Texas Stroke System of Care Report, 2018

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Table of Contents

I. EXECUTIVE SUMMARY **4**

II. INTRODUCTION **6**

III. BACKGROUND **6**

IV. STROKE IN TEXAS **7**

HOSPITALIZATIONS *7*
MORTALITY *8*

V. EVALUATING HOSPITAL CARE FOR STROKE IN TEXAS **10**

HOSPITAL PARTICIPATION *10*
FINAL STROKE DIAGNOSIS *11*
PATIENT DEMOGRAPHICS *12*

VI. HOSPITAL STROKE PERFORMANCE MEASURES **13**

HOSPITAL ARRIVAL METHOD *14*
Arrival Method, by Year *16*
ADVANCE NOTIFICATION *18*
Advance Notification by EMS, by Year *18*
NATIONAL INSTITUTES OF HEALTH STROKE SCALE (NIHSS) REPORTED *20*
NIHSS REPORTED, BY YEAR *20*
TIME TO INITIAL BRAIN IMAGING *22*
Door-to-CT Imaging ≤ 25 Minutes *23*
TIME TO INTRAVENOUS THROMBOLYTIC THERAPY - 45 MINUTES AND 60 MINUTES *24*
IV tPA ≤45 and ≤60 Minutes, by Year *24*
IV TPA ARRIVE BY 2 HOURS, TREAT BY 3 HOURS *26*
Arrive by 2 Hours, Treat by 3 Hours, by Year *26*
IV TPA ARRIVE BY 3.5 HOURS, TREAT BY 4.5 HOURS *28*
Arrive by 3.5 Hours, Treat by 4.5 Hours, by Year *28*
DRIP-AND-SHIP THERAPY *29*
Drip-and-Ship Therapy, by Year *30*
ENDOVASCULAR THERAPY *31*
Endovascular Therapy, by Year *31*
THROMBOLYTIC COMPLICATIONS *32*
Thrombolytic Complications, by Year *32*
INTENSIVE STATIN THERAPY *34*
Intensive Statin Therapy, by Year *34*
ANTITHROMBOTIC PRESCRIBED AT HOSPITAL DISCHARGE *35*
Antithrombotic Prescribed at Discharge, by Year *35*
ANTI-HYPERTENSIVES PRESCRIBED AT HOSPITAL DISCHARGE *37*
Types of Anti-Hypertensives Prescribed at Discharge, by Year *37*
REHABILITATION CONSIDERED *38*
Rehabilitation Considered, by Year *39*

STROKE EDUCATION *40*
Stroke Education, by Year *41*
MODIFIED RANKIN SCALE AT DISCHARGE *42*
Modified Rankin Scale (mRS), by Year *42*
DISCHARGE DISPOSITION *43*
Discharge Disposition, by Year *44*

VII. COMORBIDITIES 46

HYPERTENSION *46*
ATRIAL FIBRILLATION *48*
DIABETES MELLITUS *49*
DOCUMENTATION OF LIPID PROFILE *51*
LIPID MEASURES – TOTAL CHOLESTEROL, LDL, HDL, TRIGLYCERIDES *51*
DYSLIPIDEMIA *52*
SMOKING *53*
Smoking Cessation *54*
OVERWEIGHT AND OBESITY *55*

APPENDIX 57

URBAN-RURAL CLASSIFICATION FOR HOSPITAL CHARACTERISTICS AND MEASURES ... *57*
TABLE DATA SOURCES *58*
FIGURE DATA SOURCES *58*

REFERENCES 59

I. EXECUTIVE SUMMARY

In 2015, stroke was the third leading cause of death among Texans, causing 44.6 deaths per 100,000 people. (1) Stroke mortality varied by race/ethnicity. Deaths due to stroke were more common among blacks (63.3 deaths per 100,000 people) compared with whites (43.7 deaths per 100,000 people) or Hispanics (36.4 deaths per 100,000). In 2016, the prevalence of stroke among Texans ages 18 years and older was 2.6%. (2)

In 2016, about 25 hospitalizations occurred due to stroke for every 10,000 people (25.3; 95% Confidence Interval [CI]: 25.1-25.5). (3) The total charges for stroke hospitalizations in 2016 were close to $5 billion. Medicaid beneficiaries accounted for over $258 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 2017, unless otherwise stated.

Substantial stroke system of care findings, 2008-2017:

- From 2008-2017, the number of hospitals providing data on individual episodes of stroke has ranged from 21-50 hospitals (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 2017, 49 hospitals/hospital systems participated in the data collection, with 46 located in urban counties and 3 in rural counties.
- In total, 115,903 episodes of care have been reported. Out of these, 110,863 episodes of stroke care were considered eligible for analyses in this report (Pg. 10 through Pg. 13).
- Overall, about four out of ten stroke cases (39.2%) arrived at the hospital by private vehicle. For the most recent four years (2014-2017), the arrival methods of stroke cases have remained similar (Pg. 14).
  - Among rural hospitals, 43.6% cases arrived to the hospital by private vehicle, vs. 39.0% among urban hospitals;
  - Females were more likely than males to arrive via ambulance (47.1% vs. 44.2%), while males were more likely than females to arrive via private vehicle (40.1% vs. 38.3%) (Pg. 15).

- Overall, Emergency Medical Services (EMS) gave advance notification to the receiving hospital in 53.2% of stroke cases transported by EMS from home or scene (Pg. 18).
  - Advance notification occurred for 70.1% of adult stroke cases in rural hospitals, as compared with 57.9% among urban hospitals.
  - In 2017, advance notification was provided for over half (55.9%) of the EMS transported adult stroke cases (Pg. 19).
- For the most recent four years (2014-2017), the National Institutes of Health Stroke Scale (NIHSS) was reported for over 90% of adult ischemic stroke and stroke not otherwise specified (NOS) cases (Pg. 20).
  - For the last six years (2012-2017), the median NIHSS score has remained the same: NIHSS score of 4 - Minor stroke.
- Overall, almost half of all adult stroke cases (49.2%) 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 15 minutes for arrival by EMS and 21 minutes for arrival by private vehicle (Pg. 22);
- Having a door-to-imaging ≤ 25 minutes varied by arrival method: 74.1% who arrived by EMS and 62.1% who arrived by private vehicle (Pg. 22).
- Overall, three out of 10 stroke cases (32.1%) received Tissue plasminogen activator (tPA) within 45 minutes of hospital arrival, and six out of 10 (63.5%) 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 and Pg. 25).
  - 65.8% of cases arriving by EMS, vs. 58.3% 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 88 minutes in 2008 to 46 minutes in 2017 (Pg. 25).
- In 2017, four in 100 (4.0%) adult stroke cases treated with any type of thrombolytic therapy experienced bleeding complications post thrombolytic therapy (Pg. 33).
- Of the eligible adult ischemic stroke and Transient Ischemic Attack (TIA) cases, half (51.7%) were prescribed a qualifying high-intensity statin at hospital discharge (Pg. 34).
- For the last seven years, 97.9% or more of adult ischemic stroke and TIA cases were prescribed an antithrombotic at hospital discharge (Pg. 36).
- From 2008-2017, 98.0% of eligible adult stroke cases were assessed for rehabilitative services (Pg. 39).
- The percentage of eligible adult stroke cases who received all of the stroke education materials has increased, from a low of 50.8% in 2008, to a high of 97.7% in 2016, and 96.6% in 2017 (Pg. 41).
- From 2011-2017, three in ten (30.8%) adult stroke cases had a Modified Rankin Scale score (mRS) documented at discharge (Pg. 42).

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 2016, the prevalence of stroke among Texans 18 years of age and older was 2.6% (95% CI: 2.1-3.1). (2) The unadjusted prevalence of stroke for each year (2011-2016), 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, 2011-2016.

			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)	--

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 (2010-2016) age-adjusted hospitalization rates (per 10,000 individuals) for stroke among Texans of all ages. In 2016, for every 10,000 people, about 26 hospitalizations occurred due to stroke (25.3; 95% Confidence Interval [CI]: 25.1-25.5). (3) The annual age-adjusted hospitalization rate for stroke (per 10,000) has increased from 2010 to 2016.

TABLE 2. AGE-ADJUSTED STROKE HOSPITALIZATION RATES PER 10,000 INDIVIDUALS, ALL AGES, BY RACE/ETHNICITY, TEXAS, 2010-2016.

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)

Abbreviations: CI, confidence interval.

In 2016, the total charges for hospitalizations due to stroke were close to $5 billion (Table 3). (3) Medicare beneficiaries accounted for 50% percent of hospital discharges and nearly $3 billion in total charges. Total charges for Medicaid beneficiaries were over $258 million.

TABLE 3. STROKE HOSPITAL DISCHARGES AND TOTAL CHARGES BY PRIMARY PAYMENT SOURCE, TEXAS, 2016.

Payer Source	Hospital Discharges		Total Charges
Total	N=68,327	%	$4,919,615,659
Medicaid	2,447	3.6	$258,188,788
Medicare	42,175	61.7	$2,766,949,750
Private Insurance	16,708	24.5	$1,294,131,689
Uninsured	5,860	9.6	$515,353,400
Other	1,137	1.7	$85,1294119

MORTALITY

In 2015, stroke was the third leading cause of death among Texans of all ages, accounting for 45 deaths per 100,000 people (95% CI: 43.8-45.5). (1) When stratified by race/ethnicity, the age-adjusted stroke death rate was significantly higher among blacks (63.3 per 100,000; 95% CI: 60.0-66.6) than among whites (43.7 per 100,000; 95% CI: 42.7-44.8) or Hispanics (36.4 per 100,000; 95% CI: 34.8-38.0).

From 2011-2015, the average age-adjusted stroke death rate was 42.8 deaths per 100,000 Texans of all ages. Among race-ethnicity groups, deaths due to stroke were more common among blacks (60.8 per 100,000; 95% CI: 59.3-62.3) than among

whites (42.4 per 100,000; 95% CI: 42.0-42.9) or Hispanics (36.6 per 100,000; 95% CI: 35.9-37.4).

The map below displays the geographic distribution of the 5-year age-adjusted stroke death rate. per 100,000 Texans, from 2011 to 2015. The highest death rates emerge across northeast and central Texas.

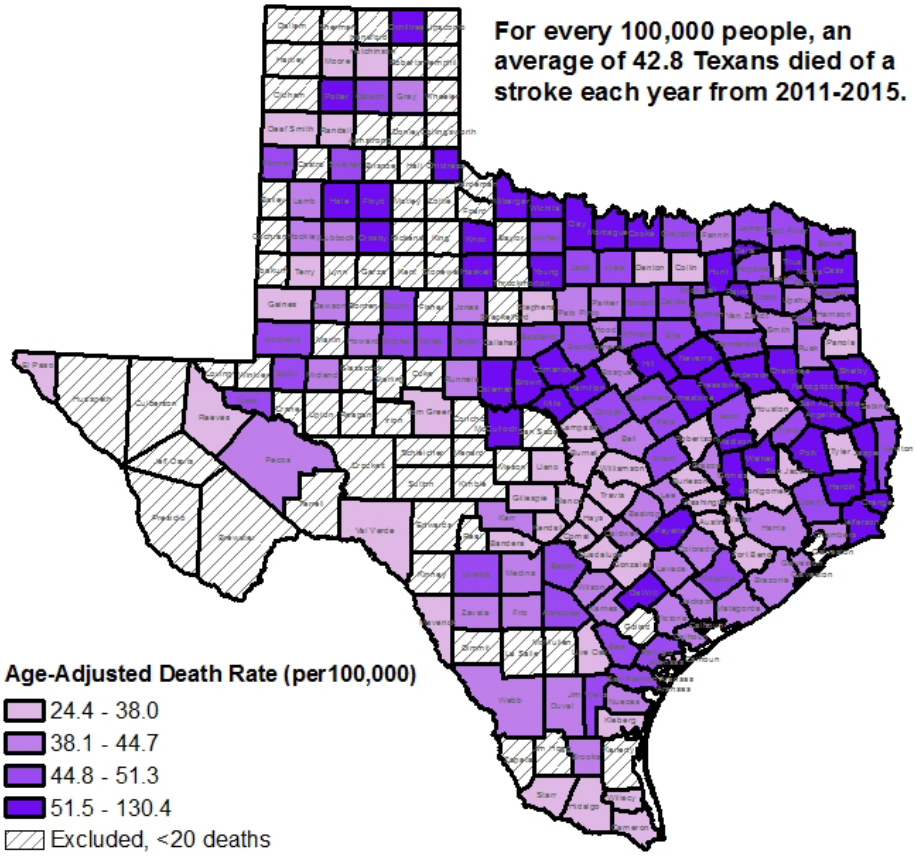

FIGURE 1. AGE-ADJUSTED STROKE DEATH RATE, PER 100,000 PEOPLE, ALL AGES, BY COUNTY, TEXAS, 2011-2015.

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, 2017.

HOSPITAL PARTICIPATION

A total of 115,903 cases of stroke were reported from 2008 through 2017. From 2008 through 2017, 51 hospitals have participated, after accounting for hospitals' participation and withdrawal across this time. Of 49* hospitals participating in 2017, 46 were located in an urban setting, and three in a rural setting.

The number of patient beds among participating hospitals ranged from 43 to 817 beds per hospital. About half of the participating hospitals (n=26; 53%) had 100 to 299 bed capacity. Roughly eight in 100 stroke cases (7.6%) were treated at hospitals with less than 100 beds. About three in ten stroke cases (32.2%) 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, 2008-2017.

	Total Reported Cases	Participating Hospitals *
	N=115,903 (%)	N
Year		
2008	4,845 (4.2)	21
2009	6,318 (5.5)	27
2010	8,329 (7.2)	33
2011	9,359 (8.1)	36
2012	10,429 (9.0)	40
2013	12,500 (10.8)	44
2014	14,046 (12.1)	49
2015	16,672 (14.4)	49
2016	16,779 (14.5)	50
2017	16,626 (14.3)	49
Patient Beds		
<100	8,777 (7.6)	8
100-299	39,151 (33.8)	26
300-499	30,622 (26.4)	11
≥500	37,353 (32.2)	6
Setting		
Urban	110,399 (95.3)	46
Rural	5,504 (4.8)	3

***** 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 2017.

From 2008-2017, ischemic stroke accounted for 66.2% of all reported cases. Among the other stroke subtypes reported, 13.6% were transient ischemic attack (TIA), 10.8% 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, 2008-2017.

Final Stroke Diagnosis	**Total Reported Cases**		**LOS** (days)	**Gender** (Female)	**Age** (years)	**Race** (White)	**Insurance** (yes)	**County** (Rural)
	N=115,903	**%**	Median	%	Median	%	%	%
Ischemic Stroke	76,674	66.4	4	49.9	68	74.3	84.7	3.9
TIA (<24hrs)	15,756	13.6	2	56.8	69	80.6	90.6	7.7
Intracerebral Hemorrhage	12,491	10.8	5	45.6	65	71.6	79.0	3.5
Subarachnoid Hemorrhage	4,273	3.7	8	61.5	58	72.5	74.0	2.0
Stroke NOS	1,669	1.4	3	50.3	70	68.8	89.1	19.4
Elective Carotid Intervention only	3,191	2.8	1	42.0	71	88.8	96.1	8.3
No stroke related diagnosis	1,490	1.3	2	50.0	66	72.2	88.2	11.4
Missing	359	0.3	3	--	--	--	--	--

Abbreviations: LOS=Length of Stay

From 2008-2017, the overall median length of hospital stay (LOS) for stroke patients was four days. LOS varied by final stroke diagnosis. Of stroke patients, those with TIA had the shortest LOS (median two days) while hemorrhagic stroke patients had the longest: median five days for intracerebral, median eight days for subarachnoid. The median LOS for Elective Carotid Intervention was one day. Figure 2 shows the 2017 median LOS by stroke type.

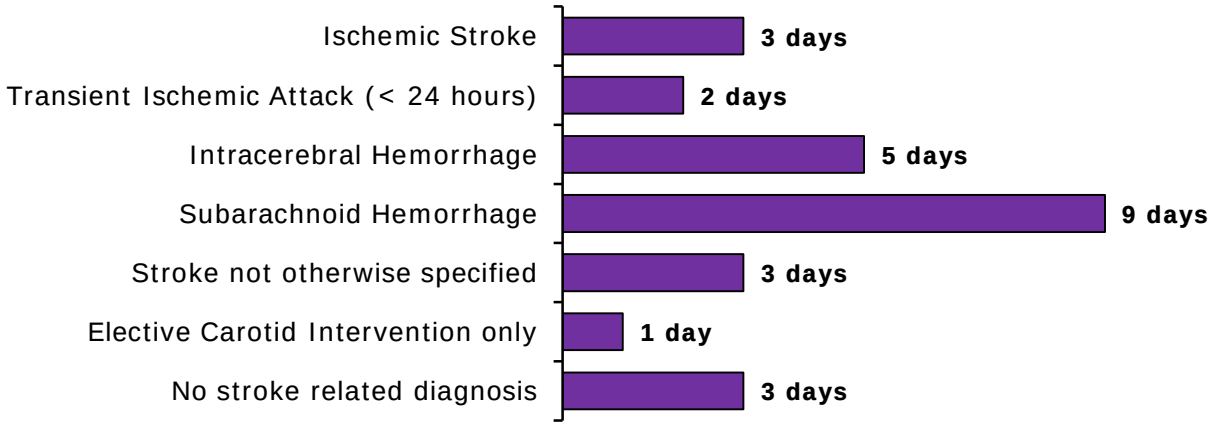

FIGURE 2. MEDIAN LENGTH OF STAY, BY FINAL STROKE DIAGNOSIS, 2017.

Note: While Table 5 and Figure 2 include cases of "elective carotid intervention only", "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 110,863 stroke cases reported from 2008 to 2017.

Women accounted for half (50.8%) of the patient population. The median age was 68 years, with patients aged 66 to 85 years accounting for 43.6% of the total patients. About three out of four patients were white (74.8%) and non-Hispanic (76.0%). More than two thirds (67.6%) 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 10 days).

TABLE 6. DEMOGRAPHIC CHARACTERISTICS AMONG REPORTED CASES, 2008-2017.

Demographics	**Total reported cases**		**LOS (days)**
	N=110,863*	%	Median
Gender			
Female	56,359	50.8	4
Male	54,450	49.1	3
Unknown	16	<0.1	4
Age (years)			
< 18	36	<0.1	10
18 – 30	932	0.8	4
31 - 45	7,655	6.9	4
46 – 65	41,253	37.2	3
66 – 85	48,299	43.6	3
> 85	12,688	11.4	4
Race			
White	82,785	74.8	3
Black or African American	18,753	16.9	4
Asian	1,506	1.4	4
American Indian/Alaskan Native	232	0.2	4
Native Hawaiian/Pacific Islander	107	0.1	4
Unable to determine (UTD)	7,277	6.6	4
Other	71	0.1	5
Ethnicity			
Hispanic	26,684	24.1	4
Non-Hispanic	84,049	76.0	3
Health Insurance Status			
Health insurance	74,890	67.6	3
Without health insurance	13,621	12.3	4
Missing	22,351	20.2	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.

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 – 2017 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 do 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 Therapy
10. Endovascular Therapy
11. Thrombolytic Complications
12. Intensive Statin Therapy
13. Antithrombotic Prescribed at Discharge
14. Anti-hypertensives Prescribed at Discharge
15. Rehabilitation Considered
16. Stroke Education
17. Modified Rankin Scale at Discharge
18. 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).

