**NATIONAL QUALITY FORUM—Evidence (Subcriterion 1a)**

**Measure Number** (*if previously endorsed*)**:** 0661

**Measure Title**: Head CT or MRI Scan Results for Acute Ischemic Stroke or Hemorrhagic Stroke Patients who Received Head CT or MRI Scan Interpretation Within 45 Minutes of ED Arrival

**IF the measure is a component in a composite performance measure, provide the title of the Composite Measure here:** Not applicable

**Date of Submission**: 11/1/2019

**Instructions**

* *Complete 1a.1 and 1a.2 for all measures. If instrument-based measure, complete 1a.3.*
* *Complete* ***EITHER 1a.2, 1a.3 or 1a.4*** *as applicable for the type of measure and evidence.*
* *For composite performance measures:*
  + *A separate evidence form is required for each component measure unless several components were studied together.*
  + *If a component measure is submitted as an individual performance measure, attach the evidence form to the individual measure submission.*
* All information needed to demonstrate meeting the evidence subcriterion (1a) must be in this form. An appendix of *supplemental* materials may be submitted, but there is no guarantee it will be reviewed.
* If you are unable to check a box, please highlight or shade the box for your response.
* Contact NQF staff regarding questions. Check for resources at [Submitting Standards webpage.](http://www.qualityforum.org/Measuring_Performance/Submitting_Standards.aspx)

***Note:*** **The information provided in this form is intended to aid the Standing Committee and other stakeholders in understanding to what degree the evidence for this measure meets NQF’s evaluation criteria.**

**1a. Evidence to Support the Measure Focus**

The measure focus is evidence-based, demonstrated as follows:

* *Outcome:* Empirical data demonstrate a relationship between the outcome and at least one healthcare structure, process, intervention, or service. If not available, wide variation in performance can be used as evidence, assuming the data are from a robust number of providers and results are not subject to systematic bias.
* *Intermediate clinical outcome:* a systematic assessment and grading of the quantity, quality, and consistency of the body of evidence 4 that the measured intermediate clinical outcome leads to a desired health outcome.
* *Process:* a systematic assessment and grading of the quantity, quality, and consistency of the body of evidence that the measured process leads to a desired health outcome.
* *Structure:* a systematic assessment and grading of the quantity, quality, and consistency of the body of evidence that the measured structure leads to a desired health outcome.
* *Efficiency:* evidence not required for the resource use component.
  + For measures derived from patient reports, evidence should demonstrate that the target population values the measured outcome, process, or structure and finds it meaningful.
* *Process measures incorporating Appropriate Use Criteria:* See NQF’s guidance for evidence for measures, in general; guidance for measures specifically based on clinical practice guidelines apply as well.

**Notes**

1. Generally, rare event outcomes do not provide adequate information for improvement or discrimination; however, serious reportable events that are compared to zero are appropriate outcomes for public reporting and quality improvement.
2. The preferred systems for grading the evidence are the Grading of Recommendations, Assessment, Development and Evaluation (GRADE) guidelines and/or modified GRADE.

Clinical care processes typically include multiple steps: assess  identify problem/potential problem  choose/plan intervention (with patient input)  provide intervention  evaluate impact on health status. If the measure focus is one step in such a multistep process, the step with the strongest evidence for the link to the desired outcome should be selected as the focus of measurement. Note: A measure focused only on collecting PROM data is not a PRO-PM.

1. Measures of efficiency combine the concepts of resource use and quality (see NQF’s Measurement Framework: Evaluating Efficiency Across Episodes of Care; AQA Principles of Efficiency Measures).

**1a.1 This is a measure of**: (*should be consistent with type of measure entered in De.1*) Outcome

## Outcome: Click here to name the health outcome

* + - Patient-reported outcome (PRO): Click here to name the PRO

*PROs include HRQoL/functional status, symptom/symptom burden, experience with care, health- related behaviors.* (*A PRO-based performance measure is not a survey instrument. Data may be collected using a survey instrument to construct a PRO measure.)*

* Intermediate clinical outcome (*e.g., lab value*): Click here to name the intermediate outcome
* Process: Head CT or MRI Scan Results for Acute Ischemic Stroke or Hemorrhagic Stroke Patients who Received Head CT or MRI Scan Interpretation Within 45 Minutes of ED
  + Appropriate use measure: Click here to name what is being measured
* Structure: Click here to name the structure
* Composite: Click here to name what is being measured

**1a.2 LOGIC MODEL** Diagram or briefly describe the steps between the healthcare structures and processes (e.g., interventions, or services) and the patient’s health outcome(s). The relationships in the diagram should be easily understood by general, non-technical audiences. Indicate the structure, process or outcome being measured.

