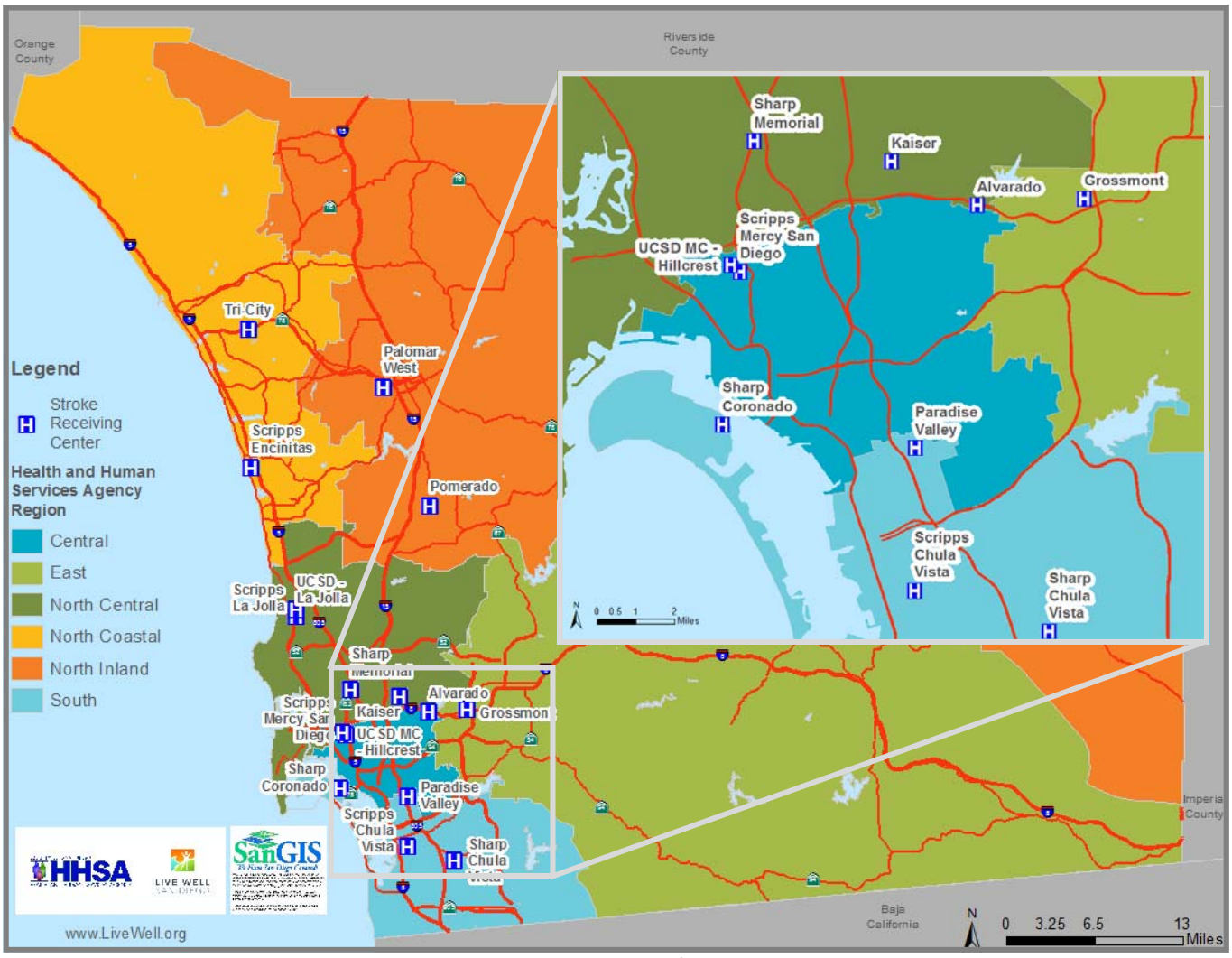
County of San Diego
Emergency Medical Services

San Diego County
Stroke Receiving System
2010-2014

San Diego County Stroke Receiving Centers, 2014



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Acknowledgments

This report represents a collaborative effort between many dedicated individuals. We gratefully acknowledge the contributions of the members of the San Diego County Stroke Consortium.

Additionally, we are grateful for the guidance and support of:

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Executive Summary

Overview of the San Diego County Stroke Receiving System

The San Diego County Stroke Receiving System was established in July 2009 to designate hospitals as stroke receiving centers and to create the San Diego County Stroke Receiving System Database for quality assurance and surveillance.

As of 2014, there were 16 stroke receiving centers in San Diego County. Two were comprehensive stroke centers and 11 were primary stroke centers, as certified by The Joint Commission. Another three hospitals were designated as a stroke receiving center by County of San Diego Emergency Medical Services (EMS).

Achievements of the Stroke Receiving System

- Organization and participation in Strike Out Stroke, an annual public education event about recognizing the symptoms of a stroke and understanding the health behaviors that increase the risk of a stroke.
- Stroke receiving centers worked with ambulance companies to improve communication so emergency department staff is prepared to receive patients and take them directly to receive a brain scan.
- Stroke receiving centers communicated with ambulance companies to decrease response time of interfacility transports.
- Administration of intravenous tissue Plasminogen Activator (IV tPA) for acute ischemic stroke (AIS) patients improves functional outcome. The percent of all AIS patients receiving IV tPA increased from 7.1% in 2010 to 12.4% in 2014, a slight decrease from 13.1% in 2013.
- In 2013, the Stroke Receiving System surpassed the Stroke Consortium goal of 50% of acute ischemic stroke cases receiving IV tPA should receive the treatment within 60 minutes of arrival to the stroke receiving center. In 2013, 56.1% of these cases received IV tPA within 60 minutes of arrival. In 2014, 64.7% of acute ischemic stroke cases receiving IV tPA received the treatment within 60 minutes of arrival. Cases receiving IV tPA within 60 minutes of arrival have better outcomes and fewer complications.

Live Well San Diego and the San Diego County Stroke Receiving System

The efforts of the stroke receiving centers, County of San Diego Emergency Medical Services, and partner organizations to provide the best care for patients suffering from a stroke directly supports *Live Well San Diego*. These efforts include providing the best clinical care as well as providing educational materials to patients who suffered from a stroke or are at risk of stroke. Outreach events, such as Strike Out Stroke, are important opportunities to teach the public to recognize stroke symptoms and to educate about the health behaviors that increase the risk of a stroke. These activities help residents to live healthy, safe, and thriving lives.

Stroke Receiving System Case Data

Between 2010 and 2014, 25,991 stroke cases have been treated by the San Diego County Stroke Receiving System's hospitals, or an average of 5,198 stroke cases treated each year. Of these:

- 66.0% were acute ischemic stroke (AIS)
- 18.8% were transient ischemic attack (TIA)
- 10.9% were intracerebral hemorrhage (ICH)
- 4.3% were subarachnoid hemorrhage (SAH)

Mode of Arrival

From 2010 to 2014, an average of 2,738 stroke cases arrived at a stroke receiving center by ambulance each year, or 8 stroke cases each day. Each year, more than half of all stroke cases arrived at a stroke center by emergency medical services (EMS):

- 52.7% arrived by EMS
- 37.8% arrived by private transport, or walk-in
- 9.5% were interfacility transfers

Length of Stay

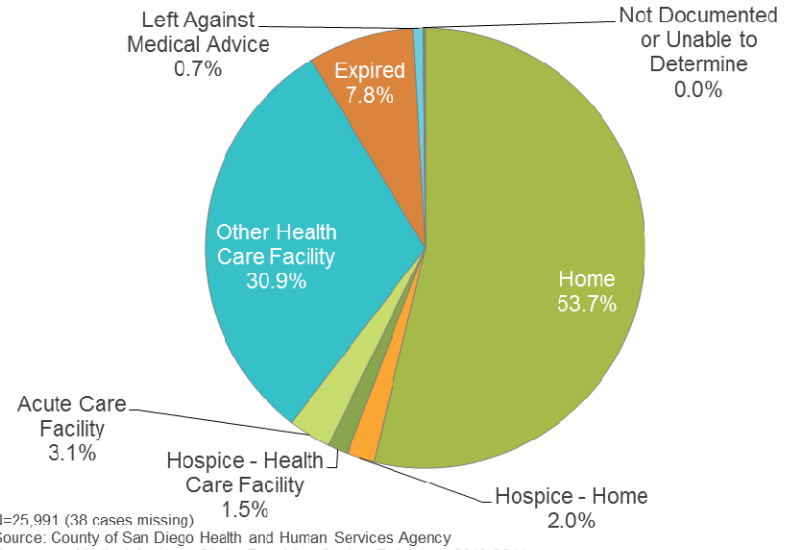
In 2014, half of the stroke cases had a length of stay of 2.4 days or less. The longest length of stay at a stroke receiving center was nearly four months.

Discharge Disposition

Among all stroke cases treated between 2010 and 2014, 53.7% were discharged home, 30.9% were discharged to another health care facility for further care and 7.8% expired in the hospital (Figure I).

Of the cases discharged to another health care facility, 68.2% went to a skilled nursing facility and 29.8% went to an inpatient rehabilitation facility.

Figure I. Percent of Stroke Cases by Discharge Disposition, San Diego County Stroke Receiving System, 2010-2014



N=25,991 (38 cases missing)
Source: County of San Diego Health and Human Services Agency Emergency Medical Services Stroke Receiving System Database, 2010-2014.

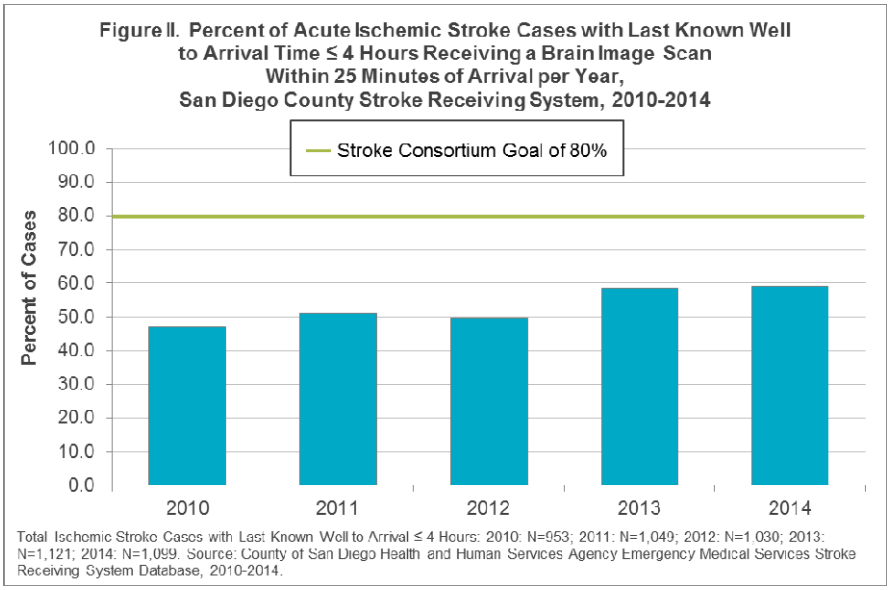
Acute Ischemic Stroke Cases and Stroke Consortium Goals

Last Known Well to Arrival Time

Among all acute ischemic stroke (AIS) cases, regardless of mode of arrival, 30.6% arrived at a stroke receiving center within four hours from when they were last known well (LKW). Cases that were transported by EMS arrived within four hours more often (41.8%) than AIS strokes arriving by another mode.

Arrival to Brain Image Time

The San Diego County Stroke Consortium created a goal of "80% of ischemic stroke cases arriving within four hours of last know well should receive a brain image scan within 25 minutes". Among the AIS cases arriving within four hours of LKW, 59.1% received a brain image scan within 25 minutes of their arrival (Figure II).

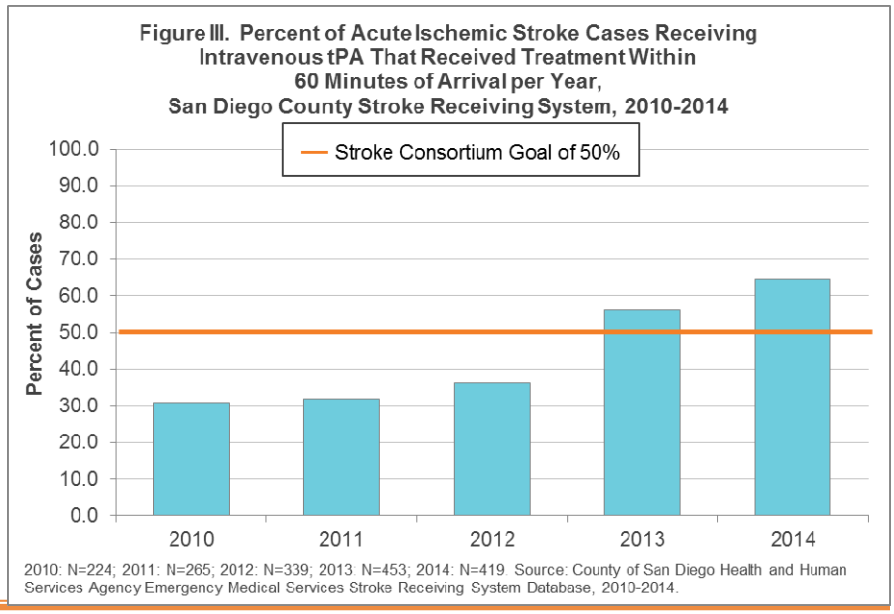


Arrival to Intravenous tPA Time

The percent of all AIS cases receiving intravenous (IV) tPA, regardless of LKW to arrival time, increased from 7.1% in 2010 to 12.4% in 2014.

