Improving Door-to-Needle Times in Acute Ischemic Stroke

The Design and Rationale for the American Heart Association/American Stroke Association’s Target: Stroke Initiative

Gregg C. Fonarow, MD; Eric E. Smith, MD, MPH; Jeffrey L. Saver, MD; Mathew J. Reeves, PhD; Adrian F. Hernandez, MD, MHS; Eric D. Peterson, MD, MPH; Ralph L. Sacco, MD; Lee H. Schwamm, MD

Background and Purpose—The benefits of intravenous tissue-type plasminogen activator (tPA) in acute ischemic stroke are time-dependent, and guidelines recommend a door-to-needle time of ≤60 minutes. However, fewer than one third of acute ischemic stroke patients who receive tPA are treated within guideline-recommended door-to-needle times. This article describes the design and rationale of Target: Stroke, a national initiative organized by the American Heart Association/American Stroke Association in partnership with other organizations to assist hospitals in increasing the proportion of tPA-treated patients who achieve guideline-recommended door-to-needle times.

Methods—The initial program goal is to achieve a door-to-needle time ≤60 minutes for at least 50% of acute ischemic stroke patients. Key best practice strategies previously associated with achieving faster door-to-needle times in acute ischemic stroke were identified.

Results—The 10 key strategies chosen by Target: Stroke include emergency medical service prenotification, activating the stroke team with a single call, rapid acquisition and interpretation of brain imaging, use of specific protocols and tools, premixing tPA, a team-based approach, and rapid data feedback. The program includes many approaches intended to promote hospital participation, implement effective strategies, share best practices, foster collaboration, and achieve stated goals. A detailed program evaluation is also included. In the first year, Target: Stroke has enrolled over 1200 United States hospitals.

Conclusions—Target: Stroke, a multidimensional initiative to improve the timeliness of tPA administration, aims to elevate clinical performance in the care of acute ischemic stroke, facilitate the more rapid integration of evidence into clinical practice, and improve outcomes. (Stroke. 2011;42:2983-2989.)

Key Words: acute stroke ■ thrombolytics ■ quality of care ■ quality improvement

Tissue-type plasminogen activator (tPA) is a proven intervention for acute ischemic stroke patients, with a Class I, evidence-based recommendation from the American Heart Association/American Stroke Association (AHA/ASA).1–4 The benefit of intravenous tPA in acute ischemic stroke is strongly time-dependent. Analyses of pooled data from large randomized intravenous tPA trials have shown greater neurological improvement at 90 days with early tPA treatment.3,4 The therapeutic benefit of tPA is greatest when given early after ischemic stroke onset and declines with time, such that there is no significant benefit after 4.5 hours.3,7 Because of the importance of rapid treatment, national guidelines recommend that hospitals complete the clinical and imaging evaluation of acute ischemic stroke patients and initiate intravenous tPA therapy within 60 minutes of patient arrival in those without contraindications.2,7–10

Despite the proven benefits, guidelines recommendations, and explicit goals for timely administration of intravenous tPA, recent evidence from the Get With The Guidelines—Stroke (GWTG–Stroke) national United States (U.S.) registry and other studies indicates that less than one third of patients with acute ischemic stroke are treated within guideline-recommended door-to-needle times (ie, time from arrival at hospital to time of intravenous tPA administration).11–12 Moreover, despite widespread publication of guidelines and recommendations for expediting reperfusion therapy with tPA in acute ischemic stroke and substantial improvements in the portion of eligible patients treated with tPA, the percent-