According to the Centers for Disease Control, stroke is the fifth leading cause of death (Kochanek et al., 2014; Heron, 2018). Prompt brain imaging is a critical component of an acute stroke patient’s ED evaluation because it provides important information about the diagnosis, prognosis, and immediate and long-term treatment of potential stroke patients. In particular, computed tomography (CT) or magnetic resonance imaging (MRI) can identify contraindications for time-sensitive treatment such as fibrinolysis. Once the appropriate therapy is determined, guidelines recommend that treatment be initiated without delay because the likelihood of favorable outcome is directly linked to the time-to-treatment (See Guideline #1 in Section **1a.3**) (Jauch et al., 2013). For example, fibrinolysis with intravenous recombinant tissue plasminogen activator (tPA or rtPA), the gold standard for acute ischemic stroke, has been approved by the Food and Drug Administration (FDA) to be administered within three hours of symptom onset (Cheng and Kim 2015). Although it has been shown to improve functional outcomes at three to six months when given within three hours of ischemic stroke onset for patients who meet eligibility criteria, there is evidence that a shorter time-to-treatment is associated with reduced mortality and symptomatic intracranial hemorrhage, and higher rates of independent ambulation at discharge and discharge to home (Saver et al. 2013). Accordingly, #0661 requires that a head CT scan or MRI be interpreted within 45 minutes for patients who are within two hours of symptom onset in order to ensure that eligible tPA candidates receive the time-sensitive treatment within the recommended three-hour window.

Cheng NT, Kim AS. Intravenous thrombolysis for acute ischemic stroke within 3 hours versus between 3 and 4.5 hours of symptom onset. Demaerschalk BM, ed. The Neurohospitalist. 2015;5(3):101-109. doi:10.1177/ 1941874415583116.

Jauch E.C., Saver J.L., Adams H.P. Jr, Bruno A., Connors J.J., Demaerschalk B.M., Khatri P., McMullan PW Jr, Qureshi AI, Rosenfield K, Scott PA, Summers DR, Wang DZ, Wintermark M, Yonas H; on behalf of the American Heart Association Stroke Council, Council on Cardiovascular Nursing, Council on Peripheral Vascular Disease, and Council on Clinical Cardiology. (2013). Guidelines for the early management of patients with acute ischemic stroke: A guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke, 44(3), 870–947.

Heron, Melonie. (2018). Deaths: Leading causes for 2016. *National Vital Statistics Reports*. 67(6). https://www. cdc.gov/nchs/data/nvsr/nvsr67/nvsr67\_06.pdf.

**1a.3 Value and Meaningfulness: IF** this measure is derived from patient report, provide evidence that the target population values the measured ***outcome, process, or structure*** and finds it meaningful. (Describe how and from whom their input was obtained.)

Not applicable, as this measure is not derived from patient-reported data.

# \*\*RESPOND TO ONLY ONE SECTION BELOW -EITHER 1a.2, 1a.3 or 1a.4) \*\*

**1a.2 FOR OUTCOME MEASURES including PATIENT REPORTED OUTCOMES - Provide empirical data demonstrating the relationship between the outcome (or PRO) to at least one healthcare structure, process, intervention, or service.**

This measure is not a health outcome/PRO-PM.

**1a.3. SYSTEMATIC REVIEW(SR) OF THE EVIDENCE (for INTERMEDIATE OUTCOME, PROCESS, OR STRUCTURE PERFORMANCE MEASURES, INCLUDING THOSE THAT ARE INSTRUMENT-BASED) If the evidence is not based on a systematic review go to section 1a.4) If you wish to include more than one systematic review, add additional tables.**

**What is the source of the systematic review of the body of evidence that supports the performance measure? A systematic review is a scientific investigation that focuses on a specific question and uses explicit, prespecified scientific methods to identify, select, assess, and summarize the findings of similar but separate studies. It may include a quantitative synthesis (meta-analysis), depending on the available data. (IOM)**

## Clinical Practice Guideline recommendation (with evidence review)

* US Preventive Services Task Force Recommendation
* Other systematic review and grading of the body of evidence (*e.g., Cochrane Collaboration, AHRQ Evidence Practice Center*)

