

Fall 12-18-2015

Decrease Arrival to CT Time to Improve Stroke Outcomes

Curt Peterson

University of San Francisco, cpeterson001@gmail.com

Follow this and additional works at: <https://repository.usfca.edu/capstone>

 Part of the [Nursing Commons](#)

Recommended Citation

Peterson, Curt, "Decrease Arrival to CT Time to Improve Stroke Outcomes" (2015). *Master's Projects and Capstones*. 200.
<https://repository.usfca.edu/capstone/200>

This Project/Capstone is brought to you for free and open access by the Theses, Dissertations, Capstones and Projects at USF Scholarship: a digital repository @ Gleeson Library | Geschke Center. It has been accepted for inclusion in Master's Projects and Capstones by an authorized administrator of USF Scholarship: a digital repository @ Gleeson Library | Geschke Center. For more information, please contact repository@usfca.edu.

Decrease Arrival to CT Time to Improve Stroke Outcomes

Curt Peterson RN

University of San Francisco

School of Nursing and Health Professions

Decrease Arrival to CT Time to Improve Stroke Outcomes

Clinical Leadership Theme

The chosen project is based on the CNL curriculum element of *Organizational and Systems Leadership*. The CNL theme is Nursing Leadership. The role as advocate is to provide leadership for changing practice based on quality improvement methods and research findings (American Association of Colleges of Nursing, 2013). The global aim of the project is to decrease the arrival to t-PA treatment times to <45 minutes in > 50% of the cases. The decreased treatment time will prove to shorten the average length of stay. The goal will be accomplished by decreasing the arrival to computerized tomography (CT) scan completion time by at least 20%.

Statement of the Problem

In the United States 795,000 people suffer from stroke annually. While stroke is only the fifth largest cause of death in this country it is the number one cause of disability. Currently in the United States there are 6.4 million stroke survivors. Twenty percent of stroke survivors still require institutional care after three months and fifteen to thirty percent experience permanent disability (Massaro, 2012). Unfortunately, only 3 to 5 percent of those who suffer a stroke reach the hospital in time to be considered for tissue plasminogen activator (t-PA), the only FDA approved pharmaceutical treatment for acute ischemic stroke (AIS) ("Stroke Awareness," 2015). Providing best practice for stroke patients relies on the ability to constantly improve stroke care process in our own microsystem. For this project patient arrival to CT scan completion time will be of focus. In 2013 the average time for CT completion time on suspected strokes was 32 minutes. In 2013 there was only one CT

scanner within the hospital and it was over 2000 feet away from the Emergency Department (ED). In December of 2013 a new CT scanner was built within the ED, hopes were that arrival to CT times would be well within the recommended time of < 25 minutes. Average arrival to CT times for suspected stroke patients averaged 27 minutes. This was still above the goal of < 25 minutes expected for Advanced Primary Stroke Centers (APSC). This also impacted our ability to deliver treatment times in < 60 minutes and was discouraging for 2015 goal of meeting new American Heart/ American Stroke (AHA/ASA) goals of treatment within 45 minutes of arrival.

Project overview

In 1996 the FDA approved tissue plasminogen activator (t-PA) as a treatment for AIS. T-PA is an enzyme found naturally in the body that converts, or activates, plasminogen into another enzyme to dissolve a blood clot ("Stroke Care," 2013, p. 1). Neurologists associated with the University of Calgary hypothesized that low rates t-PA use are only partially explained by medical considerations, and that biases, beliefs, systems, and uncertainty affect acute stroke decision-making. Their study provides evidence for the presence of uncertainty, beliefs, and biases in acute stroke decision-making and stress the importance of relying on an evidenced based stroke alert (SA) program (Shamy & Jaigobin, 2013). Another reason why it is important to rapidly diagnose an ischemic stroke is t-PA must be given within four hours of the onset of symptoms (Jauch et al., 2012). Measurement of arrival to treatment time is referred to as door to needle (DTN) time.

Of the 800, 000 strokes 86 percent are ischemic strokes. Those experiencing an AIS from a typical large vessel occlusion lose 1.9 million neurons, 14 billion synapses, and 7.5 miles of myelinated fibers every minute. The ischemic brain ages 3.6 years an hour without

treatment (Saver, 2006). Evidence shows that patients who do receive t-PA are at least 55% more likely to leave the hospital with little or no disability after three months evidence shows only three percent of patients experiencing AIS arrive to a certified stroke center in time to receive t-PA (Stroke Awareness Foundation, 2015). Such facts drive the need of the project by finding ways to decrease DTN times.

My project's specific AIM statement is to initiate a process to reduce the arrival time to CT completion time for the suspected stroke patient by 20%. Successful implementation of this goal would decrease DTN which would ultimately improve patient outcome. According AHA/ASA it is essential to initiate a CT scan or magnetic resonance imaging (MRI) within 25 minutes of arrival to exclude intracranial hemorrhage (IH) prior to administration of intravenous t-PA ("Stroke Campaign," 2010). Before this process change SA patients arriving by emergency medical services (EMS) would off load in the ED and give report to the primary nurse. During this time the ED MD and RN would assess patient and start intravenous access (IV) and draw labs, registration would log the patient in, and an electrocardiogram (EKG) and chest radiography (X-ray) would be performed and only then would the patient go to CT. With the time savings for CT scan meeting the American Heart Association's Target Stroke, phase 2 challenge will be met. The benefits of t-PA in patients with acute ischemic stroke are time-dependent, and guidelines recommend DTN times of 60 minutes or less. However, studies have found that less than 30 percent of U.S. patients are treated within this window. Target: Stroke Phase II aims to continue to reduce DTN times for eligible patients being treated with t-PA by establishing more aggressive goals for participating hospitals. While the goals do not specifically address arrival to CT completion

times, they do address DTN times which are affected by CT completion times. The goals for Target: Stroke Phase II are:

- Primary Goal: Achieve DTN times within 60 minutes in 75 percent or more of acute ischemic stroke patients treated with IV t-PA.
- Secondary Goal: Achieve DTN times within 45 minutes in 50 percent or more of acute ischemic stroke patients treated with IV t-PA ("Target Stroke," 2014, p. 1)

In order to mitigate threats to this process change the Director of Neurology presented the evidenced based data to the ED physicians at their monthly meeting. Imaging staff were educated on studies showing how to successfully implement the new process. Work was done to improve lines of communication between ED and imaging staff. An example of improved communication was to have a dedicated line in which ED would notify imaging of potential SA arrivals. The project aim is to improve arrival time to CT completion time by 20% for all stroke alert arrivals to the process's microsystem, an Advanced Primary Stroke Center (APSC) in Sacramento California. The process begins with the suspected stroke patient going directly to CT scan before fully evaluated in ED. The process ends with the suspected stroke patient having completion of necessary images before the neurologist evaluates the patient to determine eligibility for t-PA in 100% of cases. By working on the process, the expectation is to meet the American Heart's Target Stroke Stage 2 DTN challenge, which finalized recommendations in January 2015, from recommendations of the 2014 International Stroke Conference ("Target Stroke Phase II," 2015). It is important to work on this now to treat the AIS patient more efficiently resulting in improved outcomes. Currently the AIS patient has an average length of stay of five days. The goal is to show a two-day decrease in length of stay.