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Stephen M. Davis, MD, was the Guest Editor for this paper.
From the Division of Cardiology (G.C.F.), University of California, Los Angeles CA; Department of Clinical Neurosciences, Hotchkiss Brain Institute, (E.E.S.) University of Calgary, Alberta, Canada; Department of Neurology (J.L.S.), University of California, Los Angeles, CA; Department of Epidemiology (M.J.R.), Michigan State University, East Lansing, MI; Duke Clinical Research Center (A.F.H., E.D.P.), Durham, NC; Miller School of Medicine (R.L.S.), University of Miami, Miami, FL; Department of Neurology (L.H.S.), Massachusetts General Hospital, Boston, MA.
The online-only Data Supplement is available at http://stroke.ahajournals.org/lookup/suppl/doi:10.1161/STROKEAHA.111.621342/-/DC1. Correspondence to Gregg C. Fonarow, MD, Ahmanson-UCLA Cardiomyopathy Center, Ronald Reagan UCLA Medical Center, 10833 LeConte Avenue, Room 47–123 CHS, Los Angeles, CA 90095–1679. E-mail gfonarow@mednet.ucla.edu
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age of patients with door-to-needle times within 60 minutes has only modestly increased over the last decade.\textsuperscript{11} Meanwhile, hospitals are facing growing pressure to improve the quality of stroke care and reduce treatment delays. Providing tPA with short door-to-needle time reflects a complex clinical process requiring coordination across departments and disciplines to effect timely triage, diagnosis, decision making, and treatment of a critically ill acute ischemic stroke patient.\textsuperscript{10,13} Successful organizational change in this complex clinical process will require a highly coordinated, multidimensional, focused effort.\textsuperscript{10,13}

**Target:** Stroke is a national quality improvement initiative of the AHA/ASA to improve the care of stroke. A major component of this initiative focuses on reducing door-to-needle times in acute ischemic stroke and on increasing the portion of eligible acute ischemic stroke patients who receive tPA ≤60 minutes after hospital arrival. This initiative is intended to build on the success of GWTG–Stroke, the Brain Attack Coalition, Mission: Lifeline, and particularly the Door-to-Balloon Time Alliance, which represents a highly successful collaborative effort that reduced treatment times for acute myocardial infarction.\textsuperscript{6,14–17} This article describes the rationale, design, methods, and goals for the Target: Stroke initiative.

**Methods**

**Target:** Stroke was initiated by the AHA/ASA together with other partner organizations. This national initiative comprises a multidisciplinary group of clinicians and broad alliance of participating hospitals. Target: Stroke was developed to improve acute stroke care with an initial focus on door-to-needle times for eligible patients with acute ischemic stroke being treated with intravenous tPA. The initial goal of Target: Stroke is for participating hospitals to treat at least 50% of their patients within 60 minutes or less of hospital arrival.

**Organization**

Target: Stroke was conceived of in November 2009. During the planning phase, a work group was assembled including volunteers and AHA/ASA staff representing a wide range of expertise, including perspectives from stroke neurology, emergency medicine, nursing, quality improvement, emergency medical service (EMS), and hospital management. The work group performed a systematic review of the published literature on improving door-to-needle times in acute ischemic stroke, and selected the key best practice strategies that would be adopted as part of the Target: Stroke initiative. A detailed Target: Stroke tool kit including protocols, order sets, algorithms, time trackers (Figure), and other materials to assist clinicians and hospitals was created using various tools previously developed by the AHA/ASA, tools currently used by GWTG–Stroke hospitals and provided as part of the GWTG–Stroke clinical library, and other available tools from the Brain Attack Coalition or other organizations. Additional customizable clinical decision support tools were created by the work group specifically for Target: Stroke. Tools for EMS stroke screening in the field and advance hospital notification were aggregated. Patient educational materials were also developed as part of this initiative. Each of these tools is available on the Target: Stroke Web site (www.targetstroke.org). A detailed Target: Stroke implementation manual was developed with a step-by-step guide to executing the program. The work group also developed a multidimensional education program to support the initiative, including digital materials, source documentation, comprehensive slide sets, Webinars, and interactive videos. The work group also developed recognition criteria for hospitals achieving the door-to-needle time ≤60-minutes goal in at least 50% of patients: the Target: Stroke Honor Roll. A comprehensive plan for monitoring and evaluating the program was also developed.

During the planning phase, other national organizations, including the American Academy of Neurology, the Centers for Disease Control, the Paul Coverdell National Acute Stroke Registry, and the National Association of State EMS Officials were invited to join Target: Stroke, provide input into the program design, and assist with program implementation. Because successful achievement of improved door-to-needle times in acute ischemic stroke requires extensive collaboration and teamwork, input and feedback from participating hospital teams were sought and considered essential to the success of the initiative. Additional best practices, clinical decision support tools, and advice were also sought from clinicians from select GWTG–Stroke hospitals previously demonstrated to have achieved exceptionally good door-to-needle times.

