LESSONS FROM TARGET STROKE III STUDY: IMPROVING THROMBOLYTIC AND ENDOVASCULAR CARE

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DISCLOSURES

- Consultant: Gravity Medical Technology, Sevaro
- Stock options: Galaxy Therapeutics
- Chair, Clinical Events Committee (Grassroot trial)
- Global Vice-chair, SVIN Mission Thrombectomy

TARGET: STROKE PHASE I

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

- An expert clinical work group performed a literature review to identify 10 key evidence-based strategies associated with timely tPA administration that could be most rapidly and feasibly adopted by hospitals.

Fonarow GC et al. JAMA. 2014;311(16):1632-1640.

Special Report

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

TARGET: STROKE PHASE I
10 KEY BEST PRACTICE STRATEGIES

1. Hospital pre-notification by Emergency Medical Services
2. Rapid triage protocol and stroke team notification
3. Single call/paging activation system for entire stroke team
4. 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
5. Rapid acquisition and interpretation of brain imaging
6. Rapid Laboratory Testing (including point-of-care testing) if indicated
7. Pre-mixing tPA medication ahead of time for high likelihood candidates
8. Rapid access to intravenous tPA in the ED/brain imaging area
9. Team-based approach
10. Rapid data feedback to stroke team on each patient's DTN time and other performance data

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

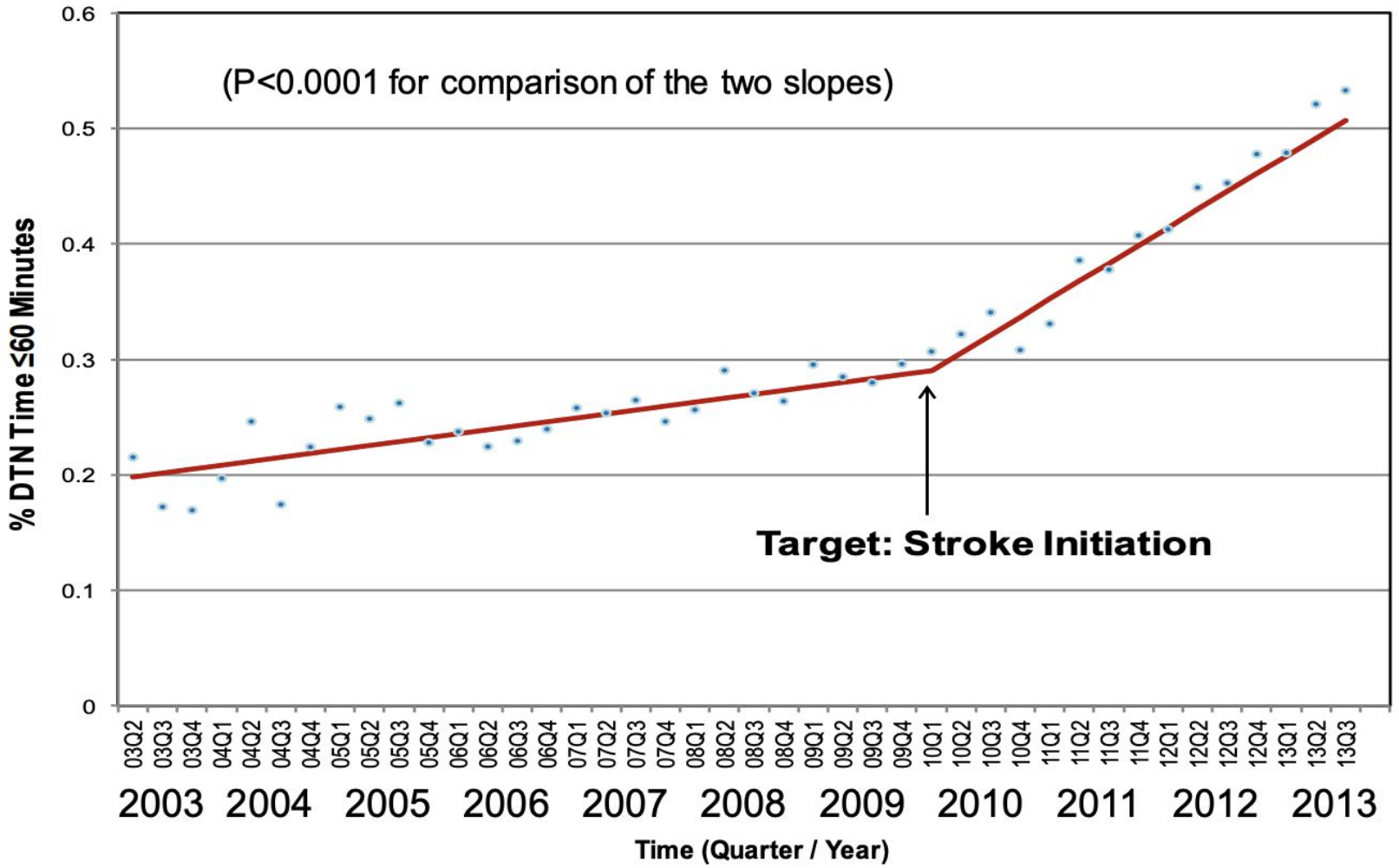
Gregg C. Fonarow, MD[1]; Xin Zhao, MS[2]; Eric E. Smith, MD, MPH[3] ; et al

