Time is Brain!

Reducing Door-to-Needle Times at Foothills Medical Centre

Hurry Acute Stroke TreatmEnt (HASTE) Project

Eric E. Smith, MD, MPH
Associate Professor of Neurology
Dept of Clinical Neurosciences
Hotchkiss Brain Institute
University of Calgary

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DISCLOSURES

- Grant funding from NINDS, Heart and Stroke Foundation of Canada, Canadian Stroke Network, Alberta Innovates-Health Solutions, Alzheimer Society of Canada.
- Co-Investigator (no salary) of ESCAPE trail, co-funded by Covidien. DSMB for MR Witness Study (Mass General Hospital).
- Volunteer member of American Heart Association Get With The Guidelines and Target:Stroke Executive Committees.
- Co-chair of Canadian Best Practice Recommendations for Stroke.

Acknowledgements
HASTE-2 Team

ED representation
Erin Bugbee
Sudhir Pandya
Erin Henderson
Sharon Holowachuk
Gordon Szol
Eddy Lang
Kathy Dorrington
Devika Kashyap

EMS representation
Renee Vilneff
Dana Dalgarno

DI representation
Melissa Kearns

Admitting representation
Lenore Demeter
Janice Carnevale
Erin Symcox

Unit 112 representation
Erin Symcox
Shantel Hunter

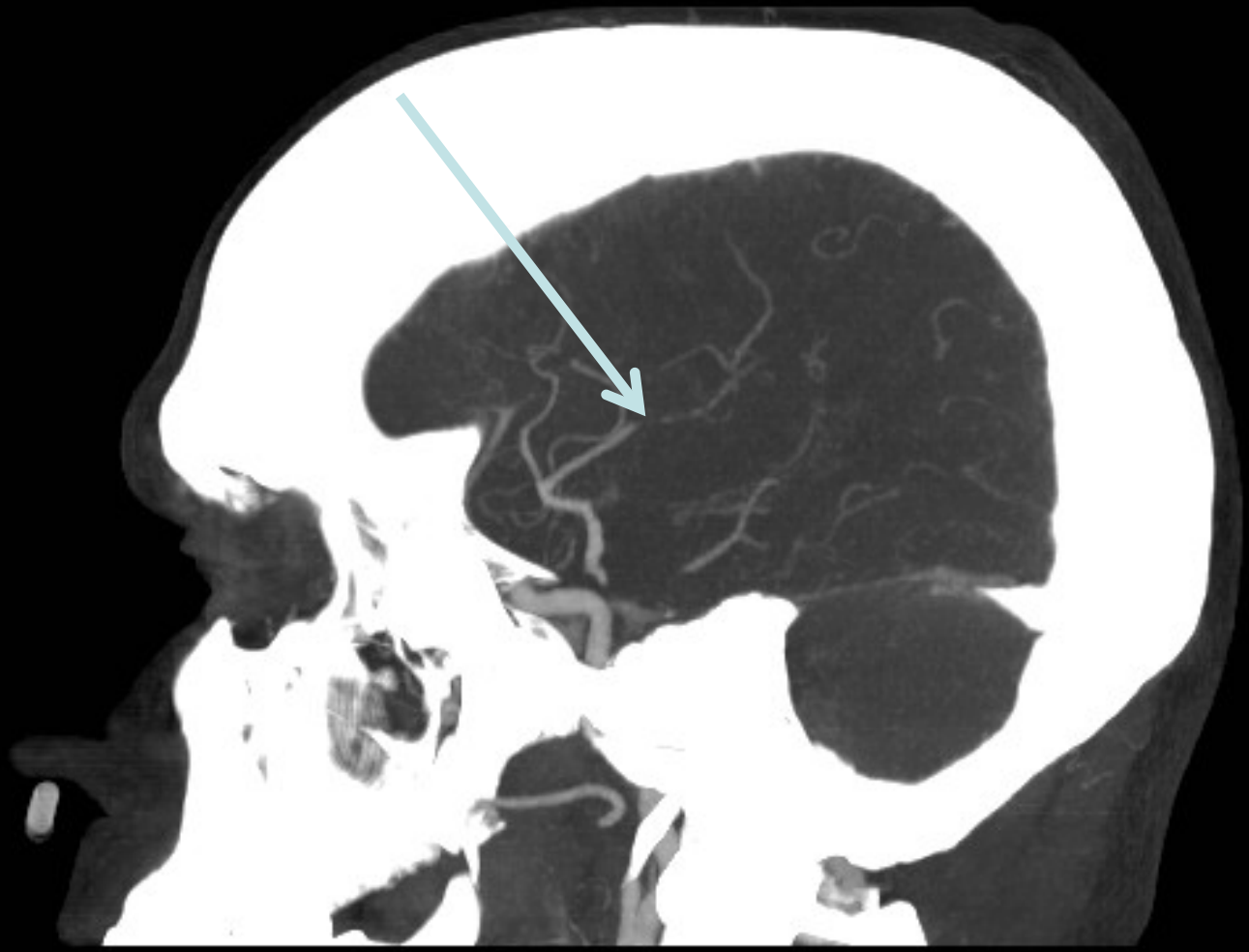
Stroke Team
Eric Smith
Andrew Demchuk
Michael Suddes
Charlotte Zerna
Nancy Newcommon

Case – N.L.

- 59 man
- Driver in car-pedestrian collision; EMS finds him aphasic with right arm weakness, with IV line in L forearm (!).
- Registered as unknown, but name from EMS.
  - Netcare: getting chemo for head/neck cancer, last platelets ok.
- ED doc: no trauma
- To CT