**Best Practice Strategies**

A systematic review of the published data on improving door-to-needle times in acute ischemic stroke (Supplemental Appendix; http://stroke.ahajournals.org) identified several key strategies that were considered for inclusion in the Target: Stroke initiative.\textsuperscript{8–10,13,18–27} With these findings, the work group focused on selecting strategies that could be most rapidly, feasibly, and cost-effectively adopted by participating hospitals. The 10 key best practices strategies selected for Target: Stroke are shown in Table 1. These include EMS prenotification of hospitals, activating the stroke team with a single call, rapid acquisition and interpretation of brain imaging, use of specific protocols and tools, premixing tPA, a stroke-team-based approach, and rapid performance data feedback.\textsuperscript{8–10,13,18–27} The use of a telestroke system for image interpretation and/or clinical evaluation was noted as an additional optional strategy for hospitals without local stroke expertise available at all times.\textsuperscript{13} These hospitals are encouraged to explore building relationships with stroke centers to facilitate more timely evaluation, decision making, and treatment. Recognizing that locating brain imaging within the emergency department might be particularly challenging for some hospitals, Target: Stroke did not include this strategy as a core strategy, despite its association with shorter door-to-needle times.\textsuperscript{28} Other strategies, such as having a stroke neurologist in the hospital at all times, are potentially costly and complex to implement, and therefore they were not incorporated into the core recommendations of the campaign, even though this strategy in particular may be associated with faster door-to-needle times.

**Program Implementation**

The launch of Target: Stroke was announced in February 2010. Target: Stroke integrated a number of strategies to facilitate implementation based on performance improvement science\textsuperscript{25,29} and was modeled after other successful performance improvement initiatives including GWTG–Stroke and the Door-to-Balloon Time Alliance (Table 2).\textsuperscript{14–16} As a condition of Target: Stroke enrollment, each hospital team was required to commit to reaching the Target: Stroke performance goal of 50% or more of patients treated within 60 minutes. Each hospital also named a clinician leader as a contact for the project and agreed to complete a baseline survey of their current door-to-needle time practices. This baseline, Web-based, Target: Stroke survey queried hospitals on previous approaches and efforts for timely tPA administration for patients for acute ischemic stroke care. Information about which best practice strategies the hospital team planned on employing as part of their participation in Target: Stroke was also collected. Each participating hospital received a kit, best practices to reduce door-to-needle times in acute ischemic stroke, and a manual that provided step-by-step instructions on how to implement the program. Hospitals were strongly encouraged to organize a multidisciplinary door-to-needle-time-improvement team and to implement each of the key best practice strategies to improve door-to-needle times.\textsuperscript{10,13} Hospitals were offered educational materials, slide sets, the Target: Stroke Webinar series, and access to an online collaborative forum of all participating hospitals. The AHA/ASA GWTG expert field staff members have been made available to provide extensive assistance to hospitals in their efforts to make...
improvements in door-to-needle times. The existing GWTG–Stroke hospital teams are an important component of Target: Stroke because they involve a strong network of stroke champions in every state who can motivate and facilitate changes at the hospital and physician level.

**Assessment**

Detailed assessment of whether the Target: Stroke initiative resulted in improvements in timeliness of tPA administration and portion of patients with door-to-needle times ≤60 minutes for acute ischemic stroke among participating hospitals are planned. For the evaluation of the change in door-to-needle times, the data source will be GWTG–Stroke and the annual rate of improvement after implementation of Target: Stroke can be compared with the previous 7 years of performance. The use of GWTG–Stroke data will also allow the comparison of Target: Stroke hospitals with those GWTG–Stroke hospitals that do not participate in Target: Stroke. We may also be able to compare practices in groups of hospitals with greater reductions in door-to-needle times with practices in groups of hospitals with little or no improvement. Data on the portion of eligible patients treated with tPA, other stroke care processes, the rate of symptomatic intracranial hemorrhage complications from tPA, and in-hospital clinical outcomes will be assessed. Baseline and follow-up Target: Stroke surveys will enable an assessment of how implementation of the key hospital strategies may have changed over the course of the initiative. The baseline survey was administered as close as possible to the enrollment date. The follow-up survey will be administered to hospitals approximately 1 year after their enrollment. Analyses will be performed to identify additional best practices for achieving rapid door-to-needle times. Target: Stroke is also intended to generate additional knowledge about how best to disseminate and translate research in optimal stroke care into clinical practice.