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

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



TARGET: STROKE PHASE II

TARGET: STROKE PHASE II WAS LAUNCHED IN 2014 WITH A GOAL OF IMPROVING DTN TIMES TO ≤60 MIN IN 75% AND ≤45 MIN IN 50% OF PATIENTS.

NATIONAL GOAL:

- Achieve DTN times within 60 minutes for 75% of eligible patients
- Achieve DTN times within 45 minutes for 50% of eligible patients

TARGET: STROKE PHASE II
12 KEY BEST PRACTICE STRATEGIES

1. Hospital pre-notification by Emergency Medical Services
2. Rapid triage protocol and stroke team notification
3. Single call/paging activation system for entire stroke team
4. 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
5. **Timer or clock attached to chart, clipboard, or bed**
6. **Transfer directly to CT/MRI scanner**
7. Rapid acquisition and interpretation of brain imaging
8. Rapid Laboratory Testing (including point-of-care testing) if indicated
9. Pre-mixing tPA medication ahead of time for high likelihood candidates
10. Rapid access to intravenous tPA in the ED/brain imaging area
11. Team-based approach
12. Rapid data feedback to stroke team on each patient's DTN time and other performance data

Updated from Fonarow GC et al Stroke. 2011;42:2983-2989.

Stroke

CLINICAL AND POPULATION SCIENCES

Achieving More Rapid Door-to-Needle Times and Improved Outcomes in Acute Ischemic Stroke in a Nationwide Quality Improvement Intervention

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

BACKGROUND: The benefits of tPA (tissue-type plasminogen activator) in acute ischemic stroke are time-dependent. However, delivery of thrombolytic therapy rapidly after hospital arrival was initially occurring infrequently in hospitals in the United States, discrepant with national guidelines.

METHODS: We evaluated door-to-needle (DTN) times and clinical outcomes among patients with acute ischemic stroke receiving tPA before and after initiation of 2 successive nationwide quality improvement initiatives: Target: Stroke Phase I (2010–2013) and Target: Stroke Phase II (2014–2018) from 913 Get With The Guidelines-Stroke hospitals in the United States between April 2003 and September 2018.