## ☒ Other

|  |  |
| --- | --- |
| **Source of Systematic Review:**   * **Title** * **Author** * **Date** * **Citation, including page number** * **URL** | Three clinical practice guidelines are provided based on their relevance to the measure. The first guideline, released in 2013 by the American Heart Association (AHA) and the American Stroke Association (ASA), evaluates the early management of patients with acute ischemic stroke. The second AHA/ASA guideline, released in 2015, is a focused update of the 2013 guideline with an emphasis on endovascular treatment. A third guideline was published in 2018 to provide comprehensive recommendations regarding care for patients with acute arterial ischemic stroke. Citations for the three guidelines follow:  1—Jauch EC, Saver JL, Adams HP Jr, Bruno A, Connors JJ, Demaerschalk BM, Khatri P, McMullan PW Jr, Qureshi AI, Rosenfield K, Scott PA, Summers DR, Wang DZ, Wintermark M, Yonas H; on behalf of the American Heart Association Stroke Council, Council on Cardiovascular Nursing, Council on Peripheral Vascular Disease, and Council on Clinical Cardiology. Guidelines for the early management of patients with acute ischemic stroke: A guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2013;44. Guideline available at: [http://stroke.ahajournals.org/content/early/2013/01/31/ STR.0b013e318284056a.full.pdf+html](http://stroke.ahajournals.org/content/early/2013/01/31/%20STR.0b013e318284056a.full.pdf+html).  2—Powers WJ, Derdeyn CP, Biller J, Coffey CS, Hoh BL, Jauch EC, Johnston KC, Johnston SC, Khalessi AA, Kidwell CS, Meschia JF, Ovbiagele B; Yavagal DR; on behalf of the American Heart Association Stroke Council. 2015 AHA/ASA focused update of the 2013 guidelines for the early management of patients with acute ischemic stroke regarding endovascular treatment: A guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2015;46. Guideline available at: [http://stroke.ahajournals.org/content/early/2015/06/26/ STR.0000000000000074.full.pdf+html](http://stroke.ahajournals.org/content/early/2015/06/26/%20STR.0000000000000074.full.pdf+html).  3—Powers WJ, Rabinstein AA, Ackerson T, Adeoye OM, Bambakidis NC, Becker K, Biller J, Brown M, Damaerschalk BM, Hoh B, Jauch EC, Kidwell CS, Leslie-Mazwi TM, Ovbiagele B, Scott PA, Sheth KN, Southerland AM, Summers DV, Tirschwell DL; on behalf of the American Heart Association Stroke Council. 2018 guidelines for the early management of patients with acute ischemic stroke: A guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2018;e46. Guideline available at: [https://www.ahajournals.org/doi/pdf/ 10.1161/STR.0000000000000158](https://www.ahajournals.org/doi/pdf/%2010.1161/STR.0000000000000158). |
| Quote the guideline or recommendation verbatim about the process, structure or intermediate outcome being measured. If not a guideline, summarize the conclusions from the SR. | *Guideline 1* provides recommendations for patients with acute cerebral ischemic symptoms that have not yet resolved. Three recommendations support the measure’s clinical intent.  Guideline 1 Recommendations: American Heart Association/ American Stroke Association   1. Emergency imaging of the brain is recommended before initiating any specific therapy to treat acute ischemic stroke. In most instances, NECT [non-contrast-enhanced computed tomography] will provide the necessary information to make decisions about emergency management. (Unchanged from the previous guideline). (Class I, Level of Evidence A; pg. 18). 2. Either NECT or MRI is recommended before intravenous rtPA administration to exclude ICH [intracranial hemorrhage] (absolute contraindication) and to determine whether CT hypodensity or MRI hyperintensity of ischemia is present. (Revised from the 2009 imaging scientific statement). (Class I, Level of Evidence A; pg. 18). 3. In intravenous fibrinolysis candidates, the brain imaging study should be interpreted within 45 minutes of patient arrival in the emergency department by a physician with expertise in reading CT and MRI studies of the brain parenchyma. (Revised from the previous guideline) (Class I, Level of Evidence C; pg. 3).   *Guideline 2* provides a focused update of the current recommendations for the endovascular treatment of acute ischemic stroke. One recommendation supports the measure’s clinical intent.  Guideline #2 Recommendation: American Heart Association/ American Stroke Association   1. Emergency imaging of the brain is recommended before initiating any specific treatment for acute stroke. In most instances, nonenhanced CT will provide the necessary information to make decisions about emergency management. (Unchanged from the 2013 guideline). (Class I, Level of Evidence A; pg. 3032).   *Guideline 3* provides a comprehensive and updated set of recommendations for patients with acute arterial ischemic stroke. Two of the recommendations support the measure’s intent.  Guideline #3 *Recommendation:* American Heart Association/ American Stroke Association   1. All patients admitted to hospital with suspected acute stroke should receive brain imaging evaluation on arrival to hospital. In most cases, noncontrast CT (NCCT) will provide the necessary information to make decisions about acute management. (Recommendation revised from 2013 guideline). (Class I, Level of Evidence B Nonrandomized; pg.e58). 2. Systems should be established so that brain imaging studies can be performed within 20 minutes of arrival in the ED in at least 50% of patients who may be candidates for IV alteplase and/or mechanical thrombectomy. (New recommendation). (Class I, Level of Evidence B Nonrandomized; pg.e58). |
