THE FAST AND THE FURIOUS: REDUCING STROKE TREATMENT TIMES

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- *Sarah Langston, BSN, RN, CCRN-K, SCRN*

OBJECTIVE:

Describe ways to facilitate quicker door to transfer times

Outline:

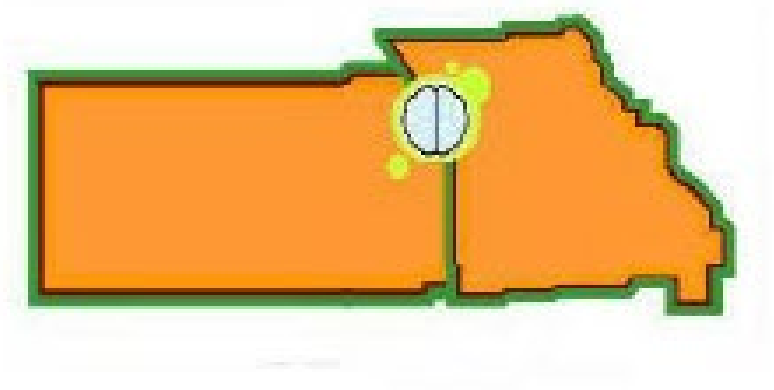
- Evidence Supporting Expedient Care
- DIDO Guidelines
- Best Practices / Tips for Success

WHAT IS THE BISTATE STROKE CONSORTIUM?

Bi-State Stroke Consortium Members

Ability KC
Advent Health Shawnee Mission
American Stroke Association
American Stroke Foundation
Belton Regional Medical Center
Cass Regional Medical Center
Centerpoint Medical Center
Hays Medical Center
Hutchinson Regional Medical Center
Kansas Rehabilitation Center
Lawrence Memorial Hospital
Lee's Summit Medical Center
Liberty Hospital
Menorah Medical Center
Mid-America Rehab Hospital
Mosaic Life Care
North Kansas City Hospital
Olathe Medical Center
Overland Park Regional Medical Center
Providence Medical Center
Research Medical Center
Saint Luke's Health System
Saint Luke's East Hospital
Saint Luke's North Hospital
Saint Luke's South Hospital
St. Joseph Med Ctr
St. Mary's Med Ctr
Stormont-Vail Health
The University of Kansas Health System
The University of Kansas Health System--St. Francis Campus
Truman Medical Center
Via Christi Hospital—St. Francis
Wesley Medical Center

- **Formed:** in 2006
- **Mission:** Facilitate clinical stroke education and improve patient outcomes through collegiality and collaboration.
- **Purpose:** To provide evidence-based educational opportunities in the care of stroke patients for all members of the Bi-State Stroke Consortium



ZOOM POLL: WHAT KIND OF STROKE CENTER DO YOU WORK AT?

- A. Acute/Emergent Stroke Ready Facility
- B. Primary Stroke Center
- C. Thrombectomy Capable or Comprehensive Stroke Center
- D. Unknown

WHY DO WE NEED TO MOVE FAST?

Let's talk about the evidence…

ORIGINAL ARTICLE

Tissue Plasminogen Activator for Acute Ischemic Stroke

The National Institute of Neurological Disorders and Stroke rt-PA Stroke Study Group*

- **Published** December 1995

- **CONCLUSION:**
  - Despite an increased incidence of symptomatic intracerebral hemorrhage……