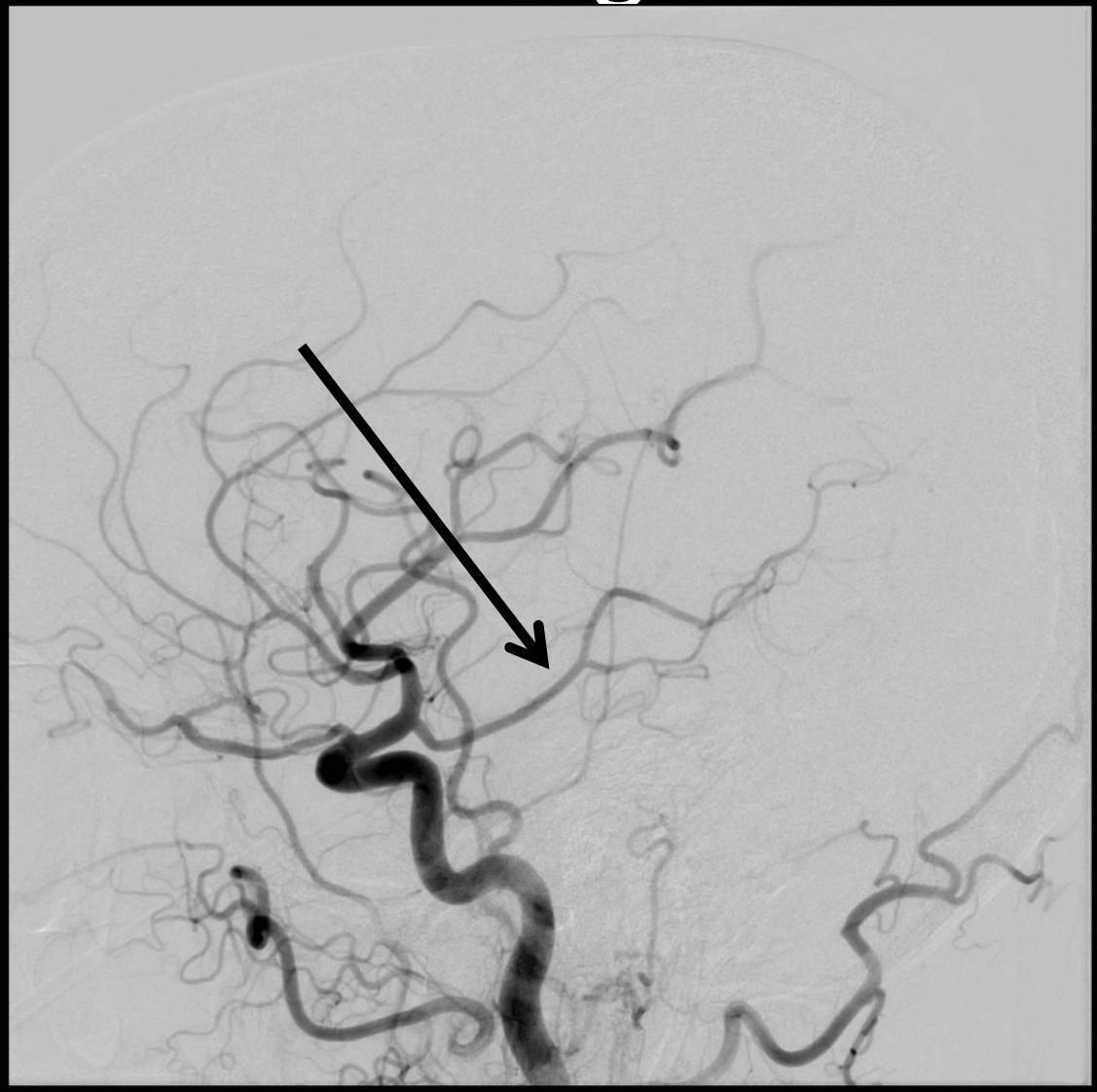
Case

Case – CT angio



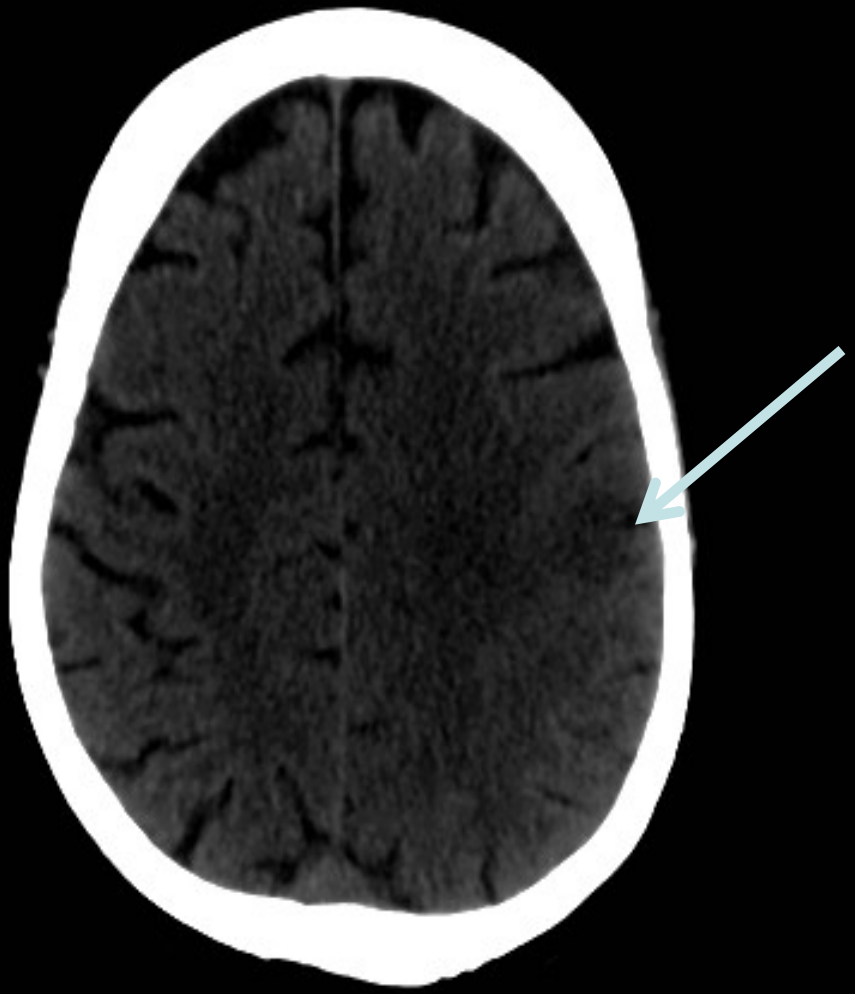
Conventional angio

- IV tPA given outside scanner
- Door to needle: 34 min.
- To angio but exam improving—recanalized!

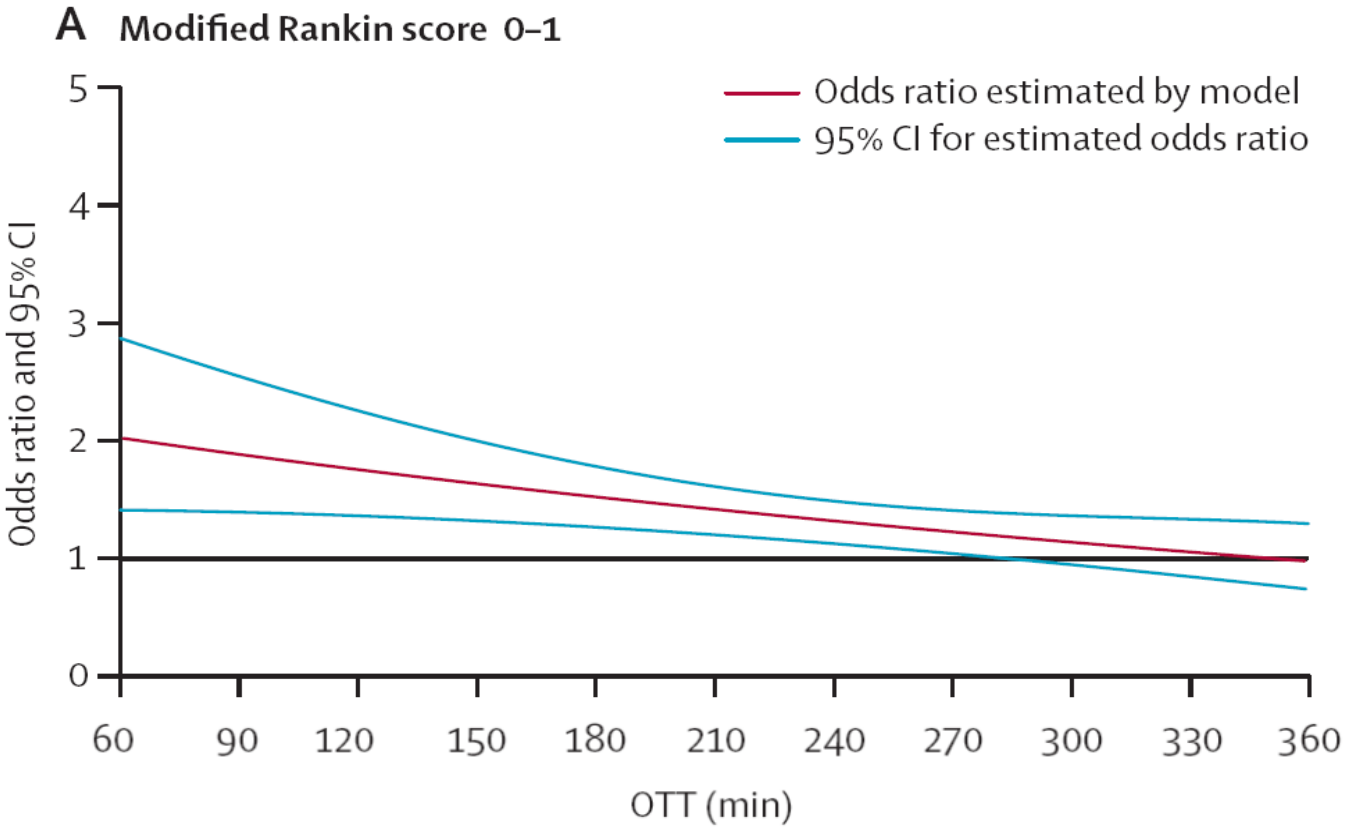


Outcome

- Small infarct
- Hemiparesis resolved.
- Mild aphasia.
- Recovered, returned to work.

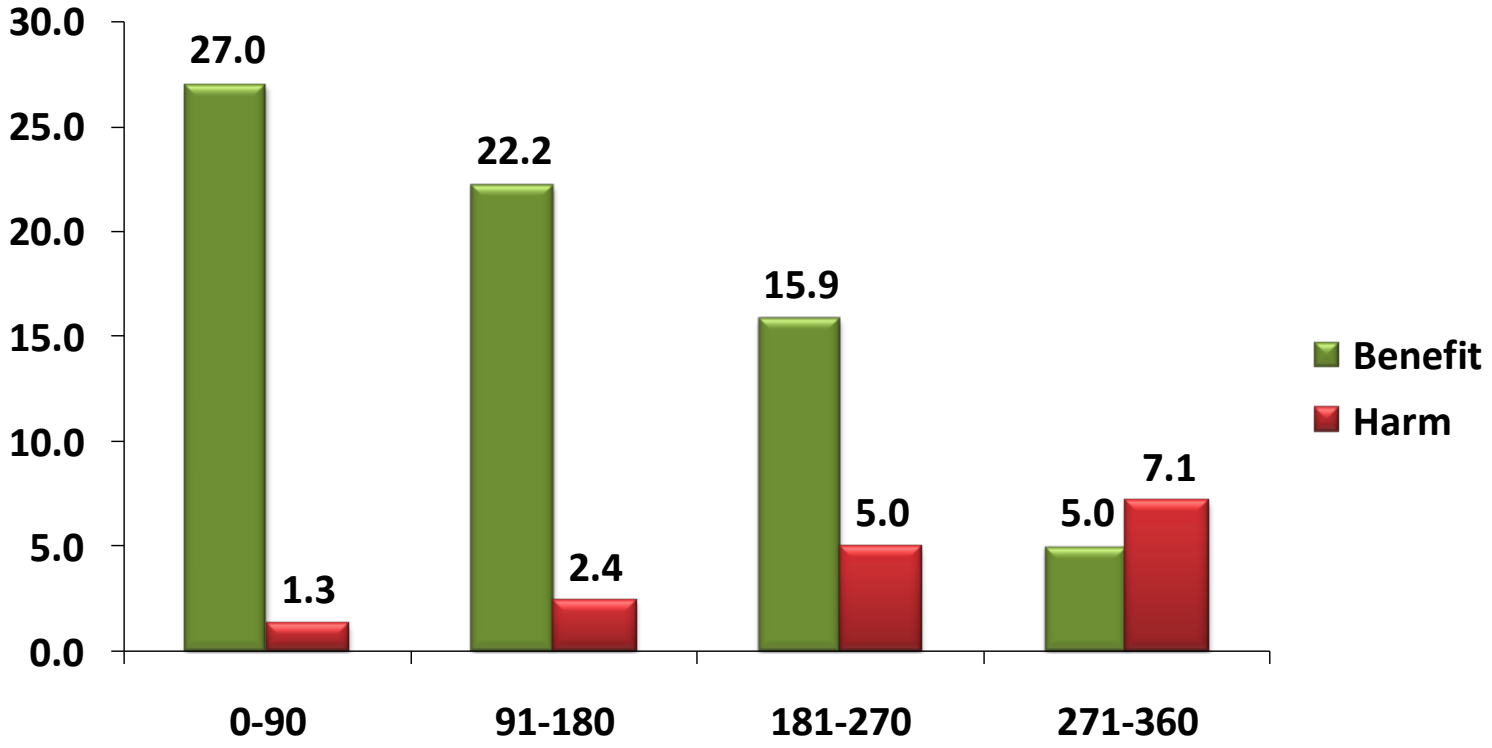


Effect of Intravenous rt-PA Declines With Increasing Time



Lees KR et al. Time to treatment with intravenous alteplase and outcome in stroke: an updated pooled analysis of ECASS, ATLANTIS, NINDS, and EPITHET trials. Lancet. 2010;375:1695-1703.

