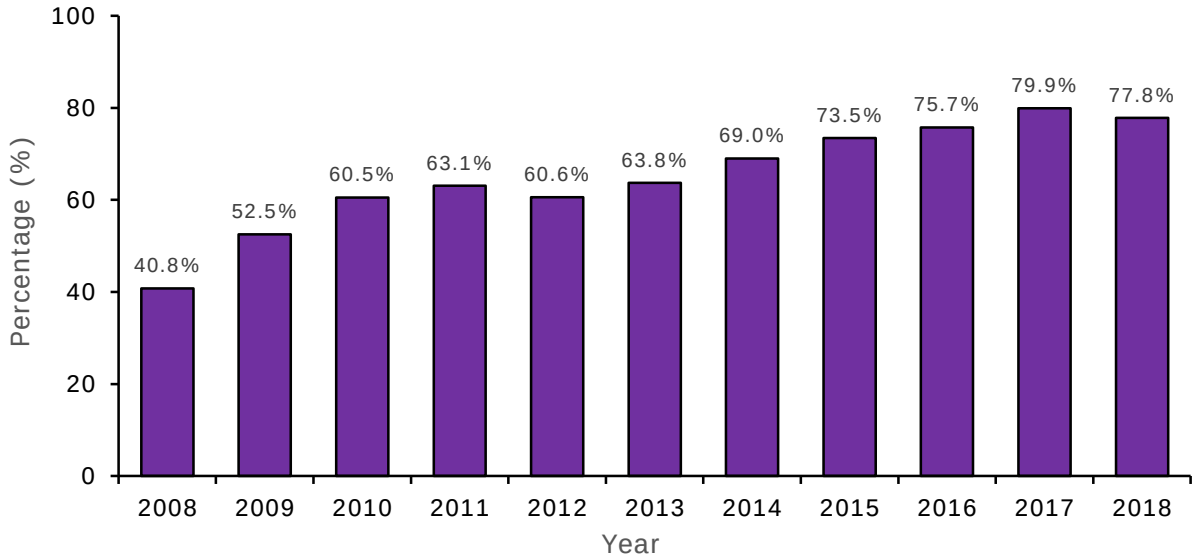


FIGURE 14. ADULT STROKE CASES ARRIVING WITHIN 3 HOURS OF TIME LAST KNOWN WELL AND HAVING AN INITIAL CT SCAN WITHIN 25 MINUTES OF HOSPITAL ARRIVAL, 2008-2018

TABLE 10. ADULT STROKE CASES ARRIVING WITHIN 3 HOURS OF TIME LAST KNOWN WELL AND HAVING AN INITIAL CT SCAN WITHIN 25 MINUTES OF HOSPITAL ARRIVAL, 2008-2018

	Stroke cases	CT scan <= 25 minutes of hospital arrival		Reporting Hospitals
Year	N=22,784	n=15,673	68.8%	N
2008	867	354	40.8	17
2009	1,202	631	52.5	25
2010	1,617	979	60.5	33
2011	1,747	1,100	63.0	34
2012	1,870	1,133	60.6	39
2013	1,998	1,274	63.8	43
2014	2,037	1,405	69.0	47
2015	2,618	1,923	73.5	49
2016	2,822	2,137	75.7	50
2017	3,059	2,444	79.9	49
2018	2,947	2,293	77.8	46

The percentage of eligible cases who arrived to the hospital within 3 hours of time LKW and had an initial CT scan performed within 25 minutes of arrival ranged from a low of 40.8% in 2008 to a high of 77.8% in 2018. Note: Percentages reported for this measure differ from previously reported; this could reflect differences in participating hospitals and/or updated inclusion/exclusion criteria for this measure.

In 2018, eight in 10 cases (77.8%) received their initial CT scan within 25 minutes of hospital arrival. The median door-to-CT time was 13 minutes.

Between 2008 and 2017, the number of participating hospitals reporting on this measure increased, from 17 in 2008, to 46-50 in 2015-2018. While there has been

improvement in door-to-CT time, opportunities exist for hospitals to reduce the time from ED arrival to initial brain imaging to promote timely and effective stroke treatment.

TIME TO INTRAVENOUS THROMBOLYTIC THERAPY - *45 MINUTES and 60* MINUTES

Thrombolytic therapy using IV t-PA is the preferred reperfusion strategy for eligible patients with acute ischemic stroke caused by a clot blocking a brain blood vessel. (5) Time to IV t-PA therapy, often referred to as door-to-needle time, is a key measure of hospitals' quality that encompasses multiple elements of the stroke system of care: time of symptom onset; first medical contact; hospital arrival; initial CT scan; and interpretation of CT scan. IV t-PA therapy should be administered within 60 minutes of hospital arrival for eligible acute ischemic stroke patients. (5)

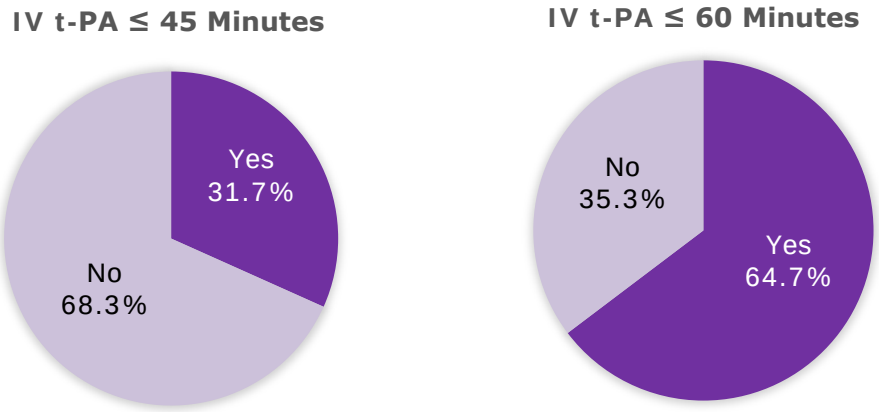


FIGURE 15. ADULT ACUTE ISCHEMIC STROKE CASES WHO RECEIVED IV TPA ≤45 MINUTES OR ≤60 MINUTES OF HOSPITAL ARRIVAL, 2008-2018

Among eligible ischemic stroke cases treated with IV t-PA from 2008-2018, about one in three, 31.7% (n=2,268) received IV t-PA within 45 minutes of arrival, and 64.7% (n=4,626) within 60 minutes of hospital arrival. The median door-to-t-PA time was 54 minutes. More cases arriving to the hospital by EMS had a door-to-t-PA time within 45 or 60 minutes (34.4% and 67.2%, respectively), than those arriving by private transport (25.0% and 60.2%, respectively).

IV tPA ≤45 and ≤60 Minutes, by Year

Figure 16 and Table 11 display the percentage of eligible adult ischemic stroke cases who received IV t-PA within 45 minutes and within 60 minutes of hospital arrival, by year, from 2008-2018.

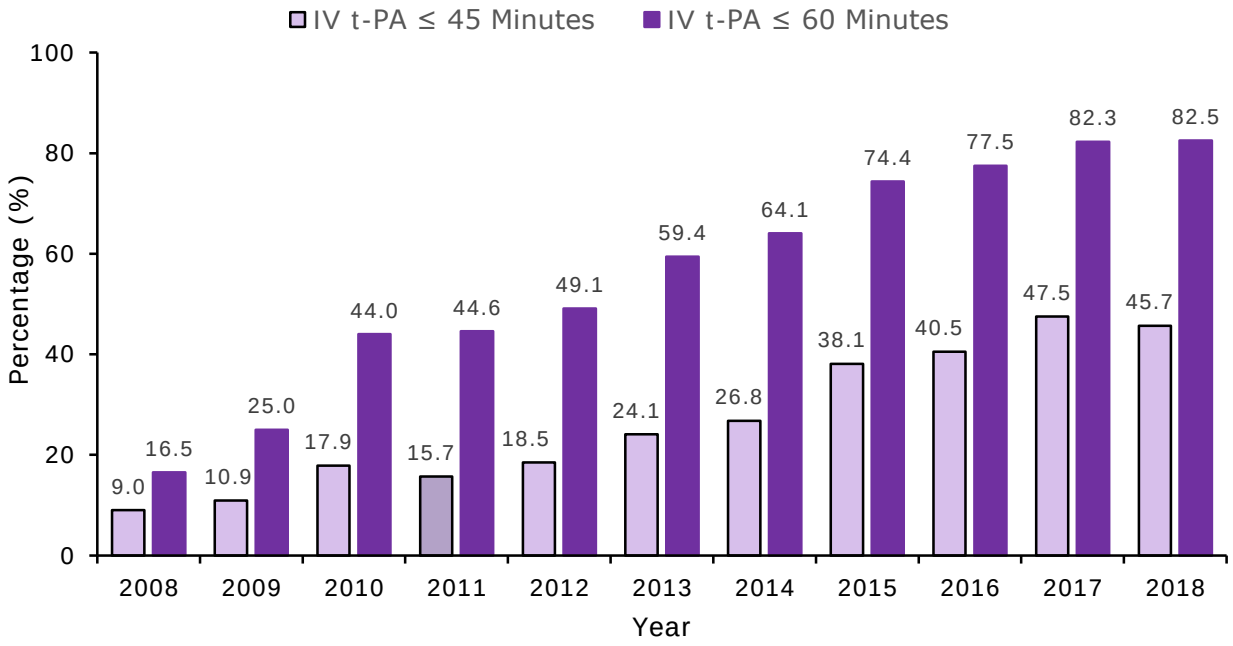


FIGURE 16. TREATMENT WITH IV T-PA WITHIN 45 MINUTES AND WITHIN 60 MINUTES OF HOSPITAL ARRIVAL AMONG ADULT ISCHEMIC STROKE CASES, BY YEAR, 2008-2018

TABLE 11. ADULT ISCHEMIC STROKE CASES TREATED WITH IV T-PA WITHIN 45 MINUTES AND 60 MINUTES OF HOSPITAL ARRIVAL, BY YEAR, 2008-2018

Adult Ischemic Stroke Cases Treated with IV tPA, 2008-2018						
	All	IV tPA ≤45 min		IV tPA ≤60 min		Reporting Hospitals
Year	N=7,146	n=2,268	31.8%	n=4,626	54.5%	N
2008	133	12	9.0	22	16.5	12
2009	284	31	10.9	71	25.0	20
2010	491	88	17.9	216	44.0	30
2011	624	98	15.7	278	44.6	33
2012	599	111	18.5	294	49.1	34
2013	626	151	24.1	372	59.4	40
2014	710	190	26.8	455	64.1	44
2015	859	327	38.1	639	74.4	45
2016	903	366	40.5	700	77.5	48
2017	992	471	47.5	816	82.3	48
2018	925	423	45.7	763	82.5	46

The percentage of cases treated with IV t-PA within 45 minutes and within 60 minutes of hospital arrival has increased annually. IV t-PA within 45 minutes ranged

from a low of 9.0% (2008) to a high of 47.5% (2017). IV t-PA within 60 minutes of hospital arrival ranged from a low of 16.5% (2008) to a high of 82.5% (2018). The median door-to-t-PA times decreased by almost half, from 90 minutes in 2008 to 47 minutes in 2018.

For the last 6 years (2013-2018), the median door-to-t-PA time was less than 60 minutes: 57 minutes in 2013; 55 minutes in 2014; 51 minutes in 2015; 50 minutes in 2016; and 47 minutes in 2017 and 2018.

The number of participating hospitals reporting on this measure increased annually, from a low of 12 in 2008 to a high of 46 - 48 in 2016-2018.

A gradual increase in the percentage of ischemic stroke cases receiving IV t-PA within 60 minutes was observed over the past few years. However, there is still need for standardization of protocols and implementation of best practices for the care of acute ischemic stroke patients across hospital systems.

IV tPA ARRIVE BY 2 HOURS, TREAT BY 3 HOURS

A critical component when evaluating a stroke patient is identifying the time last known well (LKW), or the time at which a patient was last known to be without signs and symptoms of a stroke. Acute ischemic stroke patients who arrive at the hospital within 2 hours of time LKW should be treated within 3 hours of time LKW. (5)

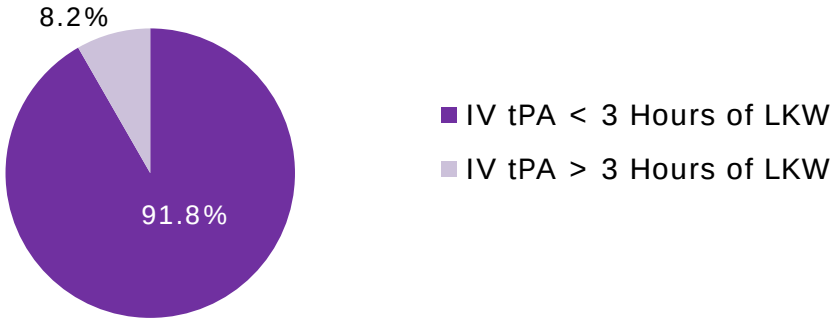


FIGURE 17. ADULT ACUTE ISCHEMIC STROKE CASES TREATED WITHIN 3 HOURS OF TIME LAST KNOWN WELL (LKW), 2008-2018

Among eligible adult ischemic stroke cases who arrived at the hospital within 2 hours of time LKW, almost all (91.8%; n=6,843) received IV t-PA within 3 hours of time LKW. Only eight in 100 cases (8.2%; n=611) received IV t-PA outside of this time (Figure 17).

Arrive by 2 Hours, Treat by 3 Hours, by Year

Figure 18 and Table 12 show eligible adult ischemic stroke cases who arrived at the hospital within 2 hours of time LKW and were treated with IV t-PA within 3 hours of time LKW, by year.