Treatment with **IV t-PA within 3 hours** of stroke onset

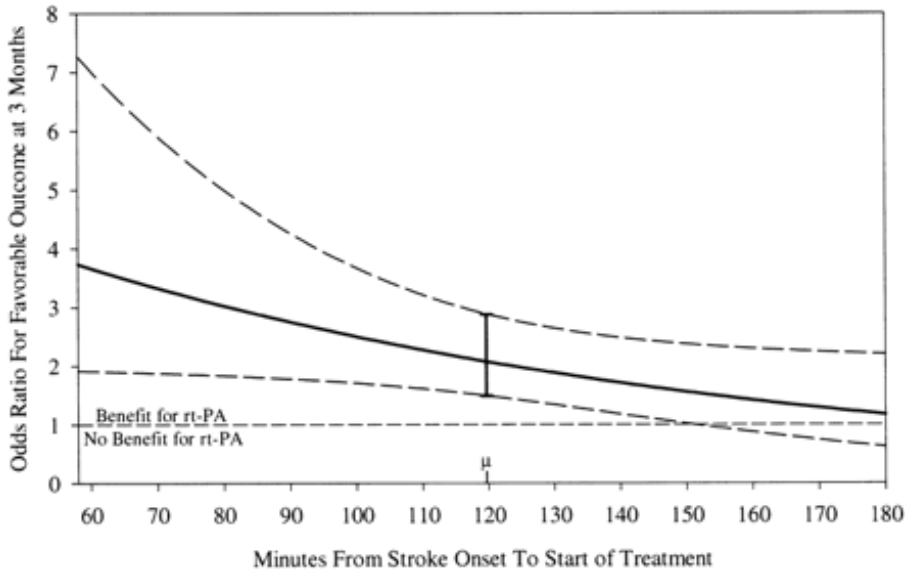
Improved Clinical Outcomes at 3 Months

Early stroke treatment associated with better outcome

The NINDS rt-PA Stroke Study

J.R. Marler, MD; B.C. Tilley, PhD; M. Lu, PhD; T.G. Brott, MD; P.C. Lyden, MD; J.C. Grotta, MD; J.P. Broderick, MD; S.R. Levine, MD; M.P. Frankel, MD; S.H. Horowitz, MD; E.C. Haley, Jr., MD; C.A. Lewandowski; and T.P. Kwiatkowski, MD, for the NINDS rt-PA Stroke Study Group*

- **Published** December of 2000
- **CONCLUSION:**
  - Patients treated with rt-PA 0 to 90 minutes from stroke onset =
    - Increased odds of improvement at 24 hours compared to patients treated later than 90 minutes
    - More favorable 3-month outcome compared to patients treated later than 90 minutes



Time Is Brain--Quantified

> Stroke. 2006 Jan;37(1):263-6. doi: 10.1161/01.STR.0000196957.55928.ab. Epub 2005 Dec 8.

Jeffrey L Saver [1]

- **Published** 2006
- **PURPOSE:** Literature review identifying consensus estimates of…
  - # of neurons, synapses, & myelinated fibers in the human forebrain
  - Volume of large vessel, supratentorial ischemic stroke
  - Interval from onset to completion of ischemic stroke
- **CONCLUSION:**

	Neurons Lost	Synapses Lost	Myelinated Fibers Lost	Accelerated Aging
Per Stroke	1.2 billion	8.3 trillion	7140 km/4470 miles	36 y
Per Hour	120 million	830 billion	714 km/447 miles	3.6 y
Per Minute	1.9 million	14 billion	12 km/7.5 miles	3.1 wk
Per Second	32 000	230 million	200 meters/218 yards	8.7 h

Thrombolysis with Alteplase 3 to 4.5 Hours after Acute Ischemic Stroke

Werner Hacke, M.D., Markku Kaste, M.D., Erich Bluhmki, Ph.D., Miroslav Brozman, M.D., Antoni Dávalos, M.D., Donata Guidetti, M.D., Vincent Larrue, M.D., Kennedy R. Lees, M.D., Zakaria Medeghri, M.D., Thomas Machnig, M.D., Dietmar Schneider, M.D., Rüdiger von Kummer, M.D., et al., for the ECASS Investigators*

- *ECASS III*
- **Published** 2008
- **PURPOSE:** Tested efficacy of IV alteplase administered within 3 – 4.5 hrs from AIS onset for adults 18-80 YO
- **CONCLUSION:**
  - Despite an increased incidence of symptomatic ICH patients who received IV alteplase 3 – 4.5 hrs following stroke onset had significantly improved clinical outcomes than those who received the placebo