The San Diego County Stroke Consortium created a goal of "50% of ischemic stroke cases receiving IV tPA should receive the treatment in 60 minutes or less of arrival".

In 2013, the Stroke Receiving System surpassed the Stroke Consortium goal with 56.1% of AIS cases that received IV tPA receiving the treatment within 60 minutes of arrival (Figure III).



San Diego County
Stroke Receiving System Overview

History of the Stroke Receiving System

The San Diego County Stroke Receiving System was established in July 2009 to designate hospitals as stroke receiving centers and to create the San Diego County Stroke Receiving System Database for quality assurance and surveillance.

Currently, there are 16 stroke receiving centers in San Diego County. Two are comprehensive stroke centers and 11 are primary stroke centers, as certified by The Joint Commission. Another three hospitals have been designated as a stroke receiving center by County of San Diego Emergency Medical Services (EMS). Each of the designated stroke receiving centers have met the requirements in County of San Diego EMS Policy S-461 and are recognized to receive 9-1-1 patients with symptoms of acute stroke. During the reporting period (2010-2014) EMS providers encountering a patient with symptoms of an acute stroke with symptom onset in the previous four hours will be taken to one of the stroke receiving centers. The emergence of stent retriever technology has lengthened the time from a patient's symptom onset to possible treatment to up to eight hours.

The 16 stroke receiving centers currently designated are:

Alvarado Hospital Medical Center	Scripps Mercy Hospital San Diego
Kaiser Foundation Hospital	Sharp Chula Vista Hospital
Palomar Medical Center	Sharp Coronado Hospital
Paradise Valley Hospital (joined in 2011)	Sharp Grossmont Hospital
Pomerado Hospital	Sharp Memorial Hospital
Scripps Memorial Hospital Encinitas	Tri-City Medical Center
Scripps Memorial Hospital La Jolla	UC San Diego Thornton Hospital
Scripps Mercy Hospital Chula Vista	UC San Diego Medical Center

San Diego County Stroke Consortium

As hospitals earned stroke center certification they recognized the need for a forum to discuss stroke treatment methodology and policies. As a result, a group of stroke program coordinators, managers, and neurologists formed to discuss issues related to the policies and guidelines for treatment of stroke patients.

Today, medical providers from each stroke receiving center along with staff from County of San Diego Emergency Medical Services and other partner organizations continue to meet quarterly as the San Diego County Stroke Consortium. Along with discussing stroke treatment, challenges, and successes of the stroke receiving system, they have also established evidence-based performance goals as a countywide system to be tracked each year.

Stroke Receiving System Data

Participating hospitals submit data to County of San Diego Emergency Medical Services each quarter. The first year, 2009, served as a pilot year, which included the review of stroke receiving centers' ability to submit data, quality of the data, and establishing guidelines for case inclusion. Formal data submission from the participating stroke centers began in January 2010.

To be included in the Stroke Receiving System Database, a stroke patient must be:

- Admitted to a stroke receiving center and received stroke work up (this does not include patients treated and discharged from the emergency department)
- Diagnosed with one of four stroke-related diagnoses (intracerebral hemorrhage, acute ischemic stroke, subarachnoid hemorrhage, or transient ischemic attack)
- The stroke must have occurred before admission to the hospital (not as an inpatient already admitted for another condition)

Surveillance of the Stroke Receiving System includes analysis of the total number of cases treated each year. Patients may have had multiple strokes, but any information allowing for identification of individual patients is not collected. Therefore, it is not possible to identify patients. Data from the Stroke Receiving System Database represents only stroke cases, not stroke patients.

It is also important to note that the number of cases in the Stroke Receiving System Database does not represent every stroke case that occurs in San Diego County. If a stroke is treated by a hospital that is not a member of the San Diego County Stroke Receiving System the case is not included in the database. For example, if a stroke receiving center provides care to a stroke patient in their emergency department but then transports the case to a non-stroke receiving center for further care, the case will not be entered in the database.

Lastly, it is possible that the same case may be counted twice. If a stroke patient is admitted to a stroke receiving center but is transferred to another stroke receiving center for further care, the case will be entered twice. It is appropriate to count these as two different cases because it accurately reflects the volume of cases treated at each stroke receiving center and the system as a whole.

Achievements of the Stroke Receiving System

- Organization and participation in Strike Out Stroke, an annual public education event about recognizing the symptoms of a stroke and understanding the health behaviors that increase the risk of a stroke.
- Stroke receiving centers worked with ambulance companies to improve communication so emergency department staff is prepared to receive patients and take them directly to receive a brain scan.
- Stroke receiving centers communicated with ambulance companies to decrease response time of interfacility transports.
- Administration of intravenous tissue Plasminogen Activator (IV tPA) for acute ischemic stroke (AIS) patients improves functional outcome.[1] The percent of all AIS patients receiving IV tPA increased from 7.1% in 2010 to 12.4% in 2014, a slight decrease from 13.1% in 2013.
- In 2013, the Stroke Receiving System surpassed the Stroke Consortium goal of 50% of acute ischemic stroke cases receiving IV tPA should receive the treatment within 60 minutes of arrival to the stroke receiving center. In 2013, 56.1% of these cases received IV tPA within 60 minutes of arrival. In 2014, 64.7% of acute ischemic stroke cases receiving IV tPA received the treatment within 60 minutes of arrival. Cases receiving IV tPA within 60 minutes of arrival have better outcomes and fewer complications.[2]

Next Steps for the San Diego County Stroke Receiving System

Recent evidence supports the value of endovascular procedures for the treatment of stroke. The procedure used to treat ischemic stroke is mechanical thrombectomy, in which a stent retriever is used to remove a blood clot at the site of the blocked blood vessel. After IV tPA administration for proximal large vessel occlusion, stent endovascular removal of the clot quickly results in improved outcomes for people suffering from strokes caused by large blood clots.[3] Endovascular procedure such as clipping and coiling to prevent ruptures can be used to treat certain hemorrhagic strokes.

In June 2015, the American Heart Association/American Stroke Association released updates regarding endovascular treatment to the *2013 Guidelines for the Early Management of Patients with Acute Ischemic Stroke*. Recommendations state the procedure should be done within six hours of the patient's last known well time and after the patient has received tPA.[1]

Currently, stent retrievers are used by all comprehensive stroke centers and many primary stroke centers.[4] If a patient is identified as qualifying for an endovascular procedure at a stroke receiving center that does not have the capabilities of performing a mechanical thrombectomy, the patient would be transferred to a center with the ability to perform the procedure.[4]

The new treatment guidelines will lead to updates in the San Diego County Stroke Receiving System protocols. Specifically, identification of patients qualifying for endovascular treatment and transferring these patients, if necessary, will be addressed. In turn, data submission among stroke receiving centers will be updated and surveillance of acute ischemic stroke cases receiving endovascular treatment will begin.

Live Well San Diego and the Stroke Receiving System

Live Well San Diego is a regional vision adopted by the San Diego County Board of Supervisors in 2010 that aligns the efforts of County government, community partners and individuals to help all San Diego County residents be healthy, safe, and thriving. The vision includes three components. Building Better Health, adopted on July 13, 2010, focuses on improving the health of residents and supporting healthy choices; Living Safely, adopted on October 9, 2012, focuses on protecting residents from crime and abuse, making neighborhoods safe, and supporting resilient communities; and, Thriving, adopted on October 21, 2014, focuses on cultivating opportunities for all people to grow, connect and enjoy the highest quality of life.

The ongoing efforts of the stroke receiving centers, County of San Diego Emergency Medical Services, and partner organizations to provide the best care possible for patients suffering from a stroke directly supports *Live Well San Diego*. These efforts not only include providing the best clinical care but also providing educational materials to patients who have suffered from a stroke or may be at risk of stroke. Outreach events, such as Strike Out Stroke, are important opportunities to teach the public to recognize stroke symptoms and to educate about the health behaviors that increase the risk of a stroke. These activities help residents to live healthy, safe, and thriving lives.

References

1. Stroke Treatments. (Last reviewed 2013, May 23). Retrieved August 12, 2015. http://www.strokeassociation.org/STROKEORG/AboutStroke/Treatment/Stroke-Treatments_UCM_310892_Article.jsp.
2. Fonarow GC, Zhao X, Smith EE, et al. Door-to-Needle Times for Tissue Plasminogen Activator Administration and Clinical Outcomes in Acute Ischemic Stroke Before and After a Quality Improvement Initiative.JAMA. 2014;311(16):1632-1640. doi:10.1001/jama.2014.3203.
3. Clot-removing devices provide better outcomes for stroke survivors - News on Heart.org. (2015, February 11). Retrieved August 12, 2015. http://blog.heart.org/clot-removing-devices-provide-better-outcomes-stroke-survivors/.
4. Guidelines urge new approach to treating worst strokes - News on Heart.org. (2015, June 29). Retrieved August 12, 2015. http://blog.heart.org/guidelines-urge-new-approach-to-treating-worst-strokes/.
5. Live Well San Diego. http://www.livewellsd.org/.

Stroke Cases Overview

The data presented in the following sections represent stroke cases, which is different than stroke patients. Someone may have had more than one stroke and therefore more than one record for that patient would be included in the data. However, the Stroke Receiving System Database does not contain any fields that would allow for the identification of individual patients.

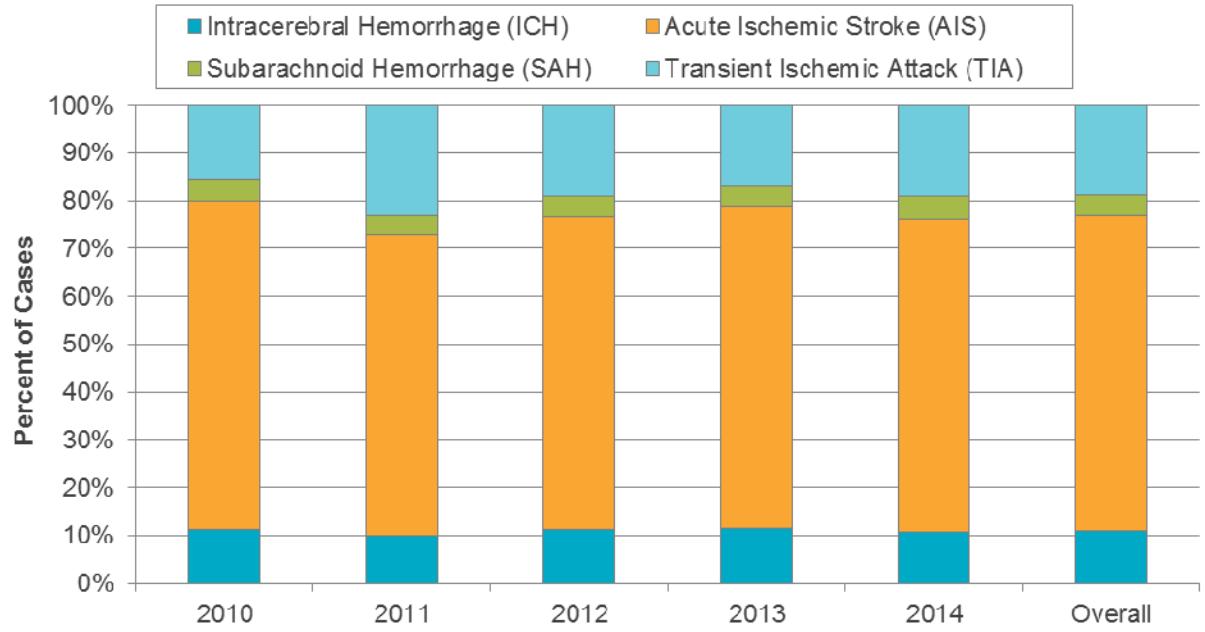
Stroke Receiving System Case Volume

Between 2010 and 2014, 25,991 stroke cases have been treated by the San Diego County Stroke Receiving System's hospitals (also referred to as stroke receiving centers). This was an average of 5,198 stroke cases treated by a stroke receiving center each year. Of these:

- 66.0% were acute ischemic stroke (AIS)
- 18.8% were transient ischemic attack (TIA)
- 10.9% were intracerebral hemorrhage (ICH)
- 4.3% were subarachnoid hemorrhage (SAH)