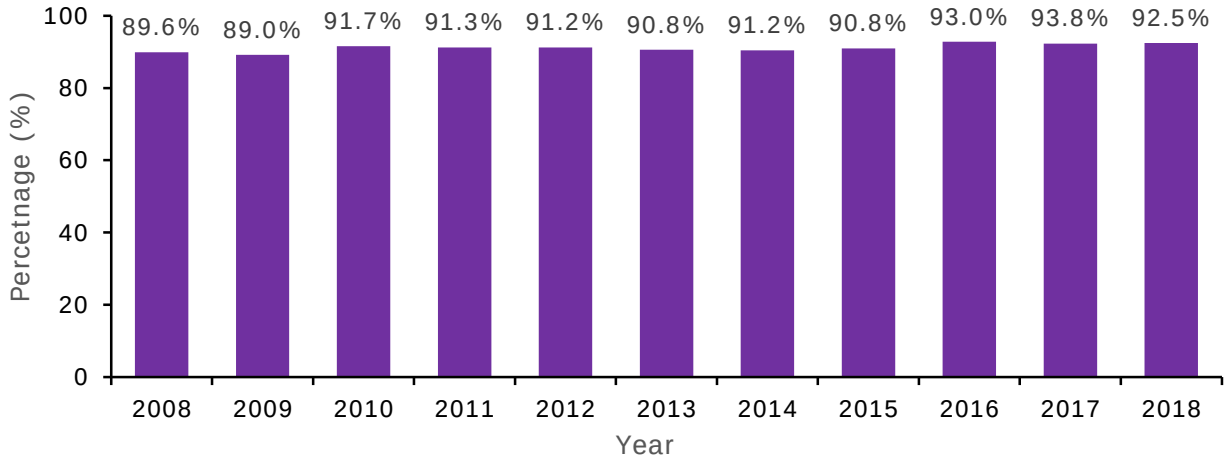


FIGURE 18. ADULT ISCHEMIC STROKE CASES ARRIVING TO THE HOSPITAL WITHIN TWO HOURS OF TIME LAST KNOWN WELL (LKW) AND TREATED WITH IV TPA WITHIN 3 HOURS OF TIME LKW, 2008-2018

TABLE 12. ADULT ISCHEMIC STROKE CASES ARRIVING TO THE HOSPITAL WITHIN TWO HOURS OF TIME LAST KNOWN WELL (LKW) AND TREATED WITH IV TPA WITHIN 3 HOURS OF TIME LKW, 2008-2018

Adult Ischemic Stroke Cases Arriving at the Hospital within 2 hours of Time Last Known Well and Treated with IV tPA				
	All	**IV tPA ≤ 3 hours**		**Reporting Hospitals**
Year	n=7,454	n=6,843	91.8%	N
2008	136	121	89.6	13
2009	272	242	89.0	20
2010	467	428	91.7	30
2011	576	526	91.3	33
2012	610	556	91.2	37
2013	682	619	90.8	40
2014	798	728	91.2	46
2015	912	828	90.8	46
2016	959	892	93.0	48
2017	1,036	972	93.8	48
2018	1,007	931	92.5	46

Between 2008 and 2018, the percentage of eligible cases who arrived at the hospital within 2 hours of time LKW and were treated with IV t-PA within 3 hours of time LKW varied but overall remained high, increasing from 89-90% in 2008-2009 to a high of 93-94% in 2017-2018. The number of participating hospitals reporting on this measure has increased from 13 in 2008 to 46-48 in 2016-2018.

IV tPA ARRIVE BY 3.5 HOURS, TREAT BY 4.5 HOURS

Eligible ischemic stroke patients who arrive at the hospital within 3.5 hours of time LKW should be treated with IV t-PA within 4.5 hours of time LKW. (5)

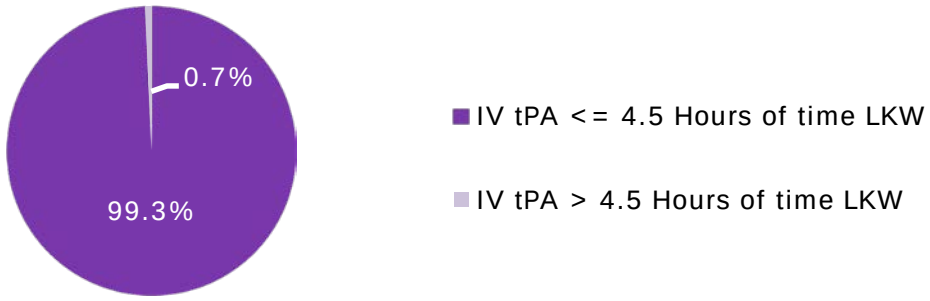


FIGURE 19. ADULT ISCHEMIC STROKE CASES WITH HOSPITAL ARRIVAL WITHIN 3.5 HOURS OF TIME LAST KNOWN WELL (LKW) AND TREATED WITH IV TPA WITHIN 4.5 HOURS OF TIME LKW, 2008-2018

Among the 8,608 eligible adult ischemic stroke cases who arrived at the hospital within 3.5 hours of time LKW, 99.3% (n=8,548) received IV t-PA treatment within 4.5 hours of time LKW, while 0.7% (n=60) received IV t-PA treatment outside this time window (Figure 19).

Arrive by 3.5 Hours, Treat by 4.5 Hours, by Year

Figure 20 and Table 13 show the adult ischemic stroke cases who arrived at the hospital within 3.5 hours of time LKW and were treated with IV t-PA within 4.5 hours of time LKW, by year.

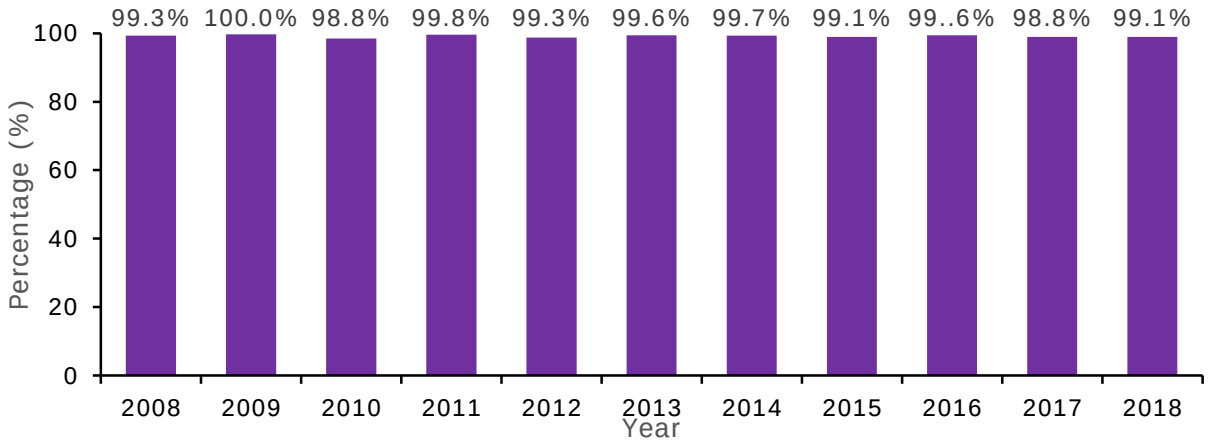


FIGURE 20. ADULT ISCHEMIC STROKE CASES WITH HOSPITAL ARRIVAL WITHIN 3.5 HOURS OF TIME LAST KNOWN WELL (LKW) AND TREATED WITH IV TPA WITHIN 4.5 HOURS OF TIME LKW, 2008-2018

TABLE 13. ADULT ISCHEMIC STROKE CASES WITH HOSPITAL ARRIVAL WITHIN 3.5 HOURS OF TIME LAST KNOWN WELL (LKW) AND TREATED WITH IV TPA WITHIN 4.5 HOURS OF TIME LKW, 2008-2018

Adult ischemic stroke cases arriving to the hospital ≤3.5 hours of time LKW and treated with IV tPA				
	All	IV tPA ≤4.5 hours		Reporting Hospitals
Year	N=8,608	n=8,548	99.3%	N
2008	139	138	99.3	13
2009	291	291	100.0	20
2010	503	497	98.8	31
2011	620	619	99.8	33
2012	665	660	99.3	37
2013	756	753	99.6	41
2014	895	892	99.7	46
2015	1,053	1,043	99.1	46
2016	1,179	1,174	99.6	48
2017	1,277	1,262	98.8	49
2018	1,230	1,219	99.1	46

The annual percentage of cases meeting this measure is consistently above 98% (2008-2018). Compared to the previous measure (time to initiation of IV t-PA treatment among cases who arrive by 2 hours of time LKW), a greater percentage of cases who arrive within 3.5 hours of time LKW receive IV t-PA within 1 hour of hospital arrival (91.8% vs. 99.3%, respectively). Between 2008 and 2018, the number of participating hospitals reporting on this measure increased, from 13 in 2008, to 49 in 2017 and 46 in 2018.

Improving the process of care, including decreased arrival to treatment times, can potentially increase the odds of favorable health outcomes among a patient population that is already at an increased risk of poor health outcomes.

DRIP-AND-SHIP THERAPY

Drip-and-ship is a term applied to ischemic stroke patients who receive IV t-PA at the ED of a local hospital and are then transferred to a comprehensive stroke facility.

TABLE 14. ADULT DRIP-AND-SHIP ISCHEMIC STROKE CASES, 2008-2017

	N (%)
Adult ischemic stroke cases without contraindication for IV t-PA	32,461 (100.0)
Adult ischemic stroke cases where IV t-PA was initiated at community hospital prior to patient transfer to comprehensive stroke facility	932 (2.9)

Among the eligible adult ischemic stroke cases without contraindication for IV t-PA seen between 2008-2018 (n=32,461), roughly three in 100 (2.9%; n=932) had

initiation of IV t-PA therapy at a community hospital ED and were then transferred to a comprehensive stroke facility (Table 14).

Drip-and-Ship Therapy, by Year

A slight, but consistent, increase in the practice of drip-and-ship therapy is noted over time. In 2008, only 0.3% of eligible cases received IV t-PA in the ED of a local hospital prior to being transferred to a stroke center. This increased to 10-12% in less than 8 years, with 4.9% of eligible cases receiving this therapy in 2018. Note: Percentages reported for this measure differ from previously reported; this could reflect differences in participating hospitals and/or updated inclusion/exclusion criteria for this measure.

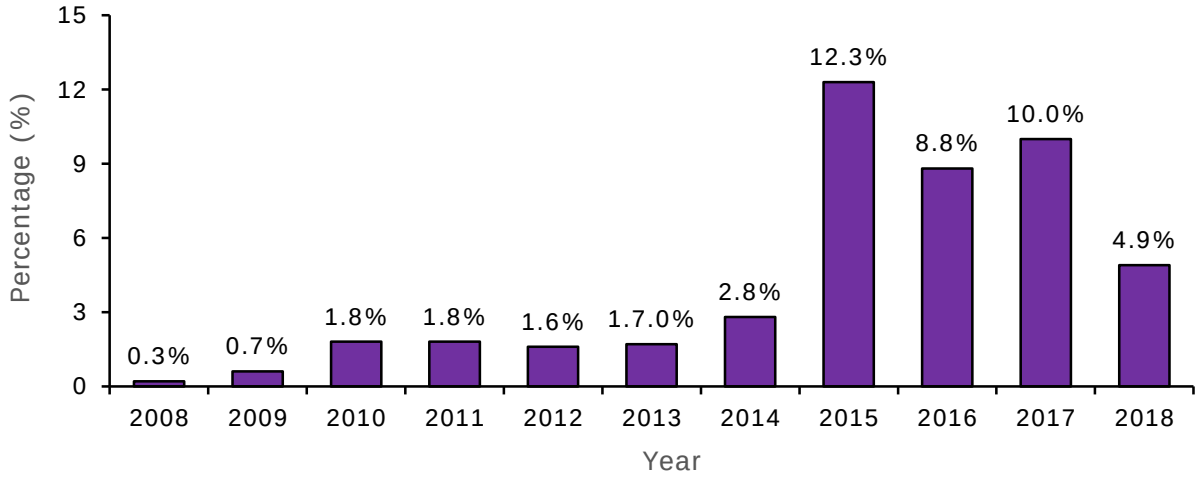


FIGURE 21. PERCENTAGE OF DRIP-AND-SHIP THERAPY AMONG ADULT ISCHEMIC STROKE CASES, 2008-2018

TABLE 15. DRIP-AND-SHIP THERAPY AMONG ADULT ISCHEMIC STROKE CASES, 2008-2018

	Adult Ischemic Stroke Patients without Contraindication for IV tPA			
	Cases	**Drip and Ship cases**		**Reporting Hospitals**
Year	N=32,461	n=932	%	N
2008	2,342	4	0.2	20
2009	2,836	18	0.6	27
2010	3,555	63	1.8	33
2011	3,965	73	1.8	36
2012	4,261	68	1.6	40
2013	4,905	84	1.7	42
2014	4,193	119	2.8	49
2015	1,145	141	12.3	49
2016	1,095	96	8.8	50
2017	1,245	124	10.0	49
2018	2,919	142	4.9	46

Between 2008 and 2016, the number of participating hospitals reporting on this measure increased annually, from 20 in 2008, to 49-50 in 2014-2017.

Early Antithrombotics

TABLE 16. ADULT ISCHEMIC STROKE AND TIA CASES RECEIVING ANTITHROMBOTIC THERAPY BY THE END OF HOSPITAL DAY TWO, 2008-2018

	N (%)
Eligible Adult ischemic stroke and TIA cases	73,409 (100.0)
Adult ischemic stroke and TIA cases received antithrombotic therapy by the end of hospital day two	71,243 (97.1)

Among the eligible adult ischemic stroke cases seen between 2008-2018 (n=73,409), almost all (97.1%; n=71, 243) had initiation of antithrombotic therapy by the end of day two stay in the hospital (Table 16).

Early Antithrombotics, by Year

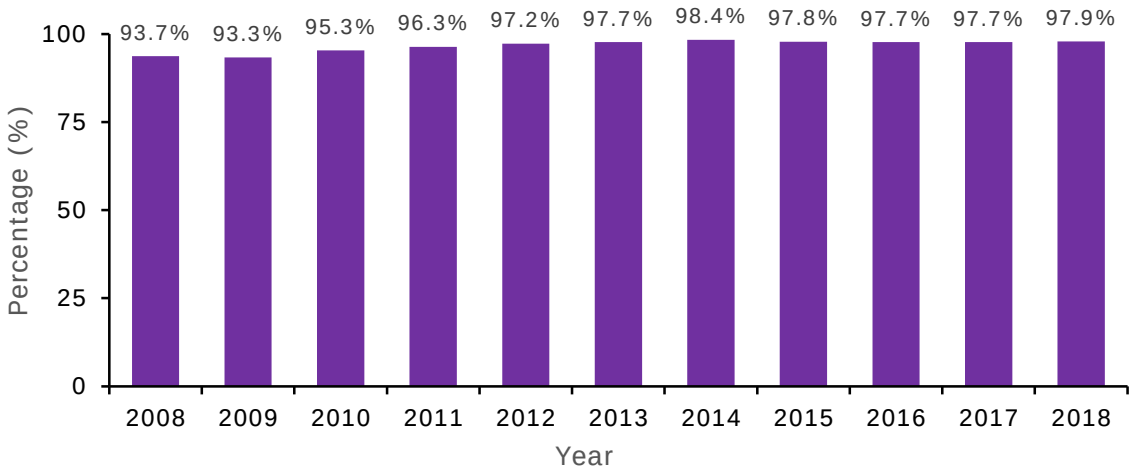


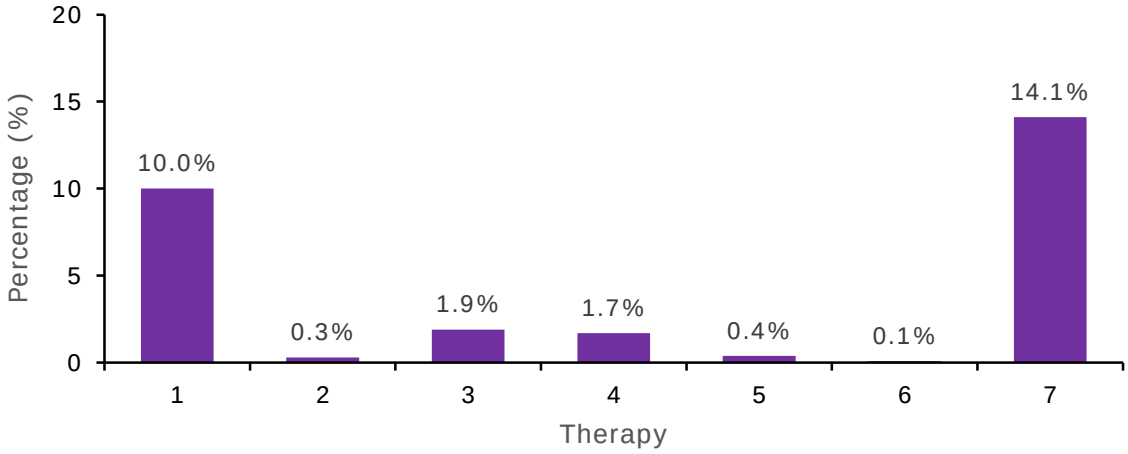
FIGURE 22. PERCENTAGE OF EARLY ANTITHROMBOTIC THERAPY AMONG ADULT ISCHEMIC STROKE AND TIA CASES, 2008-2018

TABLE 17. EARLY ANTITHROMBOTIC THERAPY AMONG ADULT ISCHEMIC STROKE AND TIA CASES, 2008-2018

	Adult Ischemic Stroke and TIA Cases Given Early Antithrombotics			
	Cases	Cases Given Early Antithrombotics		Reporting Hospitals
Year	N=73,409	n=71,243	97.1%	N
2008	3,360	3,147	93.7	20
2009	4,044	3,773	93.3	27
2010	5,071	4,832	95.3	33
2011	5,715	5,504	96.3	35
2012	6,243	6,065	97.2	40
2013	6,912	6,751	97.7	42
2014	7,400	7,279	98.4	49
2015	8,671	8,482	97.8	48
2016	8,706	8,506	97.7	49
2017	8,953	8,748	97.7	49
2018	8,334	8,156	97.9	46

Over time, the percentage of cases meeting this treatment goal has improved, from 93-94% in 2008-2009 to an average of 98% since 2013. Between 2008 and 2018, the number of participating hospitals reporting on this measure increased annually, from 20 in 2008, to 46-50 in 2014-2018.

