Debbie Summers MSN, RN, AHCNS-BC, CNRN, SCRN
Saint Lukes Hospital
NO DISCLOSURE
Every Minute Until Reperfusion the Brain Loses:

- 1.9 million neurons
- 14 billion synapses
- 7.5 miles myelinated fibers

-- Saver, Stroke 2006
### Number Needed to Treat to Benefit from IV TPA Across Full Range of Functional Outcomes

<table>
<thead>
<tr>
<th>Outcome</th>
<th>NNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal/Near Normal</td>
<td>8.3</td>
</tr>
<tr>
<td>Improved</td>
<td>3.1</td>
</tr>
</tbody>
</table>

For every 100 patients treated with tPA, 32 benefit, 3 harmed

Saver JL et al Stroke 2007; 38:2279-2283
BACKGROUND

GWTG launched in 2000 by the American Heart Association as a hospital-based–quality improvement initiative focused on U.S. management of acute MI.

In 2003, acute stroke became another focus of the program and inspired added participation of the American Stroke Association.

“Improvements in alteplase use in eligible patients were seen soon after the introduction of GWTG-Stroke in 2003, but there was minimal improvement in the percentage of patients with door-to-needle times within 60 minutes despite national guidelines.”
Substantial Opportunity to Improve Timeliness of IV tPA in Ischemic Stroke

Percent treated within DTN benchmark of 60 minutes

- 2005: 24.10%
- 2006: 22.30%
- 2007: 24.70%
- 2008: 25.80%
- 2009: 27.40%

DTN within 60 min

TARGET STROKE: PHASE 1

Target Stroke was initiated by the AHA/ASA as a national collaborative comprising a broad alliance of hospitals and clinicians. Phase 1 initiated Jan 2010.

The goal of Target Stroke was for GWTG participating hospitals to treat at least 50% of alteplase treated acute ischemic stroke patients within 60 minutes of hospital arrival.

An expert working group performed a literature review to identify 10 key evidence-based strategies associated with timely alteplase administration that could be most rapidly and feasibly adopted by hospitals.
Association of DTN Time as a Continuous Variable with in-Hospital Mortality in GWTG-Stroke

25,504 acute ischemic stroke patients treated with tPA within 3 hrs of symptom onset at 1082 hospital sites.

After adjustment, every 15 minute reduction in DTN time was associated with 5% lower odds of in-hospital mortality

Adjusted OR 0.95, 95% CI 0.92-0.98, P=0.0007

* Variables included in multivariable GEE models were age, sex, race, prior medical history of AF, stroke/TIA, CHD/MI, carotid stenosis, diabetes, PVD, hypertension, dyslipidemia, smoking, NIHSS (continuous), arrival mode (EMS vs other), arrival time on hours, hospital characteristics of geographic region, academic, PSC, bed size, annual number of strokes, annual number of tPA patients.

FONAROW GC ET AL. CIRCULATION. 2011;123:750-758.
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

*Stroke. 2011;42:00-00*
Target Stroke Core Concepts

1. Organize stroke team with focused goal to improve portion of eligible ischemic stroke patients receiving IV rt-PA in a timely fashion (DTN ≤ 60 minutes)
2. Implement Target: Stroke Best Practice Strategies
3. Utilize GWTG-Stroke clinical decision support tools and evidence based strategies for IV rt-PA
4. Participate in the Target: Stroke community of hospitals
5. Track progress to goal using GWTG-Stroke PMT quality measures
TARGET: STROKE 10 KEY BEST PRACTICE STRATEGIES

Hospital pre-notification by EMS
Rapid triage protocol and stroke team notification
Single call/paging activation system for entire stroke team
Use of a stroke toolkit containing clinical decision support, stroke-specific order sets, guidelines, hospital-specific algorithms, critical pathways, NIH Stroke Scale and other stroke tools
Rapid acquisition and interpretation of brain imaging