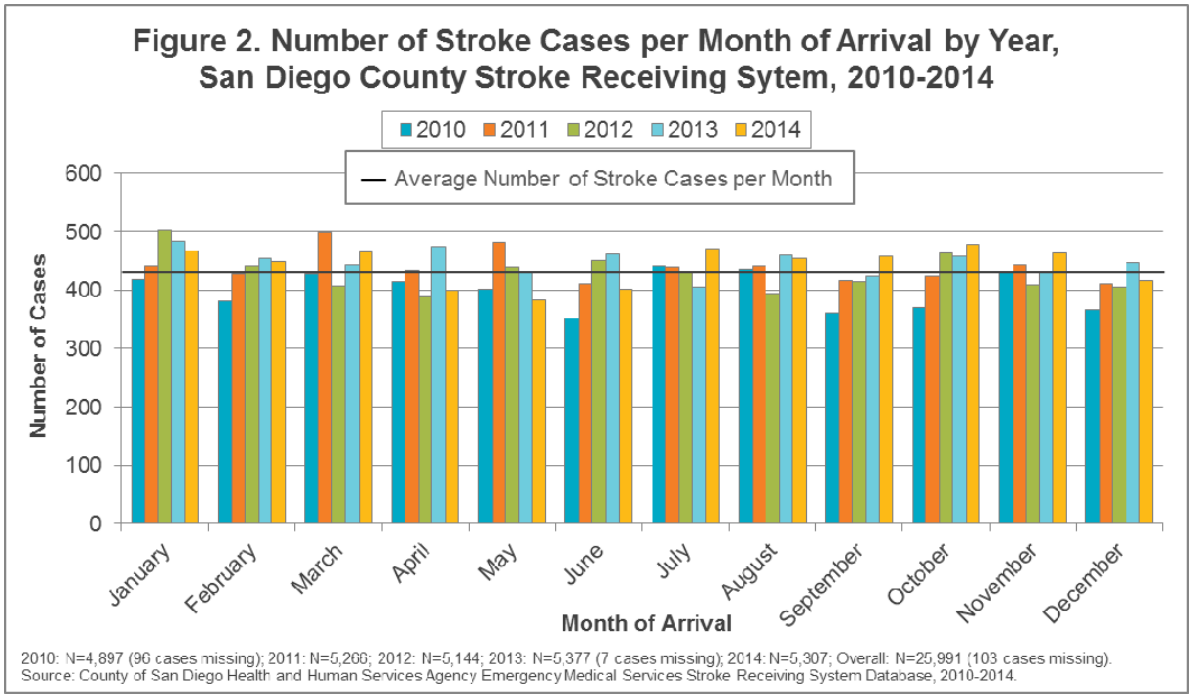
The percent of stroke cases by diagnosis for each year and overall, is shown in Figure 1.

Figure 1. Percent of Stroke Cases by Diagnosis per Year, San Diego County Stroke Receiving System, 2010-2014



2010: N=4,897; 2011: N=5,266; 2012: N=5,144; 2013: N=5,377; 2014: N=5,307; Overall: N=25,991. Source: County of San Diego Health and Human Services Agency Emergency Medical Services Stroke Receiving System Database, 2010-2014.

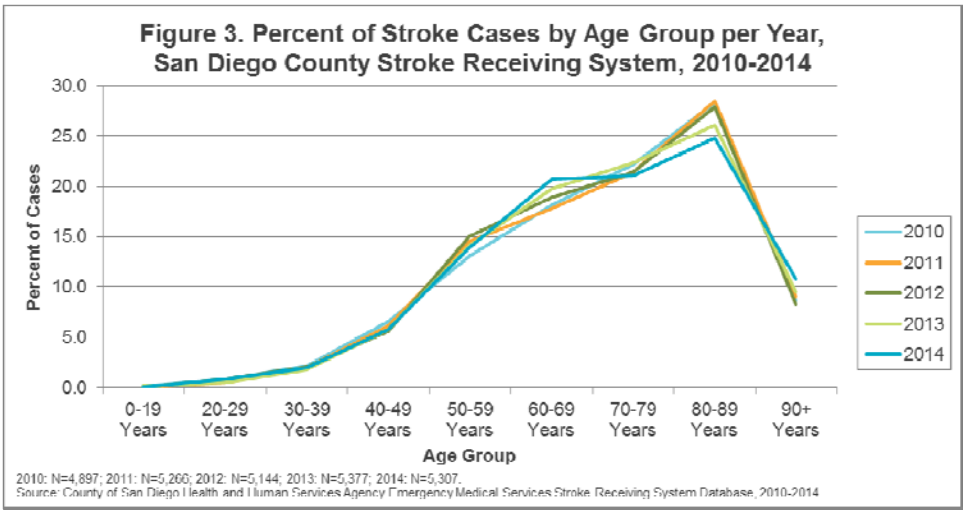
Between 2010 and 2014, an average of 433 stroke cases were treated each month at one of the stroke receiving centers, or 14 strokes treated each day. The most cases treated in a single month was 501 cases in January 2012, whereas the minimum number of cases occurred in June 2010, with 352 cases (Figure 2). The highest number of cases accessing the Stroke Receiving System on a single day was 30, on January 7, 2013.



Overall, stroke cases arrived at a stroke receiving center most often on a Monday (15.0%) and least often on a Saturday (13.2%) or Sunday (13.3%). More than one third of stroke cases arrived between 12:00 pm and 5:59 pm and another 30.6% arrived between 6:00 am and 11:59 am. Overall, this was consistent regardless of the day of the week of arrival.

Age and Gender

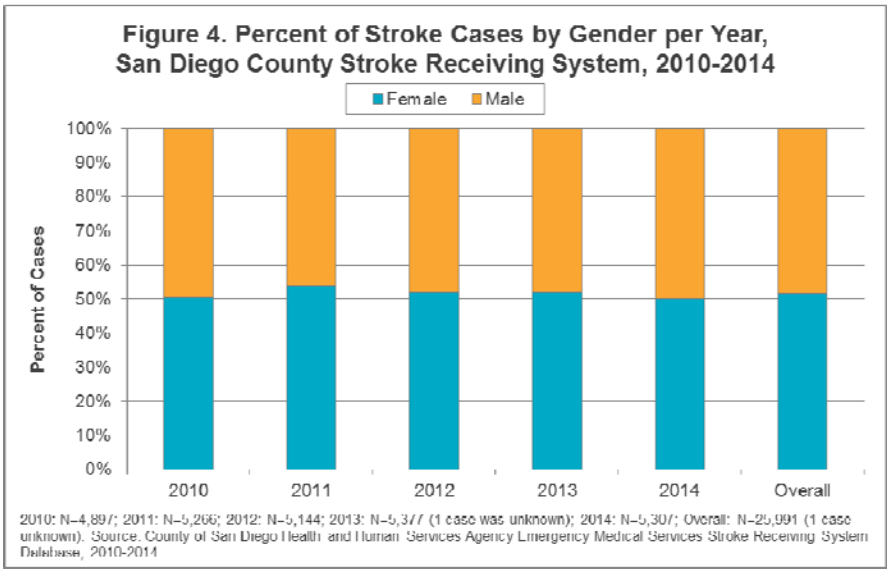
From 2010-2014, the average age among all stroke cases was 71.4 years old. However, there were more cases among 80-89 years olds than any other age group. This has remained consistent from 2010 to 2014 (Figure 3).



Overall, among the 80-89 year age group, 68.0% of strokes were diagnosed as ischemic strokes and 20.7% were transient ischemic attacks.

Among all stroke cases age 0-49 years old, 56.2% were diagnosed as ischemic strokes, while another 15.9% were intracerebral hemorrhages, 15.2% were transient ischemic attacks, and 12.7% were subarachnoid hemorrhages.

Overall, just over half (51.6%) of all stroke cases were female. This remained consisted from 2010 to 2013. In 2014, there were slightly more stroke cases among males than females (Figure 4).



Among all male stroke cases, more than two-thirds (67.5%) were ischemic strokes. The next most common type of stroke among male cases was transient ischemic attack (17.3%). Ischemic stroke cases were also the most common type of stroke among female cases (64.5%), followed by transient ischemic attacks (20.2%).

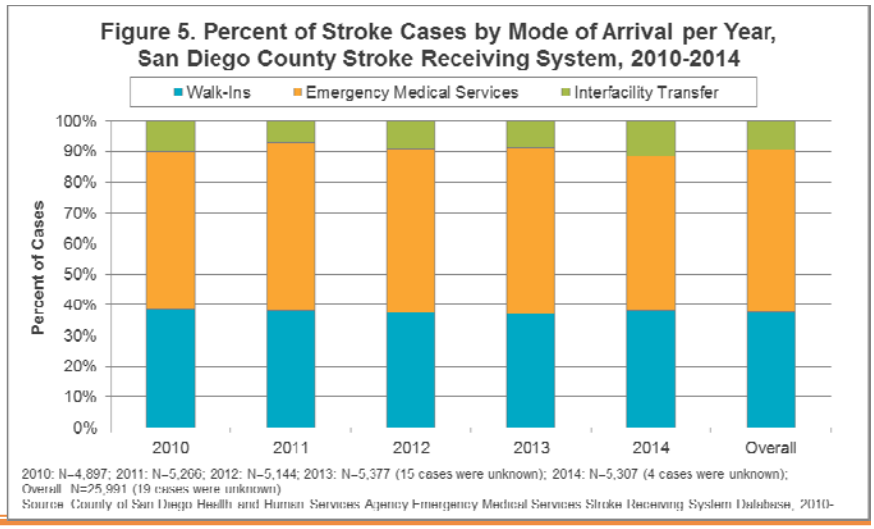
Mode of Arrival

From 2010 to 2014, an average of 2,738 stroke cases arrived at a stroke receiving center by ambulance each year, or an average of 8 stroke cases each day. San Diego County's Emergency Medical Services (EMS) system was activated to facilitate the transport of these patient to the appropriate stroke receiving center.

Each year, more than half of all stroke cases arrived by EMS (Figure 5):

- 52.7% arrived by EMS
- 37.8% arrived by private transport, or walk-in
- 9.5% were transported from a hospital to a stroke center for further care (interfacility transfer)

Among cases arriving by EMS from 2010 to 2014, two thirds were ischemic strokes.



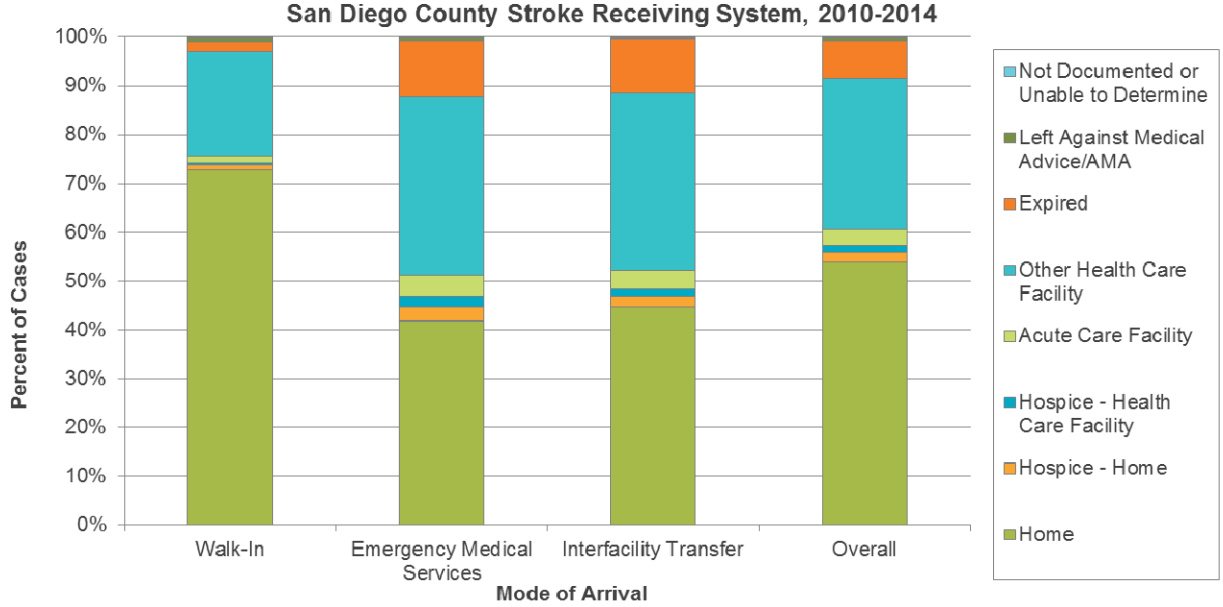
Length of Stay

In 2014, the median length of stay was 2.4 days, or half of all stroke cases had a length of stay of 2.4 days or less (data before 2014 is unavailable). Some cases were discharged on the same day they were admitted to the stroke receiving center. The longest length of stay was nearly four months.

Discharge Disposition

Each year, stroke cases were most commonly discharged home after hospitalization (53.7%). Walk-in stroke cases were discharged home 72.8% of the time, whereas 41.8% of stroke cases arriving via EMS were discharged home. From 2010 to 2014, nearly one-third of patients were discharged to another health care facility for further care (Figure 6).

Figure 6. Percent of Stroke Cases by Discharge Disposition per Mode of Arrival, San Diego County Stroke Receiving System, 2010-2014



Walk-In: N=9,816 (15 cases missing discharge disposition); Emergency Medical Services: N=13,688 (23 cases missing discharge disposition); Interfacility Transfer: N=2,468; Overall: N=25,991 (38 cases missing discharge disposition, 19 cases missing mode of arrival). Source: County of San Diego Health and Human Services Agency Emergency Medical Services Stroke Receiving System Database, 2010-2014.

On average, 404 stroke cases expired each year from 2010 to 2014. Expired cases account for 7.8% of all stroke cases each year. Of the expired cases, nearly half were ischemic stroke cases and 39.4% were intracerebral hemorrhage cases.