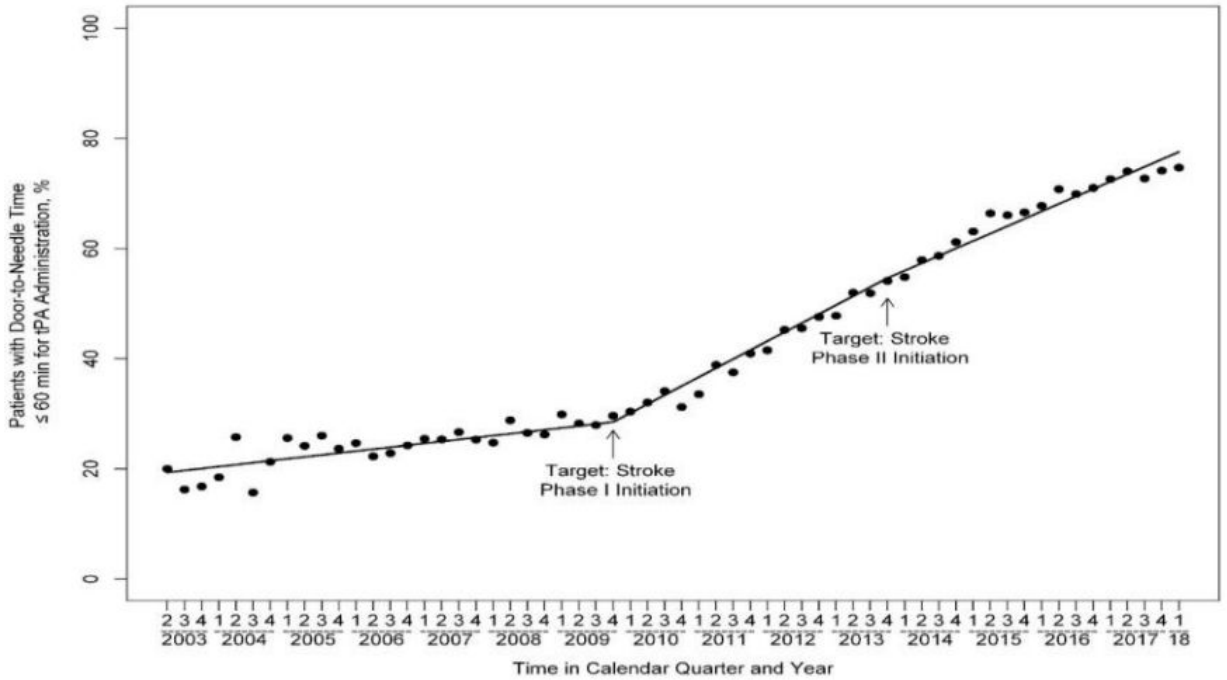
RESULTS: Among 154 221 patients receiving tPA within 3 hours of stroke symptom onset (median age 72 years, 50.1% female), median DTN times decreased from 78 minutes (interquartile range, 60–98) preintervention, to 66 minutes (51–87) during Phase I, and 50 minutes (37–66) during Phase II ($P<0.001$). Proportions of patients with DTN ≤60 minutes increased from 26.4% to 42.7% to 68.6% ($P<0.001$). Proportions of patients with DTN ≤45 minutes increased from 10.1% to 17.7% to 41.4% ($P<0.001$). By the end of the second intervention, 75.4% and 51.7% patients achieved 60-minute and 45-minute DTN goals. Compared with the preintervention period, hospitals during the second intervention period (2014–2018) achieved higher rates of tPA use (11.7% versus 5.6%; adjusted odds ratio, 2.43 [95% CI, 2.31–2.56]), lower in-hospital mortality (6.0% versus 10.0%; adjusted odds ratio, 0.69 [0.64–0.73]), fewer bleeding complication (3.4% versus 5.5%; adjusted odds ratio, 0.68 [0.62–0.74]), and higher rates of discharge to home (49.6% versus 35.7%; adjusted odds ratio, 1.43 [1.38–1.50]). Similar findings were found in sensitivity analyses of 185 501 patients receiving tPA within 4.5 hours of symptom onset.

CONCLUSIONS: A nationwide quality improvement program for acute ischemic stroke was associated with substantial improvement in the timeliness of thrombolytic therapy start, increased thrombolytic treatment, and improved clinical outcomes.