Stroke Thrombolysis

Save a Minute, Save a Day

Atte Meretoja, MD, Mahsa Keshtkaran, MSc, Jeffrey L. Saver, MD, Turgut Tatlisumak, MD, Mark W. Parsons, MD, Markku Kaste, MD, Stephen M. Davis, MD, Geoffrey A. Donnan, MD, and Leonid Churilov, PhD

- **Published** April 2014
- **CONCLUSIONS:**
  - Benefits observed in ALL groups
    - ≤ ***50YO*** improved slightly more than **> 80 YO**
    - **Women** improved slightly more than men

Every 1 minute of time saved → ↑ ~1.8 days healthy life

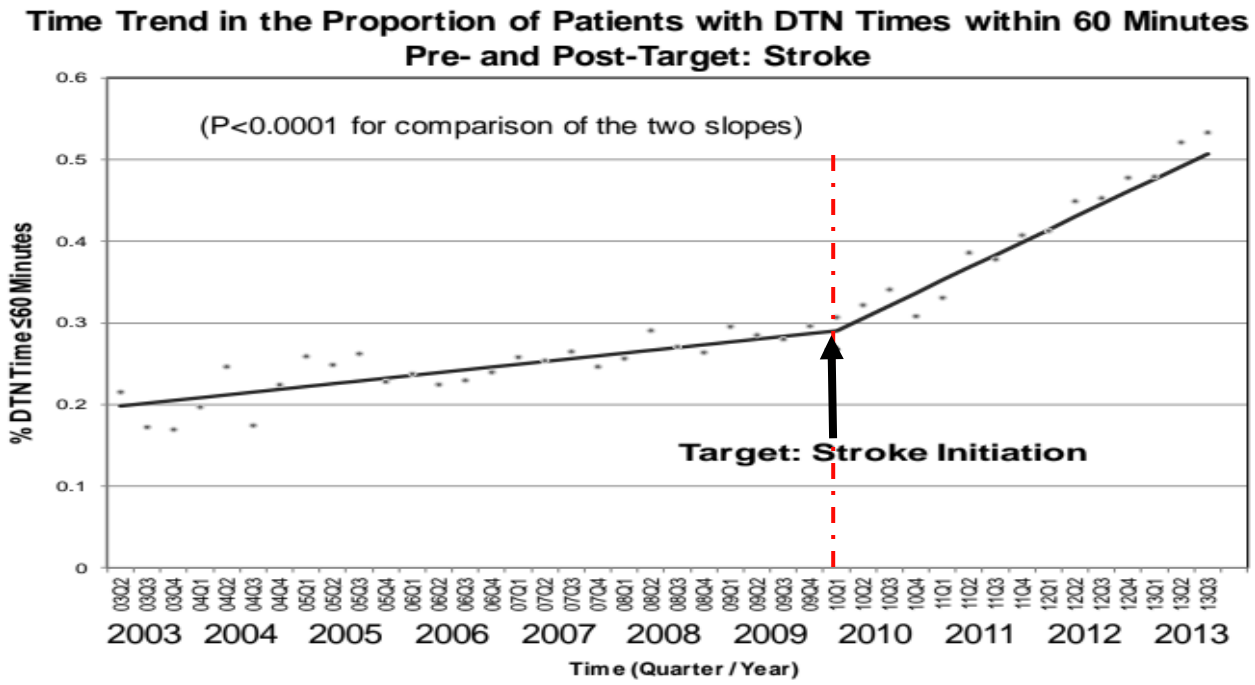
Every 15 minutes of time saved → ↑~1 month healthy life

- ***Small reductions*** *in thrombolysis delays →*
  Significant lifetime health benefits *for stroke patients*

TARGET: STROKE

EVOLUTION OF BEST PRACTICES:
TARGET: STROKE PHASE I

- Launched in 2010
- **Phase I Goal:**
  - Door-to-needle times within 60 minutes ≥ 50% of eligible Acute Ischemic Stroke (AIS) patients