Of the cases discharged to a health care facility:

- 68.2% went to a skilled nursing facility
- 29.8% went to an inpatient rehabilitation facility
- 1.5% went to a long term care hospital
- 0.3% went to an intermediate care facility
- 0.3% went to another type of facility

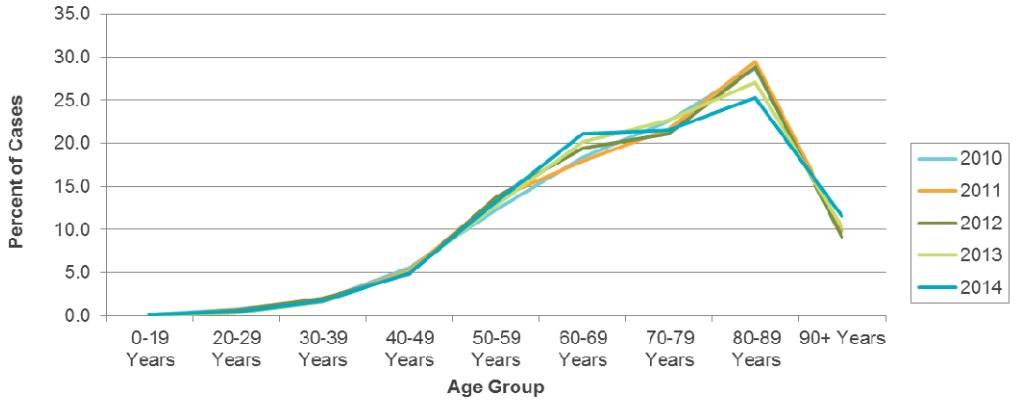
Acute Ischemic Stroke

The most common type of stroke each year was an acute ischemic stroke (AIS). From 2010 to 2014, AIS cases accounted for 66.0% of all strokes treated by a stroke receiving center in San Diego County. On average, there were 3,430 AIS cases treated each year, or nine AIS cases treated each day.

Age and Gender

A diagnosis of AIS was the most common type of stroke among all age groups. The average age of the patients diagnosed as an AIS case was 72.3 years old. However, the most common age group treated with an AIS case was 80-89 years (27.9%), followed by the 70-79 year age group (21.9%) (Figure 7).

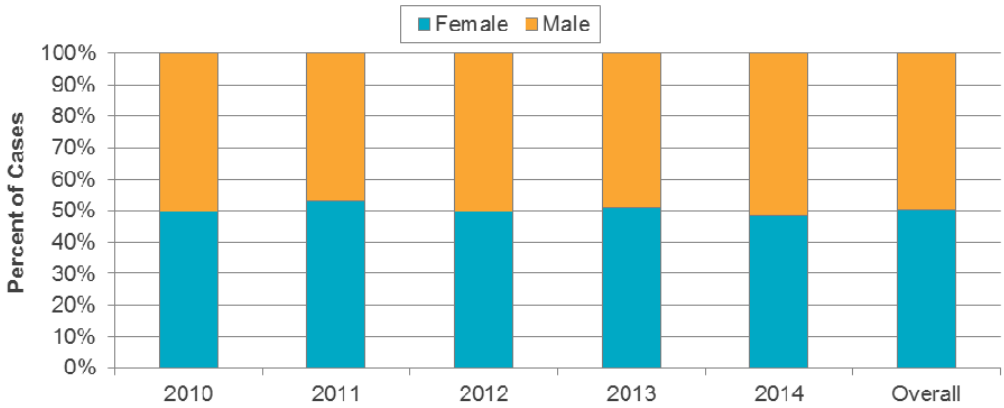
Figure 7. Percent of Acute Ischemic Stroke Cases by Age Group per Year, San Diego County Stroke Receiving System, 2010-2014



2010: N=3,369; 2011: N=3,317; 2012: N=3,366; 2013: N=3,628; 2014: N=3,468.
Source: County of San Diego Health and Human Services Agency Emergency Medical Services Stroke Receiving System Database, 2010-2014.

Overall, there were just slightly more female AIS cases than male cases (Figure 8). Each year, this was an average of 1,730 female and 1,700 male AIS cases.

Figure 8. Percent of Acute Ischemic Stroke Cases by Gender per Year, San Diego County Stroke Receiving System, 2010-2014

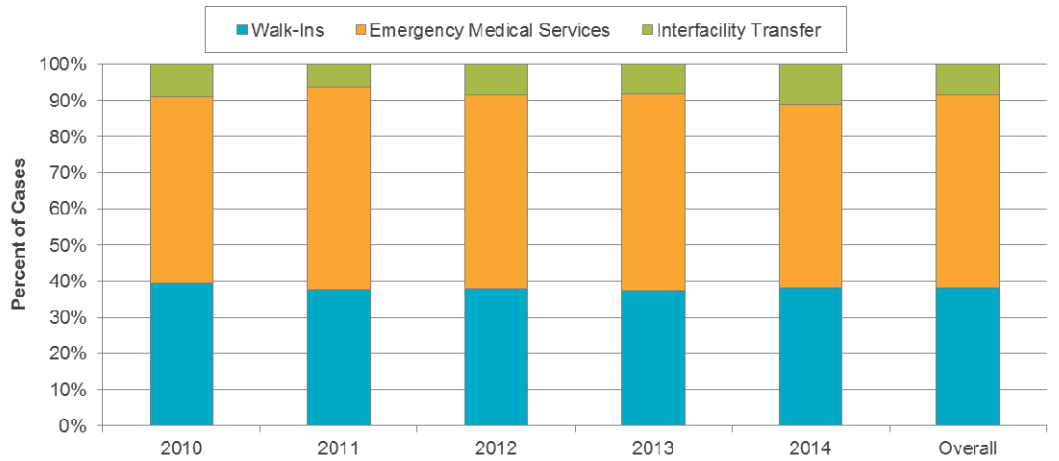


2010: N=3,369; 2011: N=3,317; 2012: N=3,366; 2013: N=3,628 (1 case unknown); 2014: N=3,468; Overall: N=17,148 (1 case unknown). Source: County of San Diego Health and Human Services Agency Emergency Medical Services Stroke Receiving System Database, 2010-2014.

Mode of Arrival

From 2010 to 2014, just over half (53.3%) of all AIS cases arrived at a stroke receiving center via EMS (Figure 9). This was consistent across all years. The second most common mode of arrival among AIS cases was walk-in (38.0%).

Figure 9. Percent of Acute Ischemic Stroke Cases by Mode of Arrival per Year, San Diego County Stroke Receiving System, 2010-2014



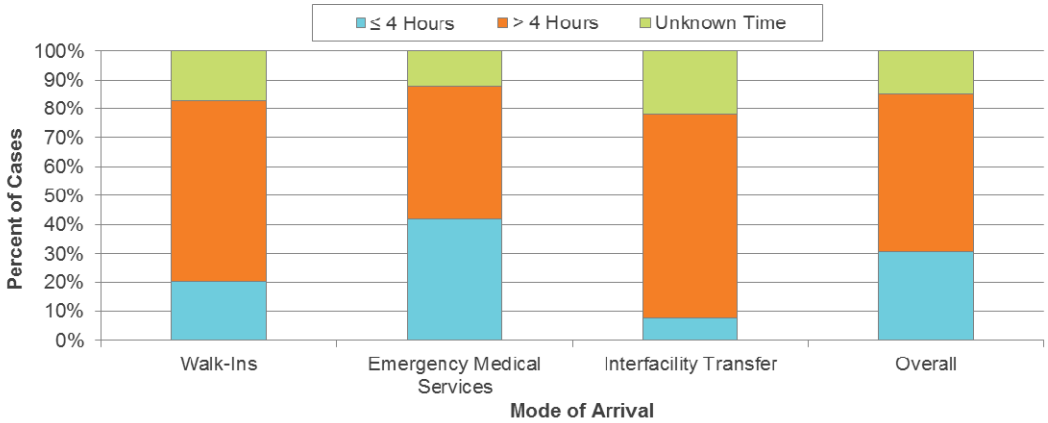
2010: N=3,369; 2011: N=3,317; 2012: N=3,366; 2013: N=3,528 (10 cases were unknown); 2014: N=3,468 (3 cases were unknown); Overall: N=17,148 (13 cases were unknown). Source: County of San Diego Health and Human Services Agency Emergency Medical Services Stroke Receiving System Database, 2010-2014.

Last Known Well to Arrival Time

Along with other factors, the last time the patient was known to be well (LKW) to the time the patient arrives at the stroke receiving center determines if they qualify to receive reperfusion treatment. IV tPA can improve a patient's functional outcome after an ischemic stroke.

Among all AIS cases from 2010 to 2014, 30.6% were reported to arrive at a stroke receiving center within four hours from LKW. Cases that were transported by EMS arrived within four hours more often (41.8%) than AIS strokes arriving by another mode (Figure 10).

Figure 10. Percent of Acute Ischemic Stroke Cases by Last Known Well to Arrival Time per Mode of Arrival, San Diego County Stroke Receiving System, 2010-2014



Walk-Ins: N=6,518; Emergency Medical Services: N=9,142; Interfacility Transfer: N=1,475; Overall: N=17,148; 13 cases unknown mode of arrival. Source: County of San Diego Health and Human Services Agency Emergency Medical Services Stroke Receiving System Database, 2010-2014.

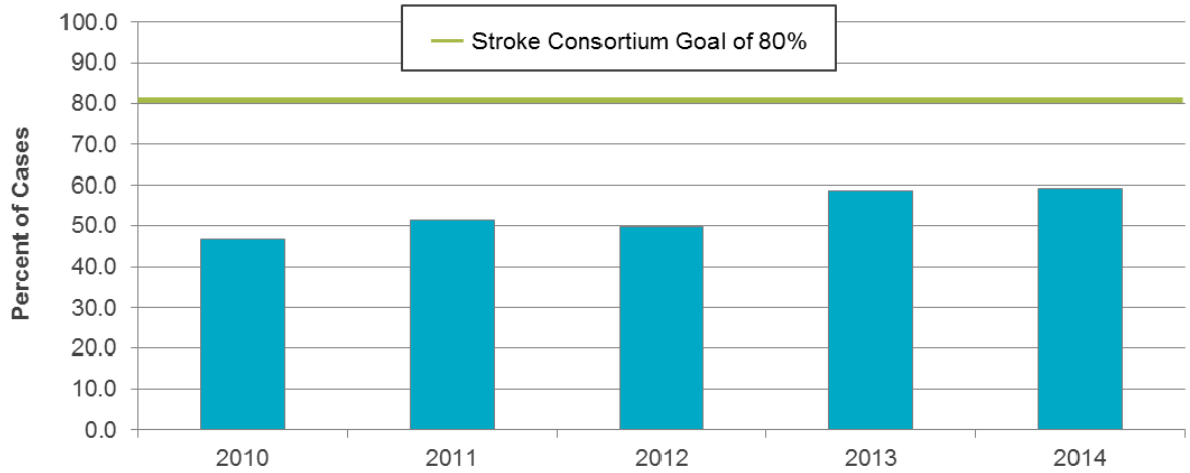
Arrival to Brain Image Time

The American Heart Association (AHA) and American Stroke Association (ASA) defined one of their Stroke Reporting Measures as the "percent of patients who receive brain imaging within 25 minutes of arrival". The San Diego County Stroke Consortium further defined this measure to create a goal of "80% of ischemic stroke cases arriving within four hours of last known well should receive a brain image scan within 25 minutes".

Among all AIS cases from 2010 to 2014, regardless of LKW to arrival time, 24.7% received a brain image scan within 25 minutes from arrival at the stroke receiving center. Half of the AIS cases received their brain image scan within 55 minutes after arrival. Among AIS cases arriving by EMS, half received their brain image scan within 39 minutes of arrival.

Among all AIS cases arriving within four hours of LKW, 59.1% received a brain image scan within 25 minutes of their arrival in 2014, an increased from 47.0% in 2010 (Figure 11).

Figure 11. Percent of Acute Ischemic Stroke Cases with Last Known Well to Arrival Time ≤ 4 Hours Receiving a Brain Image Scan Within 25 Minutes of Arrival per Year, San Diego County Stroke Receiving System, 2010-2014



Total Ischemic Stroke Cases with Last Known Well to Arrival ≤ 4 Hours: 2010: N=953; 2011: N=1,049; 2012: N=1,030; 2013: N=1,121; 2014: N=1,099. Source: County of San Diego Health and Human Services Agency Emergency Medical Services Stroke Receiving System Database, 2010-2014.