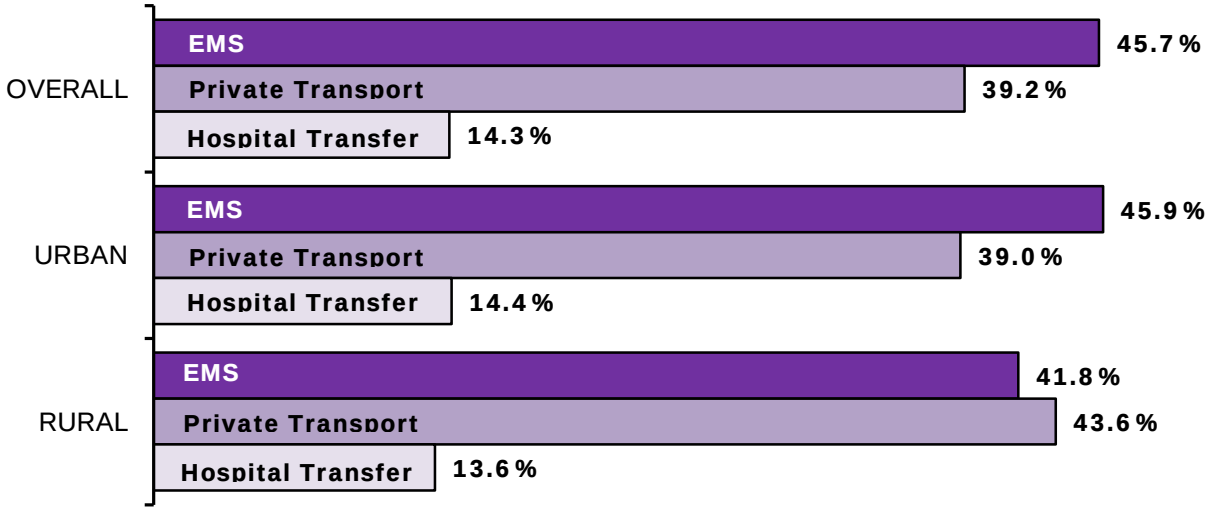

FIGURE 3. STROKE CASES BY METHOD OF HOSPITAL ARRIVAL: OVERALL, AND BY SETTING URBAN/RURAL, 2008-2017.

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

From 2008-2017, the most common mode of hospital arrival among stroke cases was EMS from home or scene (45.7%, n=46,171), followed by private transport from home or scene (39.2%, n=39,599), and transferred from other hospital (14.3%, n=14,490).

Fewer than half of stroke cases treated at rural hospitals (43.6%, n=2,170) or urban hospitals (39.0%; n=37,429) arrived at the hospital by private vehicle.

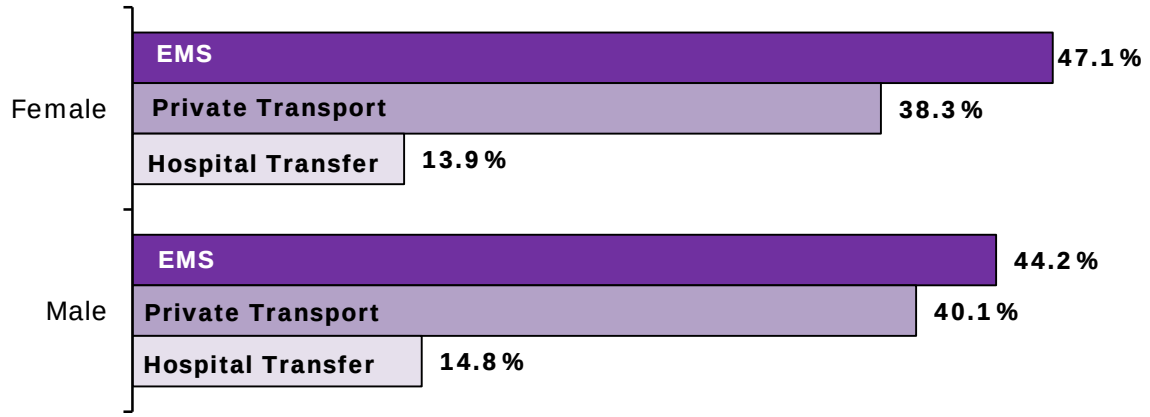

FIGURE 4. ADULT STROKE CASES BY METHOD OF ARRIVAL, BY GENDER, 2008-2017.

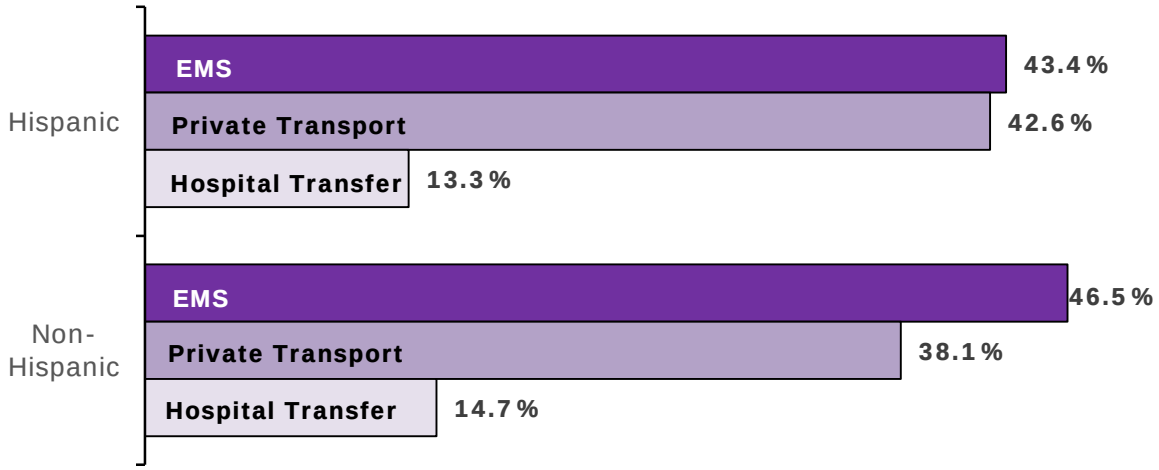

FIGURE 5. ADULT STROKE CASES BY METHOD OF ARRIVAL, BY ETHNICITY, 2008-2017.

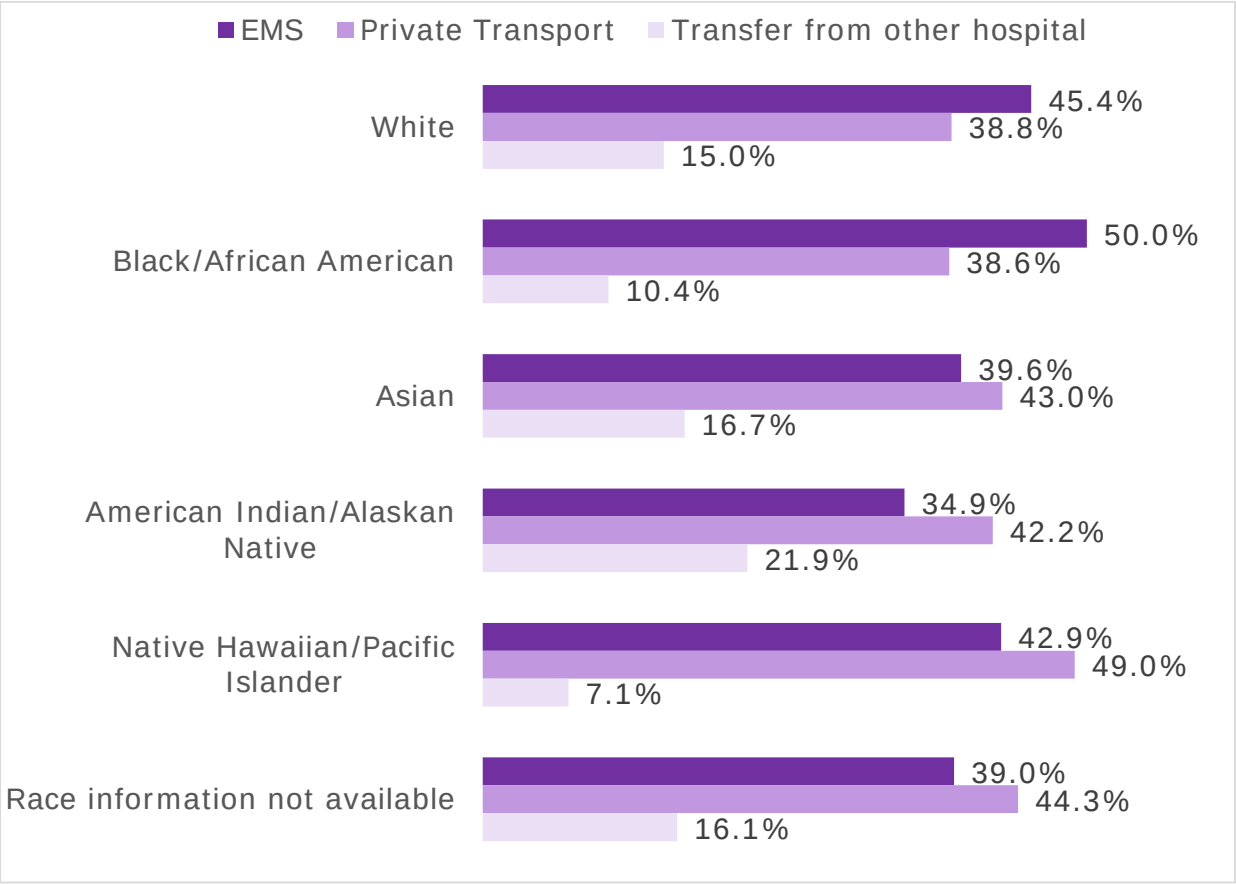

FIGURE 6. ADULT STROKE CASES BY METHOD OF ARRIVAL, BY RACE, 2008-2017.

The arrival method patterns were similar between females and males, and Hispanic and Non-Hispanic cases during 2008-2017 (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 display the annual percent and trend of arrival methods among stroke cases.

The annual percent trend for cases arriving by EMS ranged from a high of 55.9% in 2008 to a low of 30.2% in 2012. This rose to 43.5% in 2014 and has remained relatively stable since. 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 18% in 2017.

- For the past four years (2014-2017), the pattern of arrival methods of stroke cases has remained similar.

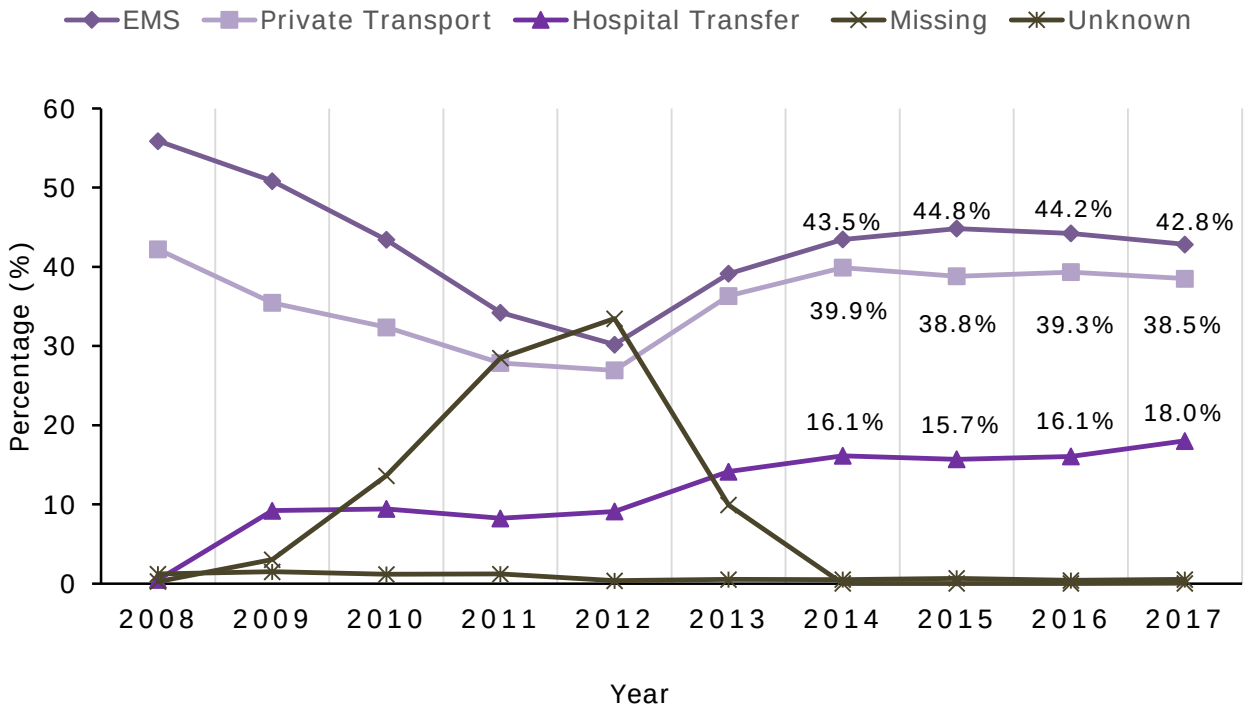

FIGURE 7. STROKE CASES, BY HOSPITAL ARRIVAL MODE, BY YEAR, 2008-2017.

TABLE 7. STROKE CASES, BY HOSPITAL ARRIVAL MODE, BY YEAR, 2008-2017.

Year	Stroke cases	EMS from home/scene	Private Transportation	Hospital Transfer	Missing	Unknown	Reporting Hospitals
	N=109,390	n=46,146 (%)	n=39,579 (%)	n=14,485 (%)	n=8,402 (%)	n=756 (%)	N
2008	4,817	2,692 (55.9)	2,032 (42.2)	23 (0.5)	12 (0.3)	58 (1.2)	21
2009	6,259	3,182 (50.8)	2,218 (35.4)	577 (9.2)	189 (3.0)	93 (1.5)	27
2010	8,118	3,522 (43.4)	2,628 (32.4)	766 (9.4)	1,107 (13.6)	95 (1.2)	33
2011	9,088	3,109 (34.2)	2,531 (27.9)	749 (8.2)	2,589 (28.5)	110 (1.2)	35
2012	10,050	3,033 (30.2)	2,706 (26.9)	914 (9.1)	3,362 (33.5)	35 (0.4)	40
2013	11,417	4,467 (39.1)	4,146 (36.3)	1,613 (14.1)	1,133 (9.9)	58 (0.5)	44
2014	12,763	5,545 (43.5)	5,092 (39.9)	2,061 (16.2)	1 (<0.1)	64 (0.5)	49
2015	15,159	6,796 (44.8)	5,882 (38.8)	2,378 (15.7)	2 (<0.1)	101 (0.7)	49
2016	15,766	6,970 (44.2)	6,202 (39.3)	2,530 (16.1)	3 (<0.1)	61 (0.4)	50
2017	15,953	6,830 (42.8)	6,142 (38.5)	2,874 (18.0)	4 (<0.1)	81 (0.5)	49

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 49 in 2017. 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

From 2008-2017, 42,089 stroke patients were transported by EMS from home or scene. Prior to hospital arrival, advance notification occurred in 53.2% of these arrivals; 34.7% did not give notification, 3.2% were not applicable, and in 8.8% cases, data were missing (Figure 8).

Among rural hospitals' eligible stroke cases (n=1,773), advance notification occurred for 70.1% (n=1,242) of cases. Among urban hospitals' eligible stroke cases (n=40,316), advance notification occurred for 57.9% (n=23,334) of cases. This excludes missing data.

Advance notification varied by stroke diagnosis. The highest percentage was seen among stroke NOS patients (65.8%, n=440) and the lowest percentage was seen among hemorrhagic stroke patients (Intracerebral 56.5%, n=3,235; Subarachnoid 51.6%, n=671).

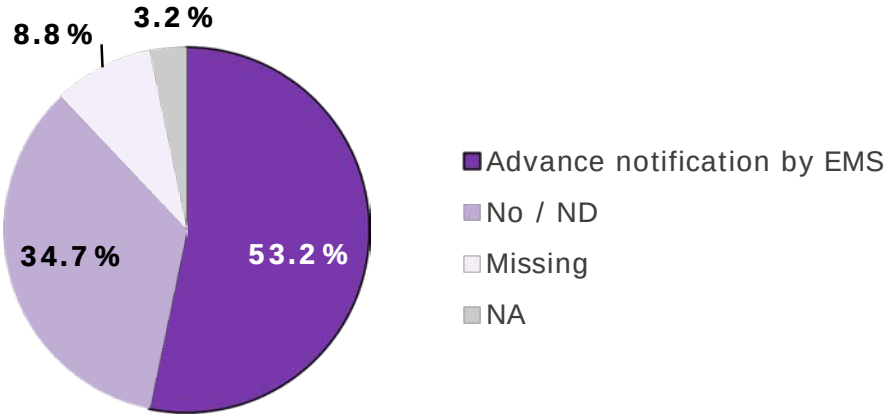

FIGURE 8. EMS ADVANCE NOTIFICATION TO HOSPITAL, 2008-2017.

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.

The yearly percentage of advance notification varied, ranging from a low of 49.7% in 2015 to a high of 70.4% in 2011.

In 2017, advance notification was provided by EMS for just over half (55.9%, n=3,818) of the EMS transported patients

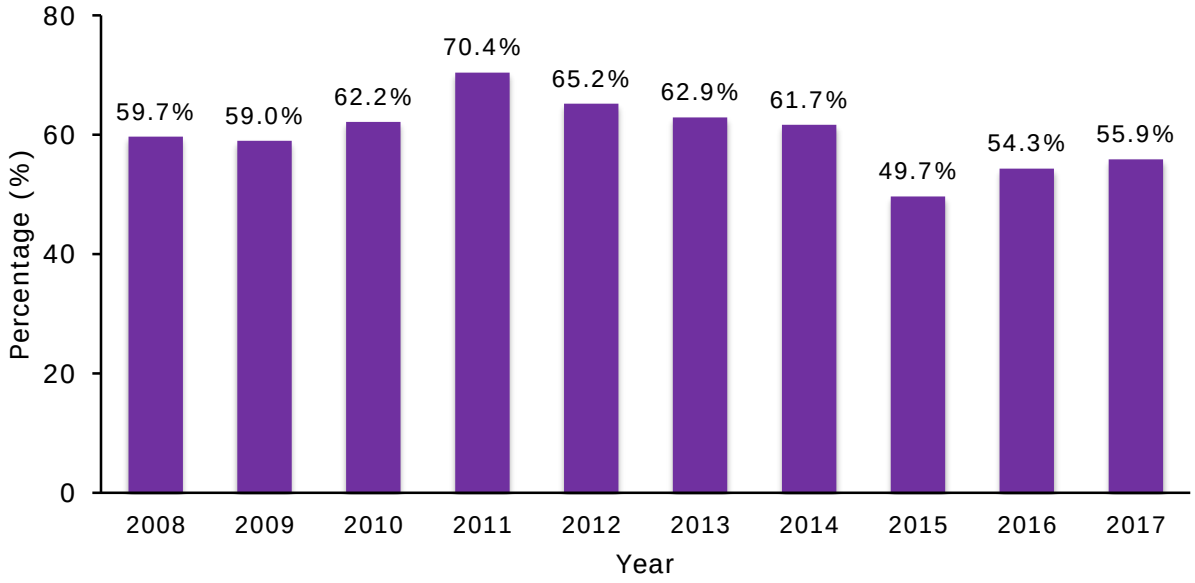

FIGURE 9. ADVANCE NOTIFICATION BY EMS, BY YEAR, 2008-2017.

TABLE 8. ADVANCE NOTIFICATION BY EMS, BY YEAR, 2008-2017.

Year	Eligible cases arriving via EMS	Advance Notification		Reporting Hospitals
	N=42,089	n=24,576	%	N
2008	2,318	1,383	59.7	19
2009	2,787	1,644	59.0	27
2010	3,139	1,951	62.2	32
2011	2,829	1,992	70.4	29
2012	2,655	1,732	65.2	34
2013	3,220	2,025	62.9	44
2014	5,103	3,148	61.7	49
2015	6,354	3,157	49.7	49
2016	6,859	3,726	54.3	50
2017	6,825	3,818	55.9	49

Over time, the number of participating hospitals reporting on this measure has increased, from the low of 19 in 2008 to 49-50 during 2014-2017. 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)

From 2008-2017, the NIHSS was performed as part of the initial examination in 84.2% (n=60,817) of eligible patients. Alternatively, 15.9% (n=11,452) of cases with a diagnosis of ischemic 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=342 cases.