| Grade assigned to the **evidence** associated with the recommendation with the  definition of the grade | All relevant recommendations from *Guideline 1* received a Class I designation. The evidence (level of evidence A) strongly and unambiguously support the recommendations to perform either an NECT or MRI before initiating treatment (and specifically before administering tPA) for acute ischemic stroke. Additionally, there is a broad consensus in the medical community (level of evidence C) supporting the recommendation that the brain imaging should be interpreted within 45 minutes of ED arrival. The AHA Stroke Council asserts that a recommendation with Level of Evidence B or C does not imply that the recommendation is weak, as many important clinical questions addressed in the guidelines do not lend themselves to clinical trials. Despite a limited pool of randomized control trial, there may be clear clinical consensus that a particular test or therapy is useful or effective. Collectively, the evidence supports these recommendations, demonstrating consensus within the clinical community that patients eligible for fibrinolysis should receive emergency imaging of the brain that should be interpreted within 45 minutes of ED arrival by a qualified physician.  The Class I recommendation from *Guideline 2* relates to the importance of expedited imaging, indicating consensus within the clinical community that emergency imaging is recommended regardless of the specific treatment being considered for acute stroke.  The following grading scale applies to recommendations from *Guideline 1*:  *Recommendation A: Class I:* Usefulness/efficacy is well established by evidence/ opinion.  *Recommendation B: Class I:* Usefulness/efficacy is well established by evidence/ opinion.  *Recommendation C: Class I:* Usefulness/efficacy is well established by evidence/ opinion.  The following evidence scales apply to recommendations from *Guideline 1*:  One class of recommendations: Class I  *Class I:* Evidence and/or general agreement that given treatment or procedure is beneficial, useful, and effective.  Two levels of evidence: Level A and Level C.  *Level A:* Data derived from multiple randomized clinical trials or meta-analyses.  *Level C:* Consensus of opinion of the experts and/or small studies, retrospective studies, registries. |
| Provide all other grades and definitions from the evidence grading system | **The following grading scale applies to recommendations from *Guideline 2*:**  *Recommendation A: Class I, Level A:* Usefulness/efficacy is well established by evidence/opinion.  The following evidence scales apply to recommendations from Guideline 2:  Two classes of recommendations: Class I and Class IIb  *Class I:* Benefit >>> Risk. Procedure/treatment SHOULD be performed/ administered.  One level of evidence: Level A.  *Level A:* Data derived from multiple randomized clinical trials or meta-analyses.  **The following grading scale applies to recommendations from *Guideline 3:***  *Recommendation A: Class I, Level B-NR (Nonrandomized):* moderate-quality evidence from 1 or more well-designed, well-executed nonrandomized studies, observational studies, or registry studies; meta-analyses of such studies.  *Recommendation B: Class I, Level B-NR:* moderate-quality evidence from 1 or more well-designed, well-executed nonrandomized studies, observational studies, or registry studies; meta-analyses of such studies*.* |
| Grade assigned to the **recommendation** with definition of the grade | All relevant recommendations from *Guideline 1* received a Class I designation. The evidence (level of evidence A) strongly and unambiguously support the recommendations to perform either an NECT or MRI before initiating treatment (and specifically before administering tPA) for acute ischemic stroke. Additionally, there is a broad consensus in the medical community (level of evidence C) supporting the recommendation that the brain imaging should be interpreted within 45 minutes of ED arrival. The AHA Stroke Council asserts that a recommendation with Level of Evidence B or C does not imply that the recommendation is weak, as many important clinical questions addressed in the guidelines do not lend themselves to clinical trials. Despite a limited pool of randomized control trial, there may be clear clinical consensus that a particular test or therapy is useful or effective. Collectively, the evidence supports these recommendations, demonstrating consensus within the clinical community that patients eligible for fibrinolysis should receive emergency imaging of the brain that should be interpreted within 45 minutes of ED arrival by a qualified physician.  The Class I recommendation from *Guideline 2* relates to the importance of expedited imaging, indicating consensus within the clinical community that emergency imaging is recommended regardless of the specific treatment being considered for acute stroke.  The following grading scale applies to recommendations from *Guideline 1*:  *Recommendation A: Class I:* Usefulness/efficacy is well established by evidence/ opinion.  *Recommendation B: Class I:* Usefulness/efficacy is well established by evidence/ opinion.  *Recommendation C: Class I:* Usefulness/efficacy is well established by evidence/ opinion.  The following evidence scales apply to recommendations from *Guideline 1*:  One class of recommendations: Class I  *Class I:* Evidence and/or general agreement that given treatment or procedure is beneficial, useful, and effective.  Two levels of evidence: Level A and Level C.  *Level A:* Data derived from multiple randomized clinical trials or meta-analyses.  *Level C:* Consensus of opinion of the experts and/or small studies, retrospective studies, registries. |