**Discussion**

Despite the proven benefits of timely administration of tPA for acute ischemic stroke, national goals, and previous pro-

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**Figure.** Target: Stroke Patient Time Tracker Tool. Time intervals derived from reference 9.
The benefits of timely intravenous tPA treatment on acute ischemic stroke outcomes are well established.1–4 Time-to-treatment with intravenous tPA has been demonstrated to be an important determinant of 90-day and 1-year functional outcomes in acute ischemic stroke.5–8 With every 10-minute delay in the start of thrombolytic infusion within the 1-to-3-hour-treatment time period, there was 1 fewer patient of 100 patients having improved disability outcome.9 There is recent data demonstrating that shorter door-to-needle times are also associated with improved outcomes in acute ischemic stroke. An analysis of 25504 ischemic stroke patients treated with the large remaining treatment gap, these findings support the need for a collaborative national campaign to improve timely treatment with intravenous tPA.9,11 The AHA/ASA Target: Stroke initiative is intended to meet this need.

Table 1. Target: Stroke Key Best Practice Strategies6–10,13,18–27

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Best Practice</th>
<th>Explanation</th>
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<tr>
<td>01</td>
<td>Advance hospital notification by EMS</td>
<td>EMS providers should, if feasible, provide early notification to the receiving hospital when stroke is recognized in the field. Advance notification of patient arrival by EMS can shorten time to CT and improve the timeliness of treatment with thrombolysis.</td>
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<td>02</td>
<td>Rapid triage protocol and stroke team notification</td>
<td>Acute triage protocols facilitate the timely recognition of stroke and reduce time to treatment. Acute stroke teams enhance stroke care and should be activated as soon as the stroke patient is identified in the emergency department or after notification from pre-hospital personnel.</td>
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<td>03</td>
<td>Single-call activation system</td>
<td>A single-call should activate the entire stroke team. A single-call activation system for the stroke team is defined here as a system in which the emergency department calls a central page operator, who then simultaneously pages the entire stroke team, including notification for stroke protocol imaging.</td>
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<tr>
<td>04</td>
<td>Stroke tools</td>
<td>A stroke toolkit containing clinical decision support, stroke-specific order sets, guidelines, hospital-specific algorithms, critical pathways, NIH Stroke Scale, and other stroke tools should be available and used for each patient.</td>
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<td>05</td>
<td>Rapid acquisition and interpretation of brain imaging</td>
<td>It is essential to initiate a CT scan (or MRI) within 25 min of arrival and complete interpretation of the CT scan within 45 min of arrival to exclude intracranial hemorrhage prior to administration of intravenous tPA.</td>
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<td>06</td>
<td>Rapid laboratory testing (including point-of-care testing if indicated)</td>
<td>When indicated, laboratories such as platelet count and—for patients in whom coagulation parameters should be assessed due to suspicion of coagulopathy—INR(PT)/PTT results should be available as quickly as possible and no later than 45 min after ED arrival. If standard stat laboratory turnaround times cannot meet this target, point-of-care testing in the emergency department can provide the data in the needed timeframe.</td>
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<tr>
<td>07</td>
<td>Mix tPA medication ahead of time</td>
<td>Mix drug and set up the bolus dose and 1-hour infusion pump as soon as a patient is recognized as a possible tPA candidate, even before brain imaging. Early preparation allows tPA infusion to begin as soon as the medical decision to treat is made. It is the policy of some drug manufacturers to replace, free of charge, medications that are mixed but not used in time-critical emergency situations such as these. Check with your hospital pharmacy for the proper procedures that will allow you to use this strategy to shorten time to treatment without financial risk.</td>
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<tr>
<td>08</td>
<td>Rapid access to intravenous tPA</td>