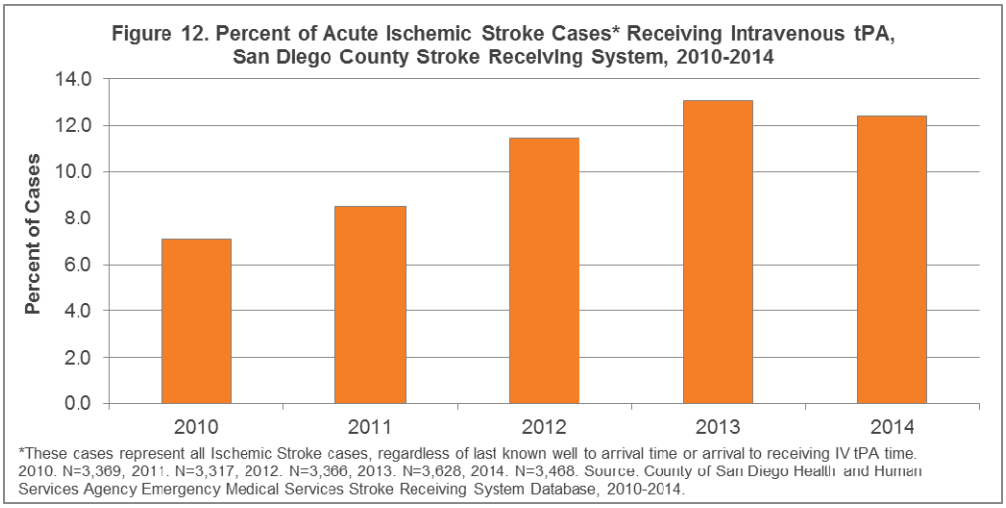
Stroke receiving centers and EMS worked to improve communication so emergency department (ED) staff is prepared to send the patient to receive a brain image scan upon arrival. Overall, 60.6% of AIS cases with a LKW to arrival time of less than four hours arriving by EMS received a brain image scan within 25 minutes of arrival. In 2014, half of AIS cases arriving at a stroke receiving center via EMS within four hours of the LKW time received a brain image scan within 17 minutes of arrival (median arrival to brain image scan time), which decreased from 23 minutes in 2010.

Arrival to Intravenous tPA Time

The AHA/ASA defined a Stroke Reporting Measure for IV tPA as the "percent of ischemic stroke patients receiving IV tPA at your hospital who are treated within 60 minutes after triage (ED arrival)". This same measure was used in the first phase of Target: Stroke, a study conducted by AHA and ASA in 2010 as part of a national quality improvement initiative.

The San Diego County Stroke Consortium further refined this measure to create a goal of "50% of ischemic stroke cases receiving IV tPA should receive the treatment in 60 minutes or less of arrival".

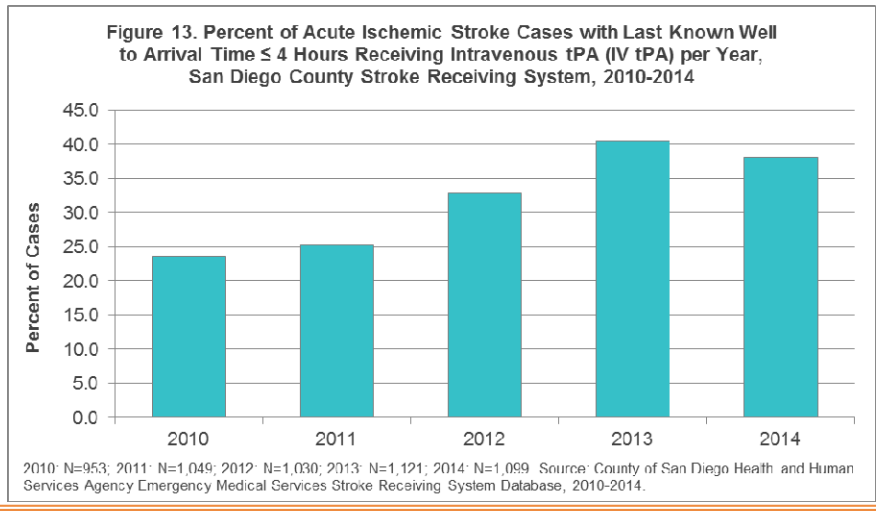
The percent of all AIS cases, regardless of LKW to arrival time, receiving IV tPA increased from 7.1% in 2010 to 12.4% in 2014 (Figure 12). This was a slight dip from a high of 13.1% in 2013.



In fact, the number of AIS cases receiving IV tPA has increased by 79.9% from 2010 to 2014, whereas the total number of AIS cases has only increased by 2.9% during the same timeframe.

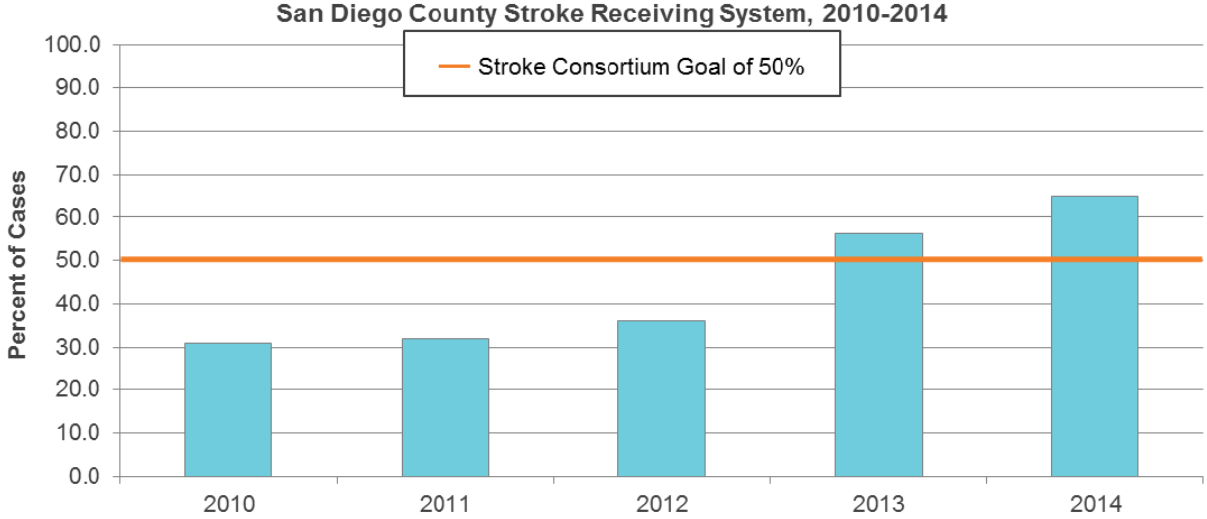
In 2014, half of the AIS cases receiving IV tPA were treated within 54 minutes of arrival (median arrival to IV tPA treatment time). This was a decrease from 76 minutes in 2010. Half of the AIS cases arriving by EMS and receiving IV tPA in 2014 received the treatment within 53 minutes of arrival, a decrease from 75.5 minutes in 2010.

The percent of AIS cases arriving within four hours of LKW that received IV tPA increased from 23.5% in 2010 to 38.1% in 2014 (Figure 13). Cases arriving within four hours of LKW that did not receive IV tPA generally did not qualify for treatment due to improving symptoms or contraindications such as the patient taking blood thinners.



In 2013, the Stroke Receiving System surpassed the Stroke Consortium goal for IV tPA with 56.1% of AIS cases receiving IV tPA within 60 minutes of arrival. The percent of these cases receiving IV tPA within 60 minutes of arrival increased from 31.0% in 2010 to 64.7% in 2014 (Figure 14).

Figure 14. Percent of Acute Ischemic Stroke Cases Receiving Intravenous tPA That Received Treatment Within 60 Minutes of Arrival per Year, San Diego County Stroke Receiving System, 2010-2014



2010: N=239; 2011: N=282; 2012: N=385; 2013: N=474; 2014: N=430.
Source: County of San Diego Health and Human Services Agency Emergency Medical Services Stroke Receiving System Database, 2010-2014.

In 2014, more than two thirds (67.6%) of AIS cases arriving by EMS within four hours of LKW received IV tPA within 60 minutes compared to only one third (32.4%) in 2010. The number of AIS cases arriving by EMS within four hours of LKW receiving IV tPA increased by 87.2% from 2010 to 2014. The number of these cases receiving IV tPA within 60 minutes increased by 290.2% during the same time period. In comparison, the total number of AIS cases arriving by EMS within four hours of LKW increased by only 16.3%.

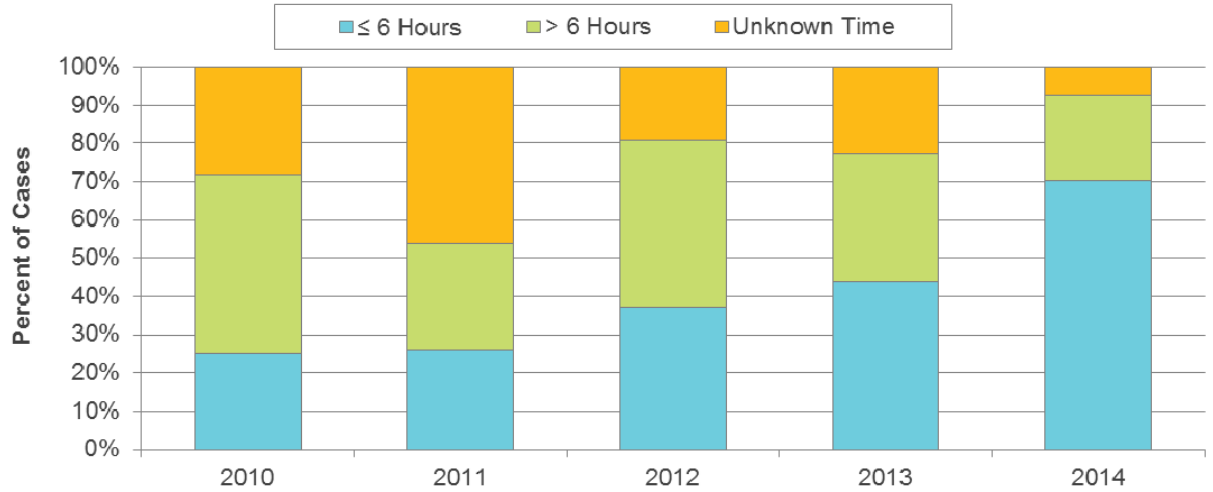
Arrival to Intra-arterial Intervention Time

Another procedure used for treating AIS cases is intra-arterial (IA) intervention, which delivers tPA directly to the site of the blockage in the brain, and removal of the clot. Cases may receive more than one IA intervention while hospitalized for treatment but information is only submitted about the first IA intervention received. Between 2010 and 2014, a total of 300 AIS cases received at least one IA intervention, with an average of 60 cases receiving at least one IA intervention each year.

Generally, AIS cases arriving at a stroke receiving center within six hours of their LKW time may be candidates for receiving an IA intervention. Between 2010 and 2014, half of the AIS cases receiving an IA intervention received the treatment within 5.7 hours from LKW. This time decreased from 7.9 hours in 2010 to 4.0 hours in 2014.

In 2010, one quarter of the AIS cases receiving an IA intervention had a LKW to IA intervention time of less than six hours. By 2014, 70.4% of the AIS cases receiving an IA intervention received it within 6 hours of their LKW time (Figure 15).

Figure 15. Percent of Acute Ischemic Stroke Cases Receiving an Intra-arterial (IA) Intervention by Last Known Well to IA Intervention Time per Year, San Diego County Stroke Receiving System, 2010-2014



2010: N=64; 2011: N=54; 2012: N=62; 2013: N=66; 2014: N=54. Source: County of San Diego Health and Human Services Agency Emergency Medical Services Stroke Receiving System Database, 2010-2014.

Between 2010 and 2014, among AIS cases arriving via EMS and receiving an IA intervention, half received their first IA intervention within 4.9 hours from LKW. In 2010, half of these cases received the IA intervention within 6.3 hours of LKW, compared to 3.8 hours in 2014.

Length of Stay

Among all AIS cases treated in 2014, regardless of LKW to arrival time or treatment received, half of the cases had a length of stay of 2.6 days or less. The longest length of stay was nearly 4 months. Among AIS cases arriving via EMS in 2014, half of the cases had a length of stay of 3.1 days or less.

In 2014, half of the AIS cases receiving IV tPA, regardless of LKW to arrival time, had a length of stay of 3.0 days or less (median length of stay). Half of the AIS cases that did not receive IV tPA had a length of stay of 2.6 days or less. The longer length of stay for cases receiving IV tPA may reflect the amount of time needed to administer the medication and the time needed to monitor the patient after IV tPA administration.

In 2014, half of the AIS cases that received an IA intervention had a length of stay of 6.3 days or less. The longest length of stay was 29.1 days. Half of AIS cases arriving via EMS receiving an IA intervention had a length of stay of 6.1 days.

Among AIS cases that received an IA intervention within six hours of LKW, half had a length of stay of 5.7 days or less. Half of the AIS cases arriving via EMS and receiving an IA intervention within six hours of LKW also had a length of stay of 5.7 days or less.