Rapid laboratory Testing (including point-of-care testing) if indicated
Pre-mixing alteplase medication ahead of time for high likelihood candidates
Rapid access to intravenous alteplase in the ED/brain imaging area
Team-based approach
Rapid data feedback to stroke team on each patient’s DTN time and other performance data
Customizable Implementation Tools

- Patient time-trackers
- Guideline based algorithms
- tPA checklist
- Standardized order sets
- Dosing charts
- Clinical pathways
- Evidence-based protocols
- EMS tools
- Patient educational materials
- Other tools

Target: Stroke tools: [www.targetstroke.org](http://www.targetstroke.org)
Clinical tools library: [heart.org/strokeclinicaltools](http://heart.org/strokeclinicaltools).
Target: Stroke timeline. *Phase I goal: Door-to-needle (DTN) times within 60 min in at least 50% of ischemic stroke patients treated with intravenous tissue-type plasminogen activator.

Original Investigation

Door-to-Needle Times for Tissue Plasminogen Activator Administration and Clinical Outcomes in Acute Ischemic Stroke Before and After a Quality Improvement Initiative

Gregg C. Fonarow, MD; Xin Zhao, MS; Eric E. Smith, MD, MPH; Jeffrey L. Saver, MD; Mathew J. Reeves, PhD; Deepak L. Bhatt, MD, MPH; Ying Xian, MD, PhD; Adrian F. Hernandez, MD, MHS; Eric D. Peterson, MD, MPH; Lee H. Schwamm, MD

Selection of the Study Population

1,587,230 Patients with Acute Ischemic Stroke

1,487,761 Excluded
- In-Hospital Strokes (n=30,897)
- Transferred In (n=174,002)
- Not Treated with IV tPA (n=1,278,602)
- tPA at Outside Hospital (n=4,260)

99,469 Patients Treated with IV tPA at Participating Hospital

21,500 Excluded
- Experimental Protocol (n=458)
- Time(s) Missing (n=4,421)
- Treated >3 Hours Post Onset (n=16,821)

6,800 Excluded
- Hospitals Not Participating During Both Pre- and Post-Target: Stroke Periods (n=6,800)

71,169 Patients Included in the Primary Analysis

Hospitals n=1030
Primary Analysis:
Patients with OTT times ≤3 hours (Class I in guidelines)

Sensitivity Analysis:
Patients with OTT times ≤4.5 hours (Class IIA in guidelines)
N=83,220

<table>
<thead>
<tr>
<th>Study Period</th>
<th>Preintervention (n = 27,319)</th>
<th>Postintervention (n = 43,850)</th>
<th>Adjusted Odds Ratio (95% CI)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>tPA DTN time, median (IQR), min</td>
<td>77 (60-98)</td>
<td>67 (51-87)</td>
<td></td>
<td>&lt; .001</td>
</tr>
<tr>
<td>tPA DTN time ≤ 60 min, % (95% CI)</td>
<td>26.5 (26.0-27.1)</td>
<td>41.3 (40.8-41.7)</td>
<td></td>
<td>&lt; .001</td>
</tr>
<tr>
<td>End of each period</td>
<td>29.6 (27.8-31.5)</td>
<td>53.3 (51.5-55.2)</td>
<td></td>
<td>&lt; .001</td>
</tr>
<tr>
<td>Improvement in tPA DTN time ≤ 60 min, % per year (95% CI)</td>
<td>1.36 (1.04-1.67)</td>
<td>6.20 (5.58-6.78)</td>
<td></td>
<td>&lt; .001</td>
</tr>
<tr>
<td>In-hospital all-cause mortality, %</td>
<td>9.93</td>
<td>8.25</td>
<td>0.89 (0.83-0.94)</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>Discharge to home, %</td>
<td>37.6</td>
<td>42.7</td>
<td>1.14 (1.09-1.19)</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>Independent ambulatory status, %</td>
<td>42.2</td>
<td>45.4</td>
<td>1.03 (0.97-1.10)</td>
<td>.31</td>
</tr>
<tr>
<td>Symptomatic intracranial hemorrhage within 36 h, %</td>
<td>5.68</td>
<td>4.68</td>
<td>0.83 (0.76-0.91)</td>
<td>&lt; .001</td>
</tr>
</tbody>
</table>