Rationale

In January of 2014 the President of Dignity Health added Stroke Measure success on his Presidential report card. All APSC hospitals within Dignity Health were required to participate in weekly calls to assure our data was in line with corporate expectations. October 2014 AHA/ASA changed their criteria Target Stroke challenge. These events caused the region to challenge individual hospital sites to find opportunities for improvement (OFI) for their stroke programs. During the 2014 year our hospital was able to achieve DTN times < 60 minutes 80% of the time. In 2013 the average door to needle time was 72 minutes. Wanting to find ways to improve stroke care the hospital decided to join the AHA/ASAs challenge to lower treatment times to < 45 minutes. In April of 2015 a root cause analysis was done to identify areas of improvement within our stroke alert process (Appendix A). A deeper dive into the process improvement was accomplished with the stakeholder analysis. (Appendix B). From May 2014 through November 2014 the average arrival to CT imaging for SA alert patients was 28 minutes, longer than the recommended time of < 25 minutes. Decreased time to CT ultimately can decrease time to treatment which is directly related to improved patient outcome. Evidence shows that earlier treatment of ischemic stroke with IV thrombolysis results in better clinical outcomes for patients, even when looking at parameters such as intracranial hemorrhage and in-hospital mortality. Dr. Daniel Strbian and colleagues looked at ultra-early intravenous thrombolysis (delivery of t-PA within 90 minutes of symptom onset) and reported that patients benefited differently based on their National Institute of Health Stroke Scale (NIHSS). Outcomes were measured at three months with an excellent outcome defined as a modified Rankin Scale of 0-1. They found that patients with an NIHSS of 7-12 had an excellent outcome when they received

ultra-early IV t-PA (Strbian et al., 2013). Ultra-early intervention saves money both in terms of long term rehabilitation and decreased length of in-patient stay. Retrospective time line studies will be used as a benchmark as a comparison before and after the new process is initiated. (Appendix C) Studies have shown a decrease length of stay of two days when t-PA is given ultra-early (<45 minutes from arrival to drug) (Audebert & Sobesky, 2014). The average cost of one day in the hospital within California is 3500 dollars. Saving on average two days of admission for the typical stroke patient, rapid stroke care could save 3500 dollars for the hospital for every day saved (Rappleye, 2015). There are costs associated with implementing this process. The ED director plans on hiring a full time resource nurse for the ED. This nurse would have many responsibilities within the department including all monitored transports, accompanying patient to lengthy exams and procedures and meeting the SA patient in CT to receive report from EMS. Responding to SAs would be the resource nurse's priority but not be a specific stroke program resource. Other costs would surround employee education and professional consultation by ED physicians and neurology. (Appendix D)

Methodology

The site for this project is a Joint Commission Certified Advanced Primary Stroke Center. The project will be implemented in the hospital's 28 bed Emergency Department (ED) where the improvement goal is to find ways to make the stroke alert process more efficient. Improved efficiency will ultimately reduce DTN times for patient's experiencing an acute ischemic stroke (AIS). In Guidelines for the Early Management of Patients with Ischemic Stroke (2009) the authors show how important early delivery of t-PA is. Earlier treatment times are directly related to decreased disability at discharge and at 30 days

(Adams, Adams, Brott, Mahler, & Hademanos, 2009). Admission days on patient's receiving t-PA will be compared from April 2014 through November 2014 to the same population from April 2015 through November 2015. Using existing evidenced based design recommendations, a new process will be implemented where the patient only stops in the ED for a rapid assessment of the ABC's and for rapid registration. After the rapid assessment the patient then goes directly to the CT scanner via the EMS gurney. This piece of the SA process will be focused on because it is the only exam necessary in determining AIS treatment. Implementation of the process was dependent on cooperation between cohorts within the microsystem in the ED. The cohorts involved are EMS, ED RN's, ED MDs, Neurology and Imaging. Buy in will be achieved by providing evidenced based literature showing that this process is considered standard of care in many regions within the US and other countries. The goal is to reduce door to imaging times by 20% which has been achieved at sites who have adopted similar processes. Two well respected studies show that this expectation is both achievable and reproducible at multiple sites in different countries. Research asserts that with multiple concurrent strategies it is possible to cut the median in-hospital delay to 20 minutes. The key is to do as little as possible after the patient has arrived at the emergency room before getting advanced imaging (Meretoja, Strbian, Mustanoja, Weir, & Ugalde, 2012). According to the American Heart American Stroke Association (AHA/ASA) it is essential to initiate a CT scan (or MRI) within 25 minutes of arrival to exclude intracranial hemorrhage prior to administration of intravenous t-PA ("Stroke Campaign," 2010). Part of the Neurovascular Coordinators responsibility is to input all patients with a discharge diagnosis of stroke into two databases, Midas and Get With the

Guidelines (GWTG). GWTG captures door to imaging time on all patients. These databases will be able to provide the information needed to monitor the project goals and objectives.

Using Kotter's eight step process change theory will be helpful with implementation of the current project's goals. The following are the outline of the eight steps used for the project's implementation:

Establish a sense of urgency: Door to treatment times have been stagnate for a year. The year before beginning the process change the average door to treatment time was 63 minutes. The AHA is challenging Primary Stroke Centers to decrease the DTN time from <60 minutes to < 45 minutes.

Create a powerful guiding coalition: Identify champions in all departments affected by the proposed change. These champions will go ahead of the change providing evidenced based data backing the process change project.

Develop a vision: Expect implementation of the process to result in meeting the AHA's challenge. When the goal is met expect a decrease in post stroke disability based on a lower modified Rankin score at discharge.

Enlist a volunteer army: EBP has shown similar process implantations to greatly improve patient outcomes. Such data will motivate the stakeholders affected by the process change. This motivated, "volunteer army", will drive the process change forward.

Enable action by removing barriers: Two groups are affected most by the project's implantation. EMS must be assured the new process will not negatively affect their work flow by changing report location for a single cohort of patient. Also ED

registration will be required to move locations to successfully implement the new process. Removing barriers for groups most affected helps assure success.

Generate short-term wins: Report out successes to RN shift huddles.

Accompany EMS to the CT suite and discuss improved patient outcome examples due to “their” change in work flow. Go to registration staff meeting thanking them for their participation.

Sustain acceleration: This hospital is the first in the Sacramento region to implement this process. Although a small community hospital, the hospital has a regional reputation for successful process change implantation. This sense of pride encourages all involved stakeholders strive for success.

Institute change: Commitment to this process change will improve ischemic stroke patient outcome. Successful implementation will serve as a blue print of success for our other hospital network partners.

One CNL competency represented by this process change is to articulate delivery process, outcomes, and care trends using a variety media and other communication methods to the healthcare team and others (End of Program Competencies, 2006). A simple to follow algorithm mirrors the AHA/ASA statement that protocols for the transport of stroke patients by EMS directly to CT has been associated with better treatment outcome ("Direct to CT/MRI protocol," 2014). (Appendix E)

Data will be collected throughout the process evaluation period of six months. (Appendix F) Once the process is implemented the ED nurse will use a paper based EMS report sheet that will collect all the needed data to be given to the Neurologist and be entered into the EMR. (Appendix G)

Data Source/Literature Review

The project focuses on the ED stroke team's ability to significantly improve stroke outcome by supporting the idea of early CT for SA patients. The benefit of the project will be improved arrival to treatment times for those patients eligible for t-PA. The literature review revealed several sources that confirmed prioritizing the CT scan can improve patient outcomes. Also revealed is that this process has been successfully implemented in hospitals around the world all showing similar outcome results. Decreased imaging times and t-PA delivery will be measured by completing a data sheet on every stroke alert that receives t-PA (Appendix G) and tracking the patient's length of stay and disability at discharge.