Discharge Disposition

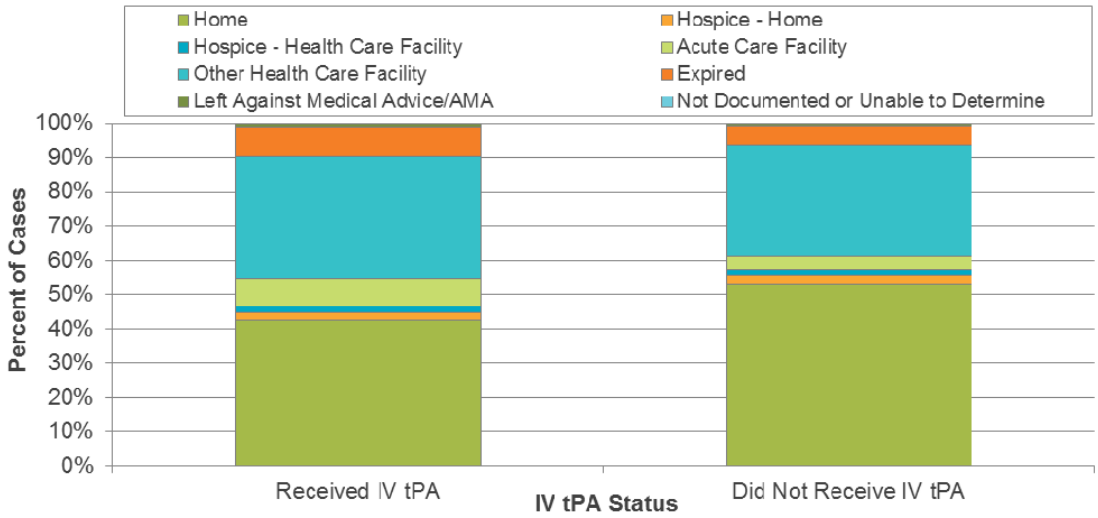
AIS cases treated from 2010 to 2014 were most commonly discharged home (49.3%), 37.0% were discharged to a health care facility for further care, and 5.6% expired at the stroke receiving center. The AIS expired cases accounted for nearly half (47.7%) of all expired stroke cases. The discharge disposition of AIS cases has remained consistent each year from 2010 to 2014.

Among the AIS cases discharged to a health care facility from 2010 to 2014, two in three cases went to a skilled nursing facility while 30.0% went to an inpatient rehabilitation facility.

AIS cases with a LKW to arrival time of less than four hours and received IV tPA (Figure 16):	AIS cases with a LKW to arrival time of less than four hours and did not receive IV tPA (Figure 16):

♦ 42.5% discharged home
♦ 35.8% discharged to a health care facility, of these cases:
  ♦ 58.6% went to a skilled nursing facility
  ♦ 40.3% went to an inpatient rehabilitation facility
♦ 8.8% expired
♦ 8.1% discharged to an acute care facility
	♦ 52.7% discharged home
	♦ 32.2% discharged to a health care facility, of these cases:
	  ♦ 69.0% went to a skilled nursing facility
	  ♦ 29.6% went to an inpatient rehabilitation facility
	♦ 5.9% expired

Figure 16. Percent of Acute Ischemic Stroke Cases with Last Known Well to Arrival Time ≤ 4 Hours by Discharge Disposition per Intravenous tPA (IV tPA) Status, San Diego County Stroke Receiving System, 2010-2014



Received IV tPA: N=1,700; Did Not Receive IV tPA: N=3,552. Source: County of San Diego Health and Human Services Agency Emergency Medical Services Stroke Receiving System Database, 2010 2014.

Among all AIS cases treated with an IA intervention between 2010 and 2014, 41.3% were discharged to a health care facility for further care. The next most common discharge disposition was to home (23.7%), followed by 14.7% expired, and 13.3% discharged to an acute care facility.

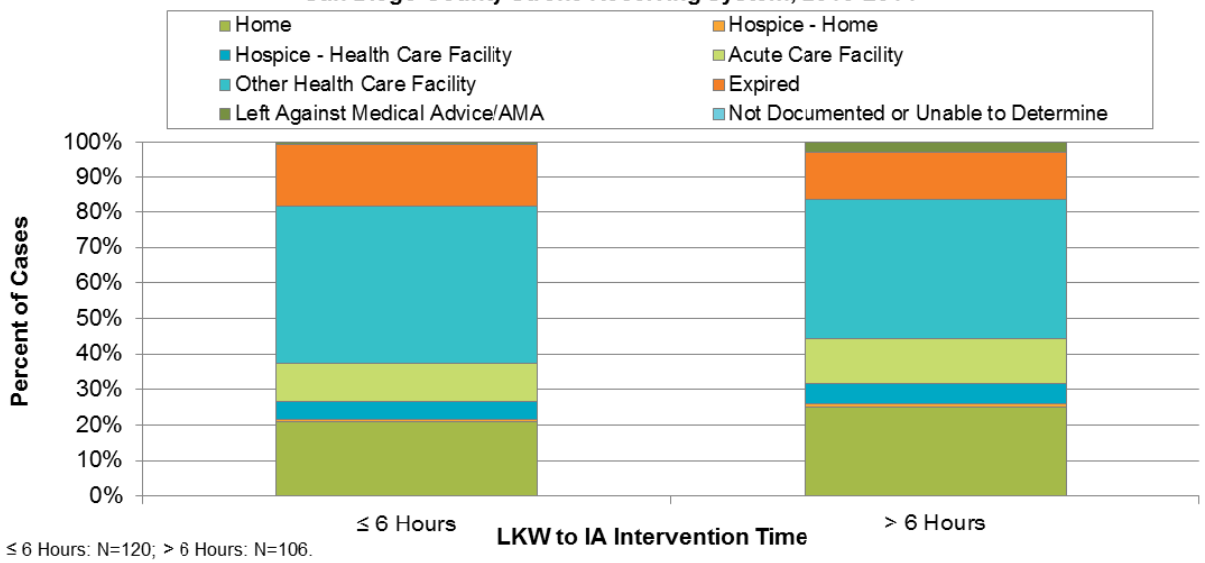
Among AIS cases with a LKW to IA intervention time less than six hours (Figure 17):

- 44.2% were discharged to a health care facility
- 20.8% discharged home
- 17.5% expired
- 10.8% went to an acute care facility

Among AIS cases with a LKW to IA intervention time greater than six hours (Figure 17):

- 38.7% were discharged to a health care facility
- 24.5% discharged home
- 13.2% expired
- 12.3% went to an acute care facility

Figure 17. Percent of Acute Ischemic Stroke Cases by Discharge Disposition per Last Known Well (LKW) to Intra-arterial (IA) Intervention Time, San Diego County Stroke Receiving System, 2010-2014



≤ 6 Hours: N=120; > 6 Hours: N=106.
Source: County of San Diego Health and Human Services Agency Emergency Medical Services Stroke Receiving System Database, 2010-2014.

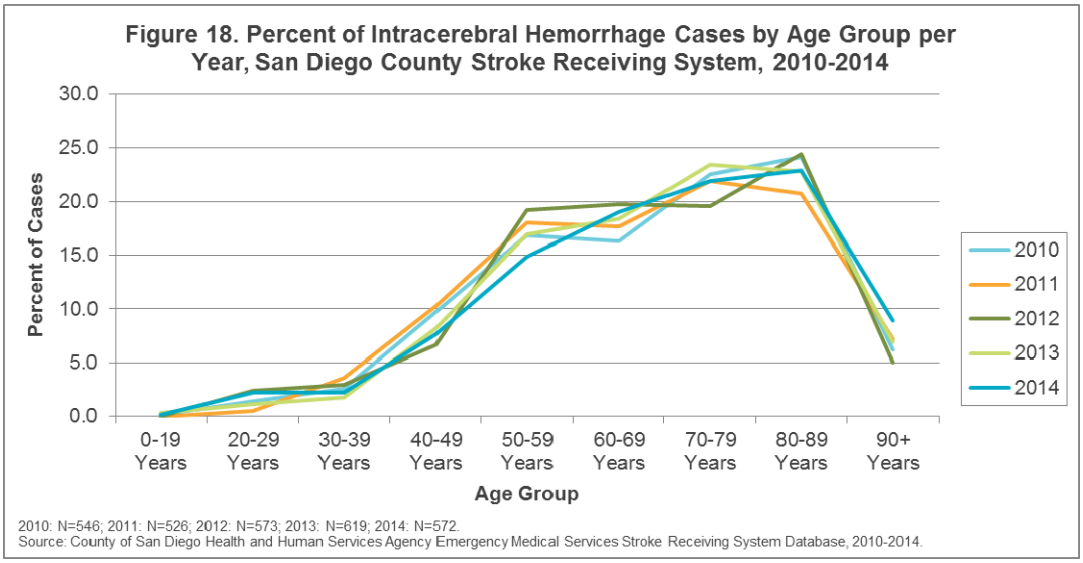
Among the AIS IA intervention cases discharged to a health care facility between 2010 and 2014, approximately half went to an inpatient rehabilitation facility and half went to a skilled nursing facility.

Intracerebral Hemorrhage

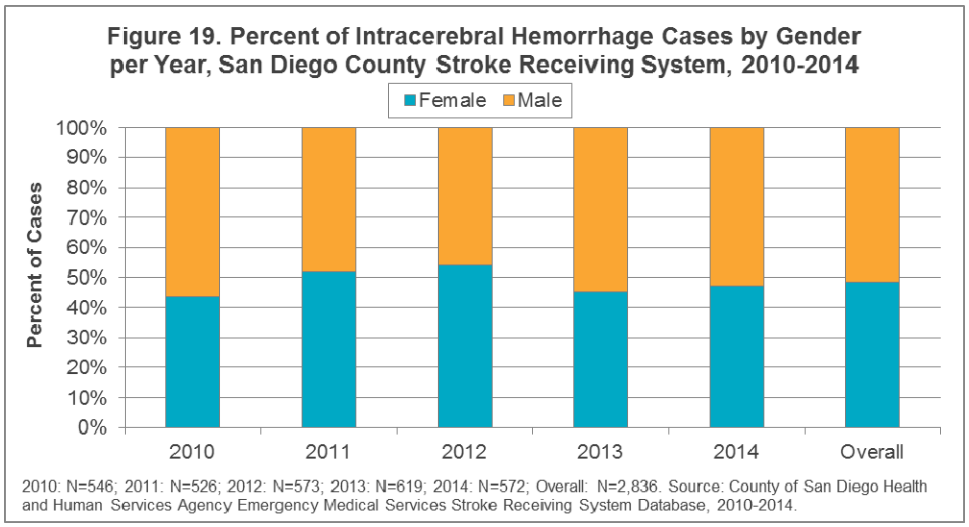
On average, there were 567 intracerebral hemorrhages (ICH) cases treated by a stroke receiving center each year, or nearly two ICH cases treated each day. These strokes account for approximately 11% of all stroke cases.

Age and Gender

Overall, the average age of the ICH cases treated in San Diego County was 68.5 years old. However, 23.0% of the ICH cases were among patients age 80-89 years old (Figure 18). Seven in ten ICH cases were 60 years old and older. This has remained consistent across each year from 2010 to 2014.



Overall, just over half of the ICH cases were among males (51.6%) (Figure 19). On average, there were 293 ICH cases among males each year and 274 ICH cases among females.

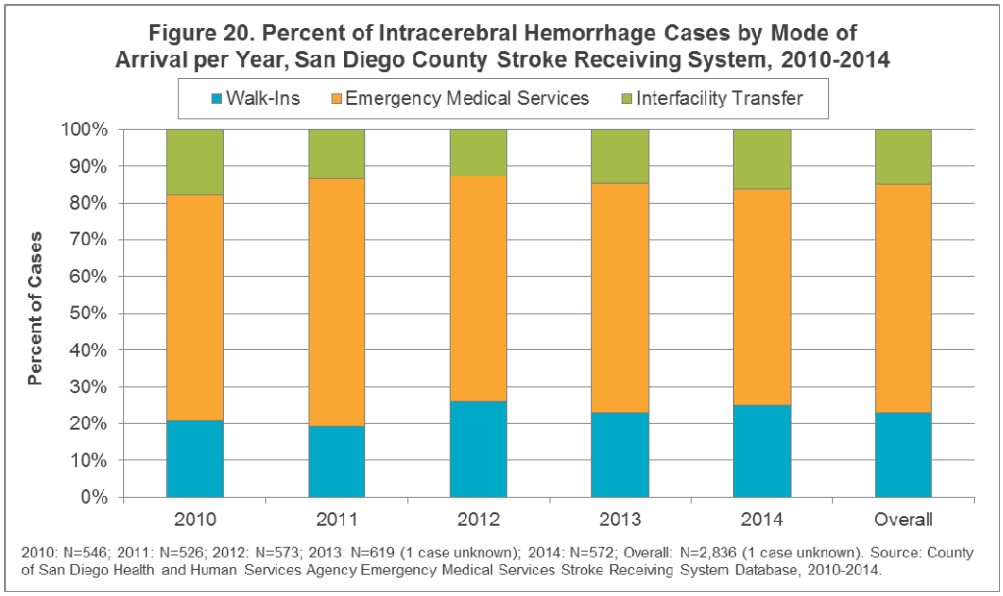


Mode of Arrival

During 2010 to 2014, nearly two thirds of the ICH cases arrived at a stroke receiving center by EMS (Figure 20). ICH cases utilized the EMS system more often than any other type of stroke, likely due to the acute nature of this type of stroke. On average, this was 353 ICH cases arriving at a stroke receiving center by ambulance each year.