| Provide all other grades and definitions from the **recommendation** grading system | **The following grading scale applies to recommendations from *Guideline 2*:**  *Recommendation A: Class I, Level A:* Usefulness/efficacy is well established by evidence/opinion.  The following evidence scales apply to recommendations from Guideline 2:  Two classes of recommendations: Class I and Class IIb  *Class I:* Benefit >>> Risk. Procedure/treatment SHOULD be performed/ administered.  One level of evidence: Level A.  *Level A:* Data derived from multiple randomized clinical trials or meta-analyses.  **The following grading scale applies to recommendations from *Guideline 3:***  *Recommendation A: Class I, Level B-NR:* moderate-quality evidence from 1 or more well-designed, well-executed nonrandomized studies, observational studies, or registry studies; meta-analyses of such studies.  *Recommendation B: Class I, Level B-NR:* moderate-quality evidence from 1 or more well-designed, well-executed nonrandomized studies, observational studies, or registry studies; meta-analyses of such studies. |
| **Body of evidence:**   * **Quantity—how many studies?** * **Quality—what type of studies?** | The three guidelines are evidenced based; details are provided below.  Guideline 1 does not indicate the specific number or type of study designs included in the body of evidence; however, two of the recommendations are Level A, which are based on data from multiple randomized clinical trials or meta analyses, and the third recommendation is Level C, which is based on consensus opinion of experts, case studies, or standard of care. The imaging recommendations referenced 228 unique citations with evidence from 3 systematic reviews, 5 guidelines, 20 randomized control trials, and 173 observational studies.  Guideline 1 provides three Class I recommendations, indicating that the benefits clearly outweigh the risks and the recommendation can be applied to most patients in most circumstances. The two Level A recommendations are based on randomized control trials (RCTs) with no important limitations or exceptionally strong evidence from observational studies, and further evidence is unlikely to change the confidence in the estimate of the the effect. A Level A study of diagnostic or prognostic accuracy would be a prospective cohort survey. Investigators would start with a group of patients suspected of having a disease (the cohort). The diagnostic test would be performed on this cohort. Some patients would have a positive test, others a negative test. The cohort would then have the actual presence or absence of the disease determined by an independent reference standard (the gold standard). Quantitative measures of the diagnostic accuracy of the test (or predictor) such as the sensitivity or specificity could then be calculated. For a study to be graded Level A, an investigator who is unaware of the results of the diagnostic test (presence or absence of the prognostic predictor) should apply the reference standard to determine the true presence of the disease (outcome). The third recommendation (Level C) is based on observational studies, case series, or indirect evidence, such as the consensus opinion of experts or standard of care.  Guideline 2 does not indicate the specific number or type of study designs included in the body of evidence; however, the Class I recommendation is Level A evidence and unchanged from the 2013 guideline. Level A evidence is defined as high-quality evidence from more than 1 RCT, meta-analyses of high-quality RCTs, or one or more RCTs corroborated by high-quality registry studies.  Guideline #3 does not indicate the specific number or type of study designs included in the body of evidence; however, the two Class I recommendations are Level B-NR. Level B-NR evidence is moderate-quality evidence from 1 or more well-designed, well-executed nonrandomized studies, observational studies, or registry studies, or meta-analyses of such studies. The two recommendations referenced 12 unique citations with evidence from systematic reviews, nonrandomized studies, and observational studies. |
| **Estimates of benefit and consistency**  **across studies** | *Guideline #3, Recommendation A*:  “Diagnostic testing is most cost-effective when it leads to a change in treatment that improves outcomes, not just a change in treatment. Although diffusion-weighted magnetic resonance imaging (DW-MRI) is more sensitive than CT for detecting AIS,routine use in all patients with AIS is not cost-effective.” |
| **What harms were identified?** | The guidelines do not provide details about potential harms associated with expedited brain imaging of acute stroke patients that were identified in the body of evidence. |
| **Identify any new studies conducted since the SR. Do the new studies change the conclusions from the SR?** | Additional evidence identified as part of the contractor’s annual review of the clinical literature is described in Section **1a.4**. |