Number of Patients Who Benefit and Are Harmed per 100 Patients tPA Treated in Each Time Window



Lansberg MG, Schrooten M, Bluhmki E, Thijs VN, Saver JL. Treatment time-specific number needed to treat estimates for tissue plasminogen activator therapy in acute stroke based on shifts over the entire range of the modified Rankin Scale. Stroke 2009;40:2079-2084

Effect of Faster tPA in Routine Clinical Practice

- Data from AHA Get With The Guidelines stroke registry (58,353 patients).
- Among 1000 treated patients, for every 15 minute acceleration of tPA treatment
  - 18 more patients will have improved ambulation at discharge
    - Including 8 who will ambulate fully independently
  - 13 more patients will be discharged to a more independent environment
    - Including 7 who will be discharged to home
  - 4 fewer patients will die prior to discharge
  - No increase in symptomatic intracranial hemorrhage.

Saver JL, Fonarow GC, Smith EE, et al. Time to treatment with intravenous tissue plasminogen activator and outcome from acute ischemic stroke. JAMA 2013;309:2480-2488.

Key Concepts

- Acute ischemic stroke evolves over 4-8 hours.
- Each minute, more brain is at risk of dying.
- The effect of rt-PA, or any recanalization therapy, is time dependent.
- Brain Attack Coalition set door-to-needle benchmark of ≤60 min.

EDITORIAL

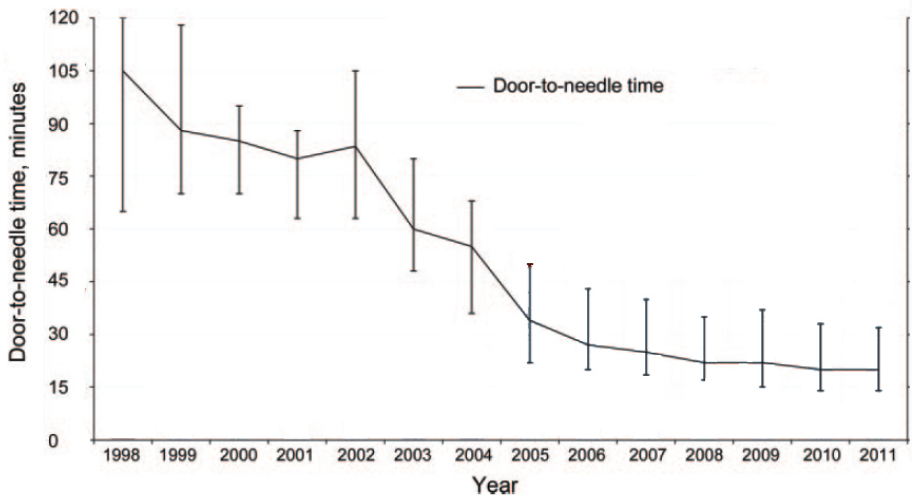
Door-to-needle times in acute ischemic stroke

How low can we go?

Eric E. Smith, MD, MPH, FAHA
Rudiger von Kummer, MD, FAHA

Reducing in-hospital delay to 20 minutes in stroke thrombolysis

Figure 1 Number of annually treated patients and median door-to-needle times



Meretoja A, Strbian D, Mustanoja S, Tatlisumak T, Lindsberg PJ, Kaste M. Reducing in-hospital delay to 20 minutes in stroke thrombolysis. Neurology 2012;79:306-313

Smith EE, von Kummer R. Door-to-needle times in acute ischemic stroke: how low can we go? Neurology 2012;79:296-297.
Desai JA, Smith EE. Prenotification and other factors involved in rapid tPA administration. Curr Athero Rep 2013;15:337.

American Heart Association Target:Stroke

- Launched 2010.
- Goal: >50% with DTN less than 60 minutes.
- Intervention: disseminated best practices, decision support tools, award recognition.

Fonarow GC, Smith EE, Saver JL, et al. 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. Stroke 2011;42:2983-2989.

TARGET: STROKE Program: Results

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

JAMA April 23/30, 2014 Volume 311, Number 16 1633

- Temporal trends in door to needle (DTN) times before/after initiation in Jan 2010.
- Change in clinical outcomes—including in-hospital mortality, discharge destination, ambulatory status, symptomatic intracranial hemorrhage ≤ 36 hours after tPA, and overall tPA complications—before/after initiation in Jan 2010.

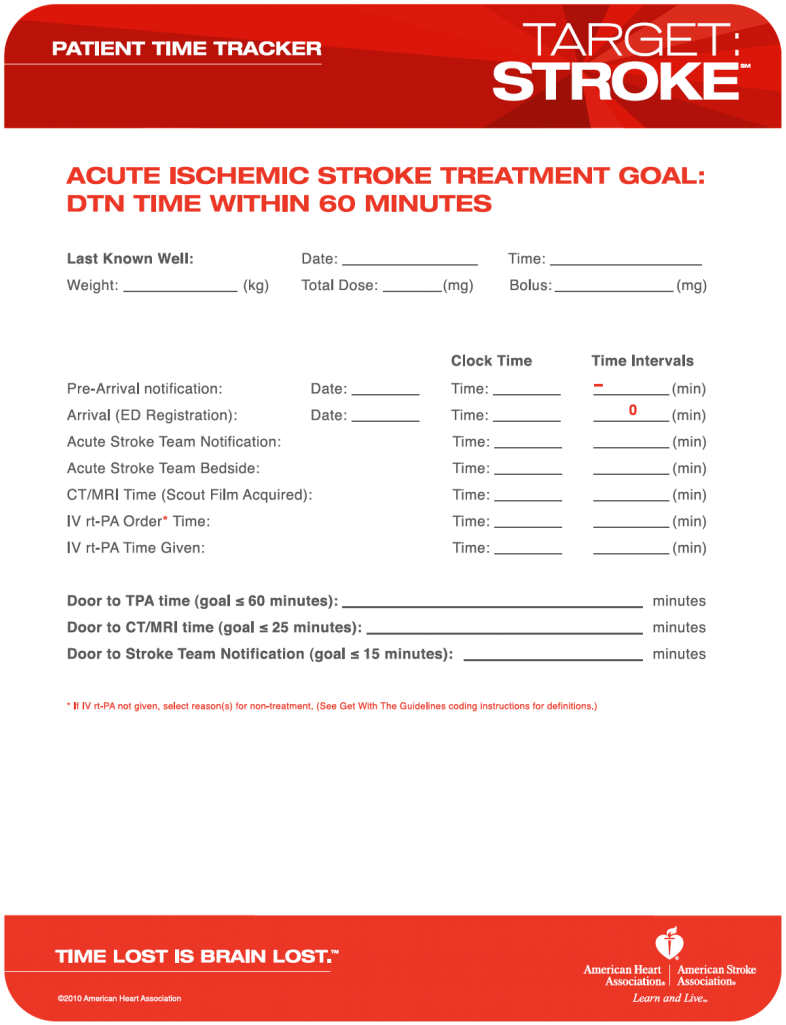
Target: Stroke 10 Key Best Practice Strategies

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

Fonarow GC, Smith EE, Saver JL, Reeves MJ, Hernandez AF, Peterson ED, Sacco RL, Schwamm LH. 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. Stroke. 2011;42(10):2983-2989.

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



PATIENT TIME TRACKER

TARGET: STROKE℠

ACUTE ISCHEMIC STROKE TREATMENT GOAL: DTN TIME WITHIN 60 MINUTES

Last Known Well: Date: _____ Time: _____

Weight: _____ (kg) Total Dose: _____(mg) Bolus: _____ (mg)

		Clock Time	Time Intervals
Pre-Arrival notification:	Date: _____	Time: _____	–_____(min)
Arrival (ED Registration):	Date: _____	Time: _____	0 (min)
Acute Stroke Team Notification:		Time: _____	_____(min)
Acute Stroke Team Bedside:		Time: _____	_____(min)
CT/MRI Time (Scout Film Acquired):		Time: _____	_____(min)
IV rt-PA Order* Time:		Time: _____	_____(min)
IV rt-PA Time Given:		Time: _____	_____(min)

Door to TPA time (goal ≤ 60 minutes): _____ minutes

Door to CT/MRI time (goal ≤ 25 minutes): _____ minutes

Door to Stroke Team Notification (goal ≤ 15 minutes): _____ minutes

* If IV rt-PA not given, select reason(s) for non-treatment. (See Get With The Guidelines coding instructions for definitions.)