- From 2008-2017, four in 10 cases had a NIHSS score of 1-4, qualifying as a minor stroke (39.9%, n=24,245), and 3 in 10 (32.8%, n=19,916) had a score of 5-15, qualifying as a moderate stroke. Over all reporting years, the overall median NIHSS score was 4.

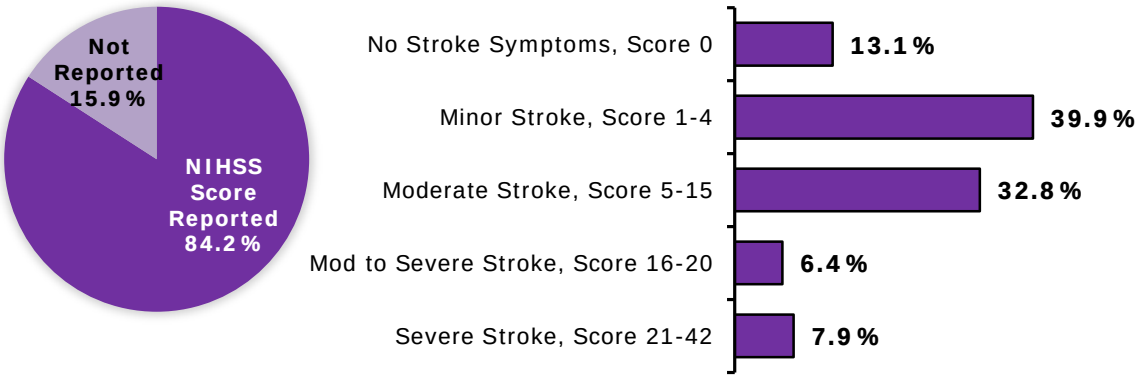

FIGURE 10. INITIAL NATIONAL INSTITUTES OF HEALTH STROKE (NIHHS) SCORES AMONG ADULT ISCHEMIC STROKE OR STROKE NOT OTHERWISE SPECIFIED CASES, 2008-2017.

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.

The percentage of eligible cases with a diagnosis of ischemic or stroke NOS who received an initial NIHSS evaluation has more than doubled over time, from 45.8% in 2008 to 94.0% in 2017.

- For the most recent four years (2014-2017), the NIHSS score was reported in over 90% of adult ischemic and NOS cases each year.
- For the last five years (2012-2017), the median NIHSS score has remained the same (minor stroke, score 4).

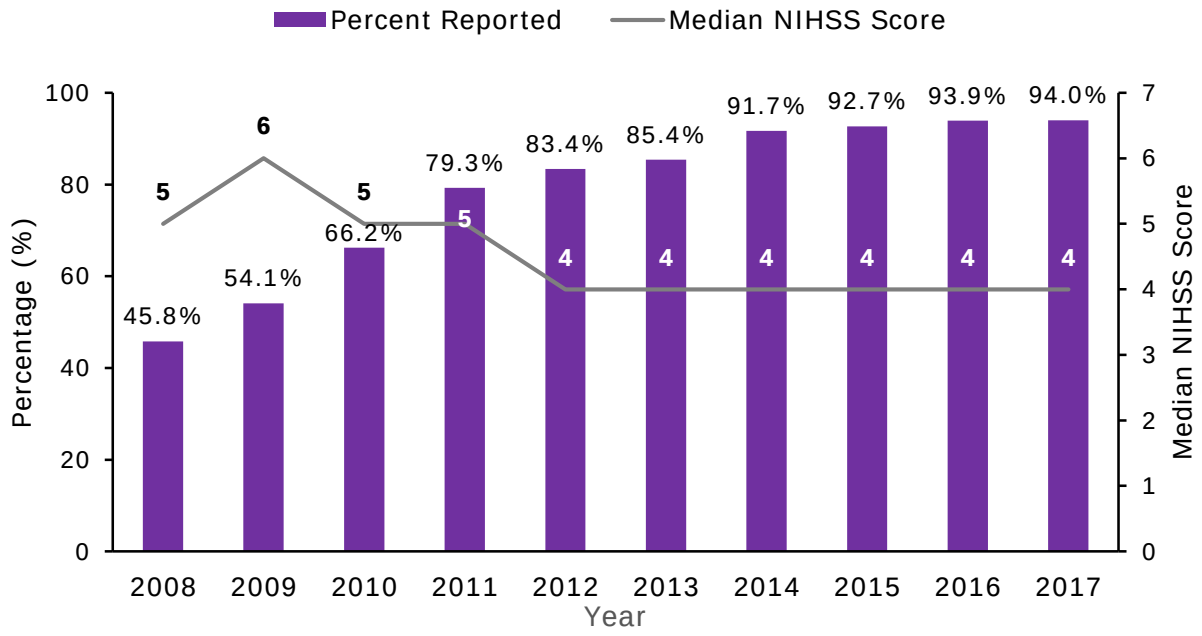

FIGURE 11. ADULT ISCHEMIC AND STROKE NOT OTHERWISE SPECIFIED CASES WITH AN INITIAL NIHSS SCORE, BY YEAR, 2008-2017.

TABLE 9. ADULT ISCHEMIC AND STROKE NOT OTHERWISE SPECIFIED CASES WITH AN INITIAL NIHSS SCORE, BY YEAR, 2008-2017.

	Ischemic & Stroke NOS cases	**NIHSS score reported**		**Reporting Hospitals**
Year	N=72,269	n=60,817	%	N
2008	3,101	1,419	45.8	20
2009	3,819	2,065	54.1	27
2010	5,417	3,586	66.2	33
2011	6,162	4,885	79.3	35
2012	6,694	5,580	83.4	40
2013	7,424	6,344	85.4	42
2014	8,545	7,834	91.7	49
2015	9,995	9,266	92.7	49
2016	10,529	9,888	93.9	50
2017	10,583	9,950	94.0	49

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

Among eligible stroke cases arriving to the hospital within 3 hours of time LKW (n=17,867), seven in ten cases (70.7%, n=12,640) received an initial CT scan within 25 minutes of hospital arrival (Figure 12). Almost half of eligible cases (49.2%, n=8,788) 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: 74.1% of patients who arrived by EMS vs. 62.1% who arrived by private vehicle. The median door-to-CT imaging time was 15 minutes for patients arriving by EMS and 21 minutes for those arriving by private vehicle (Figure 13).

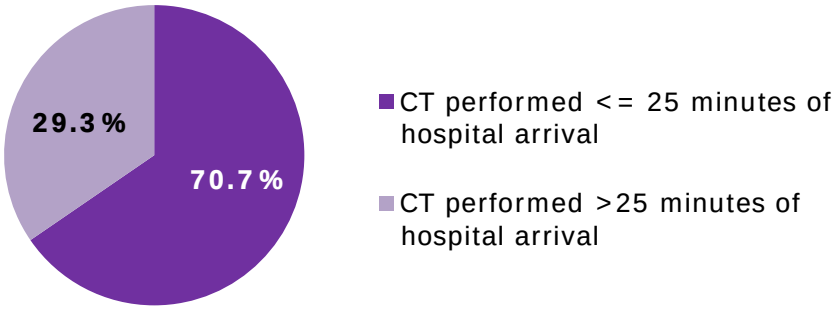

FIGURE 12. ADULT STROKE CASES ARRIVING AT HOSPITAL WITHIN 3 HOURS OF TIME LAST KNOWN WELL, WITH DOOR-TO-CT TIME WITHIN 25 MINUTES OF HOSPITAL ARRIVAL, 2008-2017.

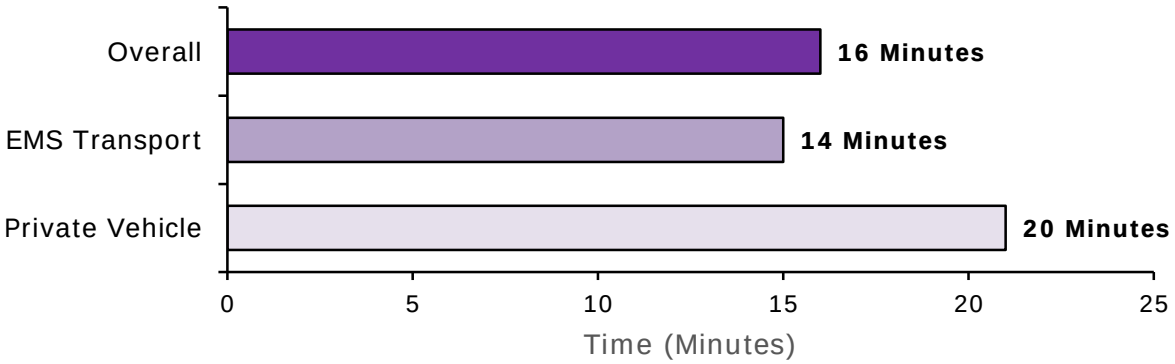

FIGURE 13. MEDIAN DOOR-TO-CT TIMES OF ADULT STROKE CASES ARRIVING AT HOSPITAL WITHIN 3 HOURS OF TIME LAST KNOWN WELL, OVERALL AND BY MODE OF TRANSPORT, 2008-2017.

Door-to-CT Imaging ≤ 25 Minutes

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 53.3% in 2008 to a high of 80.0% in 2017. 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 2017, eight in 10 cases (80.0%) received their initial CT scan within 25 minutes of hospital arrival. The median door-to-CT time was 12 minutes.

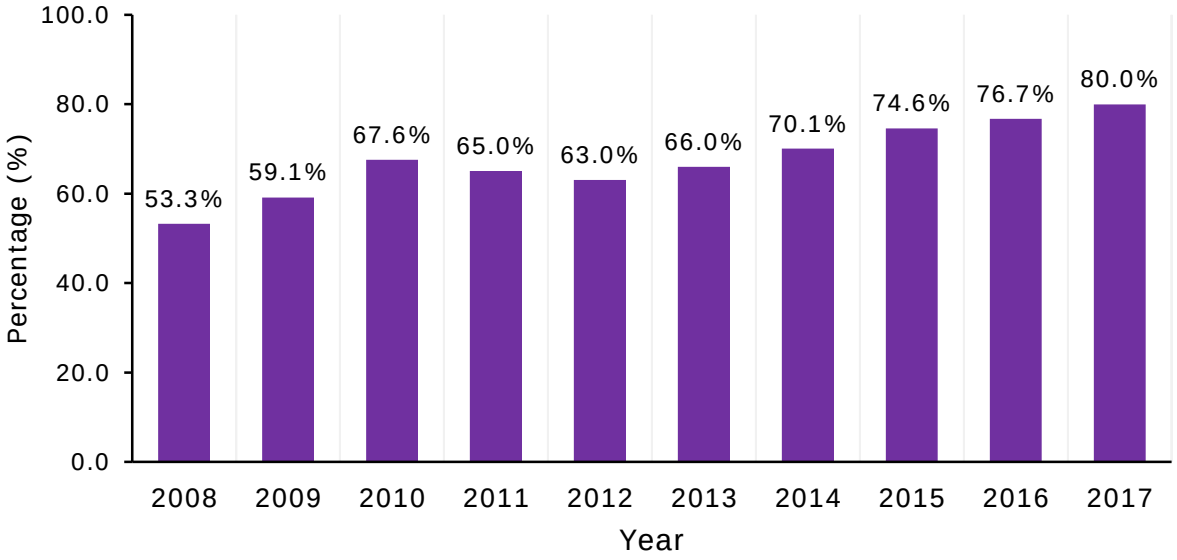

FIGURE 14. ADULT STROKE CASES ARRIVING WITHIN 3 HOURS OF TIME LAST KNOWN WELL AND HAVING AN INITIAL CT SCAN WITHIN 25 MINUTES OF HOSPITAL ARRIVAL, 2008-2017.

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, 2008-2017.

	Stroke cases	CT scan <= 25 minutes of hospital arrival		Reporting Hospitals
Year	N=17,861	n=12,640	%	N
2008	443	236	53.3	17
2009	831	491	59.1	25
2010	1,279	865	67.6	33
2011	1,561	1,016	65.0	34
2012	1,685	1,062	63.0	39
2013	1,844	1,217	66.0	43
2014	1,959	1,373	70.1	47
2015	2,538	1,892	74.6	49
2016	2,757	2,116	76.7	50
2017	2,964	2,371	80.0	49

Between 2008 and 2017, the number of participating hospitals reporting on this measure increased, from 17 in 2008, to 49-50 in 2015-2017. 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)

Among eligible ischemic stroke cases treated with IV t-PA from 2008-2017, about one in three, 32.2% (n=2,062) received IV t-PA within 45 minutes of arrival, and 63.5% (n=4,070) within 60 minutes of hospital arrival. The median door to tPA time was 55 minutes.

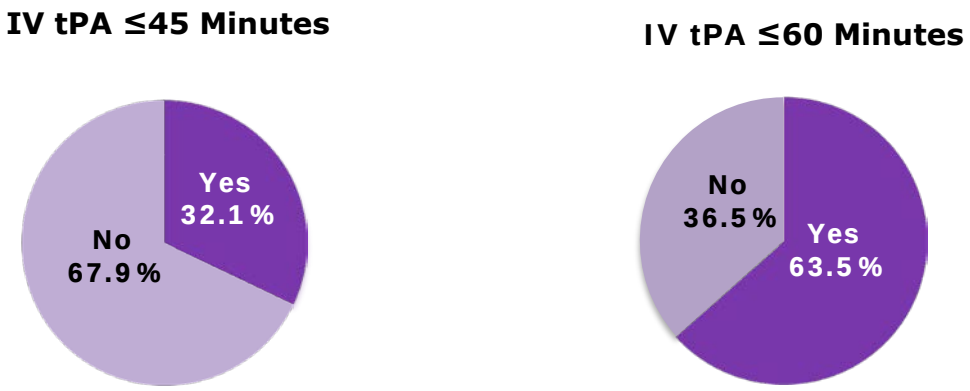

FIGURE 15. ADULT ACUTE ISCHEMIC STROKE CASES WHO RECEIVED IV TPA ≤45 MINUTES OR ≤60 MINUTES OF HOSPITAL ARRIVAL, 2008-2017.

More cases arriving to the hospital by EMS had a door-to-tPA time within 45 or 60 minutes (34.6% and 65.8%, respectively), than those arriving by private transport (17.9% and 58.3%, 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 tPA within 45 minutes and within 60 minutes of hospital arrival, by year, from 2008-2017.

The percentage of cases treated with IV tPA within 45 minutes and within 60 minutes of hospital arrival has increased annually. IV tPA within 45 minutes ranged from a

low of 13.6% (2008) to a high of 48.5% (2017). IV t-PA within 60 minutes of hospital arrival ranged from a low of 20.7% (2008) to a high of 82.7% (2017).

The median door-to-tPA times decreased by almost half, from 88 minutes in 2008 to 46 minutes in 2017.

For the last five years (2013-2017), the median door-to-tPA time was less than 60 minutes: 56 minutes in 2013; 55 minutes in 2014; 50 minutes in 2015; 49 minutes in 2016; and 46 minutes in 2017.

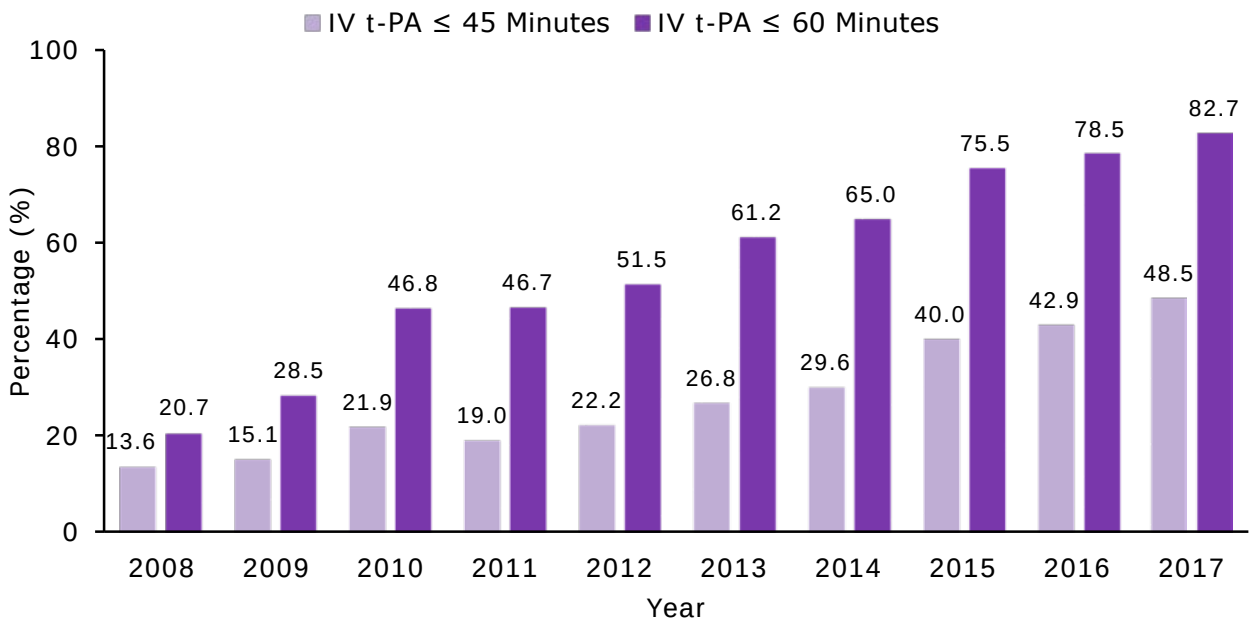

FIGURE 16. TREATMENT WITH IV T-PA WITHIN 45 MINUTES AND WITHIN 60 MINUTES OF HOSPITAL ARRIVAL AMONG ADULT ISCHEMIC STROKE CASES, BY YEAR, 2008-2017.

TABLE 11. ADULT ISCHEMIC STROKE CASES TREATED WITH IV T-PA WITHIN 45 MINUTES AND 60 MINUTES OF HOSPITAL ARRIVAL, BY YEAR, 2008-2017.

Adult Ischemic Stroke Cases Treated with IV tPA, 2008-2017						
	All	IV tPA ≤45 min		IV tPA ≤60 min		Reporting Hospitals
Year	N=6,414	n=2,062	%	n=4,070	%	N
2008	140	19	13.6	29	20.7	13
2009	298	45	15.1	85	28.5	20
2010	516	113	21.9	241	46.8	30
2011	649	123	19.0	303	46.7	33
2012	623	138	22.2	321	51.5	34
2013	639	171	26.8	391	61.2	40
2014	748	221	29.6	486	65.0	45
2015	875	350	40.0	661	75.5	45
2016	933	400	42.9	732	78.5	48
2017	993	482	48.5	821	82.7	48

The number of participating hospitals reporting on this measure increased annually, from a low of 13 in 2008 to a high of 48 in 2016-2017.

A gradual increase in the percentage of ischemic stroke cases receiving IV tPA 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)

Among eligible adult ischemic stroke cases who arrived at the hospital within 2 hours of time LKW, almost all (94.6%; n=5,844) received IV tPA within 3 hours of time LKW. Only 5 in 100 cases 5.4% (n=336) received IV tPA outside of this time (Figure 17).