**1a.4 OTHER SOURCE OF EVIDENCE**

*If source of evidence is NOT from a clinical practice guideline, USPSTF, or systematic review, please describe the evidence on which you are basing the performance measure.*

**1a.4.1 Briefly SYNTHESIZE the evidence that supports the measure.** A list of references without a summary is not acceptable.

Additional evidence supporting the measure was identified through a review of clinical literature and related policy, as further described and referenced in Sections **1a.4.2** and **1a.4.3**. These additional references provide evidence that stroke remains the fifth leading cause of death and that improved outcomes, based on practice and studies, is associated with early interventions and timeframes from door-to-imaging and door-to-treatment for patients presenting with acute ischemic stroke.

# 1a.4.2 What process was used to identify the evidence?

In addition to the three guidelines cited above, a review of the clinical literature and related policy was conducted during the measure contractor’s annual review of the literature for additional evidence and/or new studies that support the measure’s intent. The measure contractor identified relevant peer-reviewed publications by searching the PubMed MEDLINE database from January 1, 2013 to February 15, 2015 and October 1, 2017 to March 31, 2019. Search results were limited to those published in the English language and that had abstracts available in PubMed. A further review by the contractor’s clinical and measure-development team resulted in the inclusion of eight articles in the body of evidence below. Citations and summaries for the eight items included in this review can be found in Section **1a.4.3**.

# 1a.4.3. Provide the citation(s) for the evidence.

Choi J, Jang M, Kang K, et al. Comparative effectiveness of standard care with IV thrombolysis versus without IV thrombolysis for mild ischemic stroke. *Journal of the American Heart Association*. 2015; 4(1):e001306.

Choi et al. conducted an observational registry-based study to evaluate the comparative effectiveness of standard care with intravenous thrombolysis (IVT) versus without IVT in mild stroke patients. Choi et al. identified patients with acute ischemic stroke who presented within 4.5 hours of symptom onset and had National Institutes of Health Stroke Scale Scores of 5 or higher. Of 13,117 patients with stroke who were hospitalized between April 2008 and May 2012, 1,386 met eligibility criteria and 194 were treated with IVT. Choi et al. found that standard care with IVT is more effective than not receiving IVT in mild ischemic stroke patients, and there is a statistically insignificant risk of symptomatic hemorrhagic transformation.

Ciccone A, Valvassori L, Nichelatti M, Sgoifo A, et al. Endovascular treatment for acute ischemic stroke. *The New England Journal of Medicine*. 2013; 368(10):904–913.

Ciccone et al. conducted a randomized control trial of 362 patients with acute ischemic stroke who arrived within 4.5 hours after onset to compare the clinical efficacy of endovascular therapy and intravenous tPA. The median time from stroke onset to start of treatment was 3.75 hours for endovascular therapy and 2.75 hours for intravenous tPA (p = 0.001). There were no significant differences between groups in the rates of other serious adverse events or the case fatality rate, suggesting that endovascular therapy is not superior to the current gold standard of tPA.