TIME LOST IS BRAIN LOST.™

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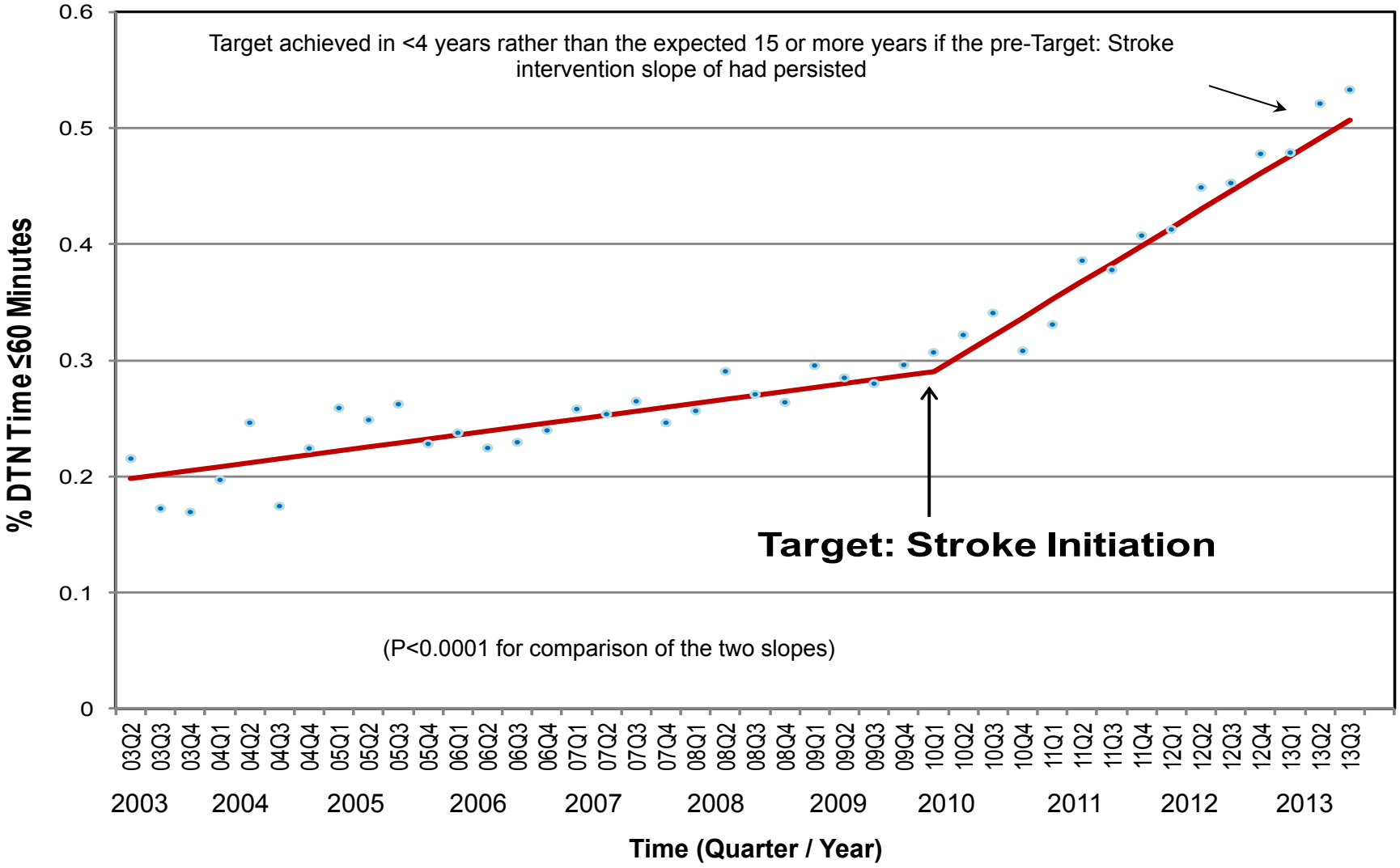
Learn and Live®

Target: Stroke tools: www.targetstroke.org
Clinical tools library: heart.org/strokeclinicaltools

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

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



Outcomes Pre- and Post-Target: Stroke

Outcome	Unadjusted Odds Ratios (95% CI)	P Value	Adjusted Odds Ratios (95% CI)*	P Value*
In-Hospital Mortality	0.81 (0.77-0.86)	<0.0001	0.89 (0.83-0.94)	0.0002
Discharge Home	1.23 (1.18-1.27)	<0.0001	1.14 (1.09-1.19)	<0.0001
Ambulatory Status Independent	1.14 (1.09-1.20)	<0.0001	1.03 (0.97-1.10)	0.3091
Symptomatic ICH	0.81 (0.75-0.88)	<0.0001	0.83 (0.76-0.91)	<0.0001
Any tPA Complications	0.80 (0.75-0.87)	<0.0001	0.83 (0.77-0.90)	<0.0001

*Adjusted for patient characteristics including age, sex, race, medical history of atrial fibrillation, prosthetic heart valve, previous stroke/transient ischemic attack, coronary heart disease or prior myocardial infarction, carotid stenosis, peripheral vascular disease, hypertension, dyslipidemia, and current smoking, stroke severity (NIHSS), arrival time during regular work hours, arrival mode, onset-to-arrival time; hospital characteristics of hospital size, region, teaching status, certified primary stroke center, annual volume of tPA, and annual stroke discharge

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

HASTE 2

HASTE 2

Goal:

- **Median door-to-needle time of 45 minutes**.

Benefits:

- Improved patient outcomes following IV tPA treatment and Neuro-Interventional Treatment.
- Continued development of partnerships between the CSP, EMS, ED, DI, and Admitting.

Process

- Convened reps from ED triage, ED docs, stroke MDs and fellow, stroke nursing, U112, EMS, admitting, CT techs.
- Applied Toyota LEAN methods and Six Sigma process to develop new protocol for patients highly likely to be treated with tPA.
- In-person team meetings involving ED, EMS, DI and admitting, smaller weekly progress meetings.
- Outputs:
  - Weekly DTN report to Stroke Program implemented May 2012.
  - STAT! Stroke Pathway implemented June 2013.

DMAIC

Define

- **Identify the challenge**
- **Clarify the goal of the work**
- **Gather the team**

Measure

- **Collect data to understand the 'current' process**
- **What are the characteristics that are critical to quality**

Analyze

- **What does the data tell us about delays or variability in the process**
- **Identify potential solutions → where to focus improvement work**

Improve

- **Design and test 'new' process**
- **Implement or redesign**

Control

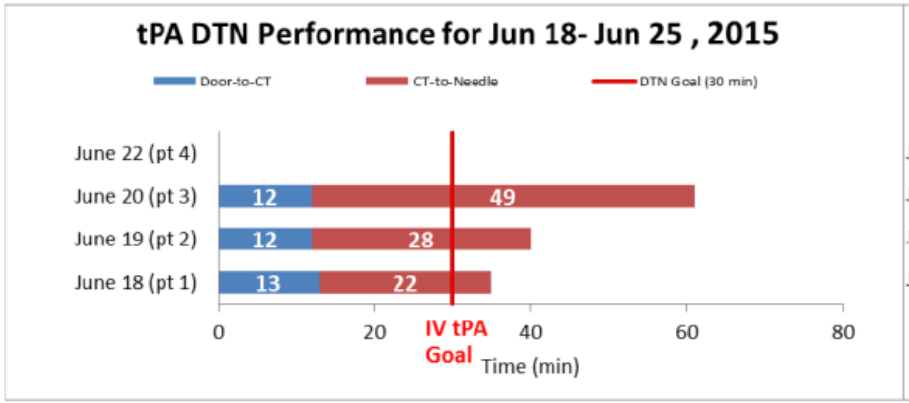
- **Activities to maintain the measurable improvement**