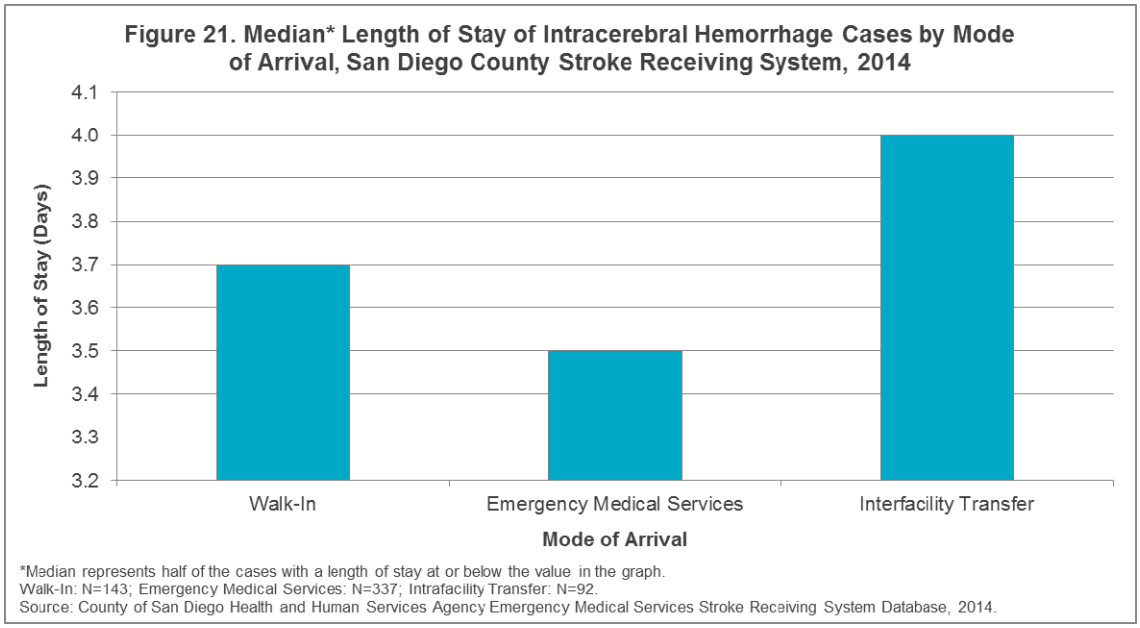
Overall, the modes of arrival for ICH cases were:

- 62.2% arriving by emergency medical services
- 22.8% arriving by walk-in
- 14.9% arriving by interfacility transfer



Length of Stay

In 2014, half of the ICH cases stayed at a stroke receiving center of 3.6 days or less. The longest length of stay was 98.5 days, or more than three months. Among ICH cases arriving via EMS, half of the cases had a length of stay of 3.5 days or less (Figure 21).

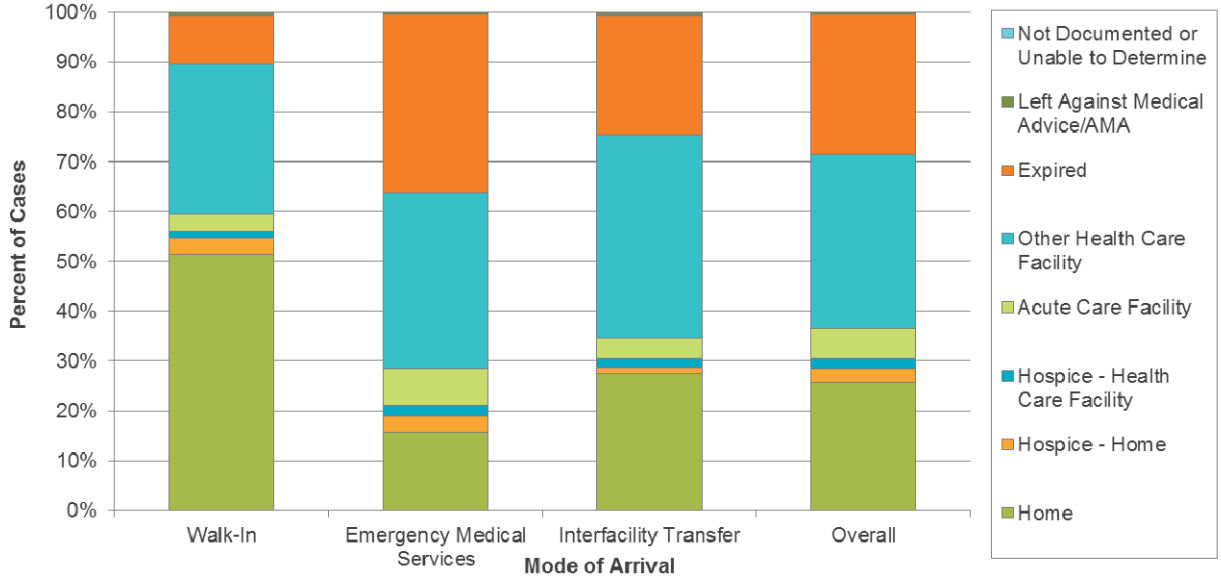


Discharge Disposition

Overall, ICH cases were most commonly discharged to a health care facility for further care (34.9%). Another 28.1% of ICH cases expired at the stroke receiving center while 25.6% were discharged home. The ICH expired cases accounted for 39.4% of all expired stroke cases from 2010 to 2014.

Between 2010 and 2014, half of the ICH cases that walked into a stroke receiving center were discharged home, whereas only 15.7% of ICH cases arriving by EMS were discharged home. Alternatively, 35.8% of ICH cases arriving by EMS expired compared to 9.7% of ICH walk-in cases (Figure 22).

Figure 22. Percent of Intracerebral Hemorrhage Cases by Discharge Disposition per Mode of Arrival, San Diego County Stroke Receiving System, 2010-2014



Walk-In: N=648 (1 case missing discharge disposition); Emergency Medical Services: N=1,765 (2 cases missing discharge disposition); Interfacility Transfer: N=422; Overall: N=2,836 (3 cases missing discharge disposition, 1 case unknown mode of arrival). Source: County of San Diego Health and Human Services Agency Emergency Medical Services Stroke Receiving System Database, 2010-2014.

Of the ICH cases discharged to a health care facility:

- 62.8% went to a skilled nursing facility
- 33.8% went to an inpatient rehabilitation facility
- 3.2% went to a long term care hospital

The ICH cases discharged to a skilled nursing facility accounted for 11.4% of all stroke cases discharged to this type of facility. The ICH cases discharged to a long term care hospital accounted for more than one in four (26.7%) stroke cases discharged to that type of facility.

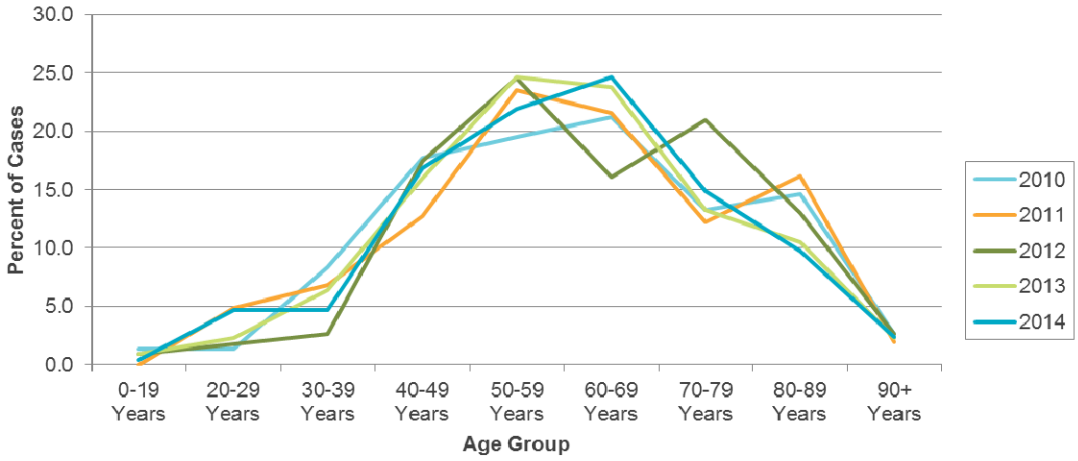
Subarachnoid Hemorrhage

From 2010 to 2014, subarachnoid hemorrhage (SAH) cases accounted for 4.3% of all stroke cases treated by San Diego County stroke receiving centers. This was an average of 226 SAH cases each year.

Age and Gender

The average age of patients treated for SAH was 60 years old. However, SAH cases were most often treated among the 50-59 year old age group (22.8%) followed closely by the 60-69 year age group (21.5%) (Figure 23).

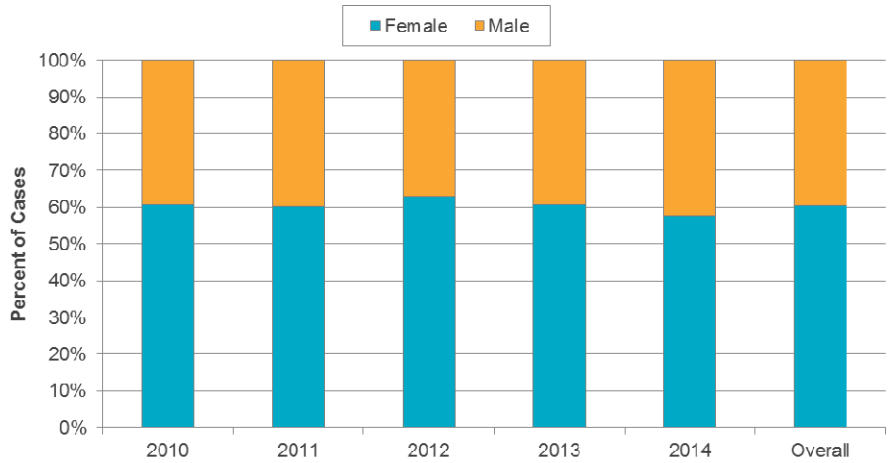
Figure 23. Percent of Subarachnoid Hemorrhage Cases by Age Group per Year, San Diego County Stroke Receiving System, 2010-2014



2010: N=226; 2011: N=204; 2012: N=224; 2013: N=219; 2014: N=256.
Source: County of San Diego Health and Human Services Agency Emergency Medical Services Stroke Receiving System Database, 2010-2014.

Each year, six in ten SAH cases were among women (Figure 24). This was an average of 136 SAH cases among women each year and 89 SAH cases among men each year.

Figure 24. Percent of Subarachnoid Hemorrhage Cases by Gender per Year, San Diego County Stroke Receiving System, 2010-2014

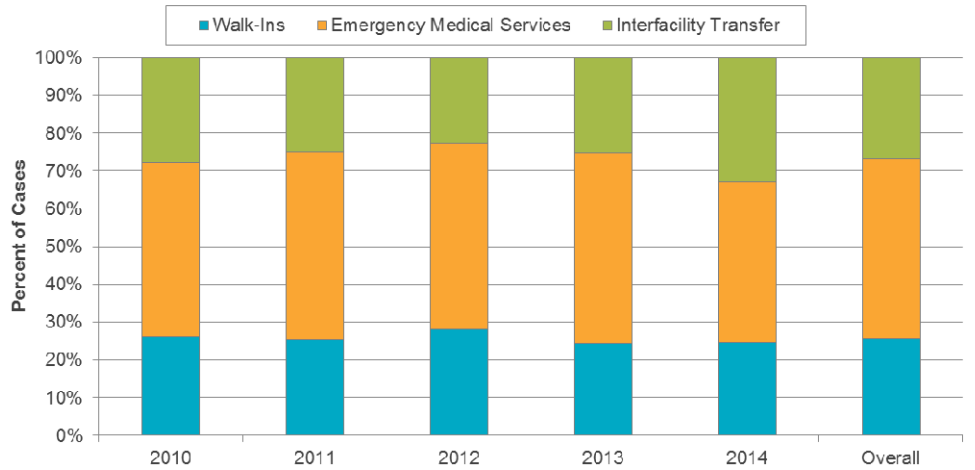


2010: N=226; 2011: N=204; 2012: N=224; 2013: N=219; 2014: N=256; Overall: N=1,129. Source: County of San Diego Health and Human Services Agency Emergency Medical Services Stroke Receiving System Database, 2010-2014.

Mode of Arrival

From 2010 to 2014, 47.4% of all SAH cases arrived at a stroke receiving center by Emergency Medical Services (EMS). This was an average of 107 SAH cases transported by EMS each year. One quarter of SAH cases arrived by walk-in (25.7%), while another quarter of cases were interfacility transfers (26.9%) (Figure 25).

Figure 25. Percent of Subarachnoid Hemorrhage Cases by Mode of Arrival per Year, San Diego County Stroke Receiving System, 2010-2014



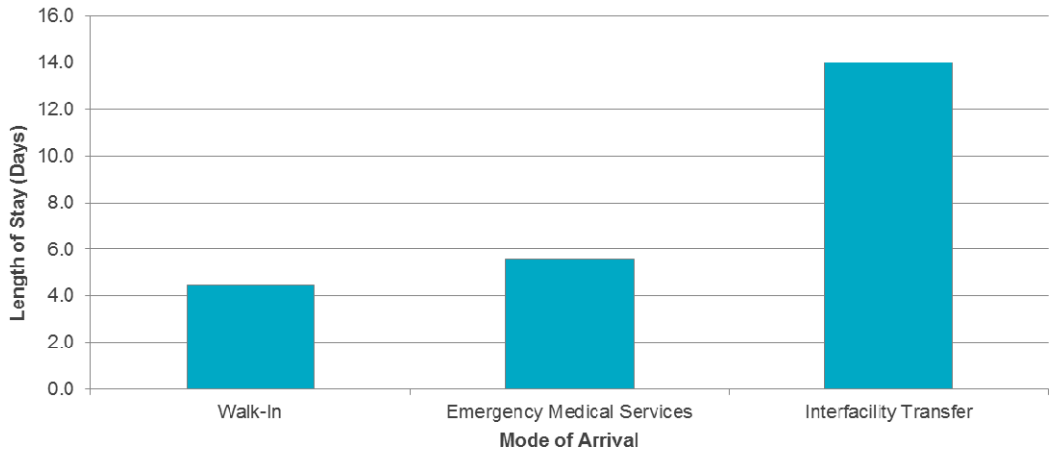
2010: N=226; 2011: N=204; 2012: N=224; 2013: N=219; 2014: N=256; Overall: N=1,129. Source: County of San Diego Health and Human Services Agency Emergency Medical Services Stroke Receiving System Database, 2010-2014.