Jauch, Saver, Adams, Connors, McMullen & Yonas (2012) present an overview of the current evidence guidelines and management recommendations for evaluation and treatment of adults with acute ischemic stroke. The goal of these guidelines is to limit the morbidity and mortality associated with stroke. The authors stress the importance of having in place a stroke system of care that strives for early intervention for the stroke patient (Jauch et al., 2012). The author's premise lays the bedrock for the project. Within the system of stroke care there needs to be a constant drive towards improvement. Proven guidelines as described by the authors lead to increased efficiency of care as described by the next article.

The AHA/ASA's publication, "Target Stroke" (2014) describes evidenced based research proving door to treatment time goals should go from < 60 minutes to < 45 minutes. The article challenges stroke centers to continue to eliminate treatment delays for people who experience an ischemic stroke. For years the mantra within the stroke community was DTN

in < 60 minutes. As technology such as telemedicine and improved digital imaging have been implemented this goal has become obsolete. According to “Time is Brain” the fifteen minutes saved represents approximately 30 million spared brain cells (Saver, 2006). Of the six sister hospitals in our service area we would be the first to fully initiate EMS direct to CT as a policy. This achievement goal was presented to hospital leaders to provide necessary resources needed for the process change.

Successful implantation of this project depends on the cooperation of all care professionals affected by the process change. Behrouz (2010) stresses that effective care of AIS is quite comprehensive and requires a team approach. The article corroborates that the team effort is imperative for the successful implantation of my project (Behrouz, 2010). All involved stakeholders, physicians, nurses, EMS and ancillary personnel need to agree to work together to make the process change happen. The next study was valuable to show leadership that my project idea would be as successful as it had in other facilities.

In the Melbourne study Meretoja, Strbian, Mustanoja, Weir, & Ugalde (2012) prove that the door to t-PA times achieved in the Helsinki trial could be duplicated in Melbourne. Both sites achieved DTN times of 20 minutes. Much of this increased efficiency was due to the patient going to CT first (Meretoja et al., 2012). The Melbourne study is a topic of study at most neurology conferences to encourage stroke centers around the country to adopt the author’s findings.

After the Melbourne study major stroke centers started to implement rapid transport to CT. Binning, Rosen, Liebman, Diaz, Silva, Eichorn & Reuben (2014) discussed the reliability of the EMS pre-report to alert the local stroke team, and showed positive results

when suspected AIS patients bypassed the ED to go directly to CT. They stress that EMS personnel are trained in the recognition of stroke. Relying on such expertise saves valuable time potentially spent on a repeated assessment before the patient has the initial CT scan. The neurologist is unable to make any treatment determination before the scan is complete. The author's research proves that decreased door to CT scan leads to a decrease in DTN times for the AIS patient. As illustrated by the next article success of process implementation is dependent on a clear policy.

The Shamy & Jaigobins (2013) study asserts that without a clear stroke alert policy and a procedure for delivering t-PA rapidly, decision making can be adversely affected by pre-existing provider bias. The authors argue that patient outcomes are improved when a consistent model was followed. Having a clear policy prevents individual prejudices from influencing process. A clear policy assures that all patients receive the agreed upon standard of care.

All of these articles as well as other research referenced in this project support each other in recommending early detection and early treatment of the AIS patient to achieve better long term outcomes. These articles support my PICO statement that identifies care improvement for all patients arriving to the ED via EMS with stroke symptoms. By decreasing door to imaging time the aim is to show improved DTN times resulting in improved health outcomes.

Timeline

The timeline of the project from start to the go live day is approximately one month. Much is accomplished during this period and is happening simultaneously. Day one, March 30th, is a brainstorming session with the director of the neurology department and this author. An agreement was made to initiate the rapid CT process. This first day the algorithm that will be used was finalized. Also on the first day the Emergency Preparedness Coordinator was asked to reach out to the EMS services necessary. EMS will have to be on board with the new process for it to be successful. The change has to be approved by three different groups which all meet at different times during the month. This is the longest part of the timeline due to the variances in meeting times. Staff education both for ED and Imaging takes only one week. After education and a trial go live there is monitoring at the one, three, and six month marks. (Appendix H)

Expected Results

The first goal is to decrease EMS arrival to CT completion times on all SAs decrease by 20%. From May 2014 through November 2014 the average arrival to CT imaging for SA alert patients was 28 minutes as mentioned previously. I will measure the data from the same months for 2015 and will expect a 5.6 (20%) minute decrease on average to meet my goal. This goal is supported by well-respected research including that of Mandy Binning and colleagues who state a stroke alert protocol that bypasses the ED, allowing the patient to be met in CT by the neurological ED team, has proven to decrease door-to-CT and door-to-needle times from data of historical means. Their prospective study of 170 pre hospital stroke alerts. EMS diagnosis of stroke was correct 66% of the time which is in line

with ED MD correct assessment percentage of 72%. The study showed a 67% improvement in door to CT completion times. Also 18% of the patients in the study were successfully treated with t-PA compared to the historical rate of five percent before process change. The study group receiving t-PA experienced shorter treatment times 43% of the time (Binning et al., 2013). The other goal is to look at this same cohort of patients and compare length of stay. According to Audebert & Sobesky (2014) It should be expected that patients receiving t-PA will have shorter lengths of stay (Audebert & Sobesky, 2014).

Nursing Relevance

According to the AHA/ASA nurses play a vital role in the rapid identification and triage of patients with AIS, initial assessment, and coordinating the timely flow of patients with acute stroke through the health system. Nurses enable delivery of relevant time critical treatments (Middleton, Grimley, & Alexandrov, 2015). This process puts nursing as the first point of contact. The nurse performs the first neurological check with the patient in CT, takes the EMS report, and delivers the initial care of the suspected stroke patient. An evidence-based guideline can improve emergency nursing care of acute stroke and optimize patient outcomes following stroke. As the continuum of stroke care begins in the Emergency Department, detailed recommendations for evidence-based emergency nursing care should be included in all multidisciplinary guidelines for the management of acute stroke (Considine & McGillivray, 2015). As similar processes are implanted the role of the nurse will rely on adherence to evidenced based practices and meticulous assessment and documentation.

Evaluation

The projects AIM statement is to decrease door to treatment times for patients experiencing an acute ischemic stroke (AIS) by decreasing door to CT times. The process change revolves around the patient initially bypassing the ED and going directly to the CT suite for report. Expediting arrival to CT time was determined to be the focus because initial CT results are the only exam necessary in determining whether an AIS is eligible for t-PA treatment. As a designated APSC EMS has an obligation to bring patients exhibiting signs and symptoms of stroke to the hospital. As mentioned previously only 3 to 5 percent of those who suffer a stroke reach the hospital in time to be considered for t-PA, the only FDA approved pharmaceutical treatment for AIS ("Stroke Awareness," 2015). Of those patients not receiving t-PA, twenty percent will require institutional care after three months and fifteen to thirty percent experience permanent disability (Massaro, 2012). Providing rapid treatment to those patients who do arrive within the timeline is the goal of the SA process.