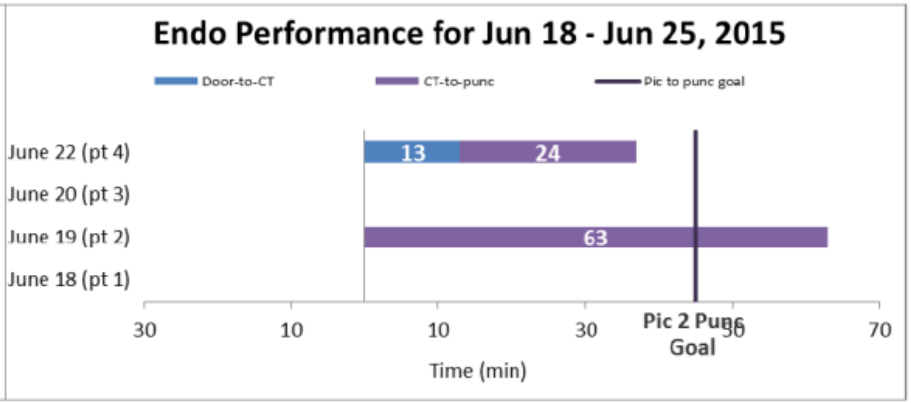
Weekly Report of DTN Times

HASTE_III **Weekly Summary** **Calgary Stroke Program**

tPA and Endovascular Performance Summary

Weekly Summary for each patient

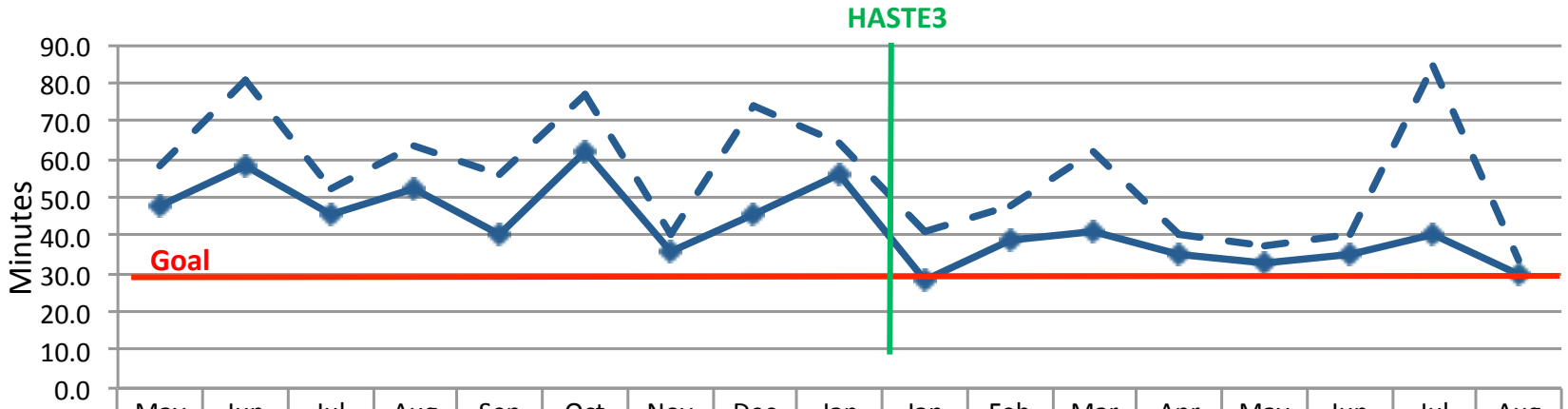




Kamal N, Smith EE, Stephenson C, Choi PM, Goyal M, Hill MD. Visualizing acute stroke data to improve clinical outcomes. Stroke 2015;46:e170-172.

Excel calculator freely available at:
http://www.ucalgary.ca/quicr/files/quicr/sample-stroke-visualization-worksheet.xls

Historical DTN Performance



	May 2014 (n=15)	Jun 2014 (n=16)	Jul 2014 (n=8)	Aug 2014 (n=6)	Sep 2014 (n=12)	Oct 2014 (n=8)	Nov 2014 (n=5)	Dec 2014 (n=15)	Jan 2015 (n=6)	Jan 2015 (n=5)	Feb 2015 (n=10)	Mar 2015 (n=14)	Apr 2015 (n=7)	May 2015 (n=4)	Jun 2015 (n-5)	Jul 2015 (n=8)	Aug 2015 (n=8)
Median DTN	48.0	58.0	45.5	52.5	40.5	62.0	36.0	45.5	56.0	28.0	38.5	41.0	35.0	33.0	35.0	40.0	30.0
75th Percentile DTN	58.0	80.8	52.3	63.5	56.0	77.0	40.0	73.8	64.3	41.0	47.8	62.0	40.5	37.0	40.0	84.3	33.3

How Many Can Be Treated Quickly?

- 103 consecutive IV tPA-treated patients at FMC
- Median DTN times:
  - No delays noted: 43 min
  - Patient-related delays: 62 min
  - Systems factors: 60 min
- At least 70% of patients should be able to be treated without delay.

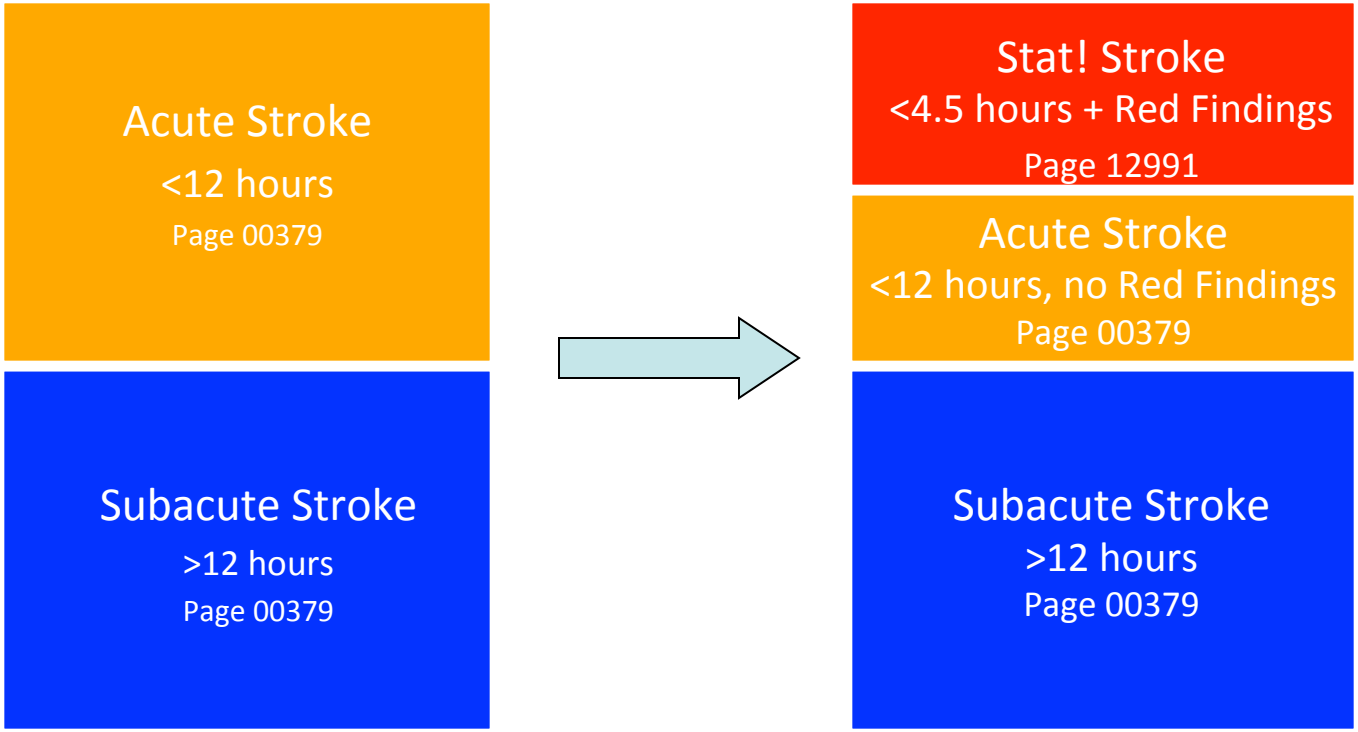
Smith EE, Kashyap D, Bohm V, Hill MD, Demchuk A. Reasons for delays in door to needle time. Stroke2014: ATP287. Under review.

Table 2. Potential reasons for delays (total 103 patients)

	N	%	Median DTN (min) (overall median 53 minutes)
None	**43**	**42**	**43**
Patient-related Reasons	**32**	**31**	**62**
Required antihypertensive	15	15	58
Emergent medical condition	8	8	92
Unable to determine eligibility-reasons other than time of onset	7	7	60
Seizure	4	4	100
Unclear time of onset	3	3	75
Initial patient refusal	0	0	--
Hypoglycemia	0	0	--
Hospital and systems factors	**42**	**41**	**60**
Delay in diagnosis	10	10	66
Need to wait for lab values	10	10	61
Delay in obtaining CT	10	10	54
Delays for technical reasons	8	8	54
Need to review advanced imaging (CTA, CTP) prior to tPA decision	7	7	64
IV not placed before ED arrival	7	7	54
Delay due to investigational protocol	6	6	51
Delay in patient registration	6	6	50
Equipment delays	2	2	55