<td>Once eligibility has been determined and intracranial hemorrhage has been excluded, intravenous tPA should be promptly administered. tPA should be readily available in the emergency department or CT scanner area (if CT scanner is not located in the ED). Dosing charts and standardized order sets can also facilitate timely administration and minimize dosing errors.</td>
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<td>09</td>
<td>Team-based approach</td>
<td>The team approach based on standardized stroke pathways and protocols has proven to be effective in increasing the number of eligible patients treated and reducing time to treatment in stroke. An interdisciplinary collaborative team is also essential for successful stroke performance improvement efforts. The team should meet frequently to review your hospital’s processes, care quality, patient safety parameters and clinical outcomes, as well as to make recommendations for improvement.</td>
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<tr>
<td>10</td>
<td>Prompt data feedback</td>
<td>Accurately measuring and tracking your hospital’s door-to-needle times, IV tPA treatment rates in eligible patients and performance on other stroke performance/quality measures equip the stroke team to identify areas for improvement and take appropriate action. A data-monitoring and feedback system includes using the Get With The Guidelines-Stroke Patient Management Tool (PMT) and creating a process for providing timely feedback on a case-by-case basis and in hospital aggregate. This system helps identify specific delays, set targets and monitor progress on a case-by-case basis.</td>
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EMS indicates emergency medical system; CT, computed tomography; NIH, National Institutes of Health; MRI, magnetic resonance imaging; INR, International Normalized Ratio; PT, Prothrombin Time; PTT, Partial Thromboplastin Time; ED, emergency department; tPA, tissue-type plasminogen activator; IV, intravenous; PMT, patient management tool.
thrombolytic therapy after hospital arrival. A National Institute of Neurological Disorders and Stroke national symposium on the rapid identification and treatment of acute stroke recommended a door-to-needle target time of 60 minutes.8 AHA/ASA guidelines recommend the target for completion of initial evaluation and start of tPA treatment should be within 1 hour of the patient’s arrival in the emergency department.2,10 The Brain Attack Coalition’s target for primary stroke centers is to achieve a door-to-needle time within 60 minutes in 80% or more of patients.9 However, despite the evidence, national guideline recommendations, and previous quality improvement efforts, hospital initiation of tPA treatment is frequently longer than the recommended national target of a door-to-needle time ≤60 minutes. In a recent analysis of GWTG–Stroke, only one quarter of patients with acute ischemic stroke treated with tPA within 3 hours of symptom onset had door-to-needle times within 60 minutes, and overall median door-to-needle time for the entire cohort of patients was 78 minutes.11 The length of time participating in the GWTG–Stroke program and the Joint Commission Primary Stroke Center Certification were not independently associated with an increase in the proportion of patients with door-to-needle time ≤60 minutes; this demonstrates the need to expand the focus of GWTG–Stroke beyond efforts to increase tPA use among eligible patients.11 Other studies have also shown relatively prolonged door-to-needle times in patients treated with tPA for acute ischemic stroke. The Standard Treatment with Alteplase to Reverse Stroke (STARS) multicenter tPA study of 57 academic and community centers in the U.S. found a median door-to-needle time of 96 minutes.12 In the Safe Implementation of Thrombolysis in Stroke-Monitoring Study (SITS-MOST) observational study conducted in 285 centers and 6483 patients in the European Union, there was a mean door-to-needle time of 68 minutes.30

Organizational Change
Implementing effective performance improvement and reducing in-hospital time delay for tPA administration requires input and collaboration of many clinicians, including neurologists, emergency medicine physicians, radiologists, nurses, technicians, EMS, and administrative personnel.10,13 A well-organized team approach is essential for the implementation of timely acute ischemic stroke care. For timely, but safe and effective, acute ischemic stroke care, the following components are necessary: early identification of a candidate for thrombolysis and activation of a stroke team; evidence-based, up-to-date, readily assessable, effective protocols; rapid ordering, acquisition, and interpretation of brain imaging; accurate and rapid physician orders and intravenous tPA treatment administration; coordinated patient monitoring and ongoing assessment; and accurate time logs for tracking and data feedback.10,11,13