The specific goal of the project is to decrease the arrival to t-PA treatment times to <45 minutes in > 50% of the cases. The decreased treatment time will prove to shorten the average length of stay on average by two days (Audebert & Sobesky, 2014). The goal will be accomplished by decreasing the arrival to computerized tomography (CT) scan completion time by at least 20%. The specific population of patients will be all stroke alert arrivals to the process's microsystem via EMS, an APSC in Sacramento California. The project will be implemented in the hospital's 28 bed Emergency Department. The planning process for the project implantation started in April and actual process implantation happened in May. Much

had to happen that first month. First the author of this paper worked with the Director of Neurology to develop an algorithm outlining the process flow. The algorithm was based on evidenced based research showing the success of having the patient go directly to CT before stopping in the ED (Meretoja et al., 2012) EMS provider groups had to give the ok to participate in the process change. This hospital was the in the region to initiate this particular process so EMS had valid concerns that needed to be alleviated. Several committees representing hospital leadership, ED physicians, and the regional neuroscience group had to approve the process change before moving forward. Once approval was granted staff education for affected ED personal and Imaging personal had to be implemented. Also data gathering tools were developed for nursing because they would not have access to the EHR when taking report from EMS in the CT suite (Appendix G). What is going well is EMS and RN staff buy-in. The ED physicians have some concerns because they are used to doing a full exam before sending patients for imaging. Also going well is that ED arrival to CT times are improving. Assuring the process is followed 100% of the time is also a challenge. This is to be expected until the process becomes more hardwired and better patient outcomes are realized. The process will be monitored for six full months. Providing evidenced based rationales for the project to all stakeholders affected has been found to be the key piece to success so far. Health care professionals accept change more readily if they understand the rational.

In April a retrospective timeline was completed on previous stroke alerts from May 2014 through November 2014 (Appendix C). The timelines clearly showed arrival to CT completion times were significantly higher than AHA/ASA recommendation of < 25 minutes. The timeline also provided data showing DTN times that would also be examined as part of the Target Phase II goal of DTN < 45 minutes for >50% of t-PA cases. Next the creation of an algorithm

outlining the project process was designed. The algorithm follows the patient from EMS arrival to CT completion (Appendix E). Once the project was implemented on May 11th data was collected on three data points. First measured was arrival to CT time, second DTN times were gathered for patients receiving t-PA, and lastly, number of days' patients receiving t-PA were admitted for.

Plan Do Study Act (PDSA) cycles were completed at the one month, three-month, and six-month point from process implementation date (Appendix I). The PDSA cycles were used to gather and compare the three data points mentioned above. At process implementation the three captured data points were as follow, arrival to CT average was 28 minutes, DTN averaged 52 minutes, average LOS for t-PA recipients was 6 days. At one month the average Door to CT time was 22 minutes. The average DTN was 48 minutes with 2 under 45 minutes, 1 over 60 minutes due to translation difficulties, and one under 60 minutes. This is moving towards goal of >50% < 45 minutes. Average LOS for patients receiving t-PA during the first month was 4 days (Goal met). At three months the data continued to improve. Average Door to CT was 19 minutes (excluding cases where patient was unstable. This reflected a 32.1% reduction, exceeding the 25% original goal. Average DTN time was 39 minutes, 4 were under 45 minutes and one was under 60 minutes. This is meeting the goal of 50% of t-PA patients treated in < 45 minutes. Average LOS for patients receiving t-PA was three days, a three days' savings, none of these patients required long term rehabilitation. Lastly at six months the average Door to CT was 16 minutes (42.9% decrease). The average DTN time was 40 minutes with 4 of the six <45 minutes. The average LOS for patients receiving t-PA was 2.5 days, a 58.3 reduction in LOS. The original goal was a 33% reduction in LOS.

Sustainability Plan

The sustainability plan for this project is reliant on several factors. First the greatest assurance of reliance is continuance of improved times for the suspected stroke patient. Positive patient outcomes tend to motivate involved stakeholders to buy into processes that help them achieve improved goals and outcomes. Also important to sustainability is continued auditing of all stroke alerts treated at this facility. Auditing these cases concurrently or as close to concurrent as possible helps identify deviations from the process early enough to have real time discussions with the stakeholders involved. The neurovascular coordinator will continue to respond to SA when on site. The neurovascular coordinator can be a valuable resource in guiding the SA team towards process compliance. Unit specific skills days are held annually for the ED. The SA flow process will be reviewed and be considered a core competency within the department. On average the ED hires two new RNs and one MD/PA per month. All new hires must spend 15 minutes with the Neurovascular Coordinator before starting their first shift. Monitoring, education and improved patient outcomes will drive the sustainability of the project.

Conclusion

The goal of the project was to meet the AHA/ASA Target Stroke Phase II goal of providing t-PA treatment to eligible patients in < 45 minutes more than half the time. To meet this goal, the arrival to CT scanner process was changed with hopes of decreasing door to CT times by 20%. By decreasing time to treatment we hoped to reproduce decreased hospitalization times experienced by hospitals who have adopted similar process changes. The last PDSA cycle data review was completed 6 months after the process had been fully

implemented. The data showed a decrease in arrival to CT completion time of 42.9%, well below the target decrease of 20%. The DTN times experienced an overall average decrease of 32.1 % and met the AHA/ASA Target Stroke Phase II goal of 50% of t-PA cases treated < 45 minutes. In February the hospital will be on track to receive the GWTG top award, Target Stroke Elite Plus. Finally, patients who received t-PA after process initiation experienced a 2.5 decrease in length of stay when compared to the previous year. This represents a 58.3% decrease in LOS compared to the goal of 50%. These results are very encouraging that the process is having a positive effect on the target patient population.

Lessons learned were many. One concern at onset was how EMS would perceive the process change. Of all the stakeholders they embraced the change easily. The EMT/Paramedics liked being part of the SA team and were actually able to off load and give report sooner than with the former process. Having the EMT/Paramedics in the CT suite provides time to educate them on the rationale of rapid imaging as it relates to patient outcome.

At one month the process seemed to be coming hard wired in. Interestingly at three months an increase in arrival to CT times was noticed. The three month PDSA cycle revealed five patients were not sent to CT even though they were stable. The ED Medical doctor found that in three cases a new provider was involved. All MDs involved in the delayed cases were spoken with and agreed to adhere to the new process going forward.

ED nurses and registration clerks were very receptive to the changes. For the registration clerks a physical change in location was necessary to make the rapid registration piece work. They commented they are happier being up front with the ED RNs and MDs, making them feel more a part of the department. The nurses embraced the change easily early in the

process. Comments heard was they received a clearer report from EMS and were able to initiate the stroke care process earlier.

Working on this project has been a rewarding experience. The success experienced will be used for the next phase, initiating the SA process for patients presenting directly to triage. Working on this process has shown the value of working as the Clinical Nurse Leader (CNL). Working closely and communicating with all stakeholders involved is the key to a successful process. Having an understanding of how all cohorts can come together to accomplish a single goal is what the CNL does to assist the microsystem. CNLs are catalysts for change, contributing to increased staff satisfaction, cost containment, and most importantly improved patient outcomes.