Note: Totals do not add to 103 because some patients had >1

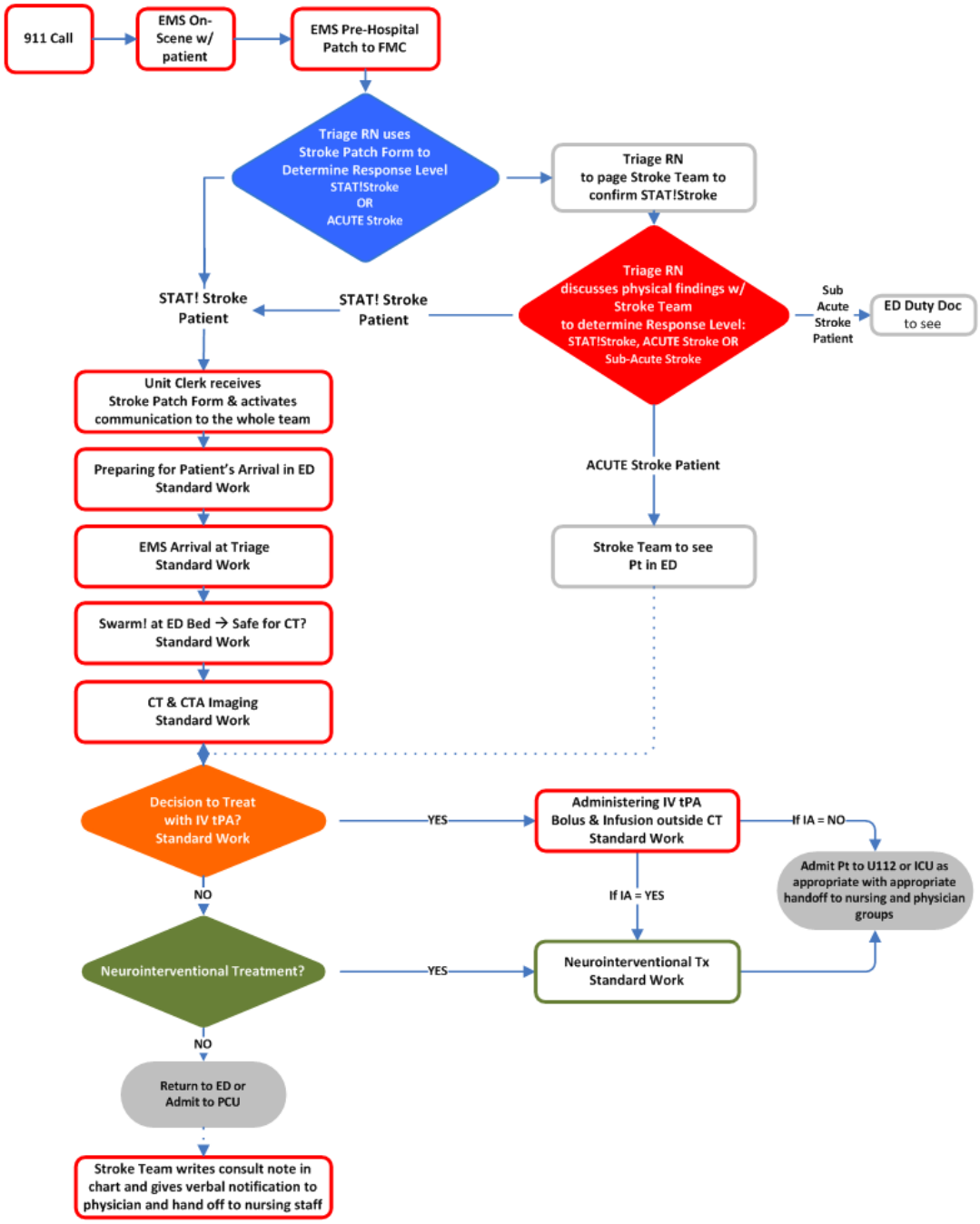
STAT! Stroke



Before June 2013

After June 2013

HASTE: STAT! Stroke Algorithm May 28, 2013



Two main criteria define STAT!Stroke activation

1. LSN ≤ 4.5 hrs

2. Presence of a Red Finding

STAT! Stroke – what we changed

On Scene

LSN ≤ 4.5 hrs
+
1 red finding

STAT! Stroke

Prep for pt Arrival

- **STAT! Stroke activated by Triage by paging 12991**
- **Registered as Unknown patient**
- **Stroke Team arrives at ED**

SWARM! Safe for CT

- **SWARM at ED bed**
- **Standard Work defined for each profession**
- **Work occurs in parallel**

- **ED RNs**
- **ED doc**
- **Stroke Team**
- **PCA**
- **RT**
- **Social Work**

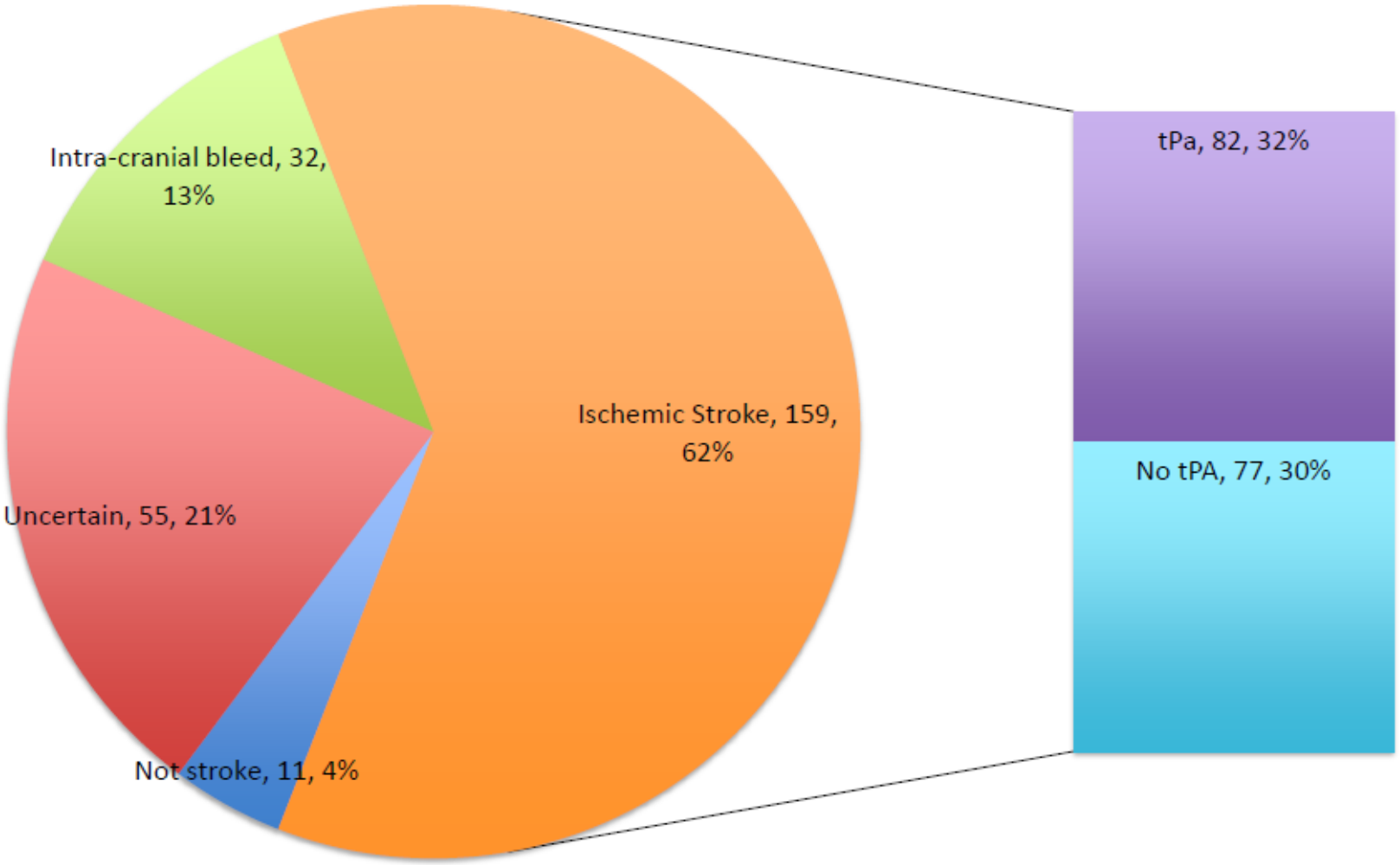
Imaging & Decision making

- **Decision to treat based on non-contrast CT (before CTA)**
- **call U112 nurse to come down to CT to treat if Nancy not there**
- **PCA and ED RN at CT**