Thrombolytic Therapies



1: IV alteplase initiated at hospitals for ED patients
2: IV alteplase initiated at hospitals for Inpatients
3: IV alteplase initiated at outside hospitals
4: IA catheter-based treatment at hospitals for ED patients
5: IA catheter-based treatment at hospitals for Inpatients
6: IA catheter-based treatment at outside hospitals
7: Any thrombolytic therapy

FIGURE 23. TYPES OF THROMBOLYTIC THERAPY AMONG ADULT ISCHEMIC STROKE CASES, 2008-2018

Thrombolytic Therapies, by Year

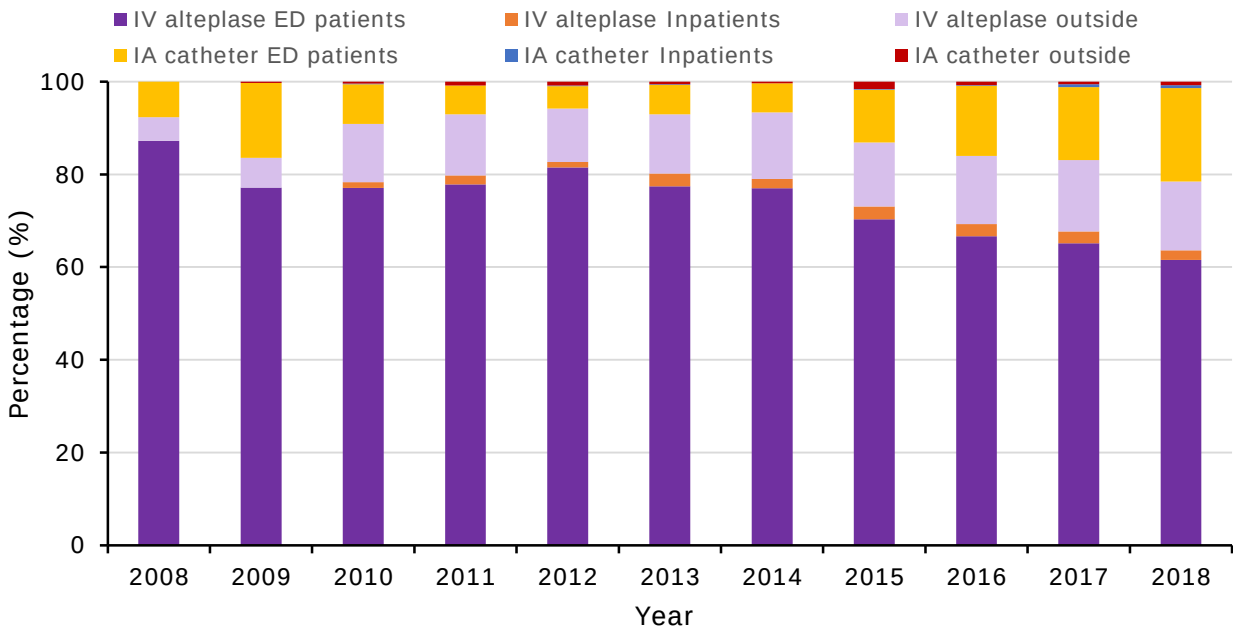


FIGURE 24. TYPES OF THROMBOLYTIC THERAPIES AMONG ADULT ISCHEMIC STROKE CASES WHO RECEIVED ANY THROMBOLYTIC THERAPY, BY YEAR, 2008-2018

TABLE 18. PERCENTAGE OF THROMBOLYTIC THERAPIES AMONG ADULT ISCHEMIC STROKE CASES, 2008-2018

	Ischemic Stroke Cases	IV alteplase at home hospital	IV alteplase at other hospital	IA catheter at home hospital	IA catheter at other hospital	Reporting hospitals
Year	N=87,847	n=9,069 (10.0%)	n=1,698 (1.9%)	n=1,536 (1.8%)	n=91 (0.1%)	N
2008	3,039	137 (4.5)	8 (0.3)	12 (0.4)	0 (-)	20
2009	3,917	287 (7.3)	24 (0.6)	60 (1.5)	1 (<0.1)	27
2010	5,663	543 (9.6)	87 (1.5)	60 (1.1)	3 (0.1)	33
2011	6,381	661 (10.4)	109 (1.7)	52 (0.8)	7 (0.1)	35
2012	7,142	714 (10.0)	100 (1.4)	43 (0.6)	7 (0.1)	40
2013	7,973	844 (10.6)	135 (1.7)	68 (0.9)	6 (0.1)	42
2014	9,044	1,002 (11.1)	182 (2.0)	80 (0.9)	4 (<0.1)	49
2015	10,747	1,164 (10.8)	219 (2.0)	185 (1.7)	25 (0.2)	49
2016	11,061	1,214 (11.0)	259 (2.3)	267 (2.4)	13 (0.1)	50
2017	11,576	1,286 (11.1)	292 (2.5)	311 (2.7)	10 (0.1)	49
2018	11,304	1,217 (10.8)	283 (2.5)	398 (3.5)	15 (0.1)	46

Of the 87,847 eligible ischemic stroke cases reported from 2008-2018, 14.1% (n=12,394) received some type of thrombolytic therapy. Of those receiving thrombolytic therapy, the most common type was IV-alteplase, accounting for 86.9% of therapies, while IA catheter-based treatment accounted for the remaining

13.1%. The frequency of IA catheter-based treatment, however, appears to be increasing; in 2008, IA catheter-based treatment accounted for 7.6% of thrombolytic therapies, compared to 21.6% in 2018. Between 2008 and 2018, the number of participating hospitals reporting on this measure increased, from 20 in 2008, to 46-50 for 2014-2018.

THROMBOLYTIC COMPLICATIONS

Thrombolytic complications occur when patients with a diagnosis of acute ischemic stroke experience bleeding complications after thrombolytic therapy was administered.

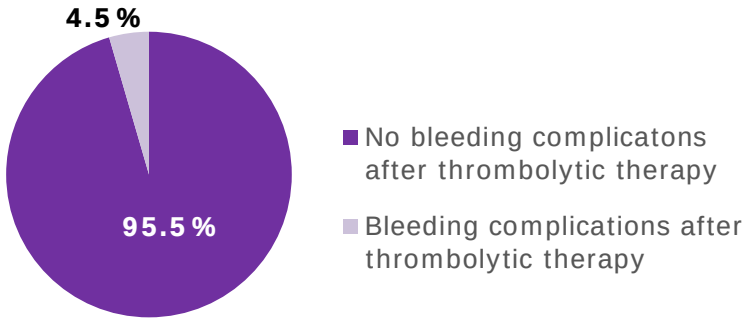


FIGURE 25. ADULT ISCHEMIC STROKE CASES WITH BLEEDING COMPLICATIONS AFTER THROMBOLYTIC THERAPY, 2008-2018

Of the 12,394 ischemic stroke cases seen between 2008-2018 who received thrombolytic treatment, 4.5% (n=563) experienced a serious bleeding complication after IV tPA or IA catheter-based treatment was administered (Figure 25).

Thrombolytic Complications, by Year

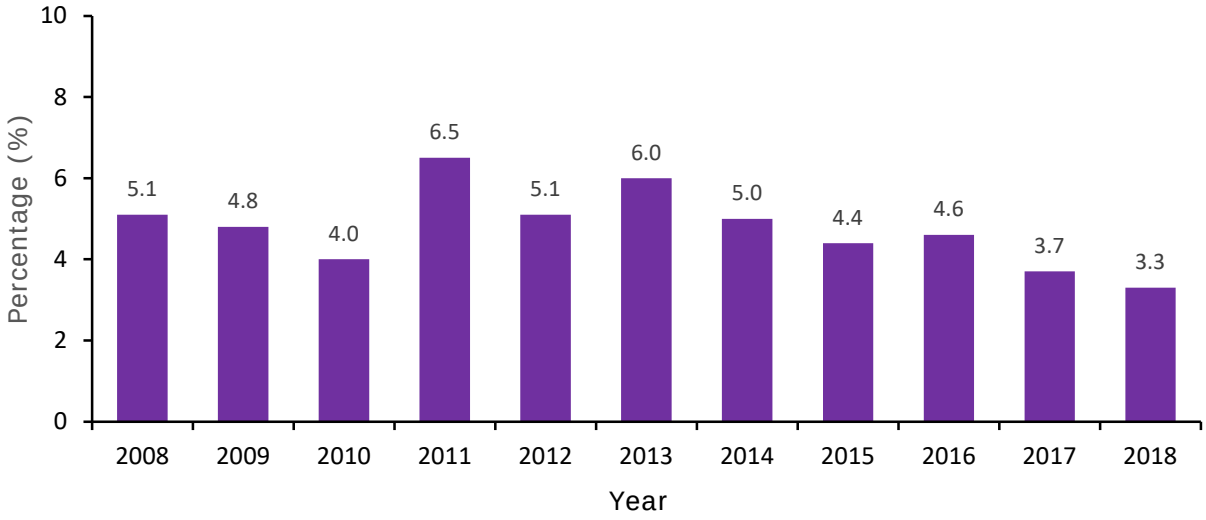


FIGURE 26. ADULT ISCHEMIC STROKE CASES WITH BLEEDING COMPLICATIONS AFTER THROMBOLYTIC THERAPY, BY YEAR, 2008-2018

TABLE 19. ADULT ISCHEMIC STROKE CASES WITH BLEEDING COMPLICATIONS AFTER THROMBOLYTIC THERAPY, BY YEAR, 2008-2018

Thrombolytic therapy-treated cases				
	Total	Bleeding complications		Reporting Hospitals
Year	n=12,394	n=563	%	N
2008	157	8	5.1	20
2009	372	18	4.8	27
2010	693	28	4.0	33
2011	829	54	6.5	36
2012	864	44	5.1	40
2013	1,053	63	6.0	42
2014	1,268	63	5.0	49
2015	1,593	70	4.4	49
2016	1,753	81	4.6	50
2017	1,899	71	3.7	49
2018	1,913	63	3.3	46

The percentage of eligible adult ischemic stroke cases who experienced bleeding complications post-thrombolytic therapy ranged from a high of 6.5% in 2011 to a low of 3.3% in 2018. Between 2008 and 2018, the number of participating hospitals reporting on this measure increased, from 20 in 2008, to 46-50 in 2014-2018.

INTENSIVE STATIN THERAPY

Of the 57,734 eligible adult ischemic stroke and TIA cases, over two-thirds (68.3%; n=36,989) were prescribed a qualifying high-intensity statin upon hospital discharge, while almost one-third (31.7%; n=17,136) were not (Figure 27). A total of 3,609 had documentation contradicting the prescription of high-intensive statin therapy.

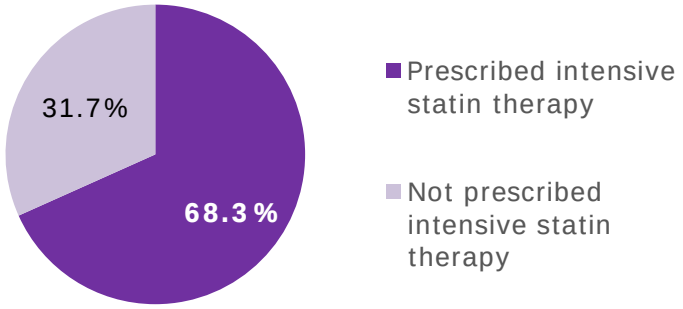


FIGURE 27. INTENSIVE STATIN THERAPY PRESCRIBED UPON HOSPITAL DISCHARGE AMONG ADULT ISCHEMIC STROKE AND TIA CASES, 2008-2018

Intensive Statin Therapy, by Year

Figure 26 and Table 19 display the percentage of eligible adult ischemic stroke and TIA cases who were prescribed a qualifying high-intensity statin upon hospital discharge, by year.

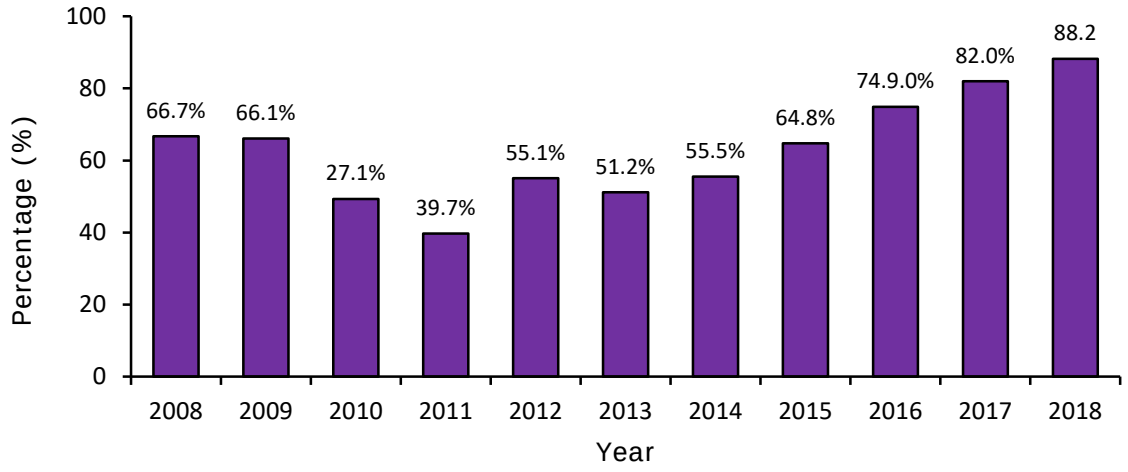


FIGURE 28. PERCENTAGE OF ADULT ISCHEMIC STROKE AND TIA CASES DISCHARGED WITH INTENSIVE STATIN THERAPY, BY YEAR, 2008-2018

TABLE 20. ADULT ISCHEMIC STROKE AND TIA CASES DISCHARGED WITH INTENSIVE STATIN THERAPY, BY YEAR, 2008-2018

	Adult Ischemic Stroke & TIA Cases			
	Total	Intensive Statin Therapy at Hospital Discharge		Reporting Hospitals
Year	N=54,125	n=15,828	56.2%	N
2008	30	20	66.7	17
2009	862	570	66.1	25
2010	1,596	787	49.3	32
2011	2,370	940	39.7	35
2012	3,711	2,045	55.1	39
2013	5,248	2,688	51.2	42
2014	6,431	3,566	55.5	49
2015	7,914	5,129	64.8	48
2016	8,242	6,175	74.9	49
2017	9,011	7,388	82.0	48
2018	8,710	7,681	88.2	45

The percentage of eligible ischemic stroke and TIA cases prescribed qualifying high-intensity statin therapy upon hospital discharge has risen steadily over the past 6 years, from 51.2% in 2013 to 88.2% in 2018. Prior to this, the percentage varied, from a low of 39.7% in 2011 to 66.7% in 2008. Note: Both numbers and percentages reported for this measure differ from previously reported; this could reflect differences in participating hospitals and/or updated inclusion/exclusion criteria for this measure.