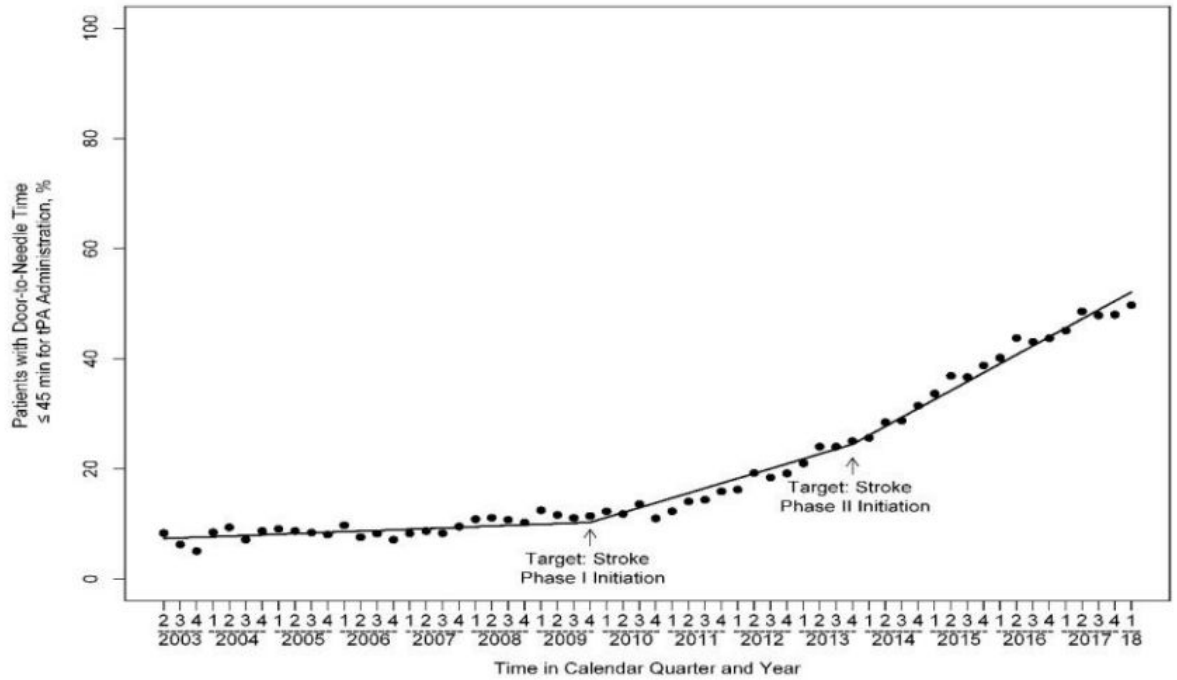
GRAPHIC ABSTRACT: A graphic abstract is available for this article.

Time Trend in DTN Times within 60 and 45 Minutes Pre-Target: Stroke, Target: Stroke Phase I, and Target: Stroke Phase II

DTN ≤ 60 Minutes



DTN ≤ 45 Minutes



TARGET: STROKE PHASE III NATIONAL GOALS

PRIMARY GOALS:

- Achieve door-to-needle times within 60 minutes in 85% or more of acute ischemic stroke patients treated with IV thrombolytics
- Achieve door-to-device times (arrival to first pass of thrombectomy device) in 50% or more of eligible acute ischemic stroke patients within 90 minutes (for direct arriving patients) and within 60 minutes (for transfer patients) treated with endovascular therapy (EVT)

SECONDARY GOALS:

- Achieve door-to-needle times within 45 minutes in 75% or more of acute ischemic stroke patients treated with IV thrombolytics
- Achieve door-to-needle times within 30 minutes in 50% or more of acute ischemic stroke patients treated with IV thrombolytics

TARGET: STROKE PHASE III DOOR-TO-DEVI PRACTICE STRATEGIES

1. Rapid Administration of Alteplase
2. Rapid Acquisition and Interpretation of CT/MR Angiography
3. Rapid Acquisition and Interpretation of Additional Imaging
4. Pre-Notification and Rapid Activation of the Neurointerventio
5. Rapid Availability of the Neurointerventional Team
6. Timer or Clock Attached to Chart, Clip Board, or Bed
7. Transfer Directly to Neuroangiography (NA) Suite
8. Transfer Directly from Brain Imaging Suite to NA Suite
9. Endovascular Therapy Ready NA Suite
10. Team Based Approach
11. Anesthesia Access and Protocols
12. Prompt Data Feedback

Door-in-Door Out Best Practice Strategies

The Western States Task Force advocates these 9 key best practice strategies for improving door-in-door-out times for acute ischemic stroke patients requiring transfer for a higher level of care. *These strategies were developed with a focus on mechanical endovascular reperfusion (MER) eligible cases, but could also be applied to other stroke transfers.*

1. **Target Door-in-Door-out Times:** Establish a policy that specifies the expected door-in-door-out times—ideally a goal of ≤90 minutes in 50 percent or more of acute ischemic stroke patients transferred.

2. **Rapid Administration of IV Thrombolysis:** Follow Target: Stroke Phase I, II, and III Key Best Practice Strategies. *Target: Stroke Key Best Practice Strategies available at: https://www.heart.org/en/professional/quality-improvement/target-stroke/clinical-tools-and-resources*

3. **Rapid Initiation of Transfer Process:**
   - Consider developing pre-existing transfer agreements with automatic acceptance.
   - Formalize agreements with transporting EMS agencies; include their capabilities and expected response times.
   - Implement parallel workflows for the assessment and transfer process.
   - Initiate the transfer process early when appropriate based on exam; may not need to wait for large vessel occlusion (LVO) confirmation.