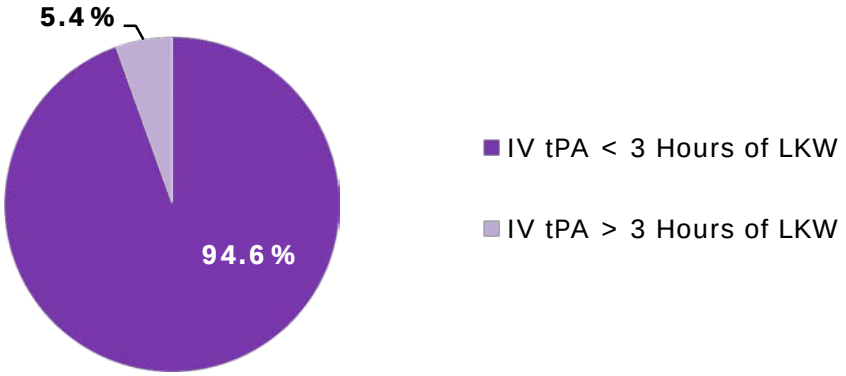

FIGURE 17. ADULT ACUTE ISCHEMIC STROKE CASES TREATED WITHIN 3 HOURS OF TIME LAST KNOWN WELL (LKW), 2008-2017.

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 tPA within 3 hours of time LKW, by year.

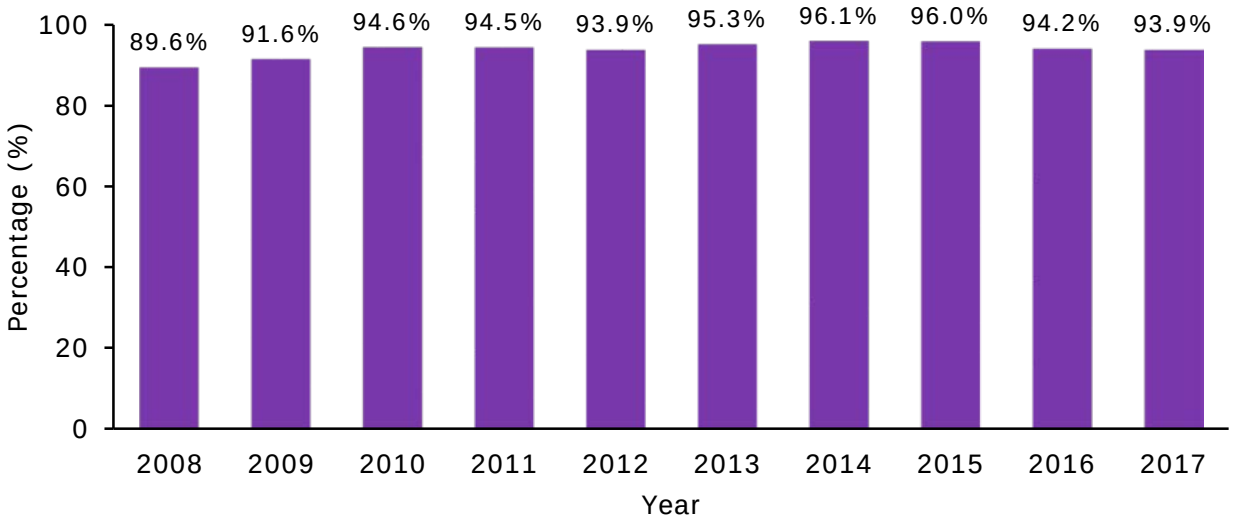

FIGURE 18. ADULT ISCHEMIC STROKE CASES ARRIVING TO THE HOSPITAL WITHIN TWO HOURS OF TIME LAST KNOWN WELL (LKW) AND TREATED WITH IV TPA WITHIN 3 HOURS OF TIME LKW, 2008-2017.

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, 2008-2017.

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=6,180	n=5,844	%	N
2008	135	121	89.6	13
2009	263	241	91.6	20
2010	446	422	94.6	30
2011	549	519	94.5	33
2012	588	552	93.9	37
2013	644	614	95.3	40
2014	752	723	96.1	46
2015	841	807	96.0	46
2016	945	890	94.2	48
2017	1,017	955	93.9	48

Between 2008 and 2017, the number of participating hospitals reporting on this measure increased, from 13 in 2008 to 48 in 2016-2017. The percentage of eligible cases who arrived at the hospital within 2 hours of time LKW and were treated with IV tPA within 3 hours of time LKW varied but overall remained high, increasing from 89.6% in 2008 to a high of 96.1% in 2014, then down slightly, to 93.9%, in 2017.

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 tPA within 4.5 hours of time LKW. (5)

Among the 7,527 eligible adult ischemic stroke cases who arrived at the hospital within 3.5 hours of time LKW, 99. 3% (n=7,208) received IV tPA treatment within 4.5 hours of time LKW, while 0.7% (n=51 received IV tPA treatment outside this time window (Figure 19). 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.

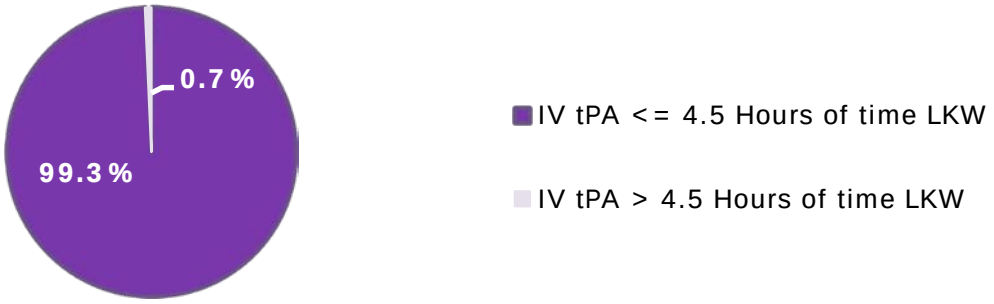

FIGURE 19. ADULT ISCHEMIC STROKE CASES WITH HOSPITAL ARRIVAL WITHIN 3.5 HOURS OF TIME LAST KNOWN WELL (LKW) AND TREATED WITH IV TPA WITHIN 4.5 HOURS OF TIME LKW, 2008-2017.

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 tPA within 4.5 hours of time LKW, by year.

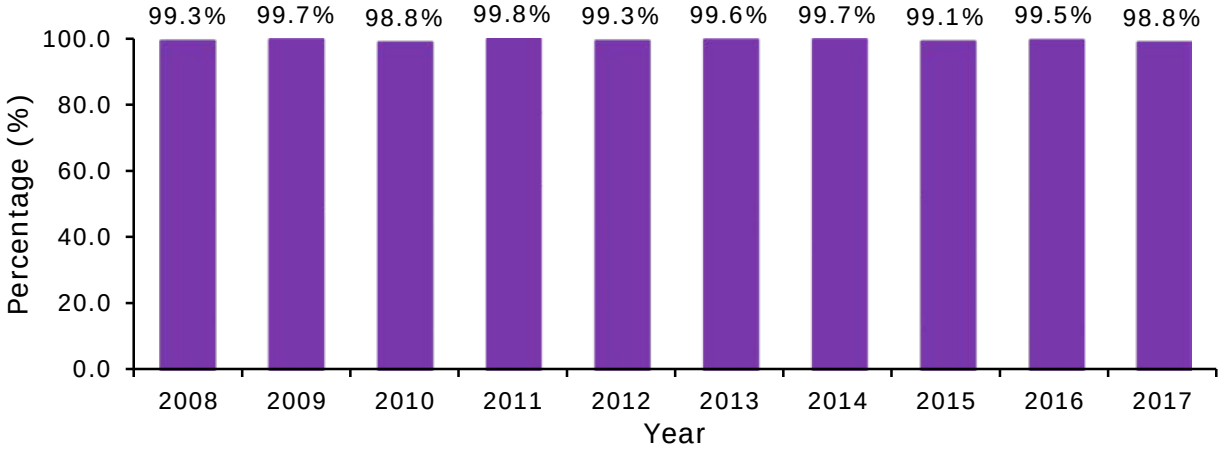

FIGURE 20. ADULT ISCHEMIC STROKE CASES WITH HOSPITAL ARRIVAL WITHIN 3.5 HOURS OF TIME LAST KNOWN WELL (LKW) AND TREATED WITH IV TPA WITHIN 4.5 HOURS OF TIME LKW, 2008-2017.

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, 2008-2017.

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=7,527	n=7,476	%	N
2008	141	140	99.3	13
2009	292	291	99.7	20
2010	507	501	98.8	31
2011	630	629	99.8	33
2012	673	668	99.3	37
2013	771	768	99.6	41
2014	918	915	99.7	46
2015	1,082	1,072	99.1	46
2016	1,216	1,210	99.5	48
2017	1,297	1,282	98.8	49

Between 2008 and 2017, the number of participating hospitals reporting on this measure increased, from 13 in 2008, to 49 in 2017. The annual percentage of treatment had remained more than 98% during 2008-2017. Compared to the previous measure (time to initiation of IV tPA treatment of 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 tPA within one hour of hospital arrival (94.6% vs. 99.3%, respectively).

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 tPA at the ED of a local hospital and are then transferred to a comprehensive stroke facility.

Among the eligible adult ischemic stroke cases without contraindication for IV tPA (n=29,514), roughly three in 100 (2.7%; n=789) had initiation of IV tPA therapy at a community hospital ED and were then transferred to a comprehensive stroke facility (Table 14).

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

	N (%)
Adult ischemic stroke cases without contraindication for IV tPA	29,514 (100.0)
Adult ischemic stroke cases where IV tPA was initiated at community hospital prior to patient transfer to comprehensive stroke facility	789 (2.7)

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 0.2% of eligible cases received IV tPA in the ED of a local hospital prior to being transferred to a stroke center. This increased to 10-12% in less than eight years, with 9.9% of eligible cases receiving this therapy in 2017. 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.

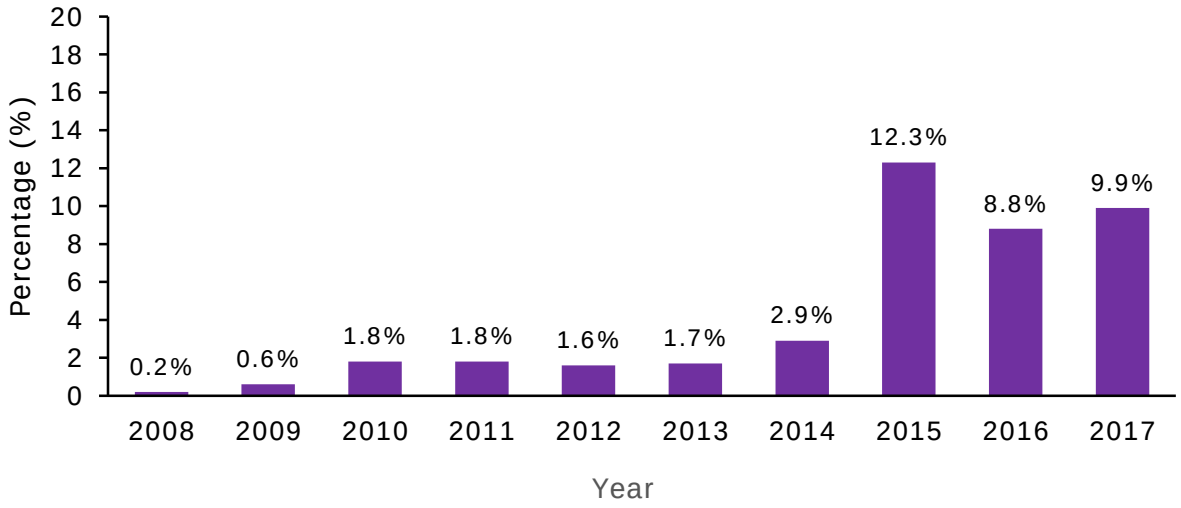

FIGURE 21. PERCENTAGE OF DRIP-AND-SHIP THERAPY AMONG ADULT ISCHEMIC STROKE CASES, 2008-2017.

TABLE 15. DRIP-AND-SHIP THERAPY AMONG ADULT ISCHEMIC STROKE CASES, 2008-2017.

	Adult Ischemic Stroke Patients without Contraindication for IV tPA			
	Cases	**Drip and Ship cases**		**Reporting Hospitals**
Year	N=29,514	n=789	%	N
2008	2,342	4	0.2	20
2009	2,834	18	0.6	27
2010	3,555	63	1.8	33
2011	3,964	73	1.8	36
2012	4,261	68	1.6	40
2013	4,905	84	1.7	42
2014	4,195	121	2.9	49
2015	1,145	141	12.3	49
2016	1,093	96	8.8	50
2017	1,220	121	9.9	49

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.

ENDOVASCULAR THERAPY

Endovascular therapy is an alternative thrombolytic treatment to IV tPA, with reperfusion methods via arterial ("IA") access. While recent studies have shown its benefits in treating acute ischemic stroke patients, it is not yet as widely utilized, for various reason, as IV tPA. (6)

Among all eligible adult ischemic stroke cases seen from 2008-2017 (n=76,657), 1.6% (n=1,217) received IA catheter-based reperfusion either at the ED, as an in-patient, or outside of the treating hospital (Table 16).

TABLE 16. ADULT ISCHEMIC STROKE CASES RECEIVING ENDOVASCULAR THERAPY AS IN-PATIENT AT HOSPITAL ED, OR OUTSIDE OF TREATING HOSPITAL, 2008-2017.

Adult Ischemic Stroke Patients	IA catheter-based reperfusion	
N	(n)	%
76,657	1,217	1.6

Endovascular Therapy, by Year

The percentage of adult ischemic stroke cases who received endovascular therapy varied over time, ranging from a low of 0.4% in 2008 to a high of 2.8% in 2017.

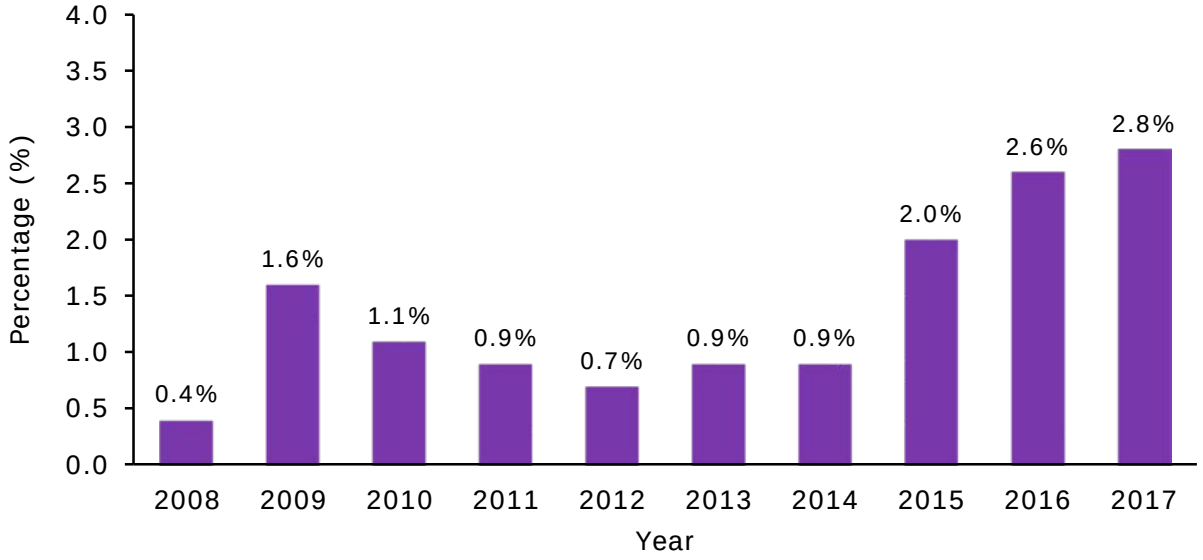

FIGURE 22. ENDOVASCULAR THERAPY AMONG ADULT ISCHEMIC STROKE CASES, BY YEAR, 2008-2017.

TABLE 17. ENDOVASCULAR THERAPY AMONG ADULT ISCHEMIC STROKE CASES, 2008-2017.

	Ischemic stroke cases	IA catheter-based reperfusion		Reporting Hospitals
Year	N=76,657	n=1,217	%	N
2008	3,065	13	0.4	20
2009	3,921	61	1.6	27
2010	5,699	62	1.1	33
2011	6,436	59	0.9	36
2012	7,186	50	0.7	40
2013	7,990	74	0.9	42
2014	9,066	84	0.9	49
2015	10,789	214	2.0	49
2016	11,090	284	2.6	50
2017	11,414	315	2.8	49

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

THROMBOLYTIC COMPLICATIONS

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

Of the 76,656 acute ischemic stroke cases seen between 2008-2017, 13.7% (n=10,104) received IV tPA or IA catheter-based treatment at the treating hospital. Of these, 4.9% (n=499) experienced bleeding complications after IV tPA or IA catheter-based treatment was administered (Figure 23).

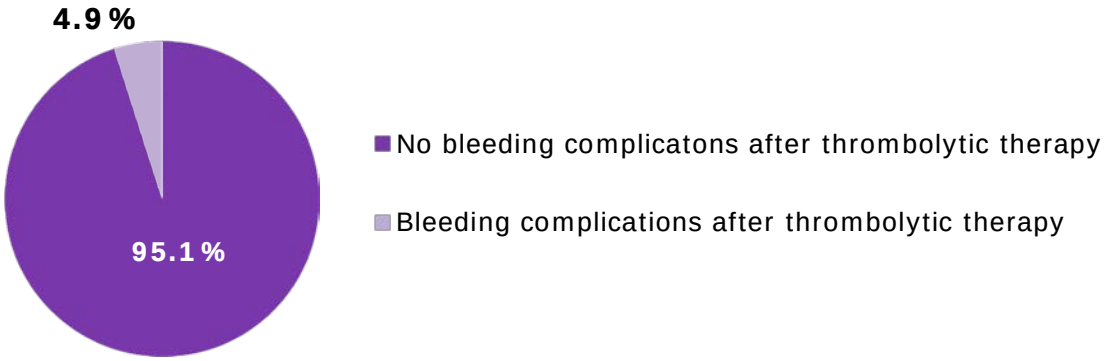

FIGURE 23. ADULT ISCHEMIC STROKE CASES WITH BLEEDING COMPLICATIONS AFTER THROMBOLYTIC THERAPY, 2008-2017.

Thrombolytic Complications, by Year

The percentage of eligible adult ischemic stroke cases who experienced bleeding complications post-thrombolytic therapy ranged from a low of 4.1% in 2010 and

2017 to a high of 6.4% in 2011. Between 2008 and 2017, the number of participating hospitals reporting on this measure increased, from 23 in 2008, to 52-53 in 2014-2017.

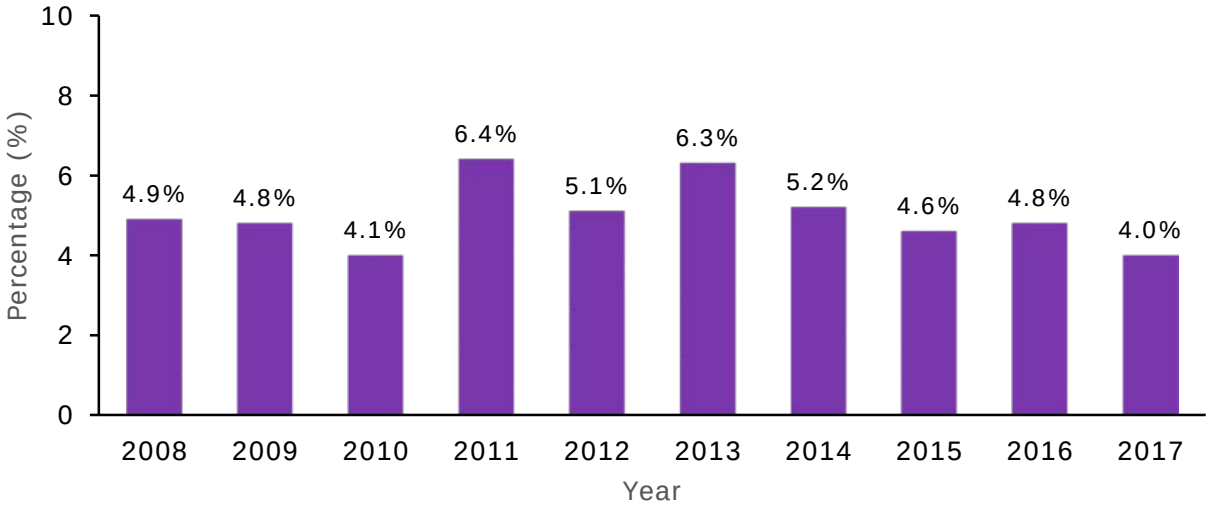

FIGURE 24. ADULT ISCHEMIC STROKE CASES WITH BLEEDING COMPLICATIONS AFTER THROMBOLYTIC THERAPY, BY YEAR, 2008-2017.