References

- AACN end-of-program competencies & required clinical experiences for the clinical nurse leader [Supplemental material]. (2006). In (Comp.), *Complete competencies expected of every graduate of a CNL program* (). San Francisco: USF.
- Adams, H., Adams, R., Brott, T., Mahler, J., & Hademanos, G. (2010). Guidelines for the early management of patients with ischemic stroke. *Stroke*, 34, 1056-1083.
<http://dx.doi.org/10.1161/01.STR.0000064841.47697.22>
- American Association of Colleges of Nursing. (2013). *Competencies and curricular expectations for clinical nurse leader education and practice*. Retrieved from:
<http://aacn.nche.edu/CNL-Competencies-October-2013.pdf>
- Audebert, H. J., & Sobesky, J. (2014, October 21st). . 'Time is brain' after stroke, regardless of age and severity, 10, 675-676. <http://dx.doi.org/10.1038.nrnerol.2014.194>
- Behrouz, R. (2010, July). Critical care management of the acute ischemic stroke patient. *Practical Neurology*, 1-25. Retrieved from
http://practicalneurology.com/pdfs/PN0810_stroke%20fea.pdf
- Binning, M. J., Sanfillippo, G., Rosen, W., D'Ambrosio, M., Veznedaroglu, E., Liebman, K., ... Ruben, M. (2013, December 12). The neurological emergency room and prehospital stroke alert: The whole is greater than the sum of its parts. *Neurosurgery*, 74.
<http://dx.doi.org/10.1227/NEU.0000000000000259>.
- Considine, J., & McGillivray, B. (2015, October 18). An evidence-based practice approach to improving nursing care of acute stroke in an Australian Emergency Department. *Journal of Clinical Nursing*, 19, 138-144. <http://dx.doi.org/10.1111/j.1365-2702.2009.02970.x>

Direct to ct/mri protocol. (2014). Retrieved from

http://www.strokeassociation.org/idc/groups/heart-public/@wcm/@gwtg/documents/downloadable/ucm_470723.pdf

Jauch, E. C., Adams, H. P., Saver, J. L., Demaerschalk, B. M., Khatri, P., & McMullan, P. W.

(2012). Guidelines for the early management of patients with acute ischemic stroke.

Retrieved from <http://stroke.ahajournals.org/content/38/5/1655.full.pdf+html>

Jauch, E., Saver, J., Adams, H., Connors, B., McMullen, P., & Yonas, H. (2013, January 31st).

Guidelines for the early management of patients with acute ischemic stroke. *Stroke*, 44(3). <http://dx.doi.org/10.1161/STR.0b013e318284056a>

Keep improving care and outcomes. (2015). Retrieved from

http://www.strokeassociation.org/STROKEORG/Professionals/TargetStroke/Target-Stroke_UCM_314495_SubHomePage.jsp

Marler, J. (1995, December 14). Tissue plasminogen activator for acute ischemic stroke. *New England Journal of Medicine*, 333, 1581-1588.

<http://dx.doi.org/10.1056/NEJM199512143332401>

Massaro, L. M. (2012, June 1st). Managing acute stroke and preventing secondary stroke:

Treatment is time sensitive. *ADVANCE for NPs & PAs*.

McGillion, M. H., Watt-Watson, J., Stevens, B., LeFort, S. M., Coyte, P., & Graham, A. (2008).

Randomized controlled trial of a psychoeducation program for the self-management of chronic cardiac pain. *Journal of Pain and Symptom Management*, 1-15.

McGonigle, D., & Mastrian, K. (2015). *Nursing informatics* (3rd ed.). 5 Wall Street Burlington, MA: Jones & Bartlett Learning.

Meretoja, A., Strbian, D., Mustanoja, S., Weir, L., & Ugalde, M. (2012, May 23). Reducing in-hospital delay to 20 minutes in stroke thrombolysis. *Neurology*, 79, 306-313.

Middleton, S., Grimley, R., & Alexandrov, A. (2015, January 26). Triage, triage, transfer: Evidenced-based clinical practice recommendations and models of nursing care for the first 72 hours of admission to hospital for acute stroke. *STROKE*, 46, 18-25.
<http://dx.doi.org/10.1161/STROKEAHA.114.006139>

Rapple, E. (2015). Average cost per inpatient day across 50 states. Retrieved from <http://www.beckershospitalreview.com/finance/average-cost-per-inpatient-day-across-50-states.html>

Saver, J. L. (2006). Time is brain. *Stroke-American Heart Association*, 37, 263-266.

Shamy, M. C., & Jaigobin, C. S. (2013). The complexities of acute stroke decision-making: a survey of neurologists. *Neurology*, 81, 1130-1133.

Strbian, D., Ringleb, P., Michel, P., Breuer, L., Ollikainen, J., Murao, K., ... Tatlisumak, T. (2013, August 22nd). Ultra-early intravenous stroke thrombolysis. *STROKE*, 44(10).
<http://dx.doi.org/10.1161/STROKEAHA.111.000819>

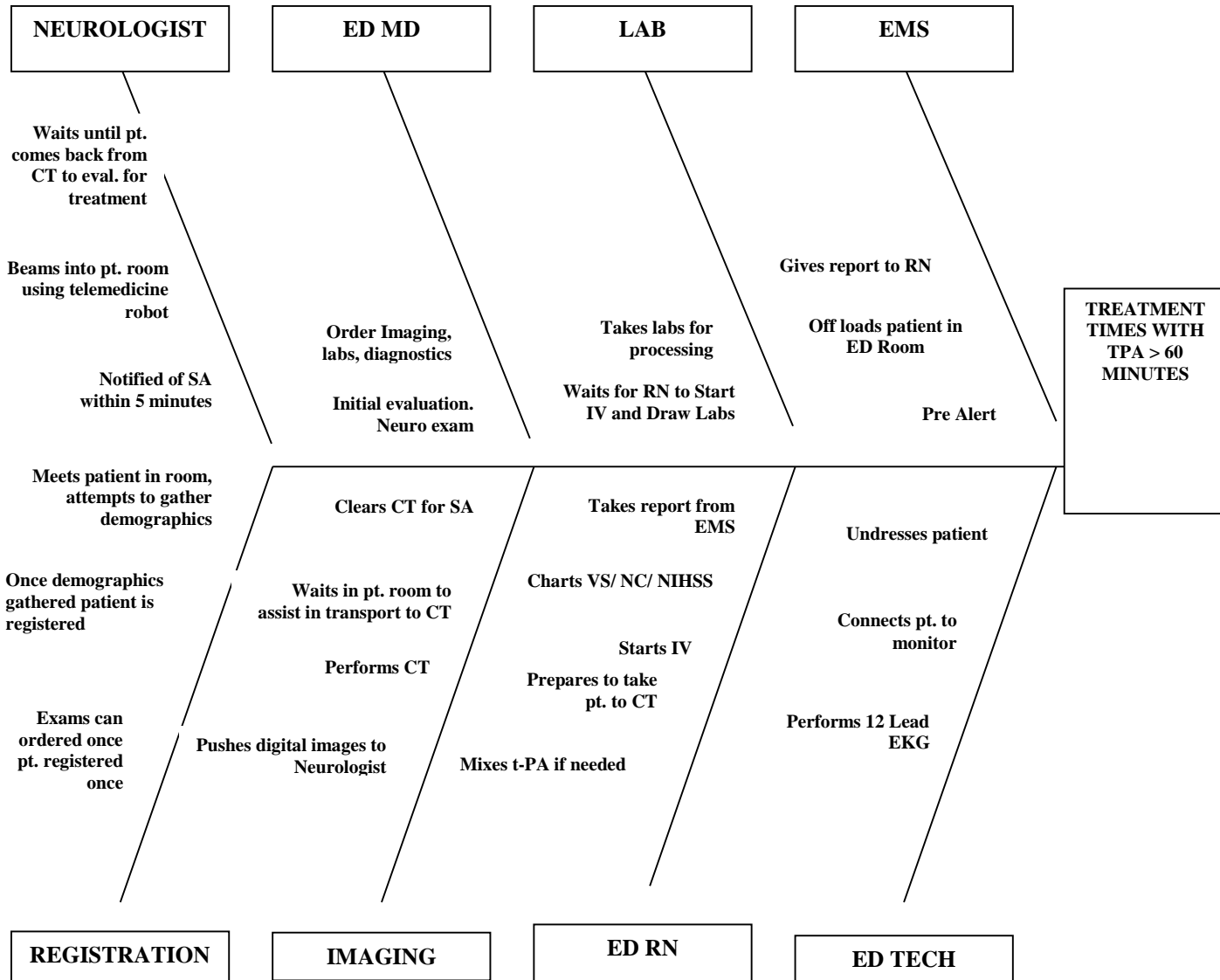
Stroke Awareness Foundation. (2015). Stroke treatment: What is the standard treatment for stroke. Retrieved from <http://strokeinfo.org/signsandsymptoms/stroke-facts/treatment-for-stroke>