4. **Participate in a Regional System of Care:**
   - Complete prehospital screening, use an LVO scale, and ensure prenotification by EMS.
   - Where EMS is both the 911 and transfer provider, consider having EMS stand-by for suspected LVO patients for immediate transfer once imaging is performed.

5. **Use of Telemedicine:**
   - Integrate telemedicine into the transfer process, where utilized.
   - Initiate contact with the telemedicine provider early so they are involved in initial patient evaluation.
   - Ensure imaging is available to the telemedicine provider to help inform decision making.

6. **Rapid Acquisition, Interpretation, and Transmission of Neuro Imaging:**
   - Perform CT/MR Angiography concurrently with non-contrast CT (NCCT).
   - Send NCCT and CT/MR Angiography for imaging interpretation immediately.
   - Do not delay IV thrombolysis for any advanced imaging beyond NCCT (or MR).

7. **Expedited Transport Handoff:**
   - Create standardized templates for the handoff process.
   - When possible, complete EMS handoff while the transporting provider is en route to the transferring facility.
   - Expedite direct handoff from transferring facility (Spoke) to receiving facility (Hub) without delaying patient's departure.

8. **Mock Code Strokes:** Encourage routine mock codes that include transfer scenarios; include external staff who are involved in the transfer process (e.g., EMS, receiving facility).

9. **Prompt Data Collection, Feedback and Quality Improvement:** Measure and track performance at the hospital and system of care levels, and promptly provide feedback.

Circulation: Cardiovascular Quality and Outcomes

ORIGINAL ARTICLE

Association of Component Strategies of the Target Stroke Phase 3 Nationwide Quality Improvement Program With Accelerated Door-to-Puncture and Door-In-Door-Out Times for Ischemic Stroke Endovascular Thrombectomy in the United States

Brian Mac Grory, MB BCh BAO, MHSc; Kaiz S. Asif, MD; Haolin Xu, MSc; Brooke Alhanti, PhD; Jay Lusk, MD, MBA; David Hasan, MD, MS; Soojin Park, MD; Amelia K. Boehme, PhD, MSPH; Kori S. Zachrison, MD, MSc; Mayank Goyal, MD, PhD; Andrew M. Southerland, MD, MSc; Ashutosh Jadhav, MD, PhD; Santiago Ortega Gutierrez, MD, MSc; Ameer Hassan, MD; Kyle Fargen, MD, MPH; Kevin N. Sheth, MD; Edward C. Jauch, MD, MS; Ying Xian, MD, PhD; Eric D. Peterson, MD, MPH; Eric E. Smith, MD, MPH; Steven R. Messe, MD; Lee H. Schwamm, MD; Peter Panagos, MD; Charles Wira; Jeffrey L. Saver, MD; Gregg C. Fonarow, MD

Circulation

ORIGINAL RESEARCH ARTICLE

Mechanical Thrombectomy Global Access For Stroke (MT-GLASS): A Mission Thrombectomy (MT-2020 Plus) Study

Kaiz S. Asif, MD; Fadar O. Otite, MD; Shashvat M. Desai, MD; Nabeel Herial, MD, MPH; Violiza Inoa, MD; Fawaz Al-Mufti, MD; Ashutosh P. Jadhav, MD, PhD; Adam A. Dmytriw, MD, MPH, MSc; Alicia Castonguay, PhD; Priyank Khandelwal, MD; Jennifer Potter-Vig, PhD; Viktor Szeder, MD, PhD; Tanzila Kulman, MD; Victor Urrutia, MD; Hesham Masoud, MD; Gabor Toth, MD; Kaustubh Limaye, MD; Sushanth Aroor, MD; Waleed Brinjikji, MD; Ansaar Rai, MD; Jeyaraj Pandian, MD; Mehari Gebreyohanns, MD; Thomas Leung, MD; Ossama Mansour, MD; Andrew M. Demchuk, MD; Vikram Huded, MD; Sheila Martins, MD; Osama Zaidat, MD; Xiaochuan Huo, MD, PhD; Bruce Campbell, MD; P.N. Sylaja, MD; Zhongrong Miao, MD; Jeffrey Saver, MD; Santiago Ortega-Gutierrez, MD, MSc; Dileep R. Yavagal, MD