TABLE 18. ADULT ISCHEMIC STROKE CASES WITH BLEEDING COMPLICATIONS AFTER THROMBOLYTIC THERAPY, BY YEAR, 2008-2017.

Thrombolytic therapy-treated cases				
	Total	**Bleeding complications**		**Reporting Hospitals**
Year	n=10,104	n=499	%	N
2008	164	8	4.9	23
2009	372	18	4.8	30
2010	692	28	4.1	36
2011	825	53	6.4	39
2012	858	44	5.1	43
2013	997	63	6.3	45
2014	1,203	63	5.2	52
2015	1,524	70	4.6	52
2016	1,691	81	4.8	53
2017	1,778	71	4.0	52

INTENSIVE STATIN THERAPY

Of the eligible adult ischemic stroke and TIA cases, just over half (51.7%; n=12,365) were prescribed a qualifying high-intensity statin upon hospital discharge, while just under half (48.4%; n=11,577) were not (Figure 25).

FIGURE 25. ADULT ISCHEMIC STROKE AND TIA CASES PRESCRIBED WITH INTENSIVE STATIN THERAPY UPON HOSPITAL DISCHARGE, 2008-2017.

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.

The percentage of eligible ischemic stroke and TIA cases prescribed qualifying high-intensity statin therapy upon hospital discharge has more than doubled over the past five years, from 31.3% in 2013 to 77.1% in 2017. Prior to this, the percentage varied, from a low of 29.4% in 2011, to 68.0% in 2008. 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.

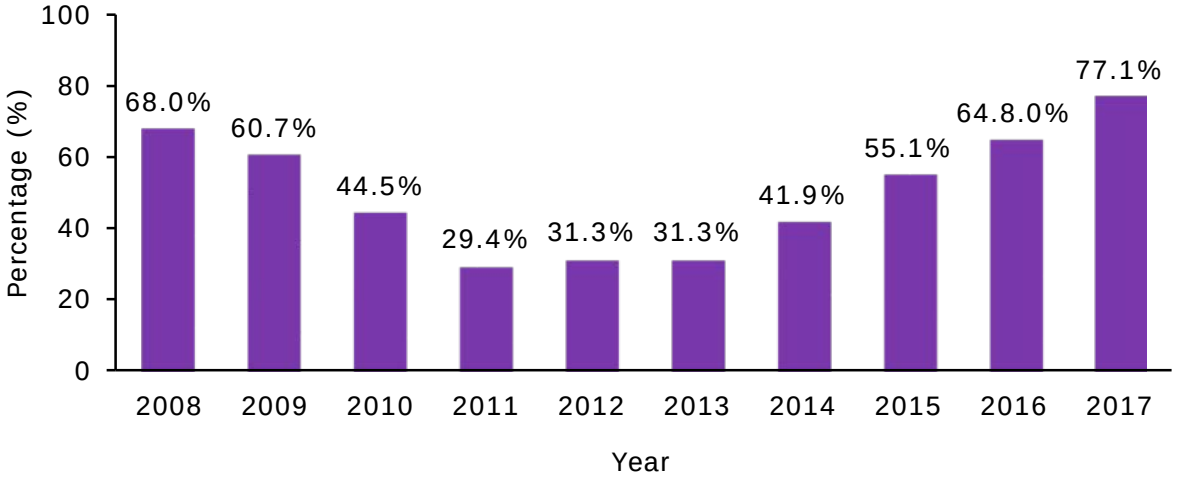

FIGURE 26. PERCENTAGE OF ADULT ISCHEMIC STROKE AND TIA CASES DISCHARGED WITH INTENSIVE STATIN THERAPY, BY YEAR, 2008-2017.

TABLE 19. ADULT ISCHEMIC STROKE AND TIA CASES DISCHARGED WITH INTENSIVE STATIN THERAPY, BY YEAR, 2008-2017.

	Adult Ischemic Stroke & TIA Cases			
	Total	Intensive Statin Therapy at Hospital Discharge		Reporting Hospitals
Year	N=23,942	n=12,365	%	N
2008	25	17	68.0	17
2009	745	452	60.7	25
2010	1,360	605	44.5	32
2011	1,710	502	29.4	35
2012	2,005	627	31.3	39
2013	2,839	888	31.3	42
2014	3,186	1,335	41.9	49
2015	3,922	2,159	55.1	48
2016	4,089	2,648	64.8	49
2017	4,061	3,132	77.1	47

Between 2008 and 2017, the number of participating hospitals reporting on this measure increased, from 17 in 2008, to 48-49 in 2014-2016. Two of the 49 participating hospitals in 2017, however, did not provide data on this measure.

ANTITHROMBOTIC PRESCRIBED AT HOSPITAL DISCHARGE

Almost all eligible adult ischemic stroke and TIA cases (98.1%, n=74,325) were prescribed antithrombotic therapy upon hospital discharge (Figure 27).

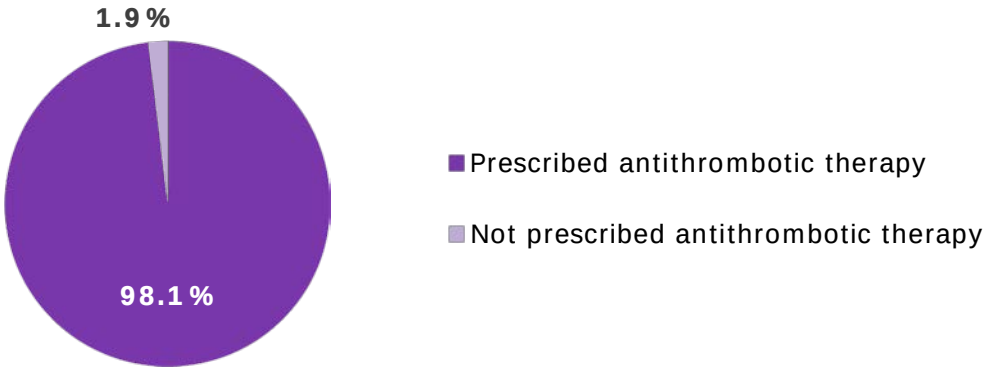

FIGURE 27. PERCENTAGE OF ADULT STROKE CASES DISCHARGED WITH ANTITHROMBOTIC MEDICATION, 2008-2017.

Antithrombotic Prescribed at Discharge, by Year

Figure 28 and Table 20 display the percentage of eligible ischemic stroke and TIA cases who were prescribed antithrombotic medication at hospital discharge, by year.

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 99.1% in 2016; it was 98.9% for reporting year 2017.

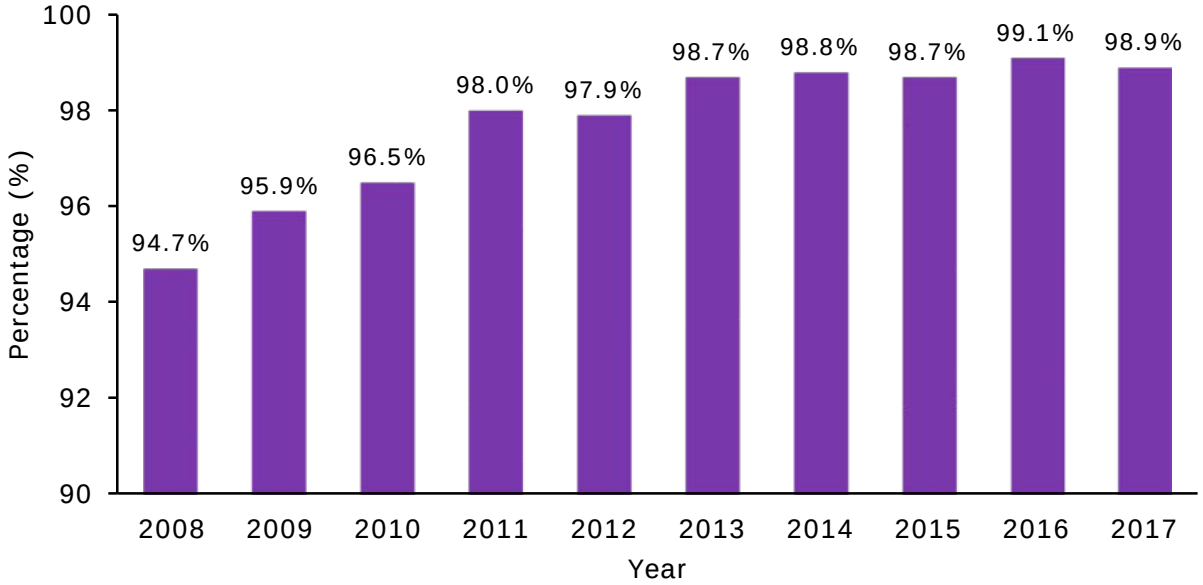

FIGURE 28. PERCENTAGE OF ISCHEMIC STROKE AND TIA CASES DISCHARGED WITH ANTITHROMBOTIC MEDICATION BY YEAR, 2008-2017.

TABLE 20. ISCHEMIC STROKE AND TIA CASES DISCHARGED WITH ANTITHROMBOTIC MEDICATION BY YEAR, 2008-2017.

Adult Ischemic Stroke and TIA Cases				
	Total	**Antithrombotic prescribed at discharge**		**Reporting Hospitals**
Year	N=75,741	n=74,325	%	N
2008	3,595	3,406	94.7	20
2009	4,484	4,299	95.9	27
2010	5,718	5,516	96.5	33
2011	6,554	6,420	98.0	35
2012	7,332	7,180	97.9	40
2013	8,179	8,071	98.7	43
2014	8,684	8,580	98.8	49
2015	10,162	10,034	98.7	48
2016	10,353	10,256	99.1	49
2017	10,680	10,563	98.9	48

Between 2008 and 2017, the number of participating hospitals reporting on this measure has increased, from 20 in 2008, to 48-49 in 2014-2017.

ANTI-HYPERTENSIVES PRESCRIBED AT HOSPITAL DISCHARGE

Of the total 57,326 stroke cases with documented hypertension (SBP ≥140 mmHg and/or DBP ≥90 mmHg) seen between 2008 and 2017, 81 in 100 (80.7%; n=46,249) were ischemic stroke and TIA cases. Of these, 37,626 had no contraindications to antihypertension medications and were eligible for this analysis. Roughly 84 in 100 (83.9%; n=31,579) were prescribed some type of anti-hypertensive medication at hospital discharge; data are missing for 7.9% (n=2,956). 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.

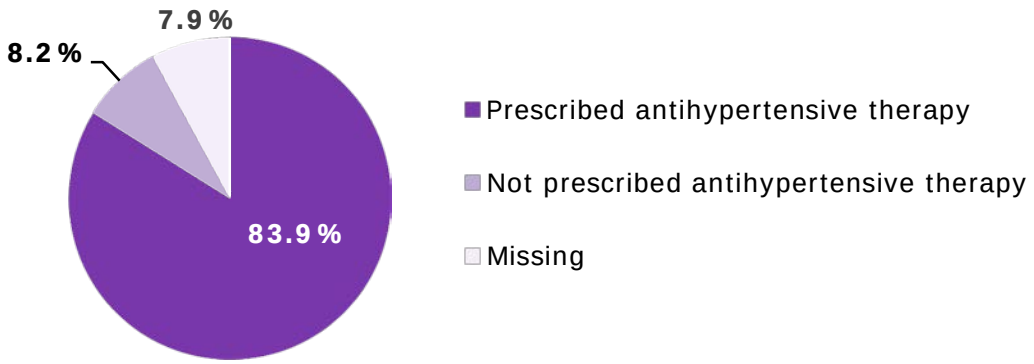

FIGURE 29. PERCENTAGE OF ADULT ISCHEMIC STROKE AND TIA CASES DISCHARGED WITH ANTIHYPERTENSIVE MEDICATION, 2008-2017.

Types of Anti-Hypertensives Prescribed at Discharge, by Year

Figure 30 displays the different types of anti-hypertensive medications prescribed at time of hospital discharge for eligible adult ischemic and TIA stroke patients, 2017. Note: Number of cases reported for this measure differ from previously reported; this could reflect differences in participating hospitals and/or updated inclusion/exclusion criteria for this measure.

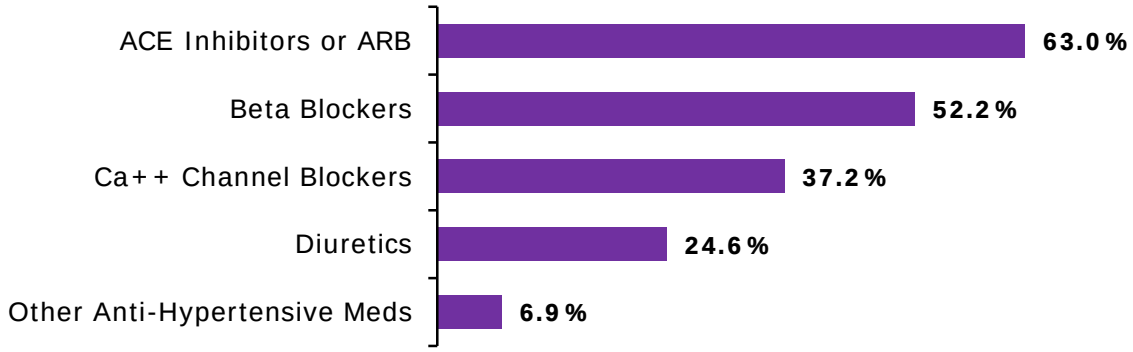

FIGURE 30. ISCHEMIC STROKE AND TIA CASES DISCHARGED WITH ANTIHYPERTENSIVE MEDICATION, 2017.

Table 21, below, displays the numbers and percentages of prescribed anti-hypertensive medications at discharge for ischemic and TIA cases from 2008- 2017.

TABLE 21. PERCENTAGE OF ANTIHYPERTENSIVE MEDICATIONS PRESCRIBED FOR ISCHEMIC STROKE AND TIA CASES AT DISCHARGE BY YEAR, 2008-2017.

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	95	64	67.4	43	45.3	24	25.3	17	17.9	3	3.2	13
2009	2,747	1,741	63.4	1,464	53.3	718	26.1	638	23.2	317	11.5	27
2010	3,205	2,126	66.3	1,700	53.0	890	27.8	635	19.8	345	10.8	30
2011	2,743	1,905	69.5	1,495	54.5	775	28.3	549	20.0	264	9.6	26
2012	2,708	1,822	67.3	1,426	52.7	825	30.5	627	23.2	264	9.8	27
2013	2,831	1,942	68.6	1,517	53.6	819	28.9	671	23.7	237	8.4	30
2014	3,405	2,279	66.9	1,785	52.4	983	28.9	866	25.4	324	9.5	37
2015	4,507	2,840	63.0	2,467	54.7	1,582	35.1	1,068	23.7	419	9.3	35
2016	4,355	2,746	63.1	2,257	51.8	1,502	34.5	1,017	23.4	365	8.4	35
2017	4,971	3,129	63.0	2,544	52.2	1,851	37.2	1,223	24.6	341	6.9	37
Total	31,567	20,594	65.2	16,697	52.9	9,969	31.6	7,311	23.2	2,879	9.1	--

The pattern of anti-hypertensive medications prescribed each year (2008-2017) 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 2016, the number of participating hospitals reporting on this measure increased, from 13 in 2008, to 37 in 2017.The number of hospitals reporting on this measure could be improved upon.

REHABILITATION CONSIDERED

Stroke severity, and timely treatment of the stroke, both 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)

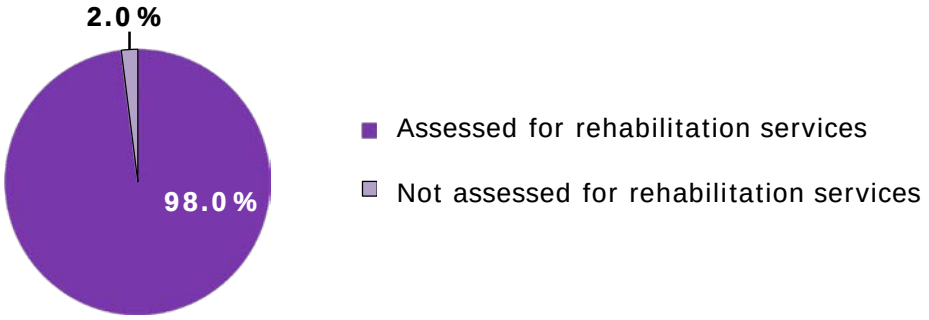

FIGURE 31. ADULT STROKE CASES ASSESSED FOR REHABILITATIVE SERVICES PRIOR TO DISCHARGE, 2008-2017.

From 2008-2017, almost all ischemic, hemorrhagic, TIA, and stroke NOS cases (98.0%, n=75,551) were assessed for rehabilitative services, while 2.0% (n=1,562) were not considered for rehabilitative services (Figure 31).

Rehabilitation Considered, by Year

Figure 32 and Table 22 display the percentage of cases diagnosed with ischemic stroke, TIA, ICH, SAH, and stroke NOS who were assessed for rehabilitative services prior to hospital discharge by year.

The percentage of eligible cases assessed for rehabilitative services ranged from a low of 94.1% in 2009 to a high of 99.2% in 2017.

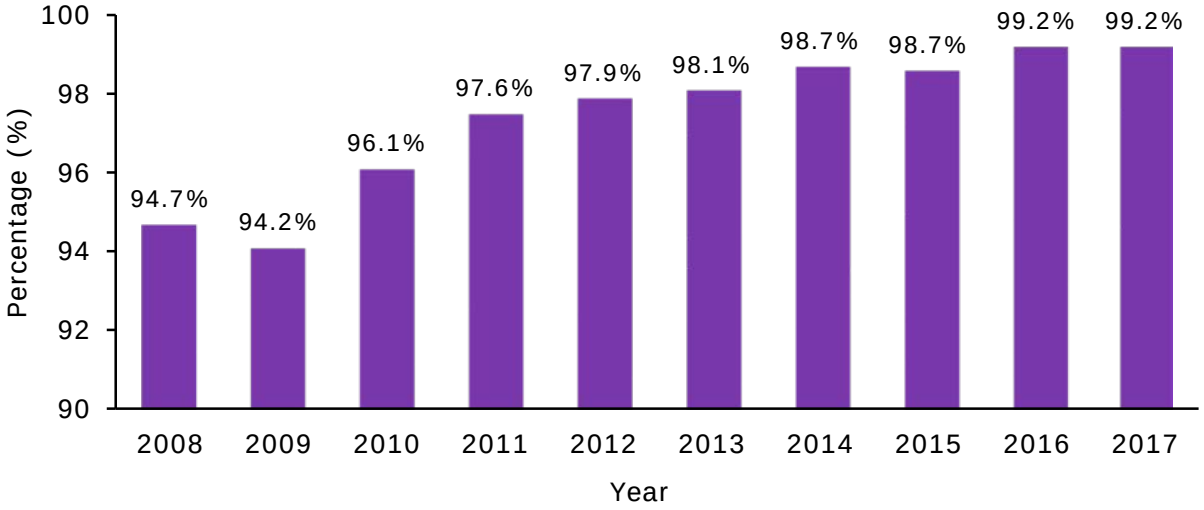

FIGURE 32. ADULT STROKE CASES ASSESSED FOR REHABILITATIVE SERVICES PRIOR TO DISCHARGE, BY YEAR, 2008-2017.