Edlow J, Smith E, Stead L, Gronseth G, et al. American College of Emergency Physicians, American Academy of Neurology. Clinical policy: Use of intravenous tPA for the management of acute ischemic stroke in the emergency department. *Ann Emerg Med*. 2013; 61(2):225–243.

A joint writing panel of the American College of Emergency Physicians and the American Academy of Neurology reviewed literature, graded evidence, and made recommendations based on the strength of available data. Recommendations were developed to help clinicians answer questions including: (1) Is intravenous tissue plasminogen activator (tPA) safe and effective for acute ischemic stroke patients if given within 3 hours of symptom onset? (2) Is intravenous tPA safe and effective for acute ischemic stroke patients treated between 3 to 4.5 hours after symptom onset? The authors indicate that although the time window for tPA may have been lengthened to 4.5 hours, patient outcomes are optimized by the earliest possible intervention after brain imaging and clinical evaluation.

Haršány M, Tsivgoulis G, Alexandrov A. Intravenous thrombolysis in acute ischemic stroke: Standard and potential future applications. *Expert Review of Neurotherapeutics*. 2014; 14(8):879–892.

Haršány et al. reviewed studies providing evidence that intravenous thrombolysis with tPA improves early functional outcomes in acute ischemic stroke patients. Additionally, successful use of intravenous thrombolysis is dependent upon the organization of the treatment team and it should be standard that intravenous tPA be administered within 4.5 hours of the onset of stroke symptoms.

Heron, Melonie. Deaths: Leading causes for 2016. *National Vital Statistics Reports*. 2018; 67(6). <https://www>. cdc.gov/ nchs/data/nvsr/nvsr67/nvsr67\_06.pdf.

# This report shares the leading causes of death in the United States by age, sex, race, and Hispanic origin using 2016 data from 50 states and the District of Columbia.

Lang C, Bland M, Cheng N, Corbetta M, et al. A case-control study of the effectiveness of tissue plasminogen activator on 6 month patients—Reported outcomes and health care utilization. *Journal of Stroke and Cerebrovascular Diseases: The Official Journal of National Stroke Association*. 2014; 23(10):2914–2919.

# Lang et al. performed a cohort study to examine the benefit of tPA on patient-reported outcomes and health care utilization on 6-month stroke patients by analyzing patients who received tPA as part of usual stroke management and patients who would have received tPA had they arrived to the hospital within the therapeutic time window. Data were collected from surveys 6 months after stroke using standardized patient-reported outcome measures and questions about health care utilization. Demographic and medical data were acquired from hospital records. The tPA (n = 78) and control (n = 156) groups were matched across variables, except for stroke severity, which was better in the control group; subsequent analyses controlled for this mismatch. Patients who received tPA were compared with those who would have received tPA had they arrived to the hospital within the therapeutic window. The tPA group reported better physical function, communication, cognitive ability, depressive symptomatology, and quality of life/participation compared with the control group and fewer people in the tPA group reported skilled nursing facility stays, emergency department visits, and rehospitalizations after their stroke. Lang et al. found that the use of tPA provides a large benefit to the daily lives of people with ischemic stroke.

Metts, E. L., A. M. Bailey, K. A. Weant and S. B. Justice. Identification of rate-limiting steps in the provision of thrombolytics for acute ischemic stroke. *J Pharm Pract.* 2017; 30(6), 606–611.

A retrospective chart review identified a number of factors that contribute to delays in DTN times greater than the guideline recommended 60 minutes. The study suggested that patient care protocols should focus on reducing *potential* delays in stroke treatment.

Schwamm L, Ali S, Reeves M, Smith E, et al. Temporal trends in patient characteristics and treatment with intravenous thrombolysis among acute ischemic stroke patients at Get With The Guidelines—Stroke hospitals. *Circulation*. Cardiovascular Quality and Outcomes. 2013; 6(5):543–549.

Schwamm et al. analyzed all acute ischemic stroke patients arriving within two hours of symptom onset and treated with tPA within three hours of symptom onset from 2003 to 2011 in the American Heart Association's Get with the Guideline-Stroke (GWTG-Stroke). A univariate analysis revealed that tPA use increased over time, particularly in those aged older than 85 years, nonwhite, and with milder strokes. Additionally, door-to-image and door-to-tPA times also improved. Schwamm et al. found that the frequency of intravenous tPA use among all acute ischemic stroke patients nearly doubled from 2003 to 2011.