Stroke awareness foundation: Stroke awareness. (2015). Retrieved from <http://strokeinfo.org/signsandsymptoms/stroke-facts/treatment-for-stroke>

Stroke Care. (2013). Retrieved from http://www.strokeassociation.org/STROKEORG/AboutStroke/Treatment/Stroke-Treatments_UCM_310892_Article.jsp

Target: Stroke campaign manual. (2010). In Target: Stroke campaign manual. []. Retrieved from http://www.strokeassociation.org/idc/groups/heart-public/@wcm/@hcm/@gwtg/documents/downloadable/ucm_308277.pdf

Appendix A
Root Cause Analysis
Fishbone Diagram



Appendix B

Stakeholder Analysis

	Beneficial	Harmful
Internal	Strengths <ul style="list-style-type: none"> • Our hospital currently meets or exceeds regional treatment times. • Many of our processes based on AHA/ASA guidelines have already been implemented • One of the most important exams to complete before the decision to give t-PA is a CT of the head to rule out a hemorrhagic stroke • Having the suspected AIS patient go directly to the CT scanner before off-loading in the Emergency Department has the greatest potential to save door to treatment time. 	Weaknesses <ul style="list-style-type: none"> • Going directly to CT does delay a complete neurological exam to be performed by the ED physician and RN. • ED RN's would be taking report from EMS outside of the actual ED room. • Registration work flow changed.
External	Opportunities <ul style="list-style-type: none"> • Create a collaborative relationship with EMS, making them feel part of the process. • There is an opportunity to decrease the door to CT completion time from the American Heart Associations recommended 25 minutes down to under 5 minutes as evidenced by the Helsinki Model (Meratoja et al., 2012). • This study showed a decrease in door to treatment time from 62 minutes to 25 minutes in 4 months' time. 	Threats <ul style="list-style-type: none"> • EMS not required to change their policy and give report outside of the ED room.

Appendix C

Stroke Alert Patient Care Timeline

Projected Timeline:

Timeline of event completed:

TIMELINE FOR PT:00000000

DATE: 04/15/2015

	MANDATED GOAL (LESS THAN OR EQUAL TO)	ACTUAL
DOOR TO PHYSICIAN	10 MINUTES	12 MINUTES
DOOR TO STROKE TEAM	15 MINUTES	15 MINUTES
DOOR TO CT INITIATION	25 MINUTES	40 MINUTES
DOOR TO EKG	45 MINUTES	25 MINUTES
DOOR TO CT INTERPRETATION	45 MINUTES	60 MINUTES
DOOR TO DRUG	60 MINUTES	75 MINUTES

Appendix D
Cost Benefit Analysis
Costs

Resource nurse utilization based on 1 hour per SA @ \$70.00. Average SA per month = 50 Total projected cost = \$3,500

ED Physician representative for neurovascular meeting and ED physician meeting. Each meeting is 1 hour. ED Physician meeting fee = \$150.00/hour. Total cost \$300.00.

Neurologist fee for meeting participation = \$275.00/hr. Participates in neurovascular meeting and ED meeting. $2 \times 275 = \$550.00$

Staff education ($\$70.00 \times 0.5 \times 60$) = \$2100.00

Benefits

Average decrease of two days length of stay with early delivery of t-PA

Cost per day = \$3500.00

Average number of AIS patients receiving t-PA monthly = 4.

Annual t-PA usage $4 \times 12 = 36$. Expected decreased hospital days $36 \times 2 = 72$