TABLE 22. ADULT STROKE CASES ASSESSED FOR REHABILITATIVE SERVICES PRIOR TO DISCHARGE, BY YEAR, 2008-2017.

	Cases	Assessed for rehabilitation		Reporting Hospitals
Year	N=76,235	n=74,696	%	N
2008	3,208	3,037	94.7	21
2009	4,254	4,018	94.2	27
2010	5,895	5,722	96.1	33
2011	6,475	6,397	97.6	34
2012	6,941	6,860	97.9	40
2013	7,753	7,679	98.1	43
2014	8.989	8,959	98.7	49
2015	10,587	10,585	98.7	49
2016	10,940	11,021	99.2	50
2017	11,108	11,273	99.2	49

Between 2008 and 2017, the number of participating hospitals reporting on this measure increased, from 21 in 2008 to 49-50 in 2014-2017.

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 2008-2017, 90.4% (n=49,237) of stroke patients and/or their caregivers were provided with stroke educational materials during their hospital stay that addressed all five of these requirements (Figure 33).

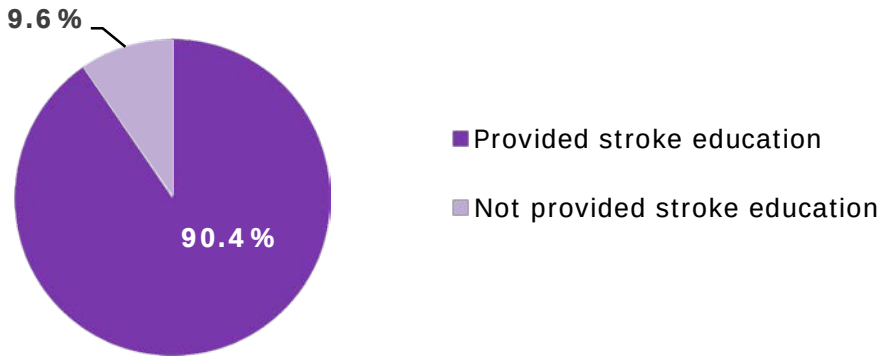

FIGURE 33. ADULT STOKE CASES AND CAREGIVERS PROVIDED WITH STROKE EDUCATION/MATERIALS, 2008-2017.

Stroke Education, by Year

Figure 34 and Table 23 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. This percentage increased rapidly over the first four reporting years, from 50.8% in 2008 to 89.0 in 2011, and has remained above 91% since 2012. In 2017, 96.6% of eligible stroke patients / caregivers were provided with stroke education prior to hospital discharge.

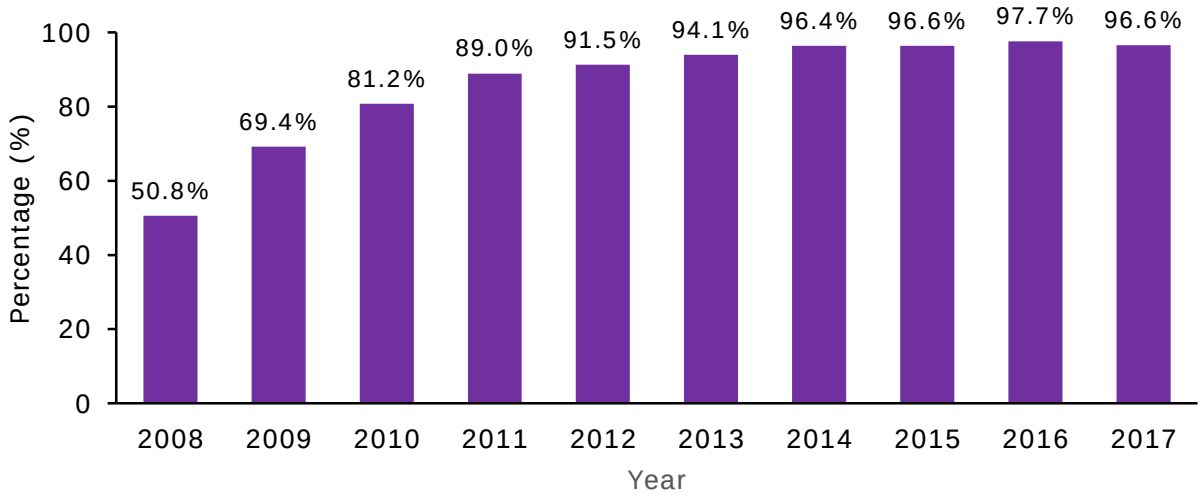

FIGURE 34. ADULT STROKE CASES AND CAREGIVERS PROVIDED WITH STROKE EDUCATION/MATERIAL DURING HOSPITAL STAY BY YEAR, 2008-2017.

TABLE 23. ADULT STROKE CASES AND CAREGIVERS PROVIDED WITH STROKE EDUCATION/MATERIAL DURING HOSPITAL STAY BY YEAR, 2008-2017.

	Stroke Cases	**Stroke Education**		**Reporting Hospitals**
Year	N=54,070	n=48,877	%	N
2008	2,559	1,299	50.8	20
2009	3,161	2,196	69.4	27
2010	4,044	3,301	81.2	33
2011	4,744	4,254	89.0	35
2012	5,175	4,759	91.5	40
2013	5,820	5,509	94.1	43
2014	6,186	6,009	96.4	49
2015	7,185	6,994	96.6	49
2016	7,425	7,331	97.7	50
2017	7,771	7,585	96.6	48

Between 2008 and 2017, the number of participating hospitals reporting on this measure has increased annually, from 20 in 2008 to 48-50 in 2014-2017.

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.

Of the eligible adult ischemic, hemorrhagic, and stroke NOS cases seen from 2011-2017 (n=69,908), three in ten, (30.8%; n=21,501) had an mRS at time of hospital discharge. Almost half of adult stroke cases (46.8%; n=32,681) did not have an mRS at discharge, or the total score was not documented. Data on this measure were missing for two in ten patients (22.5%; n=15,726) (Figure 35).

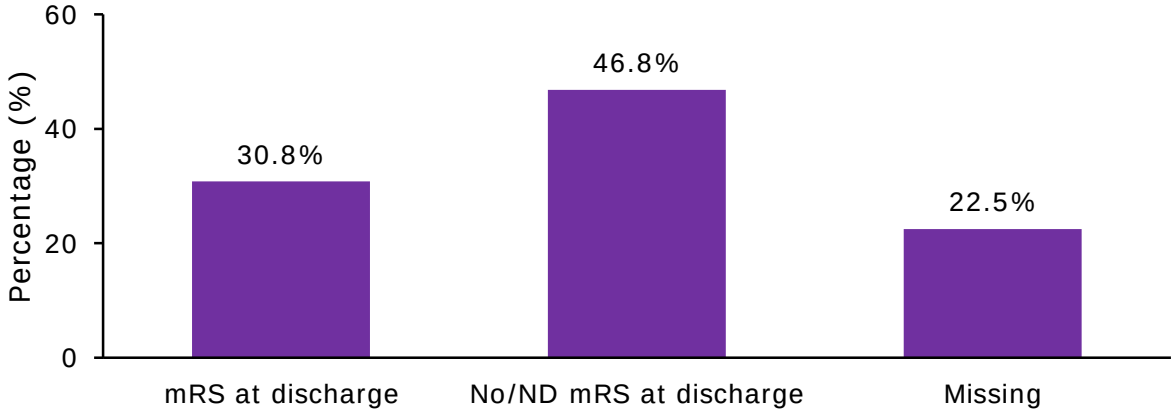

FIGURE 35. MODIFIED RANKIN SCALE PERFORMED AT HOSPITAL DISCHARGE, 2011-2017.

Modified Rankin Scale (mRS), by Year

Figure 36 and Table 24 display the percentage of eligible adult stroke cases with an mRS at hospital discharge, per year. Among the 21,501 eligible adults stroke cases who had mRS scores at hospital discharge, the median mRS score was 3, indicating moderate disability.

The percentage of adult ischemic, hemorrhagic, and stroke NOS cases with an mRS at discharge varied annually, from a low of 7.2% in 2011 to a high of 42.2% in 2017.

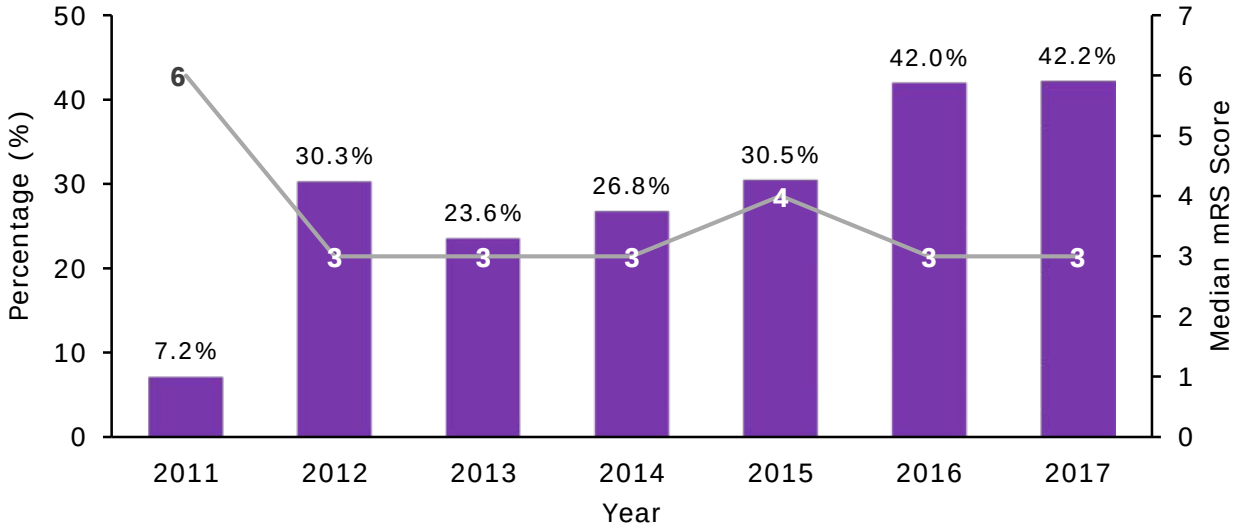

FIGURE 36. ADULT STROKE CASES WITH A MODIFIED RANKIN SCALE (MRS) SCORE AT HOSPITAL DISCHARGE, AND MEDIAN MRS SCORE, BY YEAR, 2011-2017.

TABLE 24. ADULT STROKE CASES WITH A MODIFIED RANKING SCALE (MRS) AT HOSPITAL DISCHARGE, AND MEDIAN MRS SCORE, BY YEAR, 2011-2017.

Adult Ischemic and Hemorrhagic Stroke Cases					
	Cases	**mRS at discharge**		**mRS Score**	**Reporting Hospitals**
Year	N = 69,908	n = 21,501	%	Median	N
2011	7,408	534	7.2	6	35
2012	7,644	2,319	30.3	3	40
2013	8,439	1,995	23.6	3	43
2014	9,914	2,655	26.8	3	49
2015	11,825	3,604	30.5	4	49
2016	12,239	5,141	42.0	3	50
2017	12,439	5,253	42.2	3	49

Between 20011 and 2017, the number of participating hospitals reporting on this measure increased from 35 in 2011 to 49-50 in 2014-2017.

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.

Among stroke cases discharged on or after April 1, 2011, more than half (52.5%) were discharged to home, with another one third (32.4%) discharged to other health care facilities (Figure 37A).

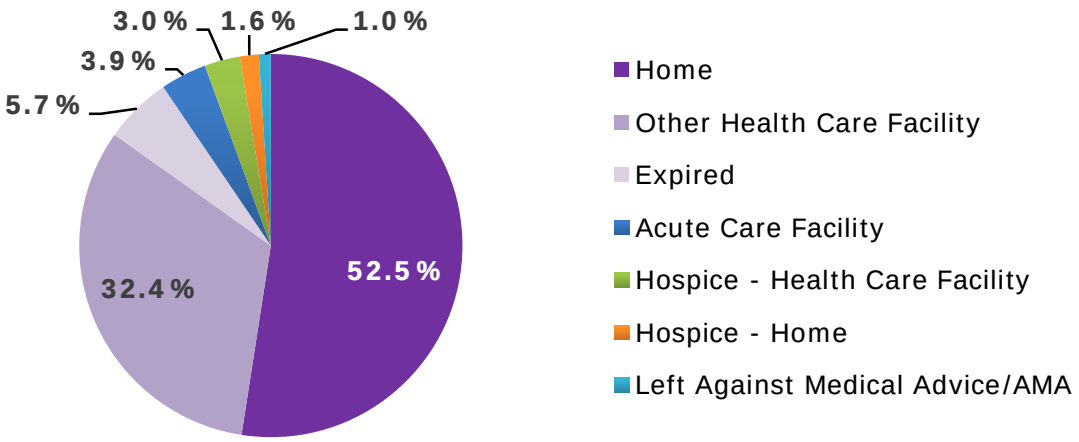

FIGURE 37A. DISCHARGE DISPOSITION OF ADULT STROKE CASES DISCHARGED ON OR AFTER APRIL 1, 2011 THROUGH DECEMBER 2017.

Of the adult cases discharged to other healthcare facilities, almost six in ten (58.1%) were discharged to an inpatient rehabilitation facility (IRF), and one-third (35.6%) to a skilled nursing facility (SNF) (Figure 37B).

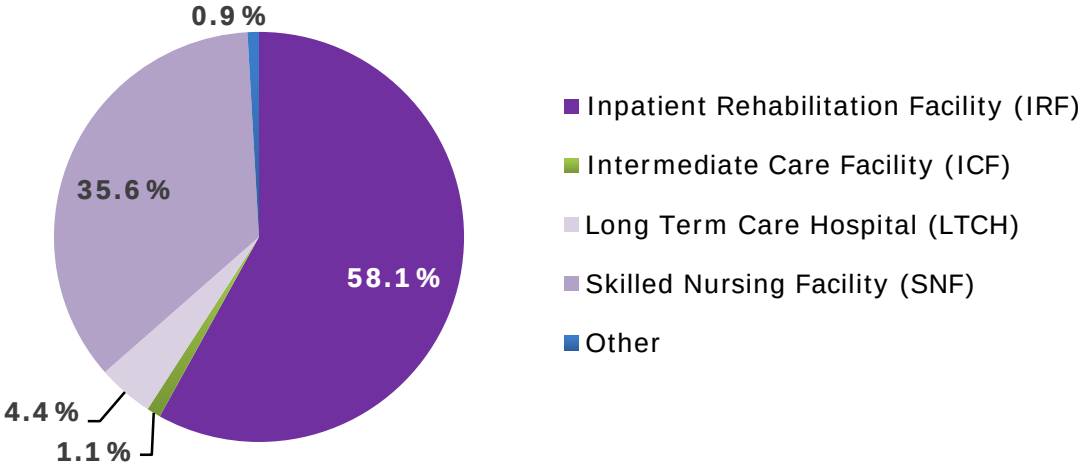

FIGURE 37B. DISCHARGE DISPOSITION AMONG ADULT STROKE CASES DISCHARGED TO OTHER HEALTHCARE FACILITIES, APRIL 2011 THROUGH DECEMBER 2017.

Discharge Disposition, by Year

Figures 38 and 39, below, display the discharge dispositions and types of healthcare facilities to which stroke patients were discharged, by year.

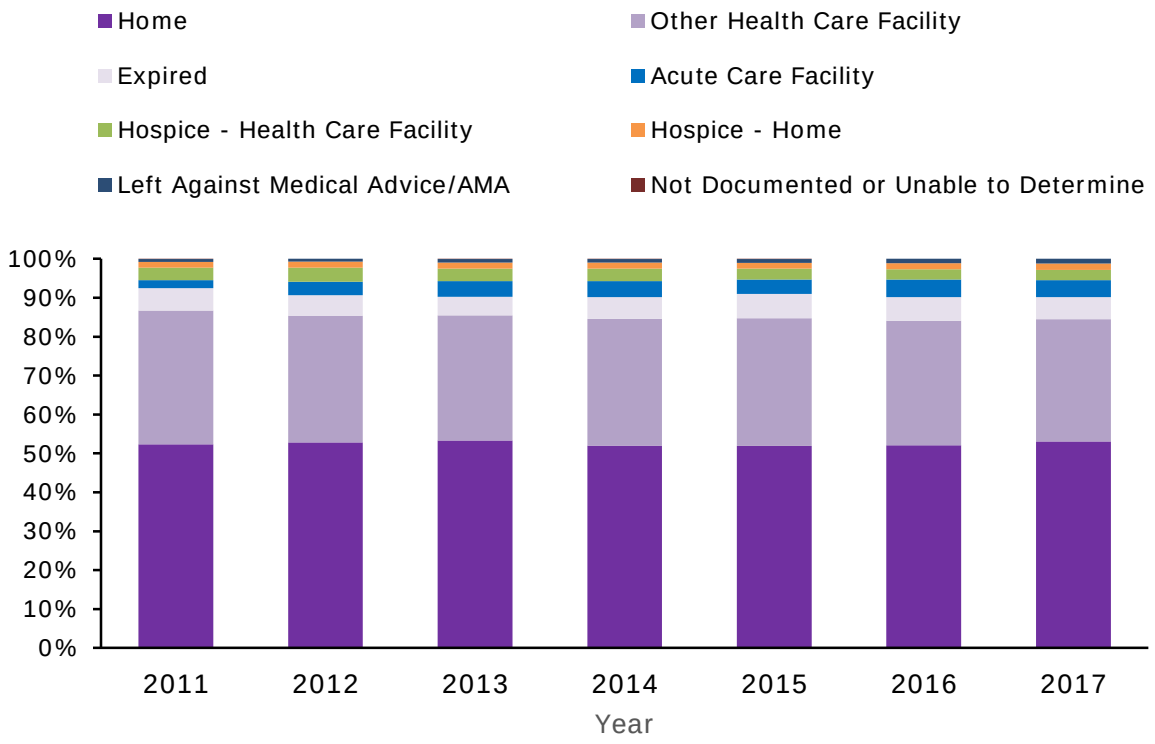

FIGURE 38. DISCHARGE DISPOSITION OF ADULT STROKE CASES, BY YEAR, 2011-2017.

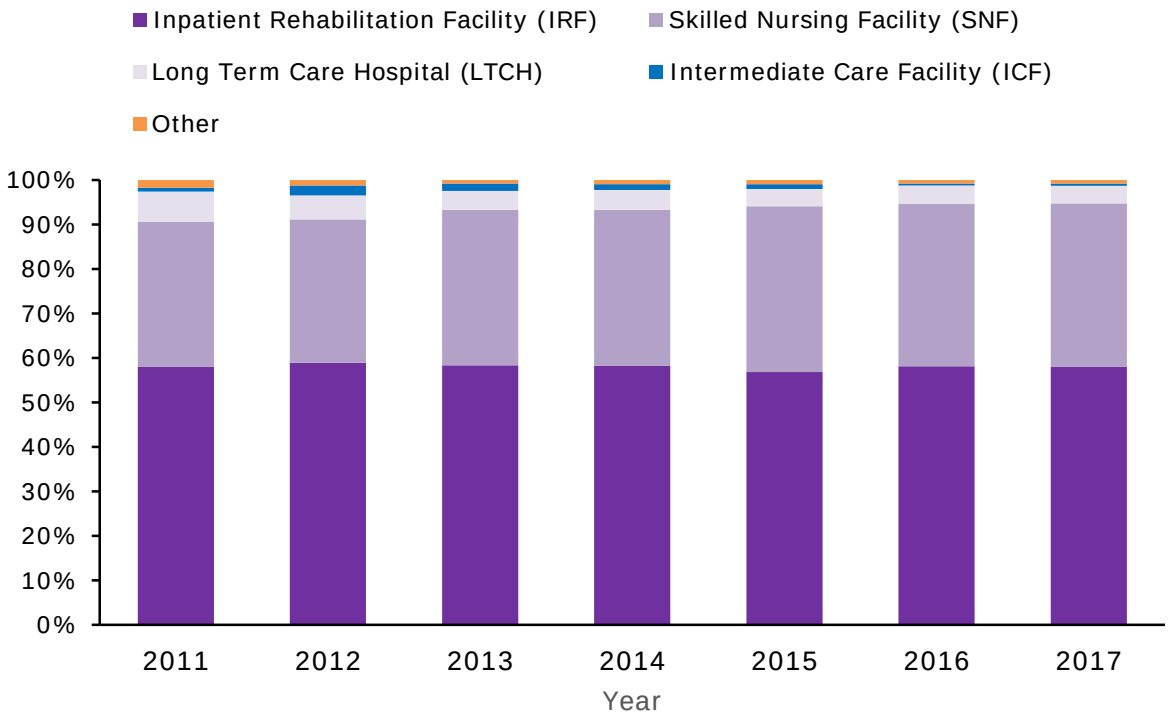

FIGURE 39. DISCHARGE DISPOSITION AMONG STROKE CASES DISCHARGED TO OTHER HEALTHCARE FACILITIES, BY YEAR, 2011-2017.