Treatment

- **treat with IV tPA outside CT**

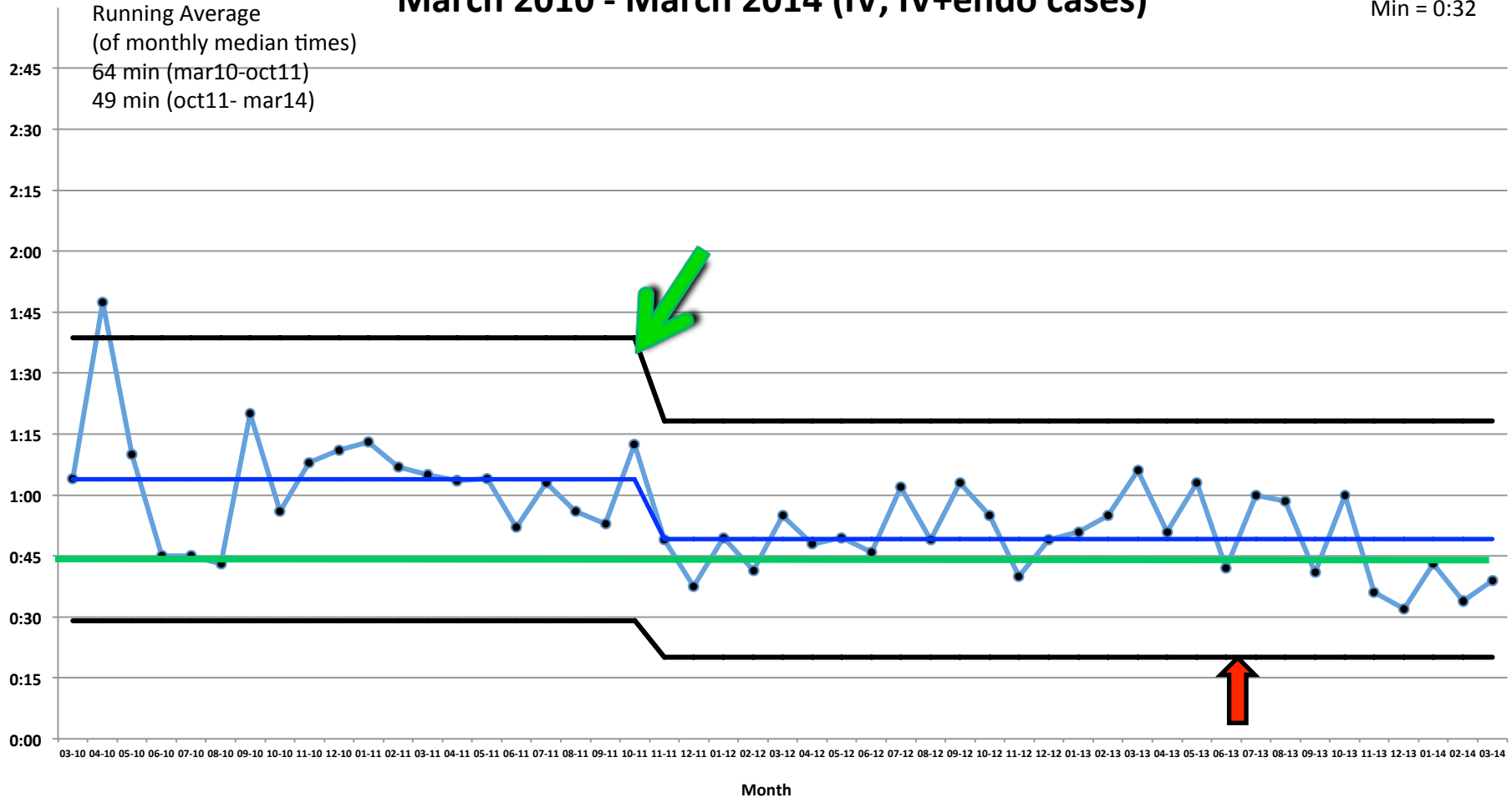
STAT stroke pink (triage) sheets June 2013 to June 2014 (n = 257)

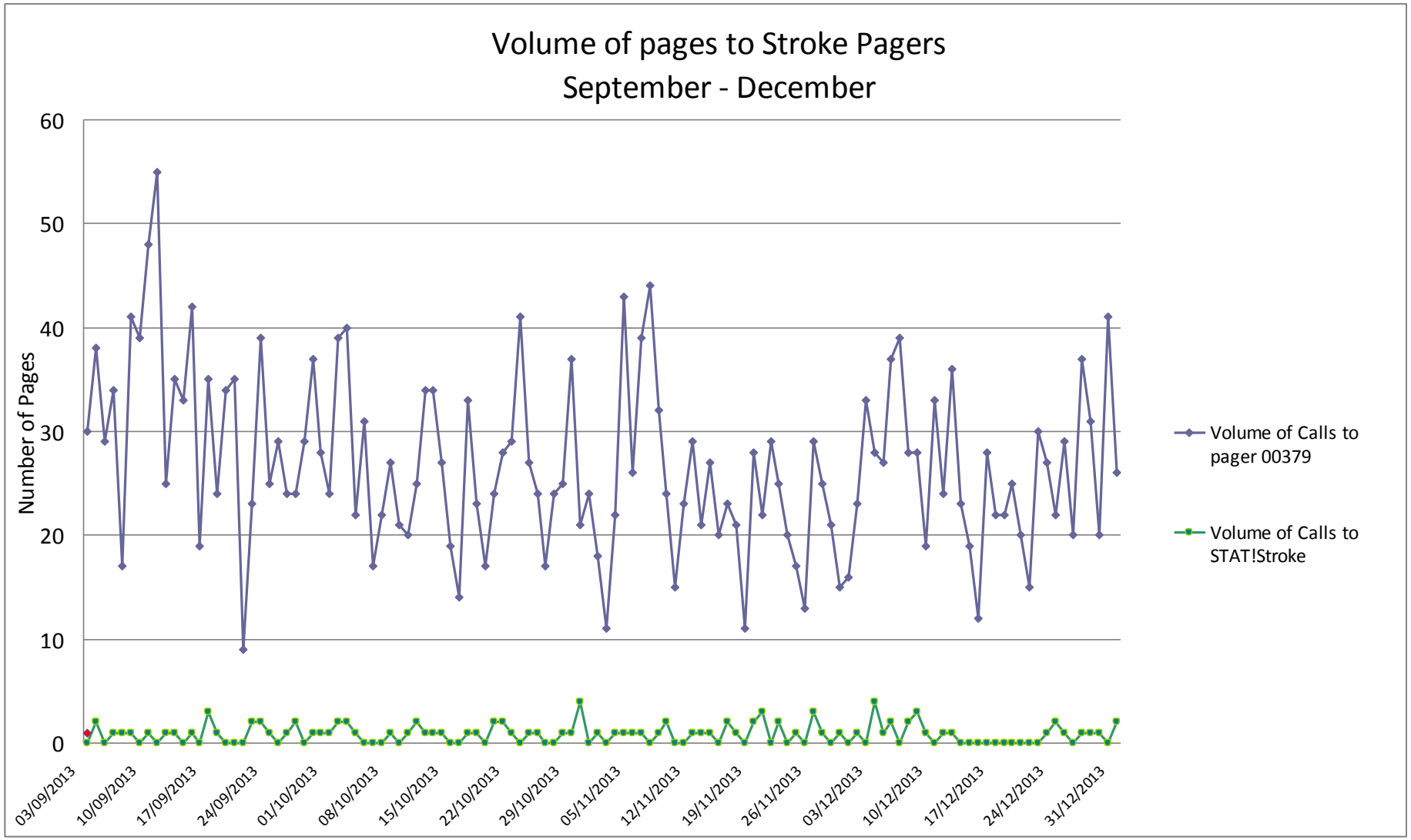


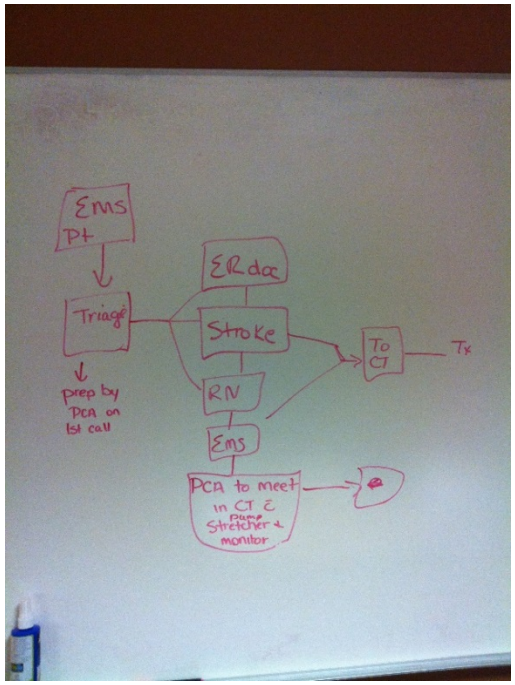
Overall, 82/257 (32%) of STAT stroke cases were treated with tPA

Median Door to Needle Time for tPA Administration
March 2010 - March 2014 (IV, IV+endo cases)

n = 541
Max = 1:47
Min = 0:32

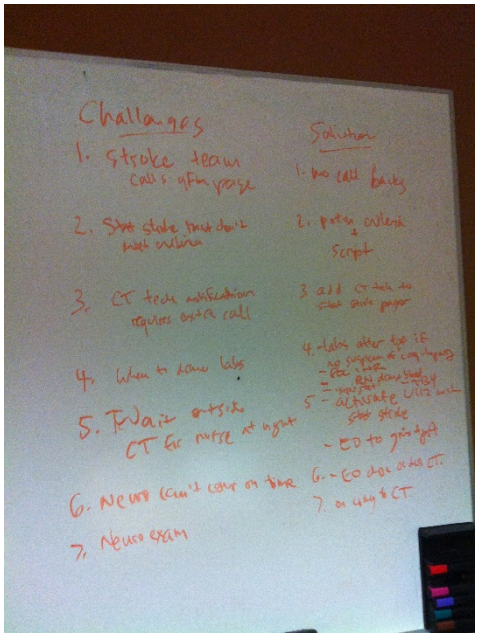



Volume of pages to Stroke Pagers
September - December
Number of Pages
60
50
40
30
20
10
0
03/09/2013
10/09/2013
17/09/2013
24/09/2013
01/10/2013
08/10/2013
15/10/2013
22/10/2013
29/10/2013
05/11/2013
12/11/2013
19/11/2013
26/11/2013
03/12/2013
10/12/2013
17/12/2013
24/12/2013
31/12/2013
Volume of Calls to pager 00379
Volume of Calls to STAT!Stroke