Previous experiences of hospitals successful in improving the quality of cardiovascular care suggest that improvement frequently does not occur in isolation, but is most effective when integrated into an environment that includes: explicit goals; collaborative, interdisciplinary teams; a patient-focused organizational culture; engaged clinical leaders and

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**Table 2. Target: Stroke Implementation, Resources, and Expectations**

<table>
<thead>
<tr>
<th>Steps to facilitate change</th>
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<tr>
<td>Commit to the explicit goal to improve door-to-needle times in acute ischemic stroke</td>
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<td>Identify clinical champions and obtain hospital administration support</td>
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<td>Organize collaborative stroke team with focus on goal to improve portion of eligible ischemic stroke patients receiving IV tPA in a timely fashion (door-to-needle times ≤60 min)</td>
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<tr>
<td>Implement Target: Stroke key best practice strategies allowing for flexibility in refining the standardized protocols</td>
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<tr>
<td>Utilize GWTG-Stroke clinical decision support tools and evidence based strategies for IV tPA</td>
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<td>Adopt organization culture to foster change and innovative quality improvement</td>
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<td>Participate in the Target: Stroke community of hospitals</td>
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<tr>
<td>Provide rapid data feedback to monitor progress and identify problems and successes</td>
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<tr>
<td>Track progress to goal using GWTG-Stroke Patient Management Tool quality measures</td>
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**Target: Stroke resources**

| Target: Stroke key best practice strategies and supporting guidelines, references, and tools |
| Customizable implementation tools, strategies, and systems                                 |
| Time interval for treatment steps and patient time-trackers                                |
| Online exchange forums to share best practices, challenges, and successes                  |
| Guideline based algorithms, order sets, dosing charts                                      |
| Educational programs for complex knowledge transfer including online resources, video education, and Target: Stroke webinar series |
| Patient education materials (e.g., patient education flyer)                               |
| Get With The Guidelines-Stroke community of hospitals                                     |

**Expectations for Target: Stroke hospitals**

| Commitment and active participation to achieve the Target: Stroke goal                     |
| Assemble dedicated Target: Stroke improvement team                                        |
| Implement Target: Stroke key best practices                                               |
| Utilize Target: Stroke tools                                                               |
| Collaborate with local Emergency Medical Services on stroke system and pre-arrival notification |
| Track progress to achieving the Target: Stroke goal using the GWTG-Stroke Patient Management Tool reporting functions |
| Share insights, experiences, and success                                                   |

GWTG indicates Get With The Guidelines; IV, intravenous; tPA, tissue-type plasminogen activator.

tPA among 1082 GWTG–Stroke hospitals demonstrated lower in-hospital mortality and less frequent symptomatic intracranial hemorrhage for patients with door-to-needle times ≤60 minutes compared with patients with door-to-needle times >60 minutes.11 For every 15-minute reduction in door-to-needle times, there was 5% lower odds of risk-adjusted in-hospital mortality.11 These findings suggest that more rapid reperfusion therapy in acute ischemic stroke can be achieved without compromising short-term clinical outcomes.

Results from clinical trials and registries have encouraged multiple organizations to set targets for timely initiation of
senior management; and detailed data feedback. Organizational change frequently poses challenges, resistance, and setbacks inherent in the process, but to be successful, these barriers must be overcome. Previous studies have linked teamwork and organizational culture to more advanced quality-improvement efforts and greater success in improving care processes. To foster successful performance improvement, hospitals need to implement clinical decision support and standardized protocols, but also maintain flexibility to be able to address individual patient needs and frequently revisit and improve protocols. Use of detailed, hospital-specific and clinician-specific data feedback to facilitate accountability while keeping nonconstructive fault-finding at a minimum are important elements to successful improvement efforts.

Collaborative, interdisciplinary teamwork and a patient-focused organizational culture have been found to be prominent features of hospitals that achieved marked improvement and outstanding performance in door-to-balloon times for ST-segment myocardial infarction. These elements may be particularly important in more complex clinical processes, such as door-to-needle time in acute ischemic stroke. These organizational change elements are important components that have been integrated into Target: Stroke.