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Sage Journals

Research

Geo-spatial analysis of acute ischemic stroke reperfusion treatment in India: An assessment of distribution and access to centers

Kaiz S Asif[1,*], Arun Mitra [2,3,*], Santiago Ortega-Gutierrez[4], Nabeel Herial[5], Shashvat Desai [6], Ashutosh Jadhav[7], Fawaz Al-Mufti[8], Adrija Roy[9], Romil Singh [10], Grant Brown[11], Amrou Sarraj [12], Arun Jose[13], Anand Alurkar[14], AP Karapurkar[15], Arvind Sharma[16], Vipul Gupta[17], Gaurav Goel[18], Dheeraj Khurana[19], Biplab Das[20], Jayanta Roy [21], Deep Das[22], Rahul Kumar[23], Gigy Kuruttukulam[24], Pradeep Kumar VG[25], MV Padma Srivastava[26], Jeyaraj Pandian [27], Vikram Huded[28], Dileep Yavagal[29], Biju Soman[13], and PN Sylaja [3] On Behalf of the Mission Thrombectomy (Society of Vascular and Interventional Neurology) Global Executive Committee & Regional Committees in India

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CLINICAL AND

Mechanic
Review a
Endovasc

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MD , Fawaz
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	Attribute	0	1	2	3
	Public education programs in stroke	None	Only in local urban centers	Regional programs including rural campaigns	Local, regional, and national campaigns
	EMS Utilization (% stroke patients brought in by EMS)	<10%	10-32%	33-66%	>67%
	Prehospital LVO specific screening and triage protocols	EMS transport to the nearest hospital (and not designated stroke center*)	EMS transport to the nearest available stroke center.	LVO screening based bypass, but inconsistently followed.	LVO screening based bypass, consistently followed.
	Availability of Transportation Strategies (including interhospital transport)	No communication between EMS and hospital or between two hospitals prior to transfer	Unofficial communication for EMS and between hub and spoke providers	Official hub and spoke transport protocols and EMS transport protocols	Regional policy for transfer that monitors DIDO and transfer times
	Emergency Department stroke triage protocols (included code stroke alert process)	No protocols	Inconsistent protocols or performed at only a minority of EDs	Consistently performed by most EDs that receive patients with stroke	Consistently performed with prenotification from EMS.
	Imaging including CTA (Vascular imaging for emergent LVO detection)	Rarely performed	Performed only at thrombectomy-capable centers	Consistently performed at both thrombectomy-capable and primary stroke centers	Routinely performed as part of the code stroke protocol in majority of centers (including centers that do not give thrombolysis)
	Stroke trained providers in the ED (e.g., Neurologist or emergency physicians with stroke expertise)	Not available	Only few EDs receiving stroke patients are staffed with stroke experts	Majority of EDs receiving stroke patients staffed with stroke experts	Always staffed with stroke experts
	Tele stroke networks (in the absence of in-house neurologists)	Not available	Available in only a few EDs or inconsistently used	Frequently used by most EDs, but no established network (either over phone or text)	Established tele stroke consult network in most EDs
	Availability of MT operators** (see formula below)	<2%	2-7%	7-25%	>25%
	Access to thrombectomy center in the region	None	One to a few in a large urban region	Several centers in most urban regions	Centers in urban and rural regions.
	Availability of devices for MT	None	Only single option	Limited options	Many devices available
	Government and health insurance coverage for MT (% procedures reimbursed)	<10%	10- 32 %	33-66%	>67%

Primary Access Barrier: Information Physical Financial

Stroke: Vascular and Interventional Neurology

ORIGINAL RESEARCH

Large-Vessel Occlusion Stroke Knowledge and Training for Stroke Severity Assessment Among Emergency Medical Services Personnel in the United States