Time Trend in the Proportion of Patients with DTN Times within 60 Minutes
Pre- and Post-Target: Stroke

(P<0.0001 for comparison of the two slopes)

Target: Stroke Initiation

% DTN Times ≤60 Minutes

Time (Quarter / Year)

Target: Stroke Results: tPA Use

The Target: Stroke intervention was also associated with an increase in tPA use.

tPA use in eligible patients arriving by 2 hours and treated by 3 hours: 64.7% pre- vs. 85.2% post-intervention, P<0.0001

tPA use in eligible patients arriving by 3.5 hours and treated by 4.5 hours: 22.5% pre- vs. 63.9% post-intervention, P<0.0001

tPA use among all acute ischemic stroke patients: 5.7% pre- vs. 8.1% post-intervention, P<0.0001

No evidence for unintended consequences with the intervention with tPA use being avoided in patients who may have less favorable DTN times

Fonarow GC et al. JAMA. 2014;311(18):1632-1640.
National Impact of Target: Stroke

Care: 18,238 more patients treated with tPA
Clinical Outcomes: 977 additional lives saved
Quality of Life: 5,883 patients reduced their long-term disability
What were the winning strategies that helped drive the improvement?

29.6% Q4 2009

53.3% Q3 2013

Fonarow GC et al. JAMA. 2014; 311(18):1632-40
Target: Stroke Phase II

- **National Goal:**
  - Achieve DTN times within 60 minutes for 75% of eligible patients
  - Achieve DTN times within 45 minutes for 50% of eligible patients
- **Additional Hospital Recognition**
  - Target: Stroke Honor Roll: existing criteria
  - Target: Stroke Honor Roll Elite: DTN ≤ 60 minutes in 75% of eligible patients
  - Target: Stroke Honor Roll Elite-Plus: DTN ≤ 60 minutes in 75% of eligible patients and DTN ≤ 45 minutes in 50% of patients
- **Additional Target: Stroke Resources**
  - Updated time tracker and new tools
  - Additional strategies (transfer patient directly to CT, timer or clock at bedside) and evidence
  - New educational resources

INITIATED APRIL 2014
Target: Stroke Phase II Survey

Use of Strategies to Improve Door-to-Needle Times With Tissue-Type Plasminogen Activator in Acute Ischemic Stroke in Clinical Practice

Findings from Target: Stroke

Ying Xian, MD, PhD; Hao Lin Xu, MS; Barbara Lytle, MS; Jason Blevins, MPH; Eric D. Peterson, MD, MPH; Adrian F. Hernandez, MD, MHS; Eric E. Smith, MD, MPH; Jeffrey L. Saver, MD; Steven R. Messé, MD; Mary Paulsen, RN, MSN, CPHQ; Robert E. Suter, DO; Matthew J. Reeves, BVSc, PhD; Edward C. Juhasz, MD, MS; Lee H. Schwamm, MD; Gregg C. Fonarow, MD

Background—The implementation of Target: Stroke Phase I, the first stage of the American Heart Association’s national quality improvement initiative to accelerate door-to-needle (DTN) times, was associated with an average 15-minute reduction in DTN times. Target: Stroke phase II was launched in April 2014 with a goal of promoting further reduction in treatment times for tissue-type plasminogen activator (tPA) administration.

Methods and Results—We conducted a second survey of Get With The Guidelines—Stroke hospitals regarding strategies used to reduce delays after Target: Stroke and quantify their association with DTN times. A total of 16,901 ischemic stroke patients were treated with intravenous tPA within 4.5 hours of symptom onset from 888 surveyed hospitals between June 2014 and April 2015. The patient-level median DTN time was 56 minutes (interquartile range, 42–75), with 39.3% of patients receiving intravenous tPA within 60 minutes and 30.4% within 45 minutes after hospital arrival. Most hospitals reported routinely using a majority of Target: Stroke key practice strategies, although direct transport of patients to computed tomographic/magnetic resonance imaging scanners, premix of tPA ahead of time, initiation of tPA in the imaging suite, and prompt data feedback to emergency medical services providers were used less frequently. Overall, we identified 16 strategies associated with significant reductions in DTN times. Combined, a total of 20 minutes (95% confidence intervals 15–25 minutes) could be saved if all strategies were implemented.