$72 \times \$3500.00 = \$252,000.00$

The Calculated Benefit

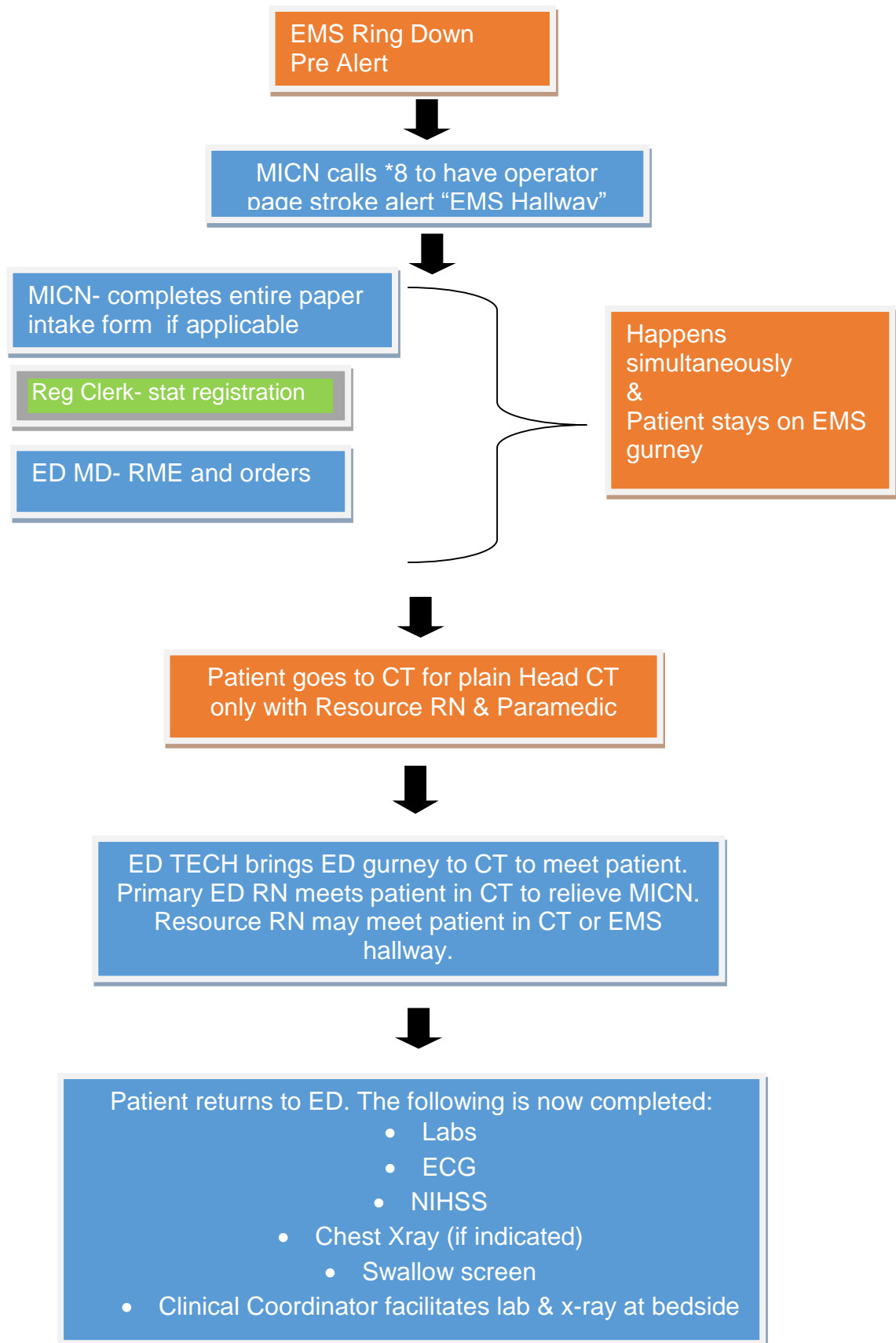
Total cost first year: \$6400.00

Total cost subsequent years: (Resource RN, Staff Education) \$5600.00

Total projected savings \$252,000 annually.

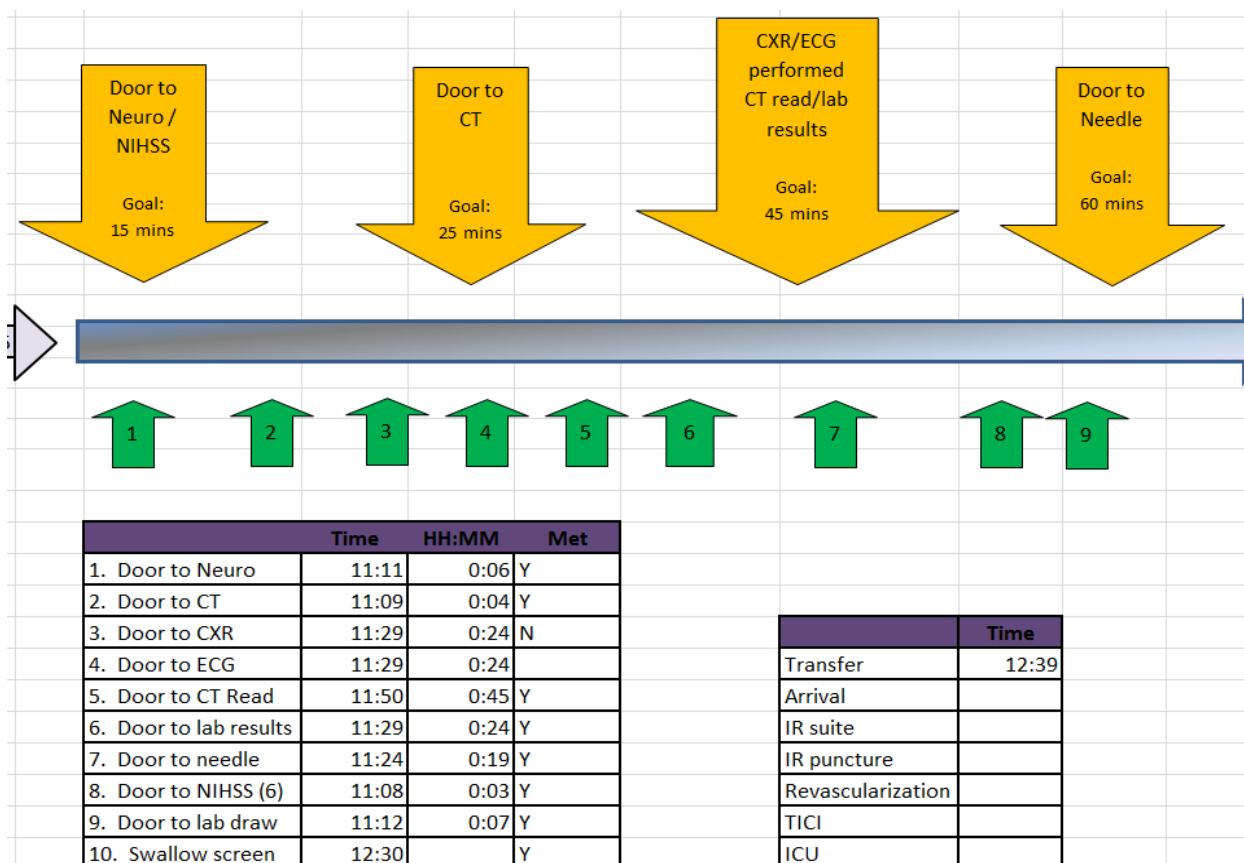
Appendix E

Process Algorithm



Appendix F

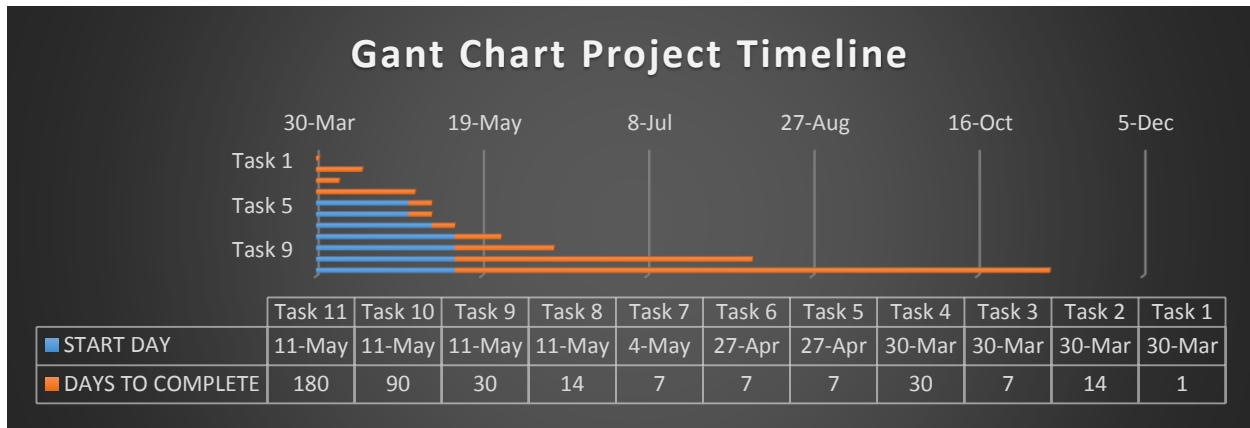
Database Timeline



Methodist Hospital Emergency Department EMS Transfer of Care Form
(To Be Completed by the ED RN While Taking the Verbal Hand-Off From EMS)