HASTE 3

Goal: DTN <30 min



COMMENTARY

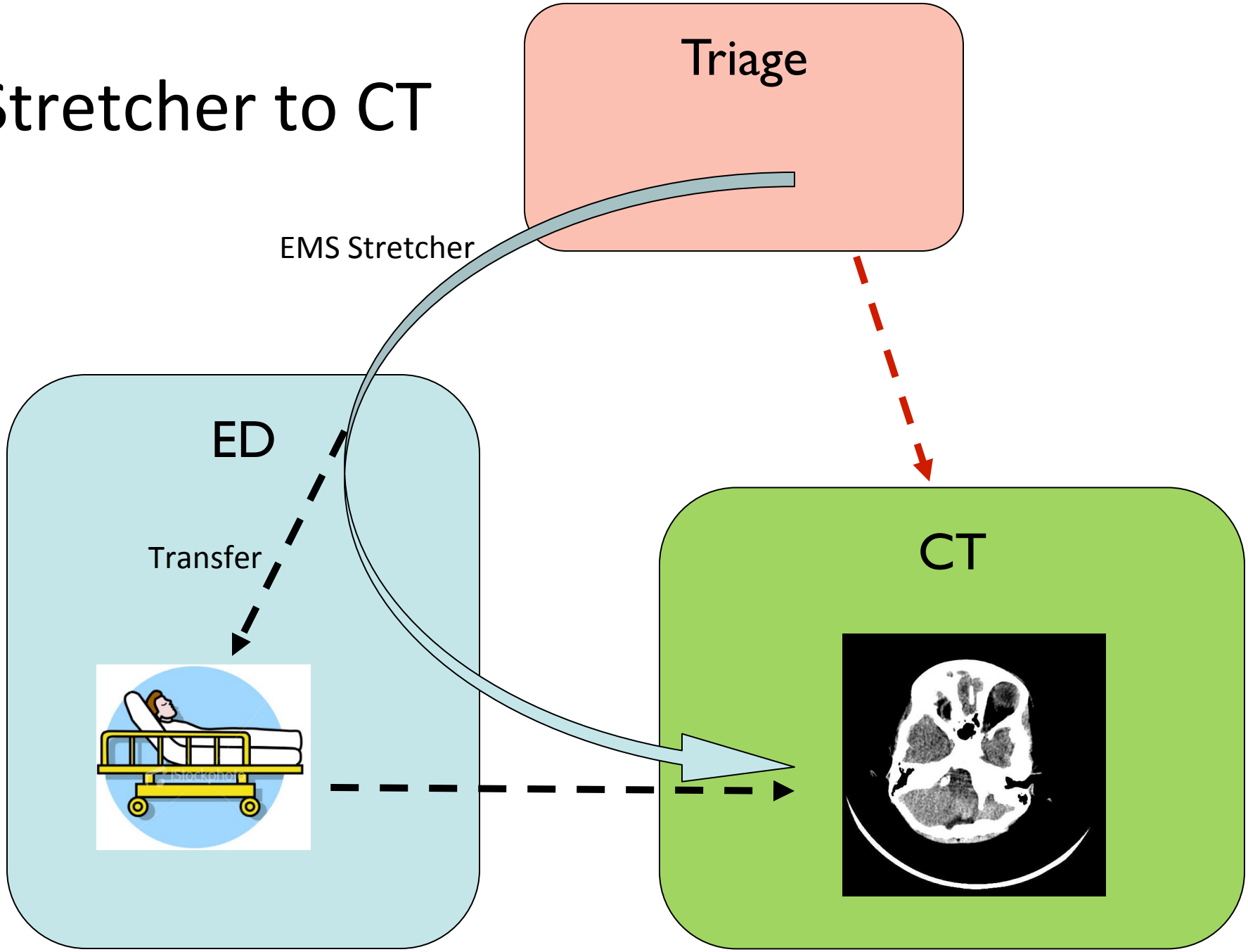
Good is not Good Enough: The Benchmark Stroke Door-to-Needle Time Should be 30 Minutes

Noreen Kamal, Oscar Benavente, Karl Boyle, Brian Buck, Ken Butcher, Leanne K. Casaubon, Robert Côté, Andrew M Demchuk, Yan Deschaintre, Dar Dowlatshahi, Gordon J Gubitz, Gary Hunter, Tom Jeerakathil, Albert Jin, Eddy Lang, Sylvain Lanthier, Patrice Lindsay, Nancy Newcommon, Jennifer Mandzia, Colleen M. Norris, Wes Oczkowski, Céline Odier, Stephen Phillips, Alexandre Y Poppe, Gustavo Saposnik, Daniel Selchen, Ashfaq Shuaib, Frank Silver, Eric E Smith, Grant Stotts, Michael Suddes, Richard H. Swartz, Philip Teal, Tim Watson, Michael D. Hill

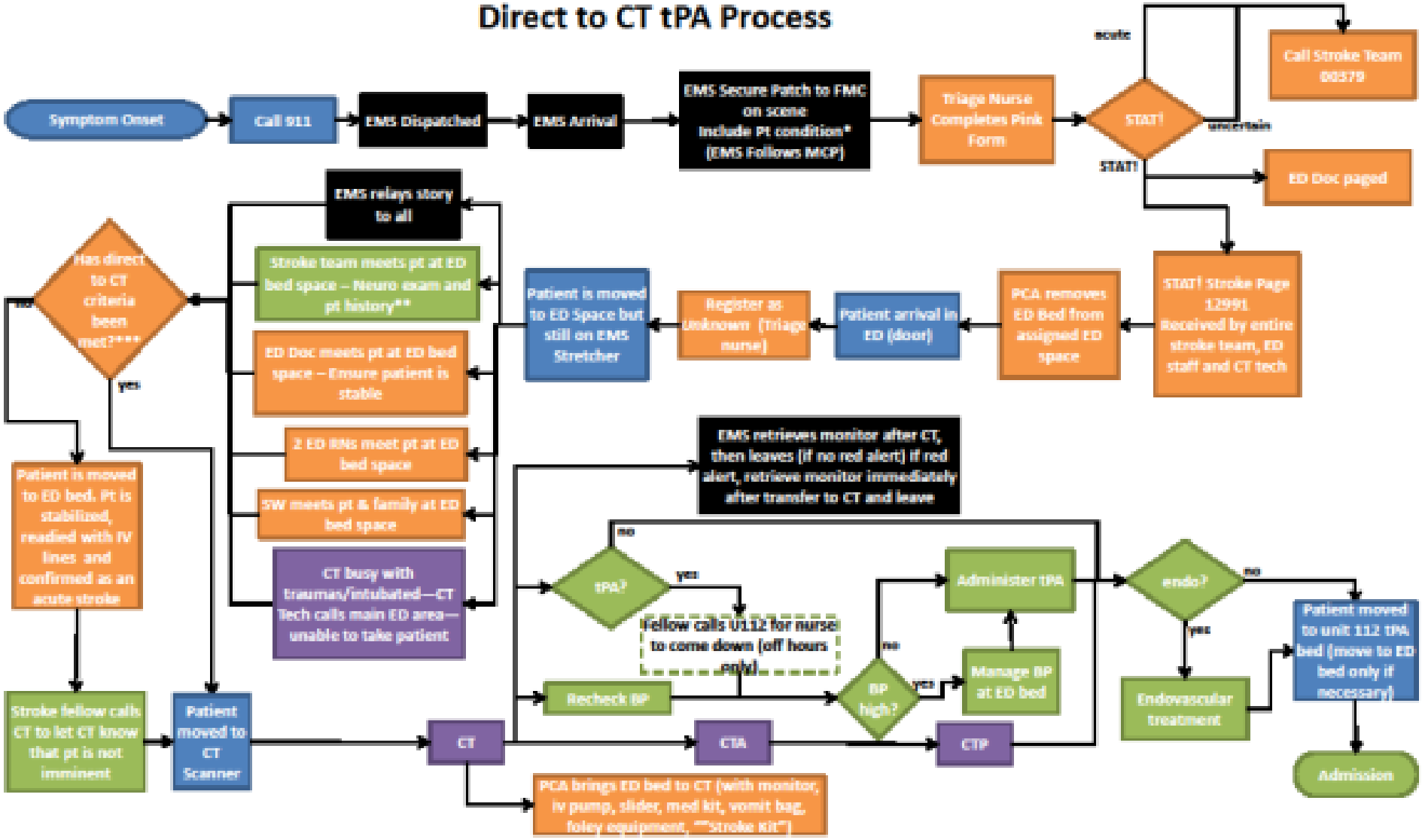
doi:10.1017/cjn.2014.41

Can J Neurol Sci. 2014; 41: 694-696

Stretcher to CT



Direct to CT tPA Process



Calgary Projected Impact of Reducing DTN from 60 min (2011) to 30 min (2015)

- Based on average 200 thrombolysis cases per year.
- Per year:
  - 7 more patients with better ambulation including 3 able to walk independently.[1]
  - 3 more patients able to be discharged home.[1]
  - 2 fewer deaths.[1]
  - Direct cost savings of up to $180,000 in the first year after stroke.[1,2]

[1]Saver JL, Fonarow GC, Smith EE, et al. Time to treatment with intravenous tissue plasminogen activator and outcome from acute ischemic stroke. JAMA 2013;309:2480-2488.

[2]Mittmann N, Seung SJ, Hill MD, et al. Impact of disability status on ischemic stroke costs in Canada in the first year. Can J Neurol Sci 2012;39:793-800.

Keys to FMC Success

- Local champion with weekly brief planning and implementation meetings.
- Larger committee with reps from EMS, ED triage, ED nurse, ED physician, Neurologist, CT Technician, Radiology, Admitting.
- QI methodological framework.
- Reporting times back to practitioners
  - Award recognition.
- Process improvements:
  - Registration as unknown.
  - STAT! Stroke activation
  - Give tPA in the scanner
  - Stretcher to CT

Thank you

Keep Lowering Your Times!

How low can you go?