Length of Stay

In 2014, half of the SAH cases stayed in the hospital for 7.1 days or less. This was the longest length of stay among each stroke diagnosis. The longest length of stay among SAH cases was 2.5 months.

Among SAH cases arriving via EMS in 2014, half had a length of stay of 5.6 days or less, while half of the walk-in SAH cases had a length of stay of 4.5 days or less (Figure 26).

Figure 26. Median* Length of Stay of Subarachnoid Hemorrhage Cases by Mode of Arrival, San Diego County Stroke Receiving System, 2014



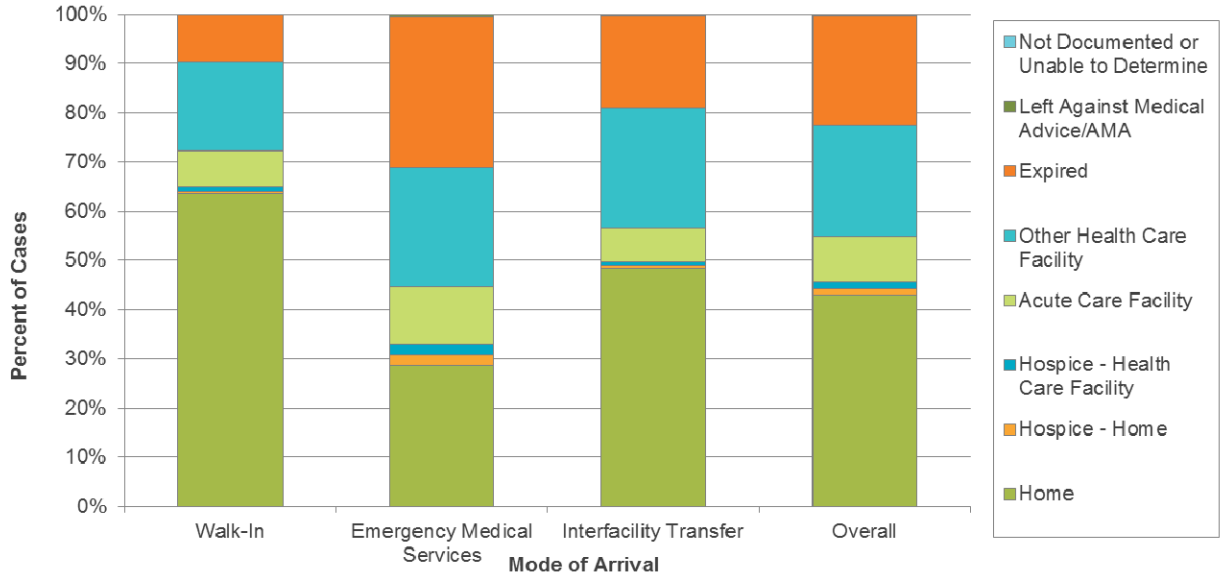
*Median represents half of the cases with a length of stay at or below the value in the graph.
Walk In: N=63; Emergency Medical Services: N=109; Interfacility Transfer: N=84.
Source: County of San Diego Health and Human Services Agency Emergency Medical Services Stroke Receiving System Database, 2014.

Discharge Disposition

Overall, 42.8% of SAH cases were discharged home. Another 22.6% were discharged to another health care facility and 22.1% expired (Figure 27). A larger proportion of SAH cases were discharged to an acute care facility than any other type of stroke.

From 2010 to 2014, among SAH cases that arrived at a stroke receiving center by walking in, 63.1% were discharged home and 9.7% expired. Only 28.6% of SAH cases arriving via EMS were discharged home, while 30.7% expired. Approximately one quarter of SAH cases arriving by EMS and one quarter of SAH cases arriving by inter-facility transfer were discharged to a health care facility for further care (Figure 27).

Figure 27. Percent of Subarachnoid Hemorrhage Cases by Discharge Disposition per Mode of Arrival, San Diego County Stroke Receiving System, 2010-2014



Walk-In: N=290 (2 cases missing discharge disposition); Emergency Medical Services: N=535 (2 cases missing discharge disposition); Interfacility Transfer: N=304; Overall: N=1,129 (4 cases missing discharge disposition). Source: County of San Diego Health and Human Services Agency Emergency Medical Services Stroke Receiving System Database, 2010-2014.

Among the SAH cases discharged to a health care facility, 49.0% went to a skilled nursing facility, 43.9% went to an inpatient rehabilitation facility, and 7.1% went to a long term care facility.

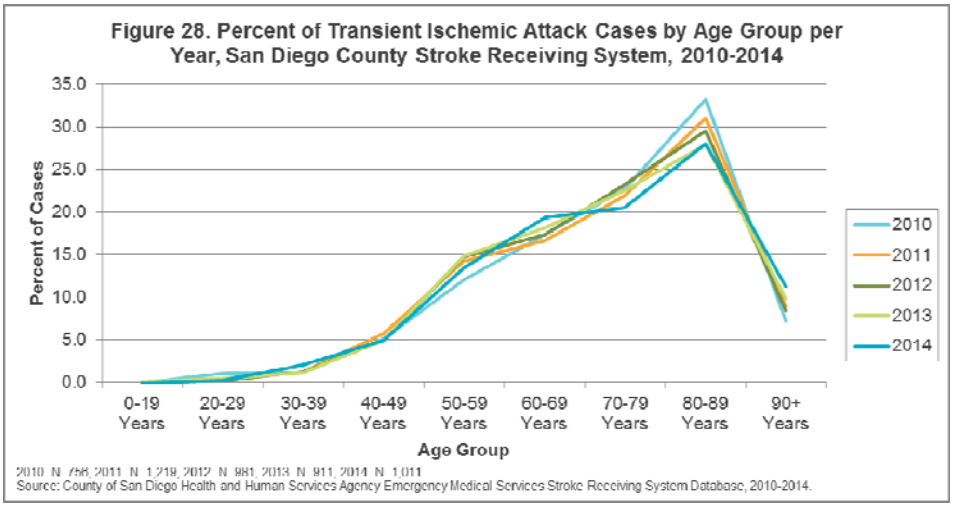
Transient Ischemic Attack

In the past five years, 4,878 transient ischemic attack (TIA) cases were treated by a stroke receiving center in San Diego County. This was an average of 976 per year, or three cases per day. TIA cases accounted for 18.8% of all cases reported in the Stroke Receiving System Database from 2010 to 2014.

When a patient has a TIA it is important to seek care because it is caused by a temporary clot. The symptoms resolve rapidly and there is no permanent damage to the brain. However, approximately one third of people who have a TIA will have a stroke within a year.[1] Diagnosis of a TIA is important so that lifestyle changes can be made to reduce the risk of stroke. These include improving diet, increasing physical activity, smoking cessation, and treating other conditions such high blood pressure and diabetes.[2]

Age and Gender

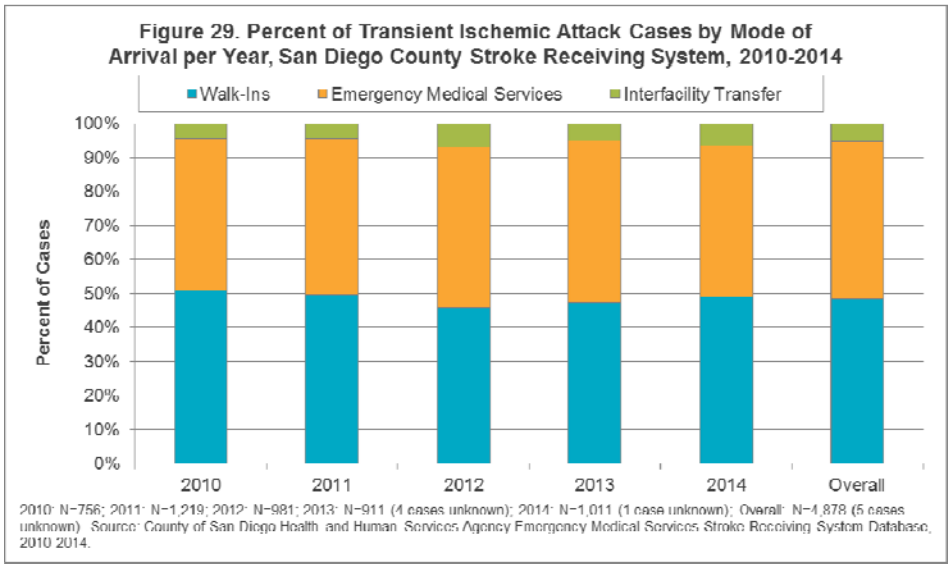
Similar to AIS cases, the average age of TIA cases was 72 years old. Three in ten TIA cases were in the 80-89 year old age group (Figure 28).



Across 2010 to 2014, an average of 540 TIA cases were among females each year. An average of 435 TIA cases were among males each year. Overall, 55.4% of TIA cases were female and 44.6% were male.

Mode of Arrival

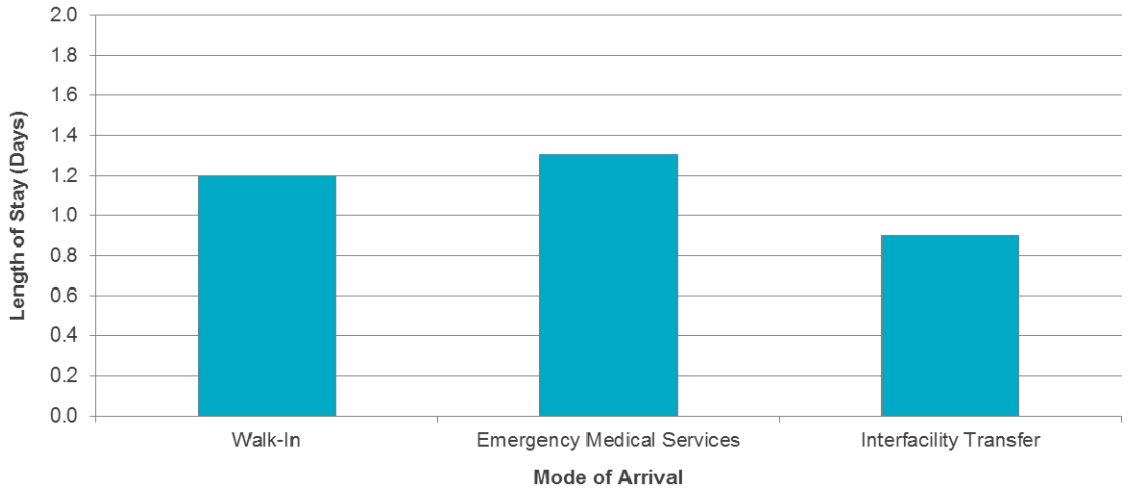
From 2010 to 2014, a larger percent of TIA cases arrived by walk-in (48.4%) to a stroke receiving center than any other type of stroke. Forty six percent of TIA cases arrived by EMS (Figure 29).



Length of Stay

In 2014, half of the TIA cases had a length of stay at a stroke receiving center of 1.2 days or less. The length of stay only varied slightly among the different modes of arrival (Figure 30).

Figure 30. Median* Length of Stay of Transient Ischemic Attack Cases by Mode of Arrival, San Diego County Stroke Receiving System, 2014



*Median represents half of the cases with a length of stay at or below the value in the graph.
Walk-In: N=489; Emergency Medical Services: N=446; Intrafacility Transfer: N=65.
Source: County of San Diego Health and Human Services Agency Emergency Medical Services Stroke Receiving System Database, 2014.

Discharge Disposition

Among all TIA cases treated from 2010 to 2014, 88.3% were discharged home. The next most common discharge disposition was to another health care facility (9.1%). Among TIA cases that arrived by walk-in to the stroke receiving center, 93.3% were discharged home. TIA cases arriving via EMS were discharged home 83.0% of the time and 13.5% were discharged to a health care facility.

From 2010 to 2014, among the cases discharged to another health care facility:

- 86.9% went to a skilled nursing facility
- 8.8% went to an inpatient rehabilitation facility
- 2.3% were discharged to an intermediate care facility
- 1.1% went to a long term care hospital

References

1. TIA (Transient Ischemic Attack). (2012, October). Retrieved September 9, 2015. http://www.strokeassociation.org/STROKEORG/AboutStroke/TypesofStroke/TIA/TIA-Transient-Ischemic-Attack_UCM_310942_Article.jsp.
2. Stroke Risk Factors. (Last reviewed 2012, October 23). Retrieved September 9, 2015. http://www.strokeassociation.org/STROKEORG/AboutStroke/UnderstandingRisk/Understanding-Stroke-Risk_UCM_308539_SubHomePage.jsp.