Between 2011 and 2016, the number of participating hospitals reporting on this measure increased annually, from 35 to 50 participating hospitals. For 2017, there were 49 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 110,689 patients seen between 2008-2017 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 (medical history is missing for 8.5%, n=9,395 patients); 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)

The prevalence of hypertension reported as a previously known medical condition was 74.0% (n=81,867). That is, 74 in every 100 adult stroke patients seen between 2008 and 2017 were known to have hypertension prior to their stroke (Figure 40).

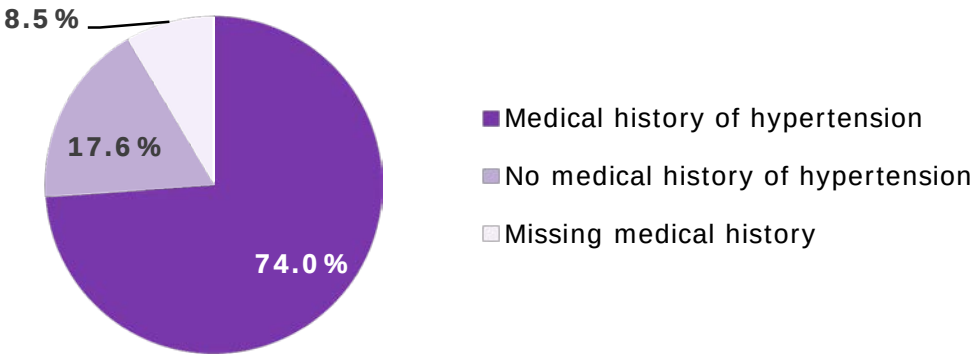

FIGURE 40. PERCENTAGE OF STROKE CASES WITH A MEDICAL HISTORY OF HYPERTENSION, 2008-2017.

Females and males, and Hispanic and Non-Hispanic patients had similar medical history of hypertension. History of hypertension was higher among Blacks/African Americans (86.5%) as compared with other races (Figure 41).

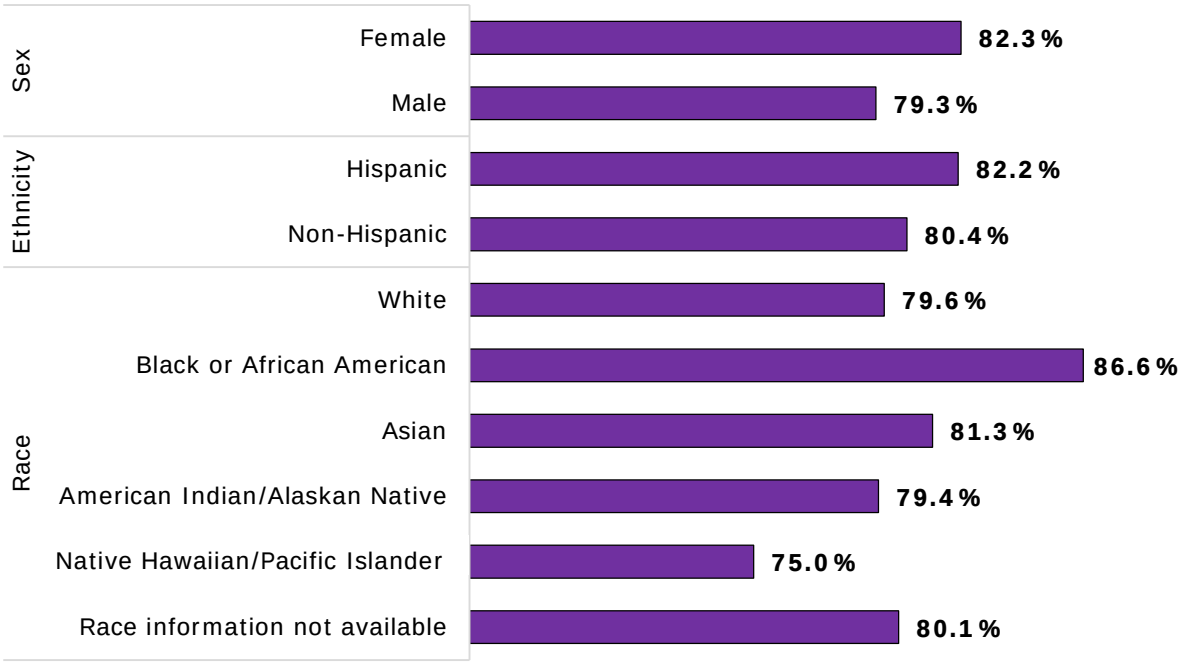

FIGURE 41. MEDICAL HISTORY OF HYPERTENSION AMONG ADULT STROKE CASES BY SEX, ETHNICITY, AND RACE, 2008-2017.

The prevalence of high blood pressure, documented as SBP ≥140 mmHg and/or DBP ≥90 mmHg during the stroke episode of care, was 50.6% (n=55,992). That is, one in two adult stroke patients had high blood pressure during their hospitalization (Figure 42).

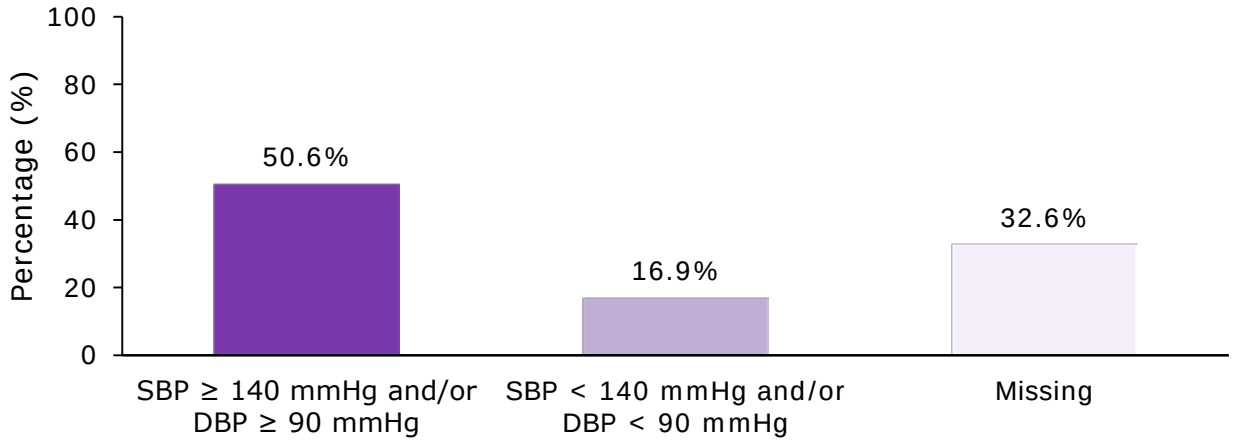

FIGURE 42. PREVALENCE OF HYPERTENSION DURING STROKE EPISODE OF CARE, 2008-2017.

The difference between the prevalence of hypertension as a previously known medical condition (74.0%) vs. measured SBP/DBP at stroke episode of care (50.6%) may reflect the management of hypertension during the stroke episode of care.

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.

The prevalence of AF reported as a previously known medical condition was 12.9% (n=14,310) (Figure 43), and was most common among whites (16.0%) (Figure 44). 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 43. MEDICAL HISTORY OF ATRIAL FIBRILLATION AMONG ADULT STROKE CASES, 2008-2017.

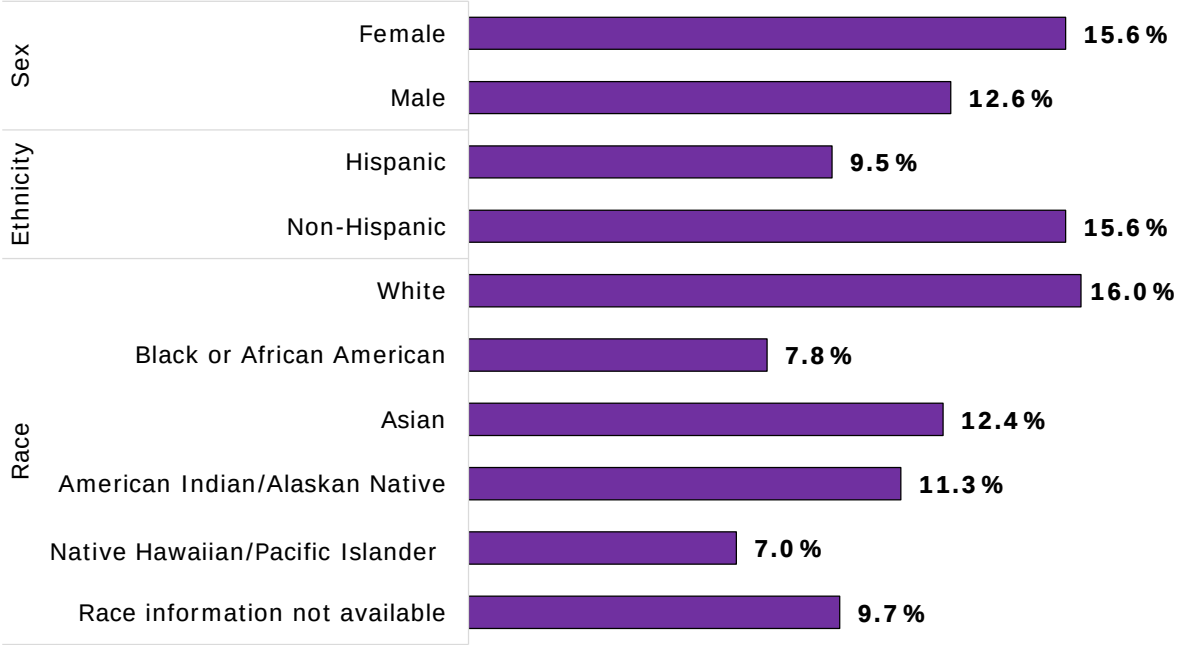

FIGURE 44. MEDICAL HISTORY OF ATRIAL FIBRILLATION AMONG ADULT STROKE CASES BY SEX, ETHNICITY, AND RACE, 2008-2017.

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)

The prevalence of diabetes mellitus reported as a previously known medical condition was 35.0% (n=38,683) (Figure 45). Diabetes affected one out of two Hispanics (52.0%) (Figure 46).

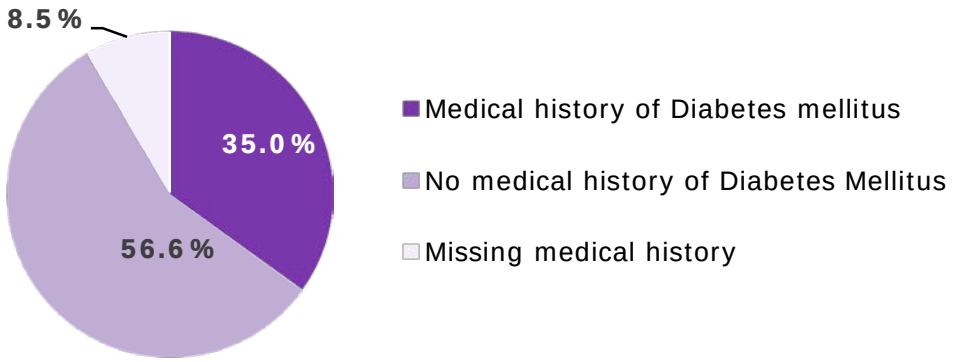

FIGURE 45. PERCENTAGE OF MEDICAL HISTORY OF DIABETES MELLITUS AMONG ADULT STROKE CASES, 2008-2017.

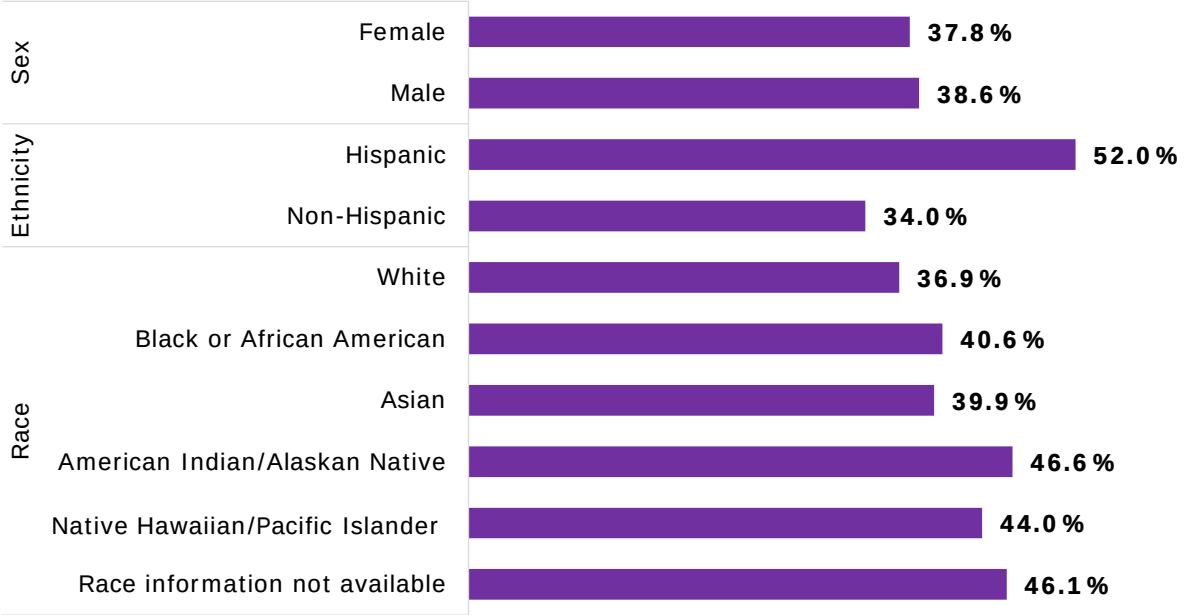

FIGURE 46. MEDICAL HISTORY OF DIABETES MELLITUS AMONG ADULT STROKE CASES BY SEX, ETHNICITY, AND RACE, 2008-2017.

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)

Among eligible adult ischemic stroke and TIA cases (n=77,166), 91.6% (n=70,681) 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 47). 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.

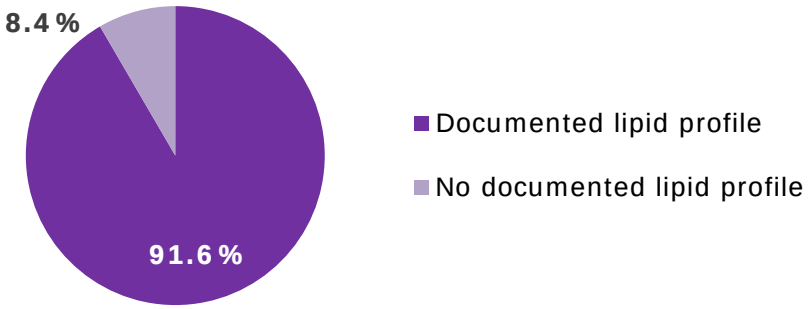

FIGURE 47. ADULT ISCHEMIC STROKE AND TIA CASES WITH A DOCUMENTED LIPID PROFILE, 2008-2017.

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 adult stroke cases, 66.2% (n=73,368) had documented HDL < 40 mg/dL; 19.8% (n=21,960) had documented triglycerides ≥ 150 mg/dL; 16.0% (n=17,782) had documented LDL ≥ 130 mg/dL; and 14.2% (n=15,753) 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%.

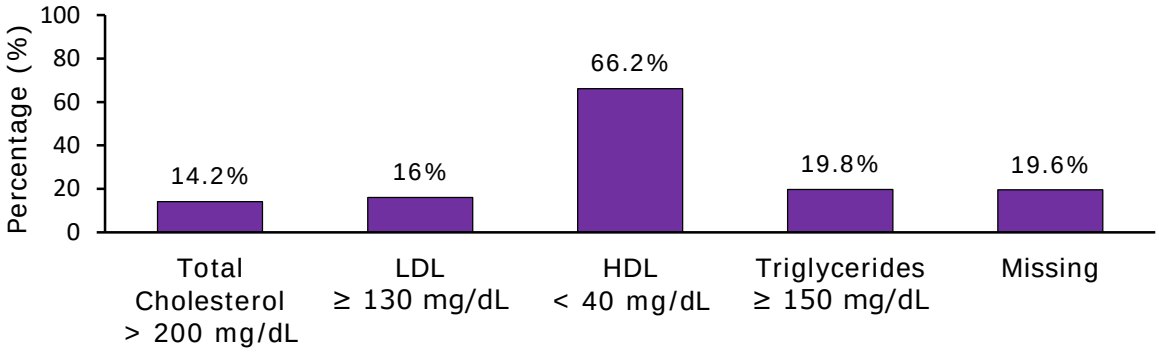

FIGURE 48. HIGH RISK LIPID LEVELS DURING STROKE EPISODE OF CARE, 2008-2017.

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)

The prevalence of dyslipidemia, reported as a previously known medical condition prior to stroke occurrence, was 39.8% (n=44,026) (Figure 49).

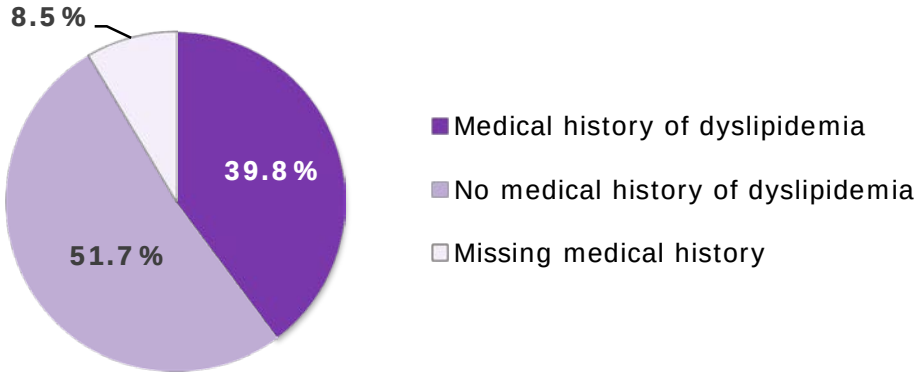

FIGURE 49. MEDICAL HISTORY OF DYSLIPIDEMIA AMONG ADULT STROKE CASES, 2008-2017.