Between 2008 and 2017, the number of participating hospitals reporting on this measure increased, from 17 in 2008, to 45-49 in 2014-2018.

ANTITHROMBOTIC PRESCRIBED AT HOSPITAL DISCHARGE

FIGURE 29. PERCENTAGE OF ADULT STROKE CASES DISCHARGED WITH ANTITHROMBOTIC MEDICATION, 2008-2018

Almost all eligible adult ischemic stroke and TIA cases (98.3%, n=84,662) were prescribed antithrombotic therapy upon hospital discharge (Figure 29).

Antithrombotic Prescribed at Discharge, by Year

Figure 30 and Table 21 display the percentage of eligible ischemic stroke and TIA cases who were prescribed antithrombotic medication at hospital discharge, by year.

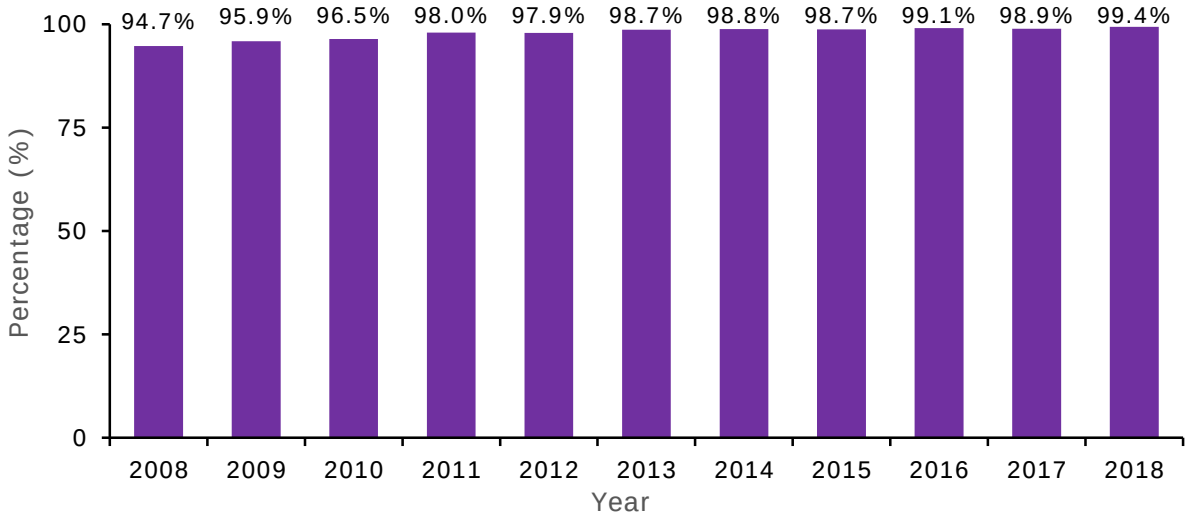


FIGURE 30. PERCENTAGE OF ISCHEMIC STROKE AND TIA CASES DISCHARGED WITH ANTITHROMBOTIC MEDICATION BY YEAR, 2008-2018

TABLE 21. ISCHEMIC STROKE AND TIA CASES DISCHARGED WITH ANTITHROMBOTIC MEDICATION BY YEAR, 2008-2018

Adult Ischemic Stroke and TIA Cases				
	Total	Antithrombotic prescribed at discharge		Reporting Hospitals
Year	N=86,144	n=84,662	%	N
2008	3,595	3,406	94.7	20
2009	4,486	4,301	95.9	27
2010	5,717	5,516	96.5	33
2011	6,552	6,418	98.0	35
2012	7,333	7,181	97.9	40
2013	8,177	8,069	98.7	43
2014	8,686	8,582	98.8	49
2015	10,159	10,031	98.7	48
2016	10,353	10,256	99.1	49
2017	10,856	10,735	98.9	49
2018	10,230	10,168	99.4	46

The percentage of eligible ischemic stroke and TIA cases discharged with antithrombotic therapy increased slightly, from a low of 94.7% in 2008, to a high of 99.4% in 2018.

Between 2008 and 2017, the number of participating hospitals reporting on this measure has increased, from 20 in 2008, to 46-49 in 2014-2018.

ANTI-HYPERTENSIVES PRESCRIBED AT HOSPITAL DISCHARGE

Of the 90,059 TIA and ischemic stroke cases seen between 2008 and 2018, half (50.2%; n=45,220) had documented high blood pressure (SBP ≥140 mmHg and/or DBP ≥90 mmHg). Of these, 1,978 had some contraindication to antihypertension medications, and data were missing for another 3,552.

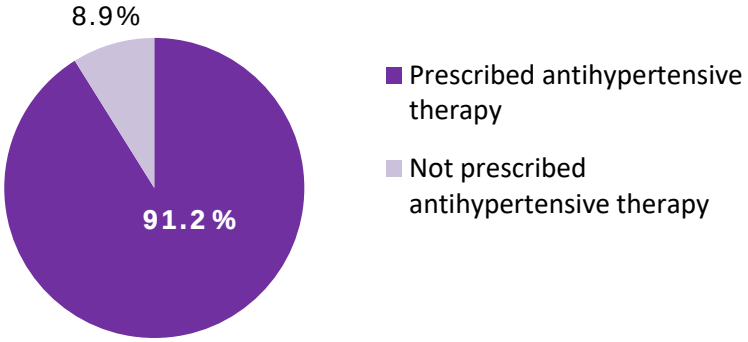


FIGURE 31. PERCENTAGE OF ADULT ISCHEMIC STROKE AND TIA CASES DISCHARGED WITH ANTIHYPERTENSIVE MEDICATION, 2008-2018

Roughly 91 in 100 cases (91.2%; n=36,176) were prescribed some type of anti-hypertensive medication at hospital discharge.

Types of Anti-Hypertensives Prescribed at Discharge, by Year

Figure 32 displays the different types of anti-hypertensive medications prescribed at time of hospital discharge for eligible adult ischemic and TIA stroke patients, 2018.

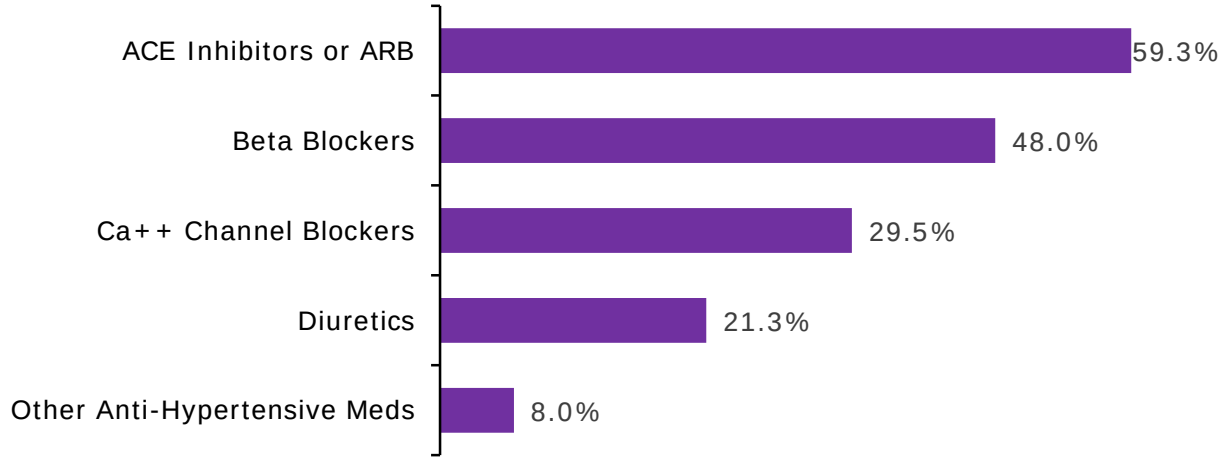


FIGURE 32. ISCHEMIC STROKE AND TIA CASES DISCHARGED WITH ANTIHYPERTENSIVE MEDICATION, 2018

Table 22, below, displays the types of anti-hypertensive medications prescribed at discharge among the 39,690 eligible ischemic and TIA cases with diagnosed high blood pressure, from 2008- 2018.

TABLE 22. PERCENTAGE OF ANTIHYPERTENSIVE MEDICATIONS PRESCRIBED FOR ISCHEMIC STROKE AND TIA CASES AT DISCHARGE BY YEAR, 2008-2018

Adult Ischemic Stroke and TIA Cases Prescribed Anti-Hypertensives at Hospital Discharge

		Type of Anti-Hypertensive										
	Cases	ACE Inhibitor/ ARB		Beta Blocker		Ca++ Channel Blocker		Diuretic		Other		Reporting Hospitals
Year	N	N	%	N	%	N	%	N	%	N	%	N
2008	112	64	57.1	43	38.4	24	21.4	17	15.2	3	2.7	13
2009	3,045	1,740	57.1	1,465	48.1	718	23.6	638	21.0	316	10.4	27
2010	3,536	2,125	58.0	1,700	48.1	890	25.2	635	18.0	345	9.8	30
2011	2,972	1,905	64.1	1,494	50.3	775	26.1	549	18.5	264	8.9	26
2012	2,915	1,822	62.5	1,427	49.0	825	28.3	627	21.5	264	9.1	27
2013	3,102	1,942	62.6	1,517	48.9	819	26.4	670	21.6	237	7.6	30
2014	3,796	2,280	60.1	1,785	47.0	983	25.9	866	22.8	326	8.6	37
2015	4,943	2,839	57.4	2,467	49.9	1,581	32.0	1,068	21.6	419	8.5	35
2016	4,808	2,747	57.1	2,258	47.0	1,502	31.2	1,017	21.2	365	7.6	35
2017	5,516	3,177	57.6	2,594	47.0	1,886	34.2	1,240	22.5	343	6.2	37
2018	4,945	2,886	58.4	2,318	46.9	1,721	34.8	1,112	22.5	307	6.2	37

The pattern of anti-hypertensive medications prescribed each year (2008-2018) remained similar: every year, ACE Inhibitors/ARBs were the most commonly prescribed, followed by Beta Blockers, then by Ca++ Channel Blocker. Note: Patients could be prescribed more than one type of medication.

From 2008 to 2018, the number of participating hospitals reporting on this measure increased, from 13 in 2008, to 37 in 2018. The number of hospitals reporting on this measure could be improved upon.

REHABILITATION CONSIDERED

Both stroke severity, and timely treatment of the stroke, affect health outcomes and patient recovery, including the stroke survivor's functionality in terms of speech, language, and physical ability. (5) In order to achieve the best results, physicians should assess all stroke patients for rehabilitative services. (7)

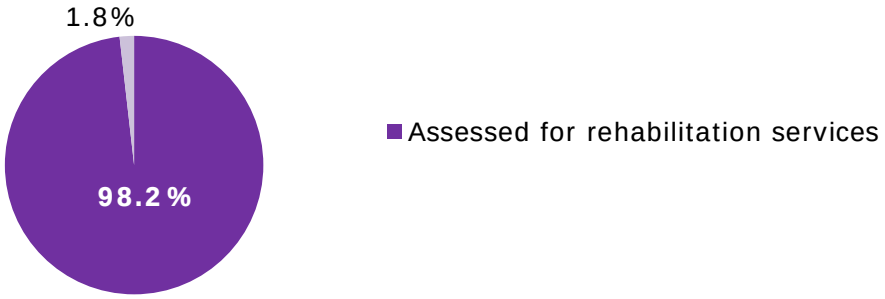


FIGURE 33. ADULT STROKE CASES ASSESSED FOR REHABILITATIVE SERVICES PRIOR TO DISCHARGE, 2008-2018

From 2008-2018, almost all ischemic, hemorrhagic, TIA, and stroke NOS cases (98.2%; n=85,953) were assessed for rehabilitative services, with less than two in 100 (1.8%; n=1,599) not considered for rehabilitative services (Figure 33).

Rehabilitation Considered, by Year

Figure 34 and Table 23 display the percentage of cases diagnosed with ischemic stroke, TIA, hemorrhagic stroke, and stroke NOS who were assessed for rehabilitative services prior to hospital discharge, by year.

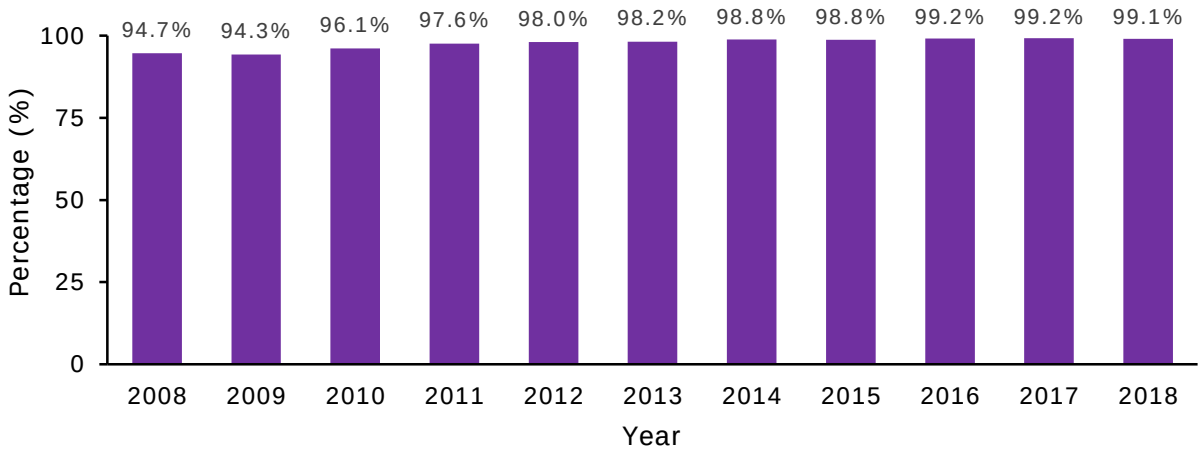


FIGURE 34. ADULT STROKE CASES ASSESSED FOR REHABILITATIVE SERVICES PRIOR TO DISCHARGE, BY YEAR, 2008-2018

TABLE 23. ADULT STROKE CASES ASSESSED FOR REHABILITATIVE SERVICES PRIOR TO DISCHARGE, BY YEAR, 2008-2018

	Cases	Assessed for rehabilitation		Reporting Hospitals
Year	N=87,552	n=85,953	98.2%	N
2008	3,184	3,014	94.7	21
2009	4,244	4,000	94.3	27
2010	5,883	5,653	96.1	33
2011	6,467	6,312	97.6	34
2012	6,930	6,792	98.0	40
2013	7,743	7,601	98.2	43
2014	8.972	8,864	98.8	49
2015	10,559	10,430	98.8	49
2016	10,938	10,847	99.2	50
2017	11,430	11,342	99.2	49
2018	11,202	11,098	99.1	46

The percentage of eligible cases assessed for rehabilitative services ranged from a low of 94.7% in 2009 to a high of 99.1-99.2% in 2016-2018.