Conclusions—Get With The Guidelines—Stroke hospitals have initiated a majority of Target: Stroke—recommended strategies to reduce DTN times in acute ischemic stroke. Nevertheless, certain strategies were infrequently practiced and represent a potential immediate target for further improvements. (Circ Cardiovasc Qual Outcomes. 2017;10:e003227. DOI: 10.1161/CIRCOU.TCOMES.116.003227.)
Frequency of Hospital Strategies Used

- Advanced hospital notification by EMS*: 95%
- Stroke tools†: 97%
- Rapid triage protocol and stroke team notification*: 100%
- Single-call activation system*: 100%
- Transport of patients by EMS directly to the CT/MRI scanner first*: 40%
- Rapid brain imaging*: 95%
- Rapid central laboratory testing†: 88%
- Pre-mix of tPA ahead of time*: 25%
- tPA stored in emergency department†: 70%
- Initiation of IV tPA bolus while patient is still in the brain imaging suite*: 0%
- A team-based approach to stroke care†: 99%
- Prompt patient-specific data feedback to the ED staff and stroke team*: 95%
- Prompt patient-specific data feedback to EMS providers*: 60%

*Percent of the time (median); †Yes.

Time or clock attached to chart, clipboard, or bed
Transfer directly to CT/MRI scanner


Target: Stroke Phase II Survey (888 hospitals) June 2014 and April 2015
Hospital Strategies and DTN Times

• We identified 16 strategies associated with significant reductions in DTN times

• On average, 1.25 minutes could be saved for each strategy implemented

• This represents a potential to reduce DTN times by as much as 20 minutes (95% CI 15-25 minutes) if all strategies were used

• At the patient level, a reduction of 20 minutes in DTN times would save 36 million neurons, reduce the risk of mortality and sICH, and increase the chance of functional independency

• At the national level, a reduction of 20 minutes could bring the median DTN times towards 30 minutes

EVT for AIS: Save a minute—save a week

Each minute saved in onset-to-treatment time granted on average 4.2 days of extra healthy life

Stroke Scale score above 10 gained more than a week per each minute saved.

In the whole cohort, every 20 minutes decrease in treatment delays led to a gain of average equivalent of 3 months of disability-free life


Meretoja et al. Neurology® 2017;88:2123–2127
During April-June 2016

- 68% of AIS patients who were brought to hospitals quickly enough to be eligible for the time-sensitive treatment of thrombolysis and got it within 60 minutes
- In sharp contrast, as recently as the end of 2009, successful, fast treatment rates were about 30%
- However, “we still have work to do,” cautioned Dr. Schwamm, who notes that 68% remains significantly short of the ideal 100%.
- 2010, the number of hospitals active in GWTG-Stroke jumped from 1427 to 1,950
TARGET STROKE PHASE: 3

National leaders are planning a Phase III Target Stroke

- DTN times within ________min for at least ________ of applicable patients required
- Incorporation of goals for using endovascular thrombectomy in appropriate patients – Honor Roll Advanced Therapy.
- Using telemedicine to quicken and broaden the availability of expert neurologic consults for identifying alteplase and thrombectomy-eligible patients

Current Target Stroke Honor Awards

- Target Stroke Honor Roll: Time to thrombolytic therapy within 60 minutes in 50% or more treated
- Target Stroke Honor Roll Elite: Time to thrombolytic therapy within 60 minutes in 75% or more treated
- Target Stroke Honor Roll Elite Plus: Time to thrombolytic therapy within 60 minutes in 75% or more of treated with IV-tPA AND door-to-needle time within 45 minutes in 50% of acute ischemic stroke patients treated with IV-tPA.
Seconds matter during a stroke.

dsummers@saint-lukes.org