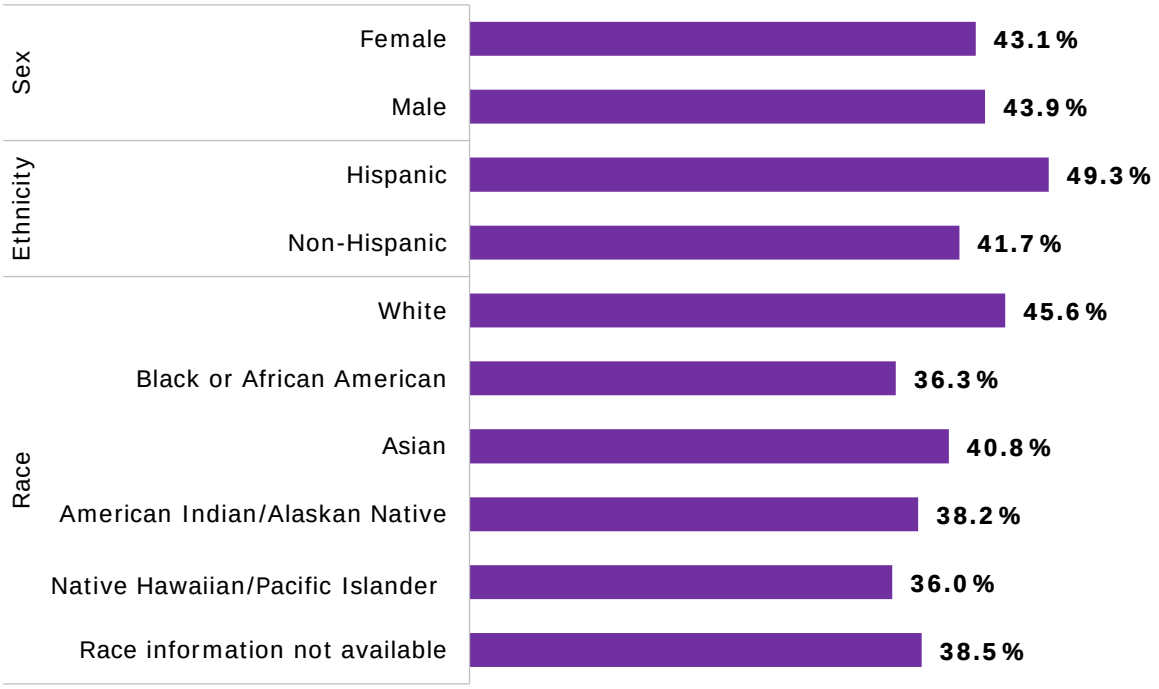

FIGURE 50. PERCENTAGE OF MEDICAL HISTORY OF DYSLIPIDEMIA AMONG ADULT STROKE CASES BY SEX, ETHNICITY, AND RACE, 2008-2017.

Men and women had a similar prevalence of dyslipidemia, and almost one out of two Hispanics (49.3%) or Whites (45.6%) had this condition (Figure 50).

Figure 51 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.

The prevalence of dyslipidemia among stroke cases seen between 2008 and 2017 was 75.8% (n=84,049) (Figure 51).

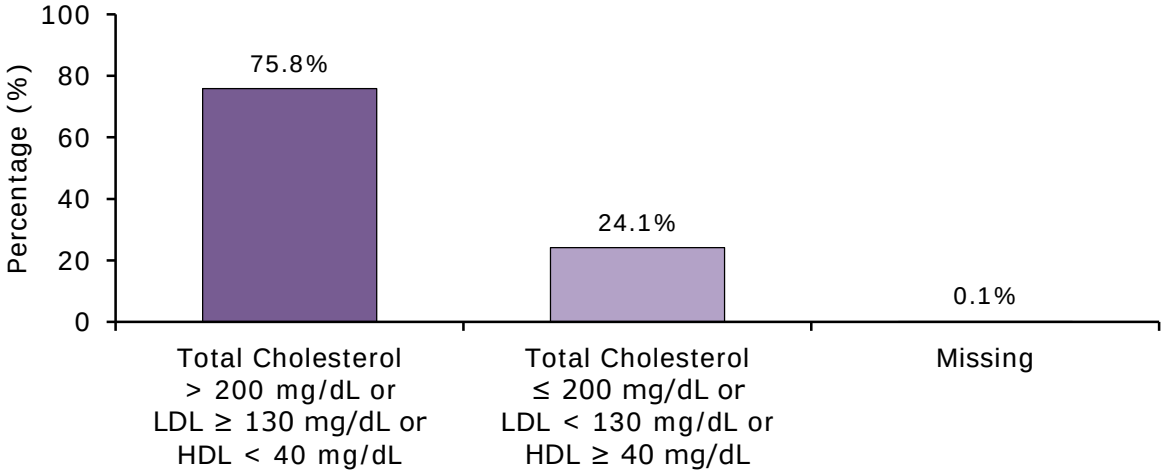

FIGURE 51. PREVALENCE OF DYSLIPIDEMIA AT TIME OF STROKE EPISODE OF CARE, 2008-2017.

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 for first ischemic stroke and appears to double the risk of stroke recurrence. (7) The prevalence of smoking reported as a previously known medical condition among all stroke cases was 17.3% (n=18,733) (Figure 52).

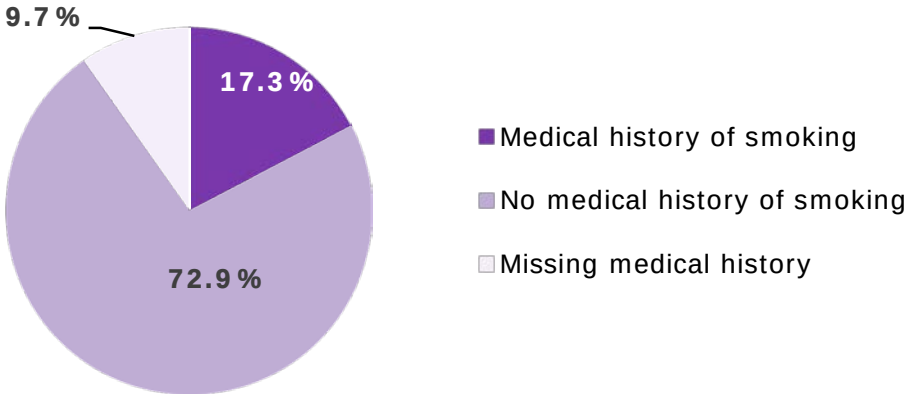

FIGURE 52. MEDICAL HISTORY OF SMOKING AMONG ADULT STROKE CASES, 2008-2017.

Among eligible adult stroke cases, smoking was more common among males than females, and was most common among Black or African Americans than other races (Figure 53).

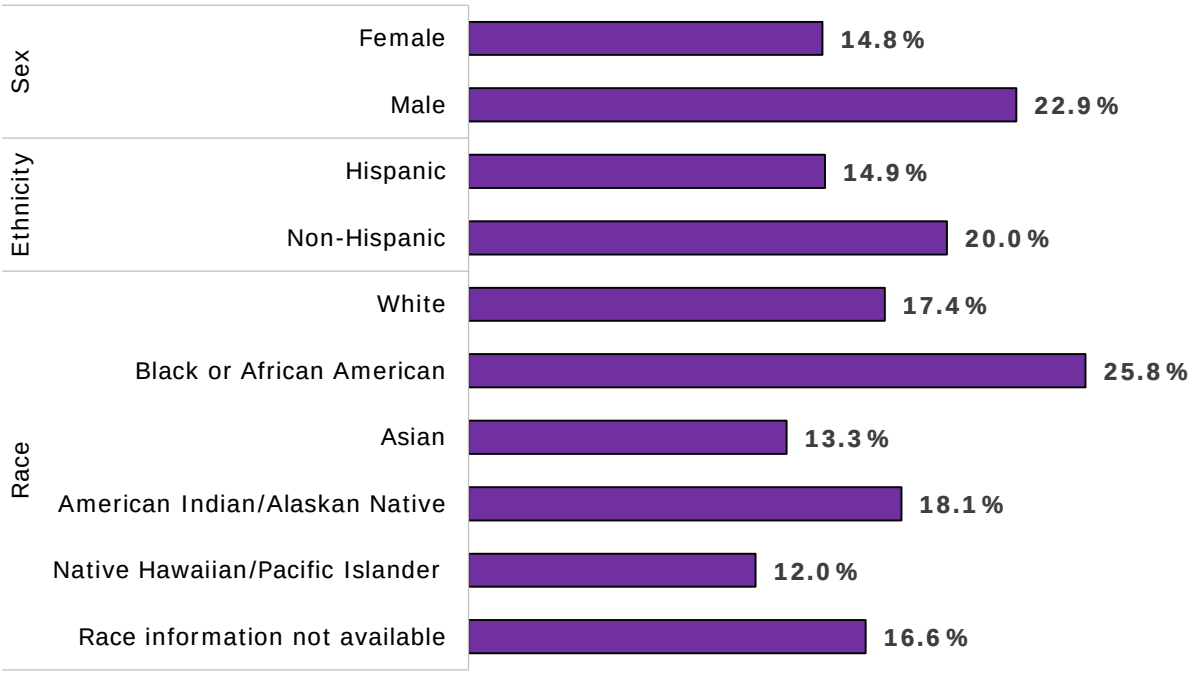

FIGURE 53. MEDICAL HISTORY OF SMOKING AMONG ADULT STROKE CASES BY SEX, ETHNICITY, AND RACE, 2008-2017.

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.

Of the eligible adult stroke cases with a self-reported history of smoking, 87 out of 100 (87.3%; n=16,266) received (or caregiver received) smoking cessation counseling prior to hospital discharge (Figure 54). 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.

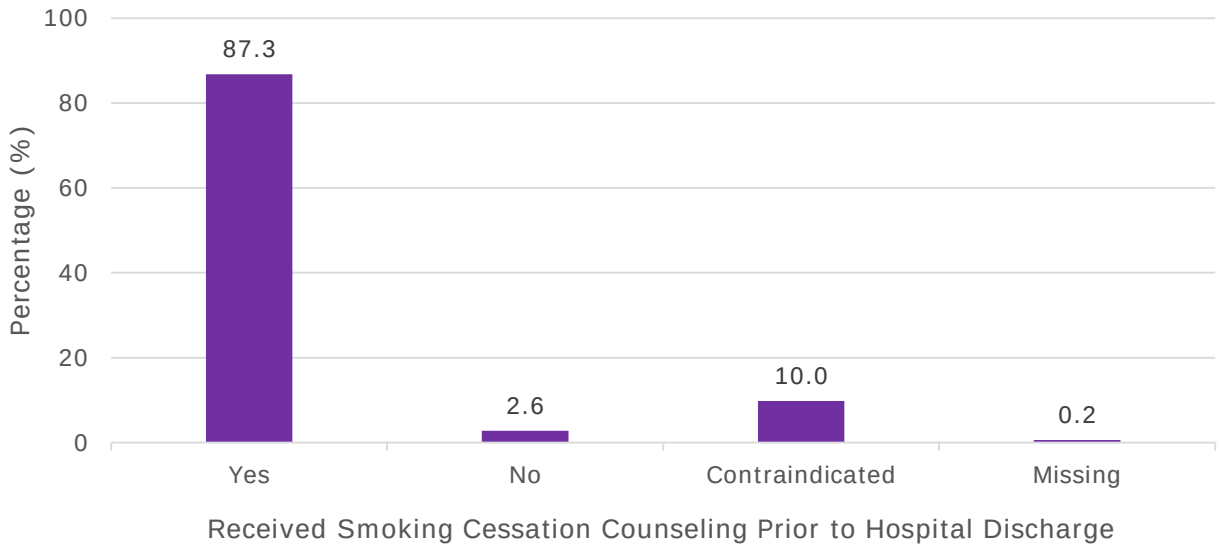

FIGURE 54. ADULT STROKE CASES WITH A HISTORY OF SMOKING, OR THEIR CAREGIVERS, WHO RECEIVED SMOKING CESSATION COUNSELING PRIOR TO HOSPITAL DISCHARGE, 2008-2017.

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 are associated with an increased risk of stroke, and this relationship appears to be linear in nature. Each unit (kg/m^2) increase in Body Mass Index (BMI) over 20 kg/m2 increases the risk of stroke by 5%. (8) Of all adult stroke patients, 14.4% (n=15,982) had overweight/obesity reported as a previously known medical condition (Figure 55).

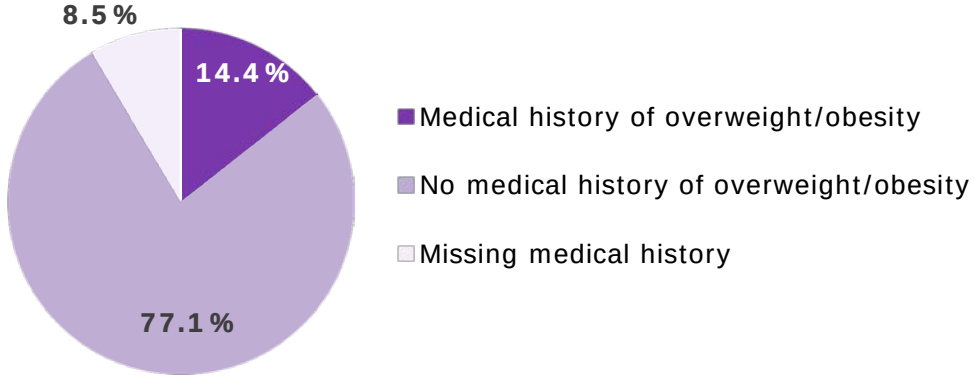

FIGURE 55. MEDICAL HISTORY OF OVERWEIGHT/OBESITY AMONG ADULT STROKE CASES, 2008-2017,

Among all adult stroke cases, overweight/obesity affected more Hispanics than non-Hispanics, and was less common among Asians than other races (Figure 56).

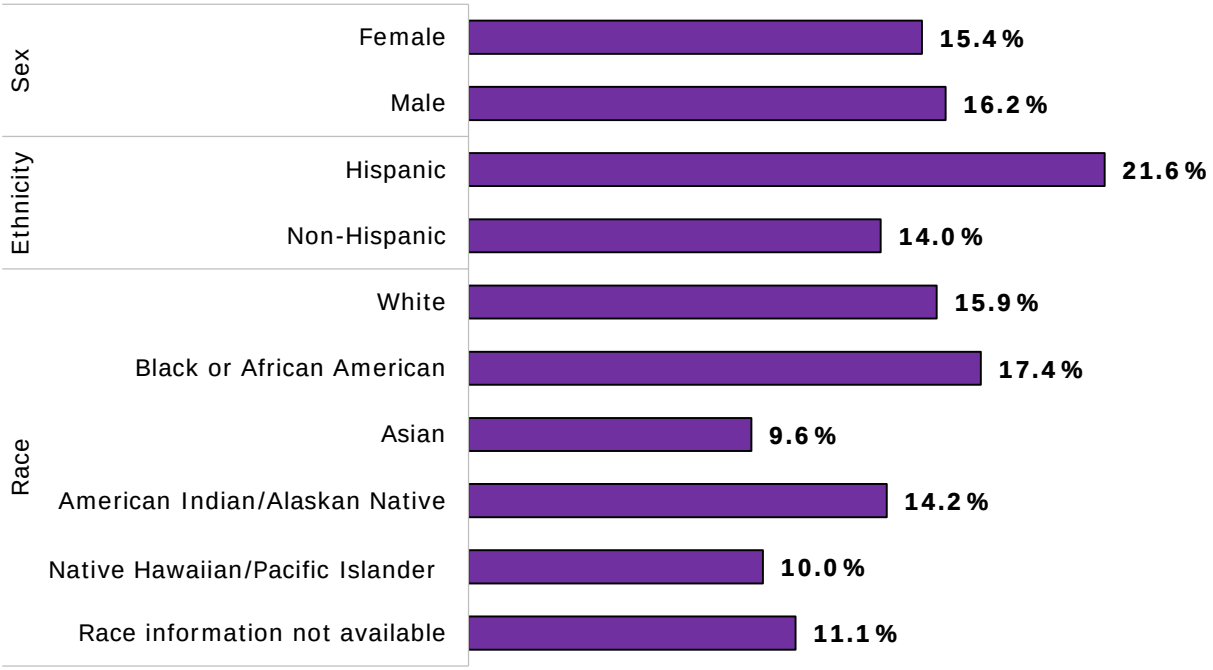

FIGURE 56. MEDICAL HISTORY OF OVERWEIGHT/OBESITY AMONG ADULT STROKE CASES BY SEX, ETHNICITY, AND RACE, 2008-2017.

The prevalence of overweight and obesity, reported as a BMI ≥ 25 kg/m^2 calculated from the patients' height and weight during the stroke episode of care was 45.5% (n=50,390) (Figure 57).

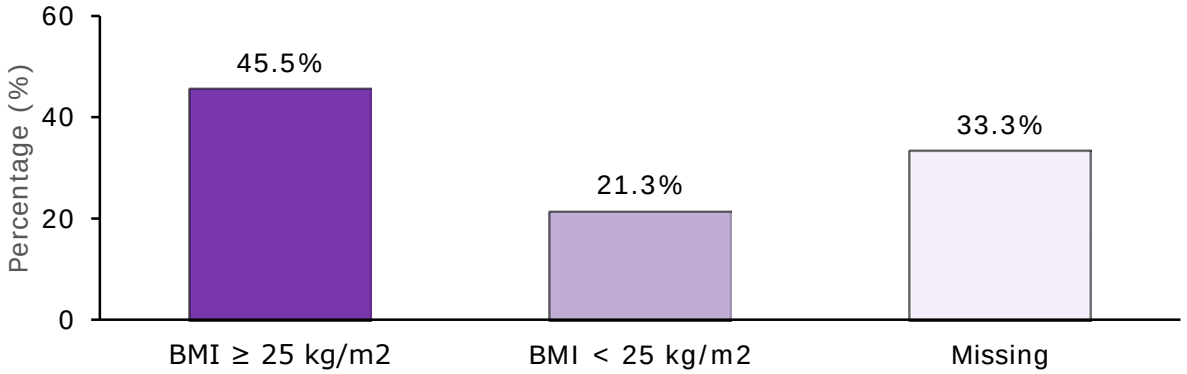

FIGURE 57 BODY MASS INDEX (BMI) CATEGORIES, KG/M^2, DURING STROKE EPISODE OF CARE, 2008-2017.

The significant difference between the prevalence of cases with self-reported medical history of overweight/obese (12.6%) and the actual measured prevalence of overweight/obese during the stroke episode of care (45.5%) indicates patients may underreport overweight/obesity. Among stroke cases with missing BMI information at time of stroke episode (33.3%; n=36,855), seven in 100 (6.8%; n=2,522) self-reported a medical history of 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. Estimated number and unadjusted prevalence of adults, 18 years and older, that report ever having had a stroke in Texas, by race/ethnicity, 2011-2016. (Pg. 6) Data source: Texas Behavioral Risk Factor Surveillance System (2011-2016).

Table 2 (Pg. 7)**.** Age-adjusted stroke hospitalization rate (per 10,000), all ages, in Texas, by race/ethnicity, 2010-2015. Data source: 2015 Texas Vital Statistics, Population Data; (2) 2015 Texas Vital Statistics, Mortality Data.

Table 3 (Pg. 7). Stroke hospital discharges and total charges by primary payment source, Texas, 2016. Data Source: Texas Health Care Information Collection (THCIC), Inpatient Hospital Discharge Public Use Data File, 2016.

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. 8). The 2011-2015, average age-adjusted number of deaths due to stroke per 100,000 people, all ages, by county, in Texas. Data source: County-level mortality data, 2011-2015, and County–level population data, 2011-2015; 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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1. *Mortality Report.* Center for Health Statistics, Texas Department of State Health Services, 2015.

2. *Texas Behavioral Risk Factor Surveillance System Public Use Data File.* Center for Health Statistics, Texas Department of State Health Services, 2016.

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8. American Heart Association/American Stroke Association. Guidelines for adult stroke rehabilitation and recovery. [Online] 2016. https://www.ahajournals.org/doi/pdf/10.1161/STR.0000000000000098.