Between 2008 and 2017, the number of participating hospitals reporting on this measure increased, from 21 in 2008 to 46-50 in 2014-2018.

STROKE EDUCATION

In order for stroke survivors and their caregivers to be actively involved in decision making and management of the subsequent long-term effects of stroke, appropriate information delivered in a timely and effective format is necessary. (8) Education and/or educational materials must address the following: 1) activation of emergency medical system; 2) need for follow-up after hospital discharge; 3) medications

prescribed; 4) personal risk factors for stroke; and 5) warning signs of stroke. From 2008-2018, 91.1% (n=56,050) of eligible stroke patients and/or their caregivers were provided with stroke educational materials during their hospital stay that addressed all five of these requirements (Figure 35).

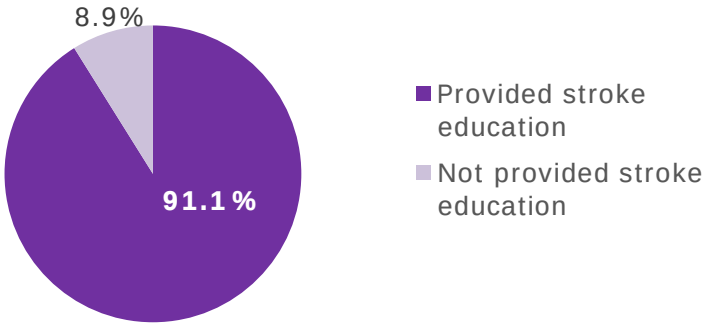


FIGURE 35. ADULT STOKE CASES AND CAREGIVERS PROVIDED WITH STROKE EDUCATION/MATERIALS, 2008-2018

Stroke Education, by Year

Figure 36 and Table 24 display the percentage of adult stroke patients and their caregivers who were provided stroke education and/or educational materials during the hospital stay, by year.

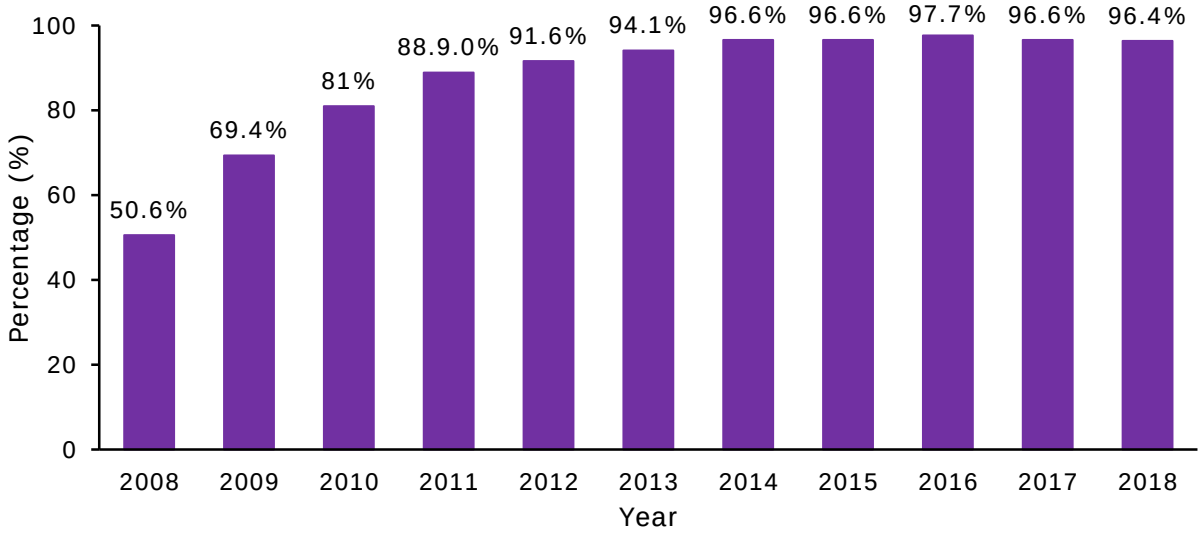


FIGURE 36. ADULT STROKE CASES AND CAREGIVERS PROVIDED WITH STROKE EDUCATION/MATERIAL DURING HOSPITAL STAY BY YEAR, 2008-2018

TABLE 24. ADULT STROKE CASES AND CAREGIVERS PROVIDED WITH STROKE EDUCATION/MATERIAL DURING HOSPITAL STAY BY YEAR, 2008-2018

	Stroke Cases	Stroke Education		Reporting Hospitals
Year	N=61,512	n=56,050	91.1%	N
2008	2,547	1,288	50.6	20
2009	3,160	2,194	69.4	27
2010	4,023	3,257	81.0	33
2011	4,716	4,193	88.9	35
2012	5,514	4,722	91.6	40
2013	5,821	5,475	94.1	43
2014	6,167	5,956	96.6	49
2015	7,171	6,924	96.6	49
2016	7,428	7,254	97.7	50
2017	7,867	7,598	96.6	48
2018	7,458	7,189	96.4	45

This percentage increased rapidly over the first four reporting years, from 50.6% in 2008 to 88.9% in 2011, and has remained above 91% since 2012. In 2018, 96.4% of eligible stroke patients / caregivers were provided with stroke education prior to hospital discharge.

Between 2008 and 2018, the number of participating hospitals reporting on this measure has increased annually, from 20 in 2008 to 45-50 in 2014-2018.

MODIFIED RANKIN SCALE AT DISCHARGE

The Modified Rankin Scale (mRS) is used to assess how severely a stroke has impacted the patients' ability in conducting daily activities of life. This measure became available in 2011. Out of 82,287 eligible stroke cases seen between 2011 and 2018, data on this measure were missing for n=16,493 (20.0%).

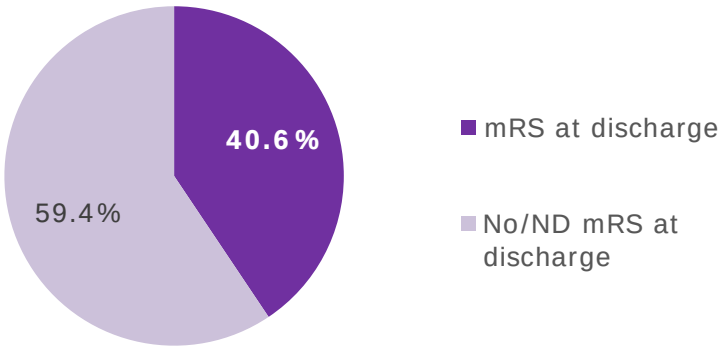


FIGURE 37. MODIFIED RANKIN SCALE PERFORMED AT HOSPITAL DISCHARGE, 2011-2018

Of the eligible adult ischemic, hemorrhagic, and stroke NOS cases seen from 2011-2018 (n=65,794), four in 10 (40.6%; n=26,692) had an mRS at time of hospital discharge while more than half (59.4%; n=39,102) did not (Figure 37).

Modified Rankin Scale (mRS), by Year

Figure 38 and Table 25 display the percentage of eligible adult stroke cases with an mRS at hospital discharge, per year. Among the 26,692 eligible adults stroke cases who had mRS scores at hospital discharge, the median mRS score was 3, indicating slight disability.

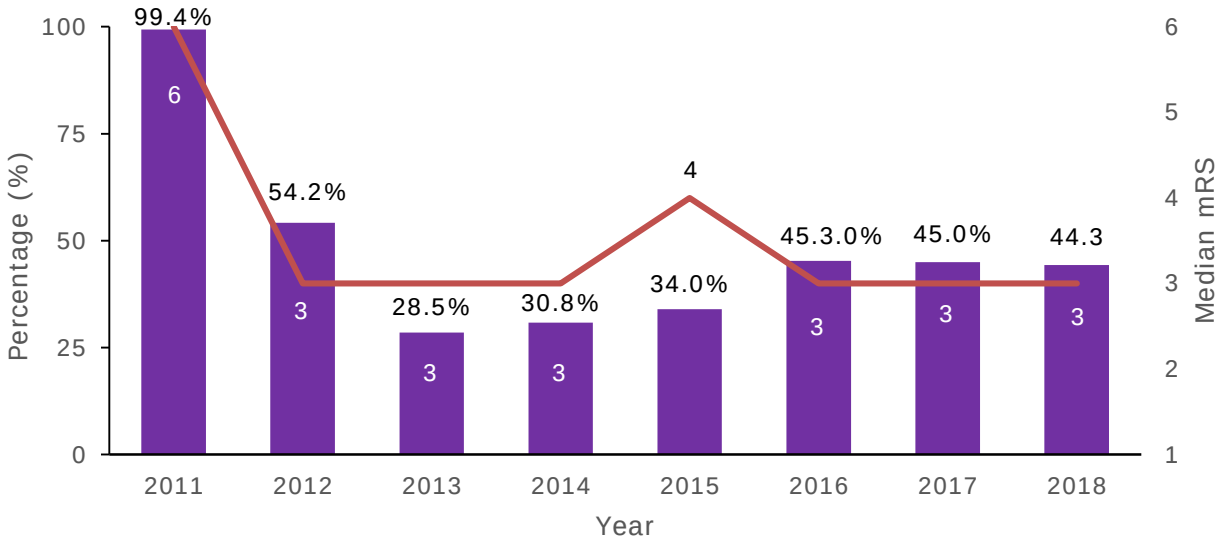


FIGURE 38. ADULT STROKE CASES WITH A MODIFIED RANKIN SCALE (MRS) SCORE AT HOSPITAL DISCHARGE, AND MEDIAN MRS SCORE, BY YEAR, 2011-2018

TABLE 25. ADULT STROKE CASES WITH A MODIFIED RANKING SCALE (MRS) AT HOSPITAL DISCHARGE, AND MEDIAN MRS SCORE, BY YEAR, 2011-2018

Adult Ischemic and Hemorrhagic Stroke Cases					
	Cases	mRS at discharge		mRS scoremRS Score	Reporting Hospitals
Year	N = 65,794	n = 26,692	40.6%	Median	N
2011	537	534	99.4	6	35
2012	4,274	2,315	54.2	3	40
2013	6.978	1,989	28.5	3	43
2014	8,638	2,657	30.8	3	49
2015	10,592	3,599	34.0	4	49
2016	11,374	5,150	45.3	3	50
2017	11,938	5,368	45.0	3	49
2018	11,463	5,080	44.3	3	46

The percentage of adult ischemic, hemorrhagic, and stroke NOS cases with an mRS at discharge varied annually, from a low of 28.5% in 2013 to a high of 45.3% in 2016. Note: Results for 2011 should be interpreted with caution; while 99.4% of eligible cases had an mRS at discharge in 2011, the measure was missing for 92.7% of eligible cases seen in this reporting year.

Between 20011 and 2017, the number of participating hospitals reporting on this measure increased from 35 in 2011 to 46-50 in 2014-2018.

DISCHARGE DISPOSITION

The discharge disposition, or the plan for care of the stroke patient after discharge from the hospital, can provide an indication of the severity and extent of disability of a stroke patient. Of the eligible 107,070 cases seen from April 1, 2011 through December 2018, data on this measure were missing for n=2,445 (2.3%) cases.

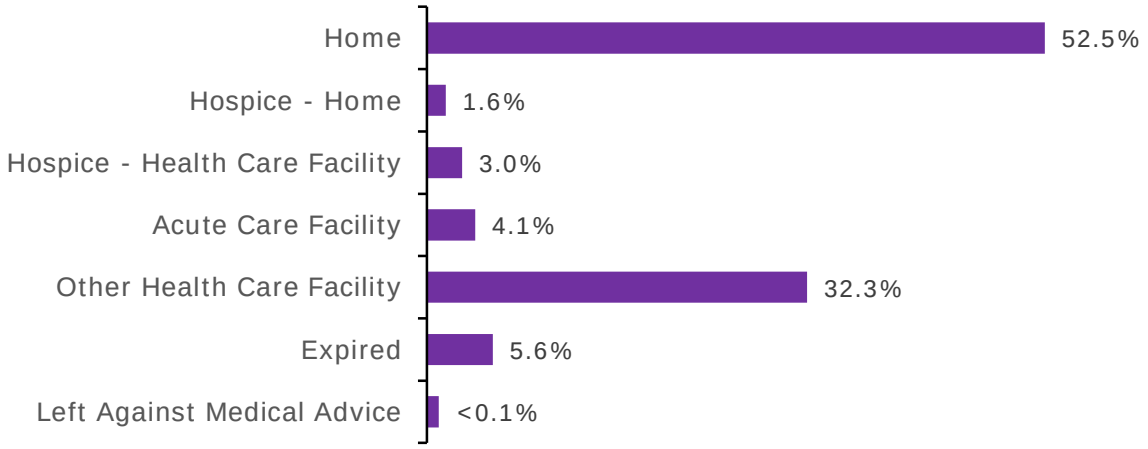


FIGURE 39A. DISCHARGE DISPOSITION OF ADULT STROKE CASES DISCHARGED ON OR AFTER APRIL 1, 2011 THROUGH DECEMBER 2018

Among stroke cases discharged on or after April 1, 2011, more than half (n=54,875; 52.5%) were discharged to home, with another one-third (n=33,832; 32.3%) discharged to other health care facilities (Figure 39A). Of those discharged to other health care facilities, data on type of facility were missing for n=1,313 cases (3.9%).

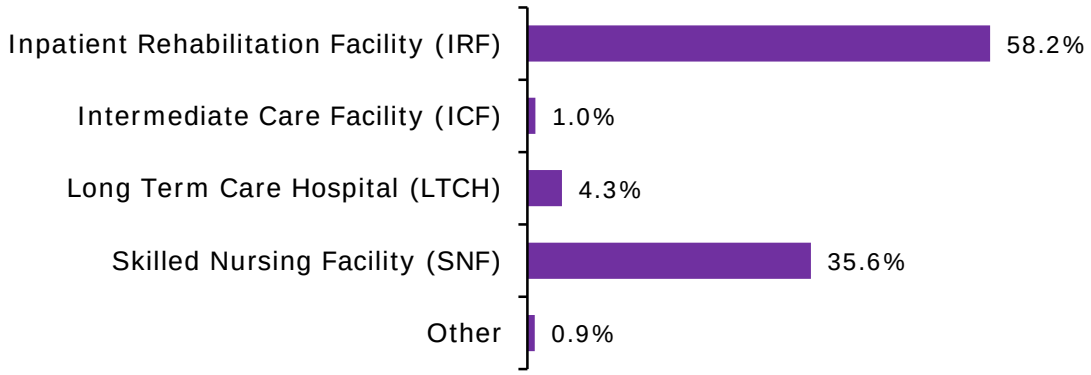


FIGURE 39B. DISCHARGE DISPOSITION AMONG ADULT STROKE CASES DISCHARGED TO OTHER HEALTHCARE FACILITIES, APRIL 2011 THROUGH DECEMBER 2018

Of the adult cases discharged to other healthcare facilities, almost six in 10 (n=18,912; 58.2%) were discharged to an inpatient rehabilitation facility, and one-third (n=11,579; 35.6%) to a skilled nursing facility (Figure 39B).