Kaiz S. Asif, MD; Robin Novakovic, MD; Thanh N. Nguyen, MD; Santiago Ortega-Gutierrez, MD; Youngran Kim, PhD; Amanda Jagolino-Cole, MD; Sushanth Aroor, MD; Alicia Castonguay, PhD; Prateek Kumar, MD; Ashutosh P. Jhadav, MD; Dileep Yavagal, MD; May Nour, MD; Gabor Toth, MD; Maxim Mokin, MD; Sunil A. Sheth, MD; Mouhammad A. Jumaa, MD; Alhamza Al-bayati, MD; Mohamed Teleb, MD; Ossama Y. Mansour, MD; Shashvat M. Desai, MD; Joshua Hartman, MBA; David S. Liebeskind, MD; Ameer E. Hassan, DO; Brijesh P. Mehta, MD; on behalf of the SVIN Education and SPEED Committees

Stroke

AHA SCIENTIFIC STATEMENT

Identifying Best Practices for Improving the Evaluation and Management of Stroke in Rural Lower-Resourced Settings: A Scientific Statement From the American Heart Association

The American Academy of Neurology affirms the value of this statement as an educational tool for neurologists.

Kori S. Zachrison, MD, MSc, Chair; Kaiz S. Asif, MD, Vice Chair; Sherita Chapman, MD; Karen E. Joynt Maddox, MD, MPH; Enrique C. Leira, MD, MS; Susan Maynard, DNP, MS; Christa O'Hana S. Nobleza, MD, MSCI; Charles R. Wira, MD; on behalf of the American Heart Association Emergency Neurovascular Care and Telestroke Committee of the Stroke Council; Council on Cardiovascular and Stroke Nursing; and Council on Cardiovascular Radiology and Intervention

Stroke: Vascular and Interventional Neurology
Volume 5, Issue 2, March 2025
https://doi.org/10.1161/SVIN.124.001564

ORIGINAL RESEARCH

Patients Residing in Rural Areas Transferred for Mechanical Thrombectomy Undergo Decreased Catheter-Based Treatment

Amanda L. Jagolino-Cole, MD, Deepa Dongarwar, Sushanth Aroor, MD, Sunil A. Sheth, MD, Anjail Sharrief, MD, MPH, Kori S. Zachrison, MD, MSC, Dileep Yavagal, MD, and Kaiz S. Asif, MD

METHODS - SURVEY DEVELOPMENT

PREHOSPITAL

- Severity scale use
- ED Response to prenotification
- Bypass/rerouting
- Prehospital technology usage
- MSU
- Feedback to EMS

INHOSPITAL

- Detailed ED workflow
- concurrent vascular imaging or not,
- automated software use,
- 24/7 neuro availability v.s telestroke, if telestroke – who provides it (health system v/s outside vendor), how is the NI informed of an LVO

METHODS – OBSERVATIONAL COHORT STUDY

- Web-based survey to all GWTG sites - 2528
- Prospectively collected GWTG-Stroke registry data (January 2017 and March 2022)
  - Inclusion: Patients who received EVT or IVT
  - Exclusion : in-hospital stroke, presentation >24 hours from LKW, and patients who received EVT as part of an investigational protocol.
- 3 overlapping cohorts were derived from this larger cohort:
  - the directly arriving EVT cohort
  - the transfer-in EVT cohort, and
  - the transfer-out cohort.
- Association between TS III strategies and DTP or DIDO times statistically analyzed using generalized linear models