FOR ALL PATIENTS				
Name		Age	Chief Complaint	
Blood Pressure	Pulse	Respiratory Rate	Pulse Ox (If applicable)	Pain Level
Pertinent Medical History:				
FOR POSSIBLE STROKE PATIENTS				
Date & Time Last Seen Normal:			Blood Sugar in the Field:	
Is the Patient On Any Medications and/or Blood Thinners?			Yes <input type="checkbox"/>	No <input type="checkbox"/>
Specifically: Coumadin, Pradaxa, Xarelto, Apixaban, Edoxaban, ASA, Plavix +/- Lovenox (Circle if taking)				
Signs & Symptoms				
Family/Caregiver Contact Information (Name, Relationship, Phone Number)				
FOR FEMALE PATIENTS OF CHILDBEARING AGE				
Pregnant?	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Maybe <input type="checkbox"/>	
FOR TRAUMA PATIENTS				
Mechanism of Injury: MVA <input type="checkbox"/> Fall <input type="checkbox"/> Assault <input type="checkbox"/> GSW <input type="checkbox"/> Auto/Ped <input type="checkbox"/> Other <input type="checkbox"/>				
Loss of Consciousness: Yes <input type="checkbox"/> No <input type="checkbox"/> If Yes, how long?				
For MVA Patients				
Speed of the Crash:				
Restrained?	Yes <input type="checkbox"/>	No <input type="checkbox"/>	Air Bag Deployed:	Yes <input type="checkbox"/> No <input type="checkbox"/>
Damage to Vehicle:	No Damage <input type="checkbox"/>	Minor Damage <input type="checkbox"/>	Moderate Damage <input type="checkbox"/>	
FOR PEDIATRIC PATIENTS				
Temperature (if applicable):			Weight:	

Appendix H

**TASK**

1. Brainstorming: Dir. Neurology
2. EMS Process Change Agreement
3. Algorithm finalization
4. Algorithm approval 3 committees (Neuro Science, ED Medicine, MTC)
5. ED shift report training:
6. Imaging shift report training
7. Trial go live
8. Actual go live date
9. One month data
10. Three month data
11. Six month data

RESPONSIBLE FOR TASK COMPLETION

NV Coordinator, ED Director, Imaging Director
 Emergency Preparedness Coordinator
 Dir. Neurology, NV Coordinator

NV Coordinator
 ED Clinical Coordinators
 Lead Techs
 NV Coordinator
 NV Coordinator; ED CC's
 DHNI Analyst
 DHNI Analyst
 DHNI Analyst

Appendix I

PDSA Cycle # 1 Date: beginning _March 30th ending _April 27th Topic: Pre-Implementation

Change being evaluated: Send patient directly to CT on arrival by EMS

Objective of this cycle: Plan for process change

Plan

Neurovascular Coordinator, Neurologist, ED Director, Imaging Director, Emergency Preparedness Coordinator will discuss project AIM.

Plan for data collection: Current Door to CT and DTN times evaluated. Evaluation tool needed.

Do Process Algorithm designed. EMS agrees to process. Timeline for treatment evaluation tool designed.

ED Physicians have concerns over not being able to perform a full patient assessment before patient goes to CT. Director of Neurology assures physician group that research shows this is a safe process.

Staff Education (Shift report training ED and Imaging staff)

Study

From May 2014 through November 2014 the average arrival to CT imaging for SA alert patients was 28 minutes. During the 2014 year our hospital was able to achieve DTN times < 60 minutes 80% of the time. The average DTN was 52 minutes.

56 patients received t-PA in 2014. The average LOS was six days.

These statistics will be used to compare data at one, three, and six months after process implementation.

Act

Process implementation May 11th, 2015.

Next cycle PDSA June 11th (One month after new process implementation)

Appendix I

Page 2

PDSA Cycle # 2 Date: beginning _May 11th ending _June 11th Topic: One month post go live

Change being evaluated: Send patient directly to CT on arrival by EMS

Objective of this cycle: Evaluate early change results

Plan

Process implemented on May 11th.

Plan for data collection: Database Timeline (Appendix F) used to collect data on all SA's.

Do Encourage use of EMS data collection tool (Appendix G)

Analyst provides data timeline on all SA within three month period.

Study

From May 11th to June 11th there were 45 SA's brought in via EMS. Five could not go directly to CT because of airway compromise. The 40 that did go directly to CT were used for data comparison. 5 of the 40 patients were eligible to receive t-PA.

Average Door to CT = 22 minutes

Average DTN (5 patients) = 48 minutes (2 under 45 minutes, 1 over 60 minutes due to translation difficulties. 1 under 60 minutes) moving towards goal of >50% < 45 minutes.

Average LOS for patients receiving t-PA = 4 days (Goal met)

These statistics will be used to compare data at one, three, and six months after process implementation.

Act

Process implementation showing positive results. Continue to monitor data gathered.

Next cycle PDSA August 11th (Three months after new process implementation)

Appendix I

Page 3

PDSA Cycle # 3 Date: beginning _May 11th ending _August 11th Topic: 3 month post implementation

Change being evaluated: Send patient directly to CT on arrival by EMS

Objective of this cycle: Evaluate process change

Plan

Plan for data collection: Database Timeline (Appendix F) used to collect data on all SA's.

Do Encourage use of EMS data collection tool (Appendix G)

Analyst provides data timeline on all SA within six month period.

Observe all SA when available to give instant feedback to ED staff and EMS staff

Study From June 11th to August 11th there were 70 SA arriving via EMS. Six did not go directly to CT due to unstable conditions. Five did not go to CT due to the new process not being followed. T-PA was given to 6 patients, none of which were part of the 5 where policy was not followed.

Average Door to CT = 19 minutes (excluding cases where patient unstable, 20% goal exceeded)

Average DTN time= 39 minutes (4 < 45 minutes; 2 < 60; Target Goal Met)

Average LOS for patients receiving t-PA= 3 days (Goal exceeded)


Act

Followed up with SA team members including RN, Tech, and ED MD where SA policy was not followed. Redirected and re-educated. ED Medical Director also followed up with ED MD who made the call not to go directly to CT.

Next cycle PDSA November 11th (Six months after new process implementation)

Appendix I
Page 4

PDSA Cycle # 4 Date: beginning _May 11th ending _November 11th Topic: Six month post Implementation

	<p>Change being evaluated: Send patient directly to CT on arrival by EMS</p> <hr/> <p>Objective of this cycle: Plan for process change</p> <hr/>
<p>Plan</p> <p>Plan for data collection: Current Door to CT and DTN times evaluated. Evaluation tool needed.</p>	
<p>Do Encourage use of EMS data collection tool (Appendix G) Analyst provides data timeline on all SA within six month period. Observe all SA when available to give instant feedback to ED staff and EMS staff</p>	
<p>Study From August 11th to November 11th there were 90 SA arriving via EMS. Ten were too unstable to go directly to CT. Of the remaining 80 patients all followed the process and went directly to CT. Nine patients qualified for t-PA during this period. Average Door to CT = 16 minutes Average DTN time = 40 minutes (4 < 45; 2 < 60 minutes: Goal Met) Average LOS for patients receiving t-PA = 2.5 days (Goal Exceeded)</p>	
<p>Act Process implementation May 11th 2015. Improvement shown in three areas:</p> <ol style="list-style-type: none"> 1. Arrival to CT 2. DTN 3. Decreased LOS for patient's receiving t-PA <p>AHA/ASA Target Stroke Phase II challenge met Full meal provided for day and night shift for excellence in process implementation and goal achievement.</p>	