Discharge Disposition, by Year

Figures 40 and 41, below, display the discharge dispositions and types of healthcare facilities to which stroke patients were discharged, by year.

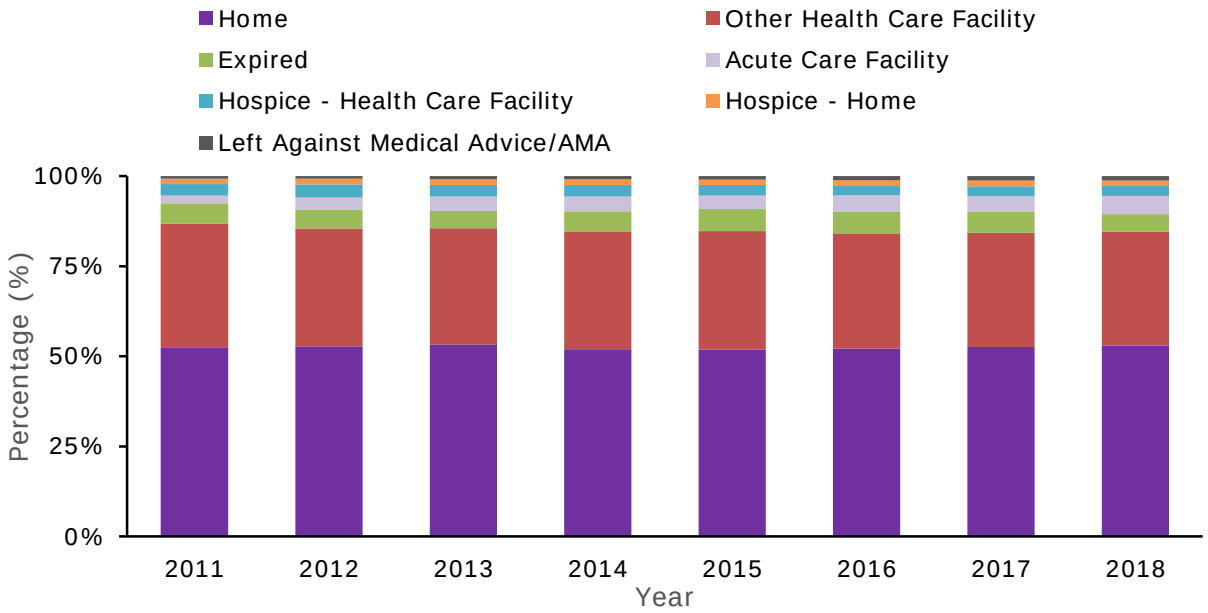


FIGURE 40. DISCHARGE DISPOSITION OF ADULT STROKE CASES, BY YEAR, 2011-2018

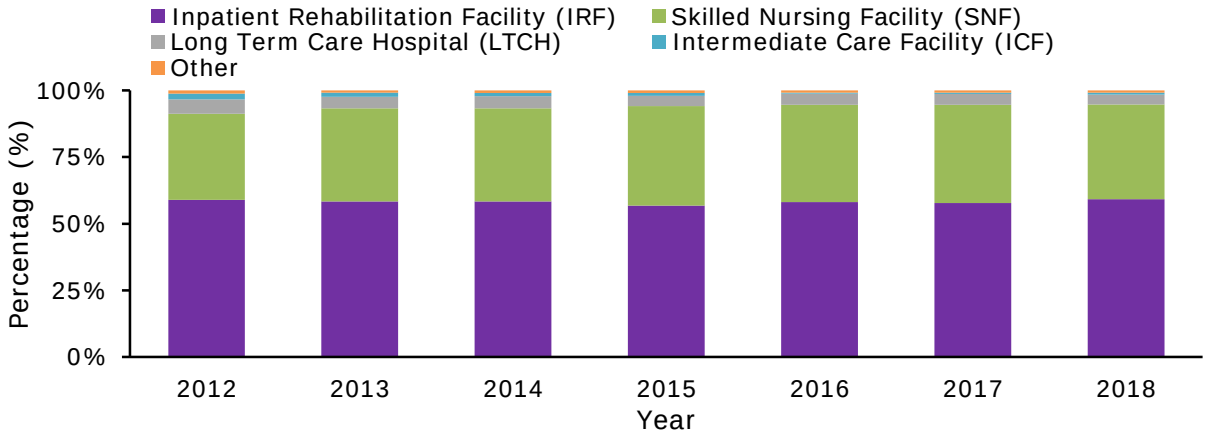


FIGURE 41. DISCHARGE DISPOSITION AMONG STROKE CASES DISCHARGED TO OTHER HEALTHCARE FACILITIES, BY YEAR, 2011-2018

Discharge disposition has remained stable since April 2011, with half of eligible cases discharged to home. Similarly, for those discharged to other healthcare facilities, more than half were discharged to an inpatient rehabilitation facility.

Between 2011 and 2016, the number of participating hospitals reporting on this measure increased annually, from 35 to 50 participating hospitals. For 2018, there were 46 participating hospitals. Opportunities may exist in determining if an association exists between patients discharge disposition, home vs. other healthcare facility, and the stroke survivors' utilization of rehabilitative services.

VII. COMORBIDITIES

The following section describes the prevalence of select risk factors and comorbid conditions among 126,758 patients seen between 2008-2018 with a diagnosis of Ischemic stroke, Transient Ischemic Attack (TIA), Intracerebral hemorrhage, Subarachnoid hemorrhage, or Stroke not otherwise specified (NOS). Two different methods are used to estimate the prevalence of the risk factors: 1) Documented medical history either self-reported by the patient or previously documented (missing for 6%, n=7,583 of cases); and 2) Documented clinical results measured during the stroke episode of care, if applicable.

The following comorbidities are included in the report:

1. Hypertension
2. Atrial Fibrillation
3. Diabetes Mellitus
4. Documentation of Lipid Profile
5. Lipid Measures – Total Cholesterol, LDL, HDL, and Triglycerides
6. Dyslipidemia
7. Smoking
8. Overweight and Obesity

HYPERTENSION

Treatment of hypertension is thought to be the most important intervention for secondary prevention of ischemic stroke. (7) Though the relationship between hypertension and stroke recurrence has been less well studied, its importance in preventing recurrent stroke is thought to be of equal importance. (7)

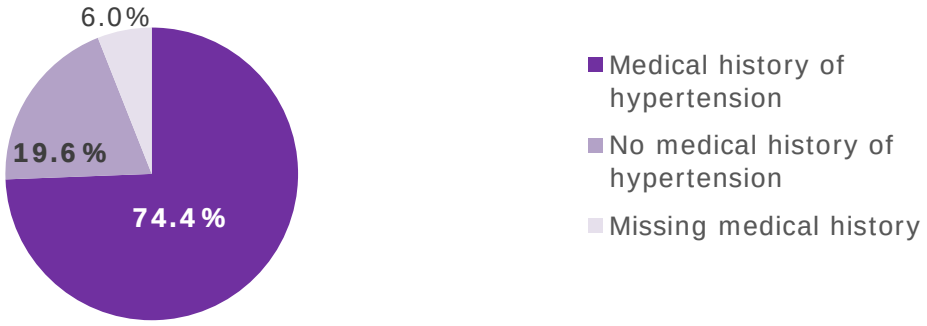


FIGURE 42. PERCENTAGE OF STROKE CASES WITH A MEDICAL HISTORY OF HYPERTENSION, 2008-2018

The prevalence of hypertension reported as a previously known medical condition was 74.4% (n=93,942). That is, 74 in every 100 adult stroke patients seen between 2008 and 2018 were known to have hypertension prior to their stroke (Figure 42).

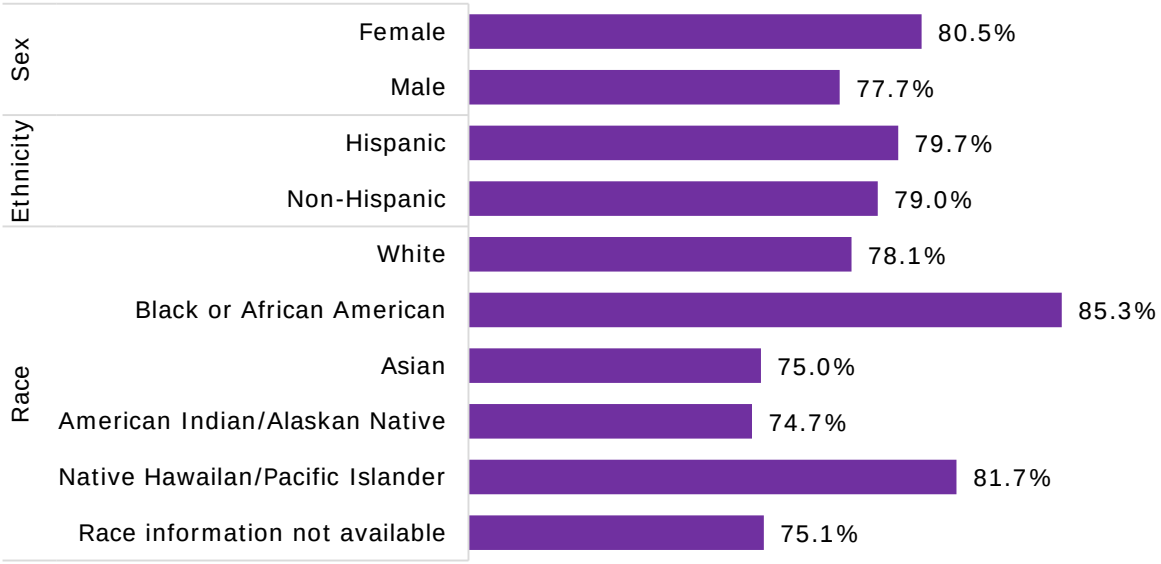


FIGURE 43. MEDICAL HISTORY OF HYPERTENSION AMONG ADULT STROKE CASES BY SEX, ETHNICITY, AND RACE, 2008-2018

History of hypertension was slightly more common among females than among males. While the prevalence of pre-existing hypertension did not differ by Hispanic ethnicity, it was more common among Blacks and Native Americans than among other race groups (Figure 43).

The prevalence of high blood pressure, documented as SBP ≥130 mmHg and/or DBP ≥80 mmHg during the stroke episode of care, was 58.7% (n=74,140). That is, one in two adult stroke patients had high blood pressure during their hospitalization (Figure 44). Data were missing for one-third of cases (32.4%; n=40,964).

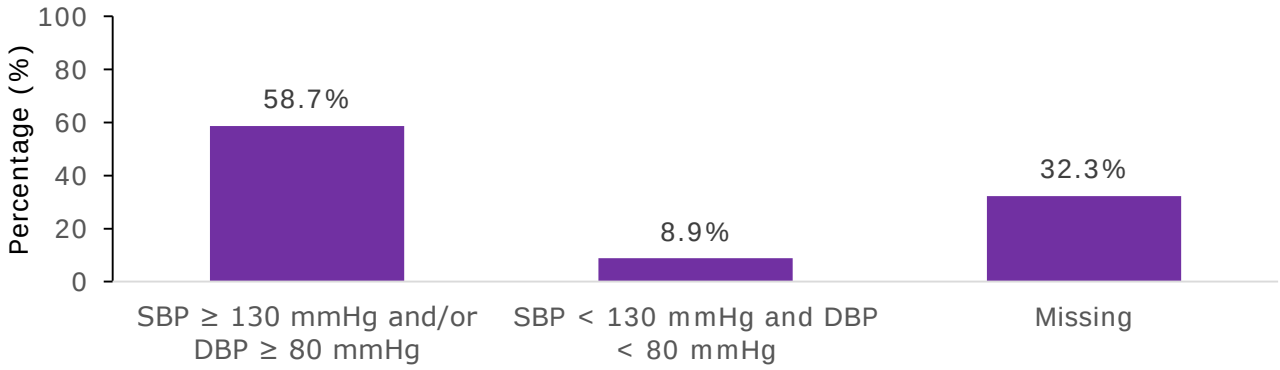


FIGURE 44. PREVALENCE OF HIGH BLOOD PRESSURE DURING STROKE EPISODE OF CARE, 2008-2018

The difference between the prevalence of hypertension as a previously known medical condition (74.4%) vs. measured SBP/DBP at stroke episode of care (58.7%) may reflect differences in missingness of data, the management of hypertension during the stroke episode of care, and/or the definition of hypertension (140/80 mmHg vs. 130/80 mmHg).

ATRIAL FIBRILLATION

Atrial fibrillation (AF) is thought to cause approximately 10-12% of all ischemic stroke cases in the United States. (7) AF also increases the risk of stroke recurrence in patients with prior and/or recent ischemic stroke or TIA.