Successful efforts to accelerate door-to-needle times in acute ischemic stroke have been previously reported. These include prearrival notification by EMS providers; written protocols for acute triage and patient flow; single call systems to activate all stroke team members; computed tomography or magnetic resonance imaging scanner clearance as soon as center is made aware of an incoming patient; locating the computed tomography scanner in the emergency department; storage and rapid access to thrombolytic drug in the emergency department; collaboration in developing treatment pathways among physicians, nurses, pharmacists, and technologists from emergency medicine, neurology, and radiology; and continuous data collection to drive iterative system improvement. Avoiding delays resulting from the performance of nonessential imaging protocols or laboratory testing is also important. It is also imperative that stroke programs continually evaluate their performance using quality improvement methods to ensure that eligible patients are evaluated and treated in a timely, but safe and effective, manner. These key best practice strategies are prominently featured in Target: Stroke.

There may be concerns that attempting to achieve shorter door-to-needle times may lead to rushed assessments, dosing errors, and greater likelihood of complications. It is also important to acknowledge that a door-to-needle time \( \leq 60 \) minutes may not be appropriate or achievable in all ischemic stroke patients, particularly those with unstable hemodynamics, respiratory compromise, or challenging clinical presentations. Nevertheless, for the majority of patients, timely administration of tPA is feasible and can be provided in a safe and effective fashion. There is concern that if hospitals focus too prominently on achieving rapid door-to-needle time, other important components of stroke care will be neglected, or clinicians will only choose to treat with tPA those patients in which door-to-needle times \( \leq 60 \) minutes can be achieved. Quality, safety, and outcome data including tPA treatment rates, tPA complication rates, and in-hospital mortality from Target: Stroke participating hospitals will be closely monitored to assess for unintended consequences of the program and to modify it to address fully any that are detected.

**Target: Stroke Research**

As part of the Target: Stroke initiative, quantitative studies are planned to determine the degree to which each of the key best practice strategies and other strategies are associated with door-to-needle times though analyses of the baseline Target: Stroke Surveys. In addition, a study is underway to understand better organizational systems and structures that are most closely associated with various door-to-needle times for tPA in acute ischemic stroke. Detailed phone interviews with key personnel will be conducted from a random sample of GWTG–Stroke hospitals with diverse door-to-needle time performance. Data on door-to-needle time and the portion of patients with door-to-needle time of \( \leq 60 \) minutes is being monitored on a monthly basis; this is so that overall progress can be tracked and the program can be revised and resourced as necessary. There may be important lessons from the experience of creating and implementing Target: Stroke that will have implications for future stroke quality-improvement campaigns.

**Limitations**

Participation in Target: Stroke is voluntary. Participating hospitals likely have greater interest in stroke quality improvement and better-organized stroke systems of care than do nonparticipating hospitals. As such, any findings of improvements in door-to-needle times observed among Target: Stroke hospitals may not be generalizable to other U.S. hospitals. Data collected by survey has inherent limitations. In addition, door-to-needle time and other data collected as part of GWTG–Stroke are dependent on the accuracy and completeness of abstraction from the medical record. To optimize data quality, the GWTG–Stroke program includes detailed training of site chart abstractors; standardized case definitions and coding instructions; and predefined logic and range checks on data fields at data entry, audit trails, and regular data quality reports for all sites. Limited source documentation audits at the individual state and site level have shown high data quality. Participating hospitals are instructed to include all consecutive admissions for ischemic stroke. However, because these processes are not audited, the potential exists for selection bias.

**Conclusions**

Despite evidence, guidelines, and previous quality improvement efforts, less than 1 in 3 patients being treated with tPA for acute ischemic stroke have door-to-needle times \( \leq 60 \) minutes. These findings lend support for a targeted initiative to shorten door-to-needle times for tPA in acute ischemic stroke to maximize clinical benefit. Target: Stroke, a multidimensional initiative to improve the timeliness of tPA administration, aims to elevate clinical performance in the care of acute ischemic stroke and to facilitate more rapid integration of evidence into clinical practice.
Sources of Funding
Target: Stroke is an initiative provided by the American Heart Association/American Stroke Association.