RESULTS

- 1455 out 2528 hospitals

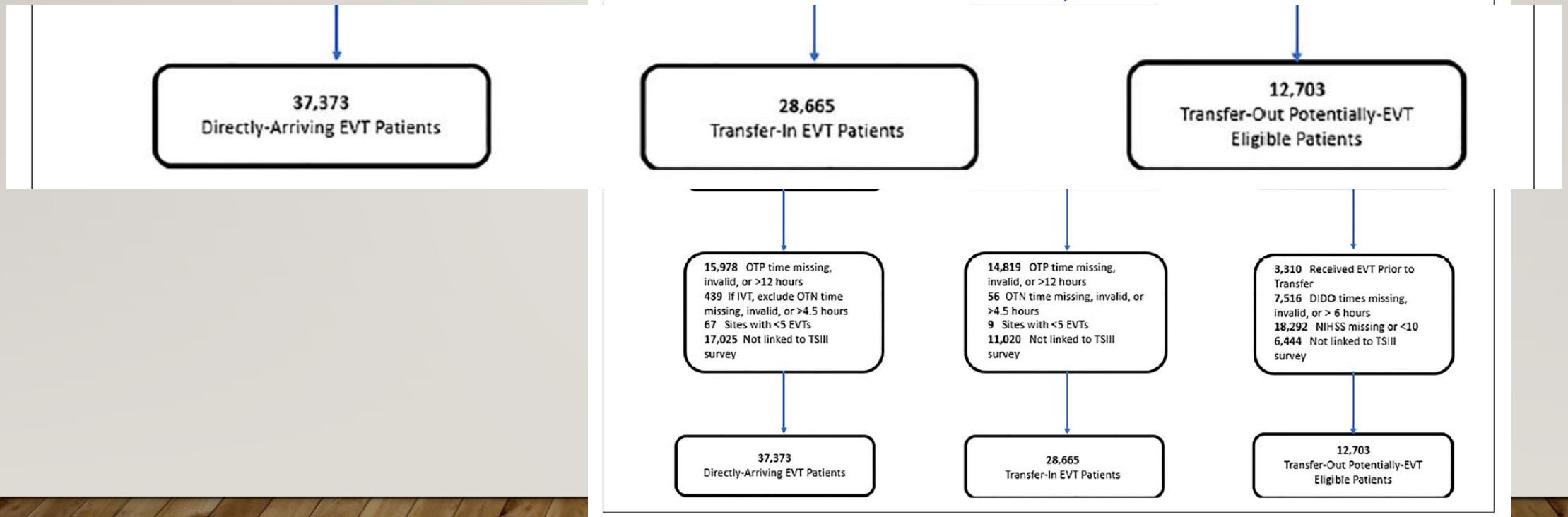

Figure 1. Flowchart of patient selection for inclusion in the study.
Please note that trained hospital personnel use a patient management tool to collect data on consecutive patients with acute ischemic stroke (AIS) admitted to each participating hospital. DIDO indicates door-in-door-out; EVT, endovascular thrombectomy; GWTG, Get With The Guidelines; IVT, intravenous thrombolysis; OTA, onset-to-arrival; OTN, onset-to-needle; OTP, onset-to-puncture; and TSIII, Target Stroke Phase III.

RESULTS

- Prehospital stroke screening tool used 76% to 99% of the time - 44.2%
- Prehospital stroke severity scale used 76% to 99% of the time - 20.5%
- 24/7 neurology coverage (either in-person or via telemedicine) - 96.5% sites
- Telestroke used - 74.9%

RESULTS: DTP AFFECTING STRATEGIES

Shorter DTP

- **Neurointerventional Workflow: Alerting the neurointerventional team based on EMS prenotification of LVO stroke**
  - shorter adjusted DTP time (−21.9 [95% CI, −42.5 to −1.3] minutes).
- **Imaging: Simultaneous performance of a brain CT and CT angiography (CTA) in all patients presenting ≤24 hours**
  - shorter DTP time (−6.6 [95% CI, −11.8 to −1.5] minutes).
- **Telestroke Increased use of a camera during telestroke consultations**
  - shorter DTP time (−5.8 [95% CI, −10.7 to −0.9] minutes per 25% increase in camera use

Longer DTP

- **By contrast, adding a CTA or CT perfusion that would otherwise would not have been performed concurrently to a noncontrast CT**
  - longer DTP time (7.1 [95% CI, 1.1–14.4] minutes)
- **EMS policy of bypass/rerouting was associated**
  - longer DTP time of 8.3 (95% CI, 0.3–16.3) minutes.

DIDO TIME AFFECTING STRATEGIES

- EMS:
  - Patient-specific data feedback to EMS providers (−2.5 [95% CI, −4.2 to −0.8] minutes per 25% increase).
- IMAGING
  - Simultaneous performance of vascular imaging (CTA or magnetic resonance angiography) on all patients with acute stroke within 24 hours from last known well, regardless of the severity of examination findings (−5.7 [95% CI, −10.1 to −1.2] minutes)
  - Use of automated neuroimaging software (−7.7 [95% CI, −12.2 to −3.1] minutes).
- IVT administration:
  - IVT commenced in the imaging suite (−2.8 [95% CI, −5.1 to −0.5] minutes per 25% increase in proportion of time this strategy was used).
- Telestroke processes
  - Telestroke providers based at a hub facility within the same health system where most patients are transferred for intervention (−11.4 [95% CI, 16.2 to −6.6] minutes).

LIMITATIONS:

- Self reported survey data
- Findings are associative in nature and do not establish the strategy itself is causative
- 40% hospitals didn't respond

THANKS