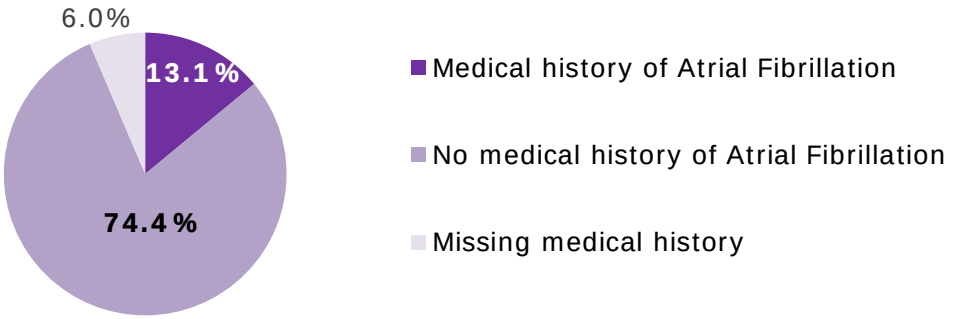


FIGURE 45. MEDICAL HISTORY OF ATRIAL FIBRILLATION AMONG ADULT STROKE CASES, 2008-2018

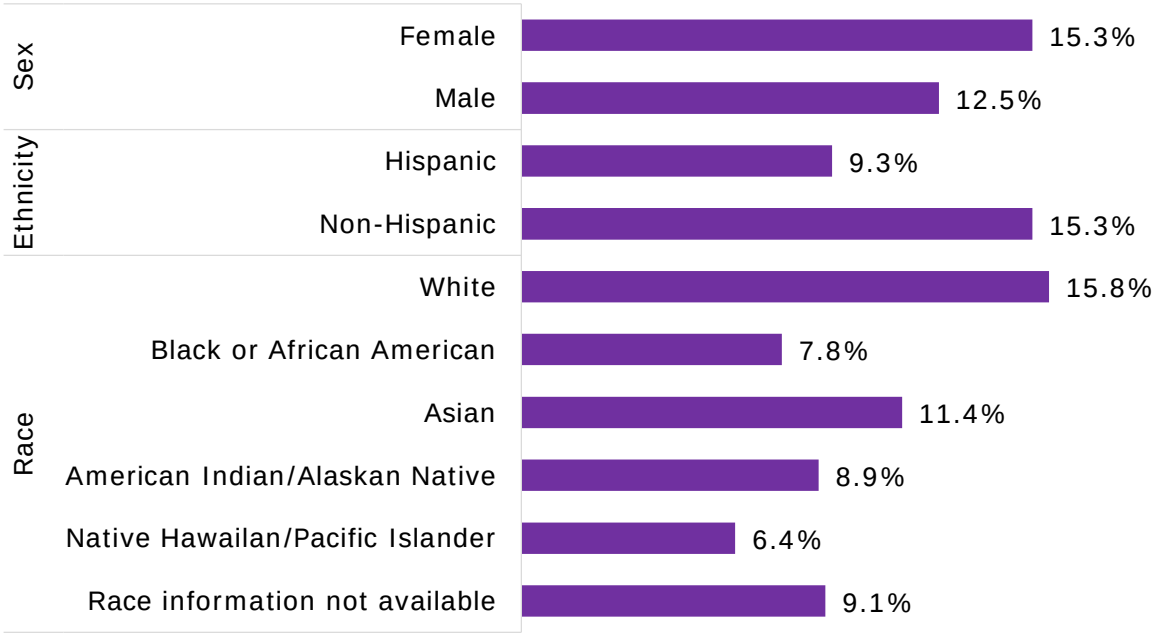


FIGURE 46. MEDICAL HISTORY OF ATRIAL FIBRILLATION AMONG ADULT STROKE CASES BY SEX, ETHNICITY, AND RACE, 2008-2018

The prevalence of AF reported as a previously known medical condition was 13.1% (n=16,479) (Figure 43). AF was more common among females than males, among non-Hispanics than Hispanics, and among Whites than other race groups (Figure 46). Note: Percentages reported for this measure differ from previously reported; this could reflect differences in participating hospitals and/or updated inclusion/exclusion criteria for this measure.

DIABETES MELLITUS

Diabetes mellitus is associated with an increased risk of an initial ischemic stroke and it also increases the risk of stroke recurrence. (7)

FIGURE 47. PERCENTAGE OF MEDICAL HISTORY OF DIABETES MELLITUS AMONG ADULT STROKE CASES, 2008-2018

The prevalence of diabetes mellitus reported as a previously known medical condition was 35.2% (n=44,404) (Figure 47).

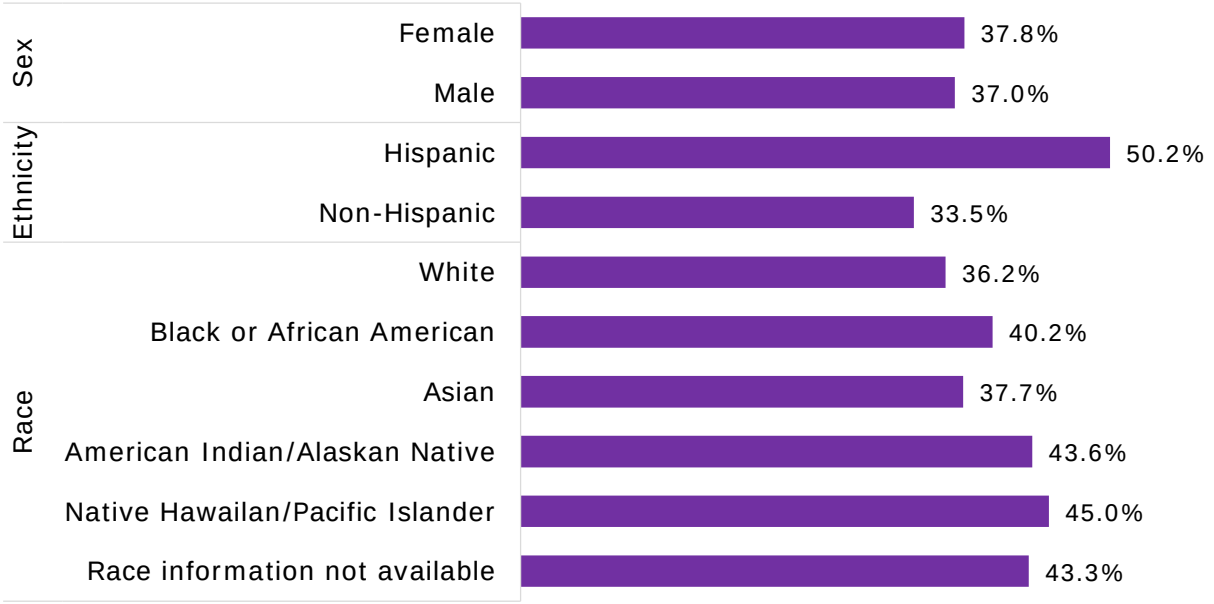


FIGURE 48. MEDICAL HISTORY OF DIABETES MELLITUS AMONG ADULT STROKE CASES BY SEX, ETHNICITY, AND RACE, 2008-2018

The prevalence of diabetes mellitus as a previously known medical condition was similar for males and females. However, pre-existing diabetes was less common among non-Hispanics than Hispanics, as well as among Whites and Asians than other race groups.

DOCUMENTATION OF LIPID PROFILE

Patients diagnosed with ischemic stroke or TIA should have a lipid profile measurement performed within 24-48 hours of hospital admission, unless the patient's medical record contains documented lipid profile results performed within the past 30 days. (7)

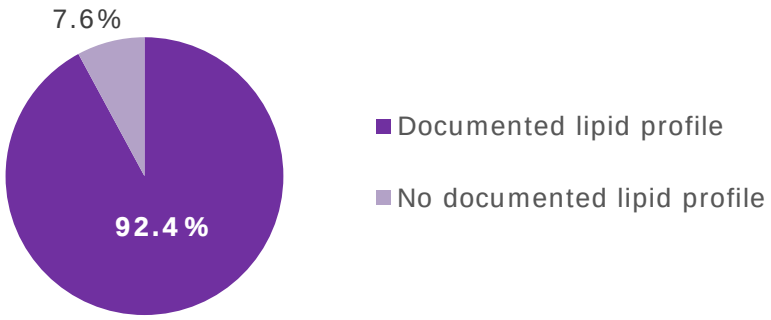


FIGURE 49. ADULT ISCHEMIC STROKE AND TIA CASES WITH A DOCUMENTED LIPID PROFILE, 2008-2018

Of the 85,684 eligible adult ischemic stroke and TIA cases, nine out of 10 cases (92.4%; n=79,128) had lipid results either performed and documented within 48 hours of hospital admission or previously performed and documented within 30 days prior to hospital admission (Figure 49). Note: Percentages reported for this measure differ from previously reported; this could reflect differences in participating hospitals and/or updated inclusion/exclusion criteria for this measure.

This indicates a potential gap in the stroke system of care. Opportunity exists in requiring standardized documentation of lipid profiles across all Texas hospitals.

LIPID MEASURES – TOTAL CHOLESTEROL, LDL, HDL, TRIGLYCERIDES

Among the 79,128 eligible adult stroke cases with a documented lipid profile, 46.1% (n=16,206) had documented HDL < 40 mg/dL; 31.7% (n=24,864) had documented triglycerides ≥ 150 mg/dL; 20.0% (n=20,133) had documented LDL ≥ 130 mg/dL; and 22.7% (n=17,831) had documented total cholesterol > 200 mg/dL (Figure 48). The prevalence of these lipid measure categories are not mutually exclusive and may not add up to 100%.

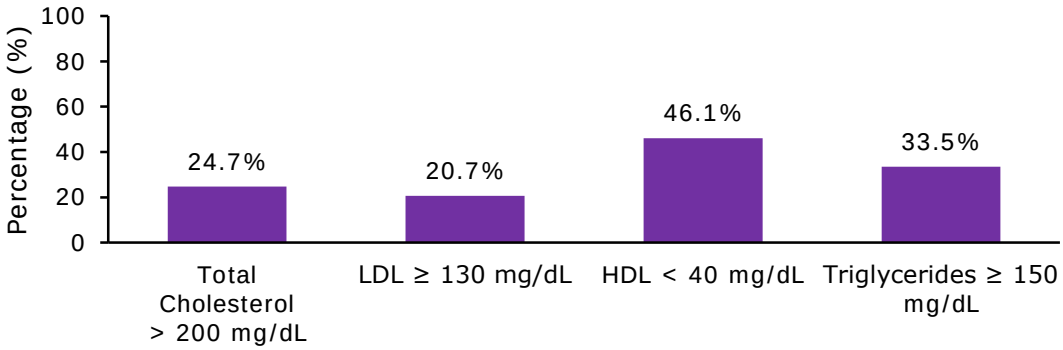


FIGURE 50. HIGH RISK LIPID LEVELS DURING STROKE EPISODE OF CARE, 2008-2018

DYSLIPIDEMIA

Certain serum lipid biomarkers (elevated triglycerides, low HDL, and high LDL) are associated with an increased risk of stroke and are primary targets for preventing stroke recurrence. (7)

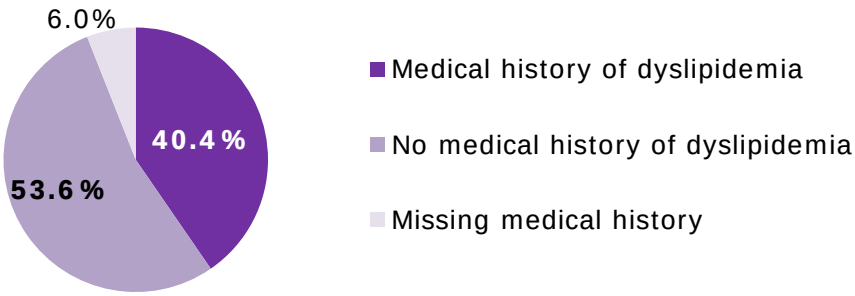


FIGURE 51. MEDICAL HISTORY OF DYSLIPIDEMIA AMONG ADULT STROKE CASES, 2008-2018

The prevalence of dyslipidemia, reported as a previously known medical condition prior to stroke occurrence, was 40.4% (n=51,056) (Figure 51).

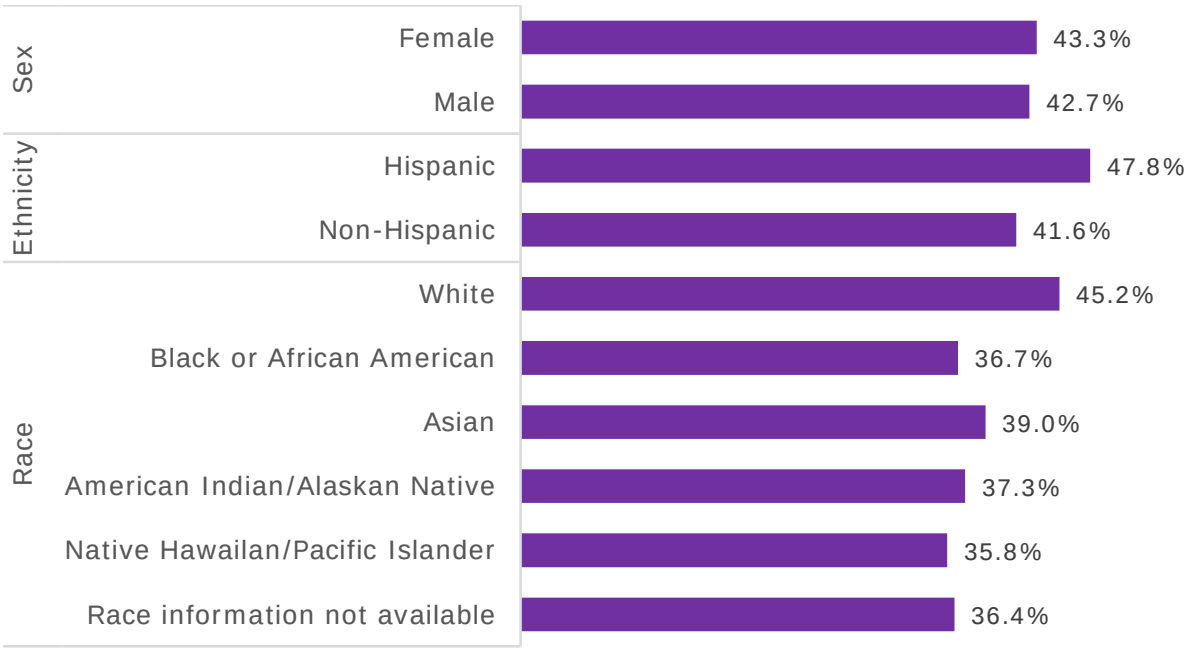


FIGURE 52. PERCENTAGE OF MEDICAL HISTORY OF DYSLIPIDEMIA AMONG ADULT STROKE CASES BY SEX, ETHNICITY, AND RACE, 2008-2018

The prevalence of dyslipidemia as a pre-existing condition was similar for males and females. It was more common among Hispanics than non-Hispanics, and among Whites than other race groups (Figure 52).

Figure 53 displays the prevalence of dyslipidemia (total cholesterol > 200 mg/dL, LDL ≥ 130 mg/dL, or HDL < 40 mg/dL) from lab tests performed within 48 hours of hospital admission or from existing documented results of a lipid profile performed within 30 days prior to the onset of stroke signs and symptoms.

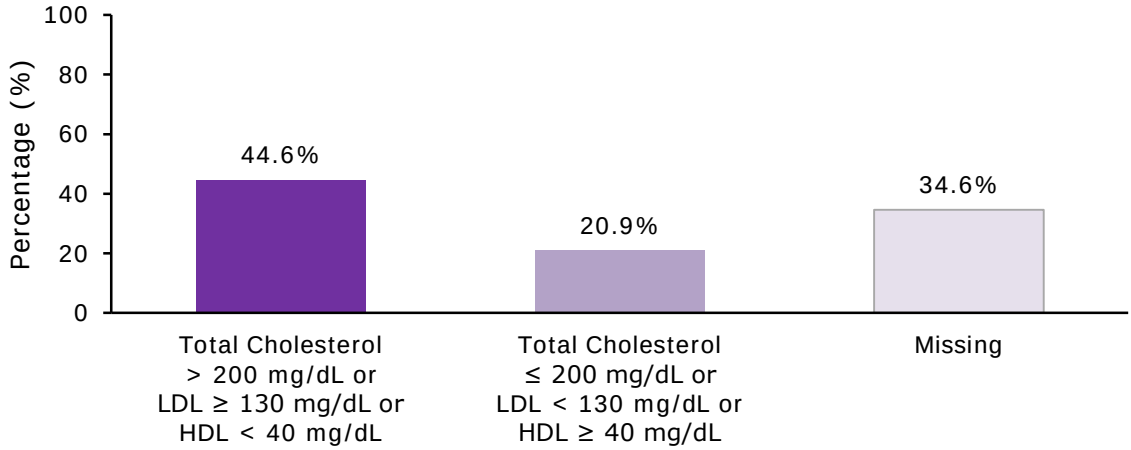


FIGURE 53. PREVALENCE OF DYSLIPIDEMIA AT TIME OF STROKE EPISODE OF CARE, 2008-2018

Dyslipidemia at time of stroke was documented from lab testing among 44.6% (n=56,482) of eligible adult stroke cases seen between 2008 and 2018 (Figure 51).

SMOKING

Tobacco use, a modifiable risk factor, is the greatest contributor to premature morbidity and mortality in Texas. Smoking cigarettes is an independent risk factor for a first ischemic stroke, and appears to double the risk of stroke recurrence. (7)

FIGURE 54. MEDICAL HISTORY OF SMOKING AMONG ADULT STROKE CASES, 2008-2018

The prevalence of smoking reported as a previously known medical condition among eligible adult stroke cases was 18.1% (n=22,874) (Figure 54).

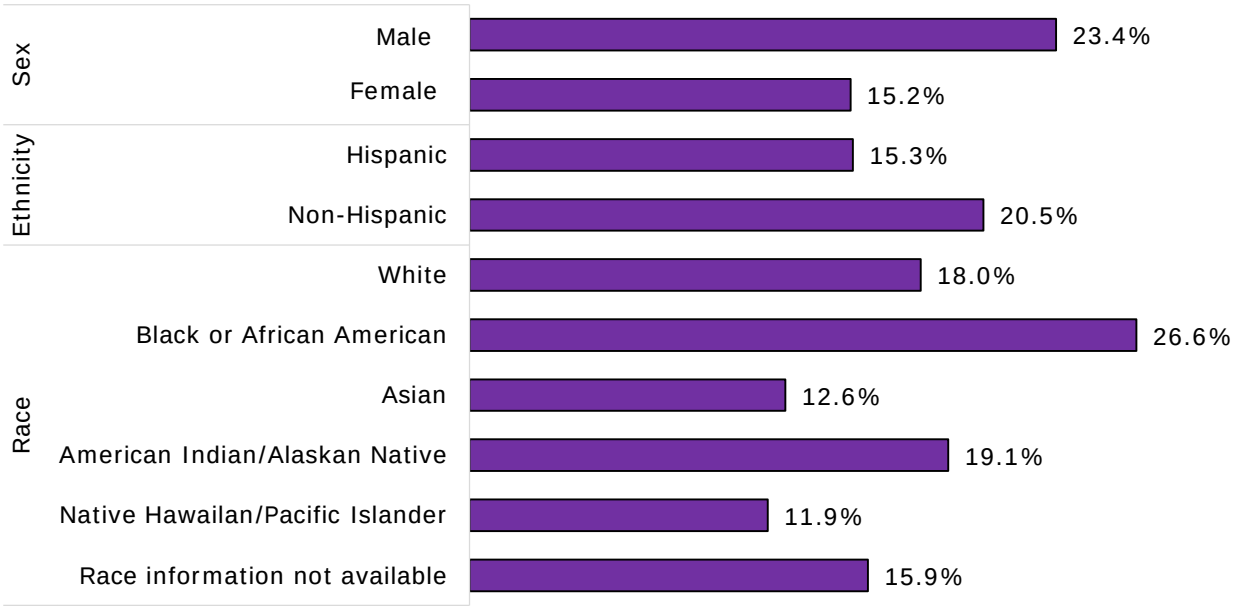


FIGURE 55. MEDICAL HISTORY OF SMOKING AMONG ADULT STROKE CASES BY SEX, ETHNICITY, AND RACE, 2008-2018

Among eligible adult stroke cases, a history of smoking was more common among males than females, among non-Hispanics than Hispanics, and among Blacks than other race groups (Figure 55).

Smoking Cessation

Healthcare providers should strongly advise every stroke patient who reports having smoked in the past year to quit smoking in an effort to decrease the risk of recurrent stroke.

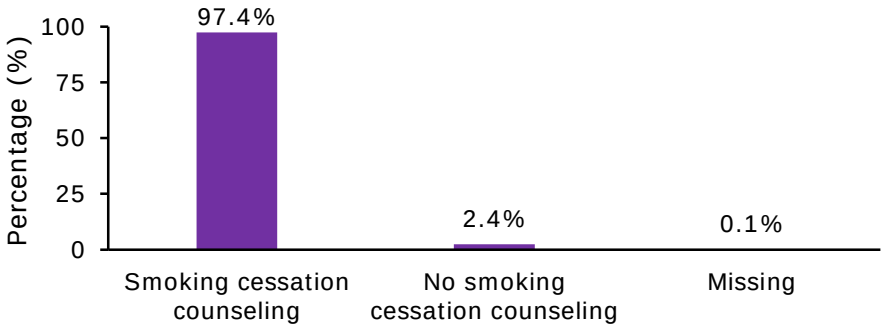


FIGURE 56. ADULT STROKE CASES WITH A HISTORY OF SMOKING, OR THEIR CAREGIVERS, WHO RECEIVED SMOKING CESSATION COUNSELING PRIOR TO HOSPITAL DISCHARGE, 2008-2018

Of the eligible adult stroke cases with a self-reported history of smoking, 97 out of 100 (97.4%; n=18,238) received (or caregiver received) smoking cessation counseling prior to hospital discharge (Figure 56). Note: Percentages reported for this measure differ from previously reported; this could reflect differences in participating hospitals and/or updated inclusion/exclusion criteria for this measure.

Research suggests that stroke patients who receive even brief smoking cessation advice from their healthcare provider are more likely to quit smoking than those receiving no counseling at all. (8) Opportunities for improvement in smoking cessation counseling exist.

OVERWEIGHT AND OBESITY

Overweight/obesity, defined as a reported as a Body Mass Index (BMI) ≥ 25 kg/m^2, is associated with an increased risk of stroke, and this relationship appears to be linear in nature. Each unit increase in BMI over 20 kg/m^2 increases the risk of stroke by 5%. (8)

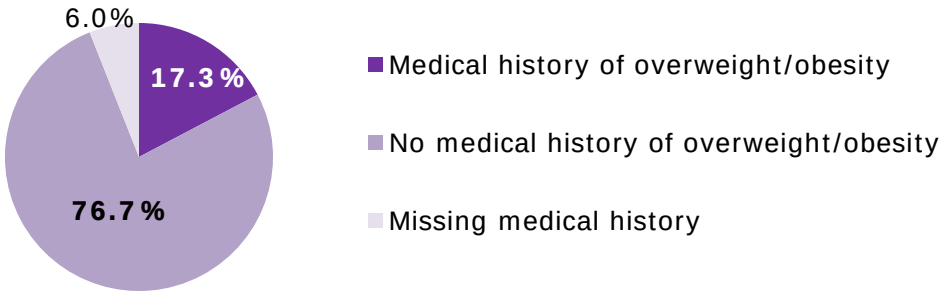


FIGURE 57. MEDICAL HISTORY OF OVERWEIGHT/OBESITY AMONG ADULT STROKE CASES, 2008-2018

Of all eligible adult stroke patients, 17.3% (n=21,798) had overweight/obesity reported as a previously known medical condition (Figure 57).

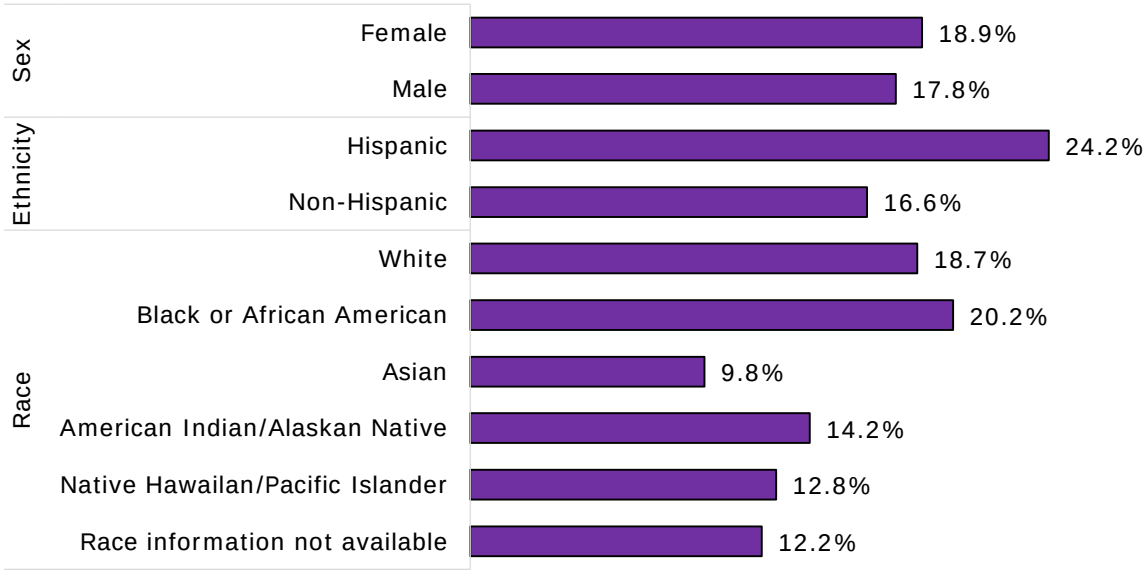


FIGURE 58. MEDICAL HISTORY OF OVERWEIGHT/OBESITY AMONG ADULT STROKE CASES BY SEX, ETHNICITY, AND RACE, 2008-2018

The prevalence of overweight/obesity as a pre-existing condition was similar for males and females. Overweight/obesity was more common among Hispanics than non-Hispanics, and among Blacks than other race groups (Figure 58).

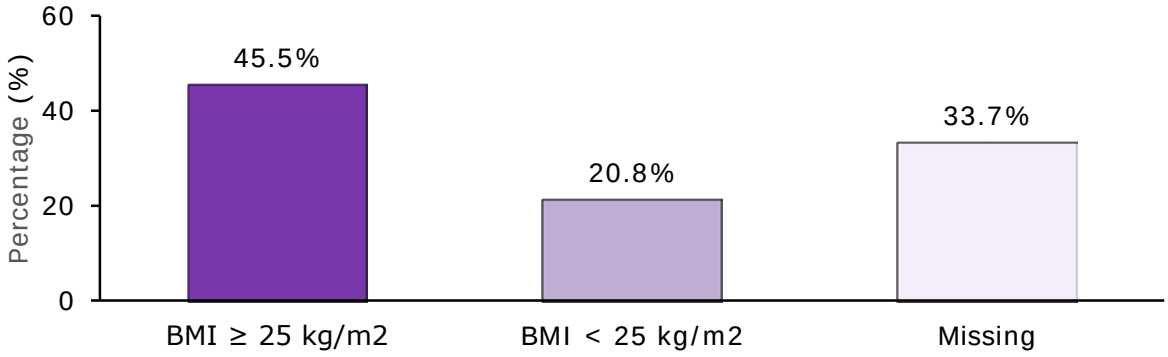


FIGURE 59. BODY MASS INDEX (BMI) CATEGORIES, KG/M^2, DURING STROKE EPISODE OF CARE, 2008-2018

In contrast, the prevalence of overweight/obesity calculated from the patients' height and weight during the stroke episode of care, was 45.5% (n=57,437) (Figure 59).

The large difference between the prevalence of cases with self-reported medical history of overweight/obese (17.3%) and the actual measured prevalence of overweight/obese during the stroke episode of care (45.5%) indicates patients may underreport overweight/obesity.

APPENDIX

URBAN-RURAL CLASSIFICATION FOR HOSPITAL CHARACTERISTICS AND MEASURES

The Texas Department of State Health Services (DSHS) follows the Metropolitan and Non-Metropolitan county designations defined by the U.S. Office of Budget and Management (OBM). In Texas, 82 counties are designated as Metropolitan and 172 are designated as Non-Metropolitan. The terms “Non-Metropolitan and Metropolitan” and interchangeable with “Urban and Rural.”

Accessible at: https://www.dshs.texas.gov/chs/hprc/counties.shtm

The following are definitions used specifically for this report. The urban and rural categories used are defined based upon the 2013 National Center for Health Statistics (NCHS) Urban-Rural Classification Scheme for Counties. This includes six county-level categories: metropolitan (large central metro, large fringe metro, medium metro, and small metro) and nonmetropolitan (micropolitan and noncore).

URBAN COUNTY

- Large central metro—counties in metropolitan statistical areas (MSA) of 1 million or more population that: contain the entire population of the largest principal city of the MSA, or have their entire population contained in the largest principal city of the MSA, or contain at least 250,000 inhabitants of any principal city of the MSA.
- Large fringe metro—counties in MSAs of 1 million or more population that did not qualify as large central metro counties.
- Medium metro—counties in MSAs of populations of 250,000 to 999,999.
- Small metro—counties in MSAs of populations less than 250,000.

RURAL COUNTY

- Micropolitan—Counties in micropolitan statistical areas.
- Noncore—Nonmetropolitan counties that did not qualify as micropolitan.

TABLE DATA SOURCES

Table 1 (Pg. 7)**.** Estimated number and unadjusted prevalence of adults, 18 years and older, that report ever having had a stroke in Texas, by race/ethnicity, 2011-2017. Data source: Texas Behavioral Risk Factor Surveillance System (2011-2017).

Table 2 (Pg. 8)**.** Age-adjusted stroke hospitalization rate (per 10,000), all ages, in Texas, by race/ethnicity, 2010-2017. Data source: 2017 Texas Vital Statistics, Population Data; (2) 2017 Texas Health Care Information Collection (THCIC), Inpatient Hospital Discharge Public Use Data File.

Table 3 (Pg. 8). Stroke hospital discharges and total charges by primary payment source, Texas, 2017. Data Source: Texas Health Care Information Collection (THCIC), Inpatient Hospital Discharge Public Use Data File, 2017.

Table 4–24 (Pgs. 9-53)**.** EVALUATING HOSPITAL CARE FOR STROKE IN TEXAS
Data Source: This Get With The Guidelines® Aggregate Data report was generated using the Quintiles PMT® system. Copy or distribution of the Get With The Guidelines® Aggregate Data is prohibited without the prior written consent of the American Heart Association and Quintiles.

FIGURE DATA SOURCES

Figure 1 (Pg. 9). The 2011-2016, average age-adjusted stroke mortality rate per 100,000 people, all ages, by county, in Texas. Data source: County-level mortality data, 2011-2016, and County–level population data, 2011-2016; Texas Department of State Health Services, Center for Health Statistics, Austin, Texas.

Figure 2–57 (Pgs. 10-53)**.** EVALUATING HOSPITAL CARE FOR STROKE IN TEXAS
Data Source: This Get With The Guidelines® Aggregate Data report was generated using the Quintiles PMT® system. Copy or distribution of the Get With The Guidelines® Aggregate Data is prohibited without the prior written consent of the American Heart Association and Quintiles.

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2. *Texas Behavioral Risk Factor Surveillance System Public Use Data File 2017.* Center for Health Statistics, Texas Department of State Health Services.

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8. American Heart Association/American Stroke Association. Guidelines for adult stroke rehabilitation and recovery. [Online] Accessed September 2019 https://www.ahajournals.org/doi/pdf/10.1161/STR.0000000000000098