Disclosures
G.C.F. serves a member of the GWTG Steering Committee, receives research support from the National Institutes of Health (significant), served as a consultant to Pfizer (modest); and is an employee of the University of California, which holds a patent on retriever devices for stroke (significant). E.E.S. serves as a member of the GWTG Steering Subcommittee and has served on an advisory board for Genentech (modest). J.L.S. serves as a member of the GWTG Science Subcommittee, as a scientific consultant regarding trial design and conduct to CoAxia, Concentric Medical, Talacris, Ferrer, Photothera, Braimsgate, Sygns, and Ev3; received lecture honoraria from Ferrer; is an employee of the University of California, which holds a patent on retriever devices for stroke. M.J.R. receives salary support from the Michigan Stroke Registry and serves as a member of several AHA GWTG Subcommittees. A.F.H. is a member of the Duke Clinical Research Institute, which serves as the AHA/ASA GWTG data coordinating center; is a recipient of an AHA Pharmaceutical Roundtable grant (0675060N) and has received a research grant from Johnson & Johnson; has received an honorarium from AstraZeneca and Amgen. E.D.P. has received research grants from Lilly, Johnson & Johnson, and Bristol-Myers Squibb, Sanofi-Aventis, and Merck-Schering Plough partnership. Dr. Peterson serves as Principle investigator of the Data Analytic Center for AHA/ASA’s GWTG. R.L.S. is president of the AHA/ASA. L.H.S. serves as Chair of the Data Analytic Center for AHA/ASA’s GWTG. R.L.S. is president of the AHA/ASA. L.H.S. serves as chair of the Data Analytic Center for AHA/ASA’s GWTG Steering Committee; serves as a consultant to the Research Triangle Institute and to the Massachusetts Department of Public Health, and serves on the Steering Committee for Lundbeck’s DIA54 clinical trial.

References
Improving Door-to-Needle Times in Acute Ischemic Stroke: The Design and Rationale for the American Heart Association/American Stroke Association’s Target: Stroke Initiative

Gregg C. Fonarow, Eric E. Smith, Jeffrey L. Saver, Mathew J. Reeves, Adrian F. Hernandez, Eric D. Peterson, Ralph L. Sacco and Lee H. Schwamm

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SUPPLEMENTAL MATERIAL

Improving Door-to-Needle Times in Acute Ischemic Stroke: The Design and Rationale for the American Heart Association/American Stroke Association’s Target: Stroke Initiative

The methods for the systemic literature review to identify strategies for improving door-to-needle times in acute ischemic stroke were as follows: The target population of published studies for inclusion in the systematic review consisted of observational studies, interventions, or trials that evaluated the relationship between care processes and onset-to-needle or door-to-needle times in the population of acute stroke admissions treated with intravenous tPA. The literature search was conducted using MEDLINE, EMBASE, and Google Scholar and included studies published before January 31st, 2010. We conducted several searches by combining the term “stroke” and “tissue plasminogen activator” or “thrombolysis” with the following keywords/phrases: “time to treatment,” “door-to-needle,” “onset-to-needle,” “time,” “timeliness,” “speed,” “rapid,” “shorten,” “reduce,” “delays,” “strategies,” “improving,” “systems of care,” “best practices,” “quality improvement,” and “process of care”. We supplemented the search by screening the bibliographies of the papers that underwent full review. The search was limited to English language articles. For the relevancy screen, two authors (GF, ES) independently reviewed each title and abstract. Articles identified as potentially relevant by either reviewer then underwent a full review to determine if the article met inclusion criteria. Final determination of study eligibility was done at a consensus meeting. Because of the heterogeneity of the final selected studies we were unable to assess study quality. Eligible strategies were not limited to those advocated by any specific accrediting body, government institution or non-profit corporation. Because of the limited studies we
expanded this search to also include articles that addressed time to treatment reduction strategies in acute ST segment elevation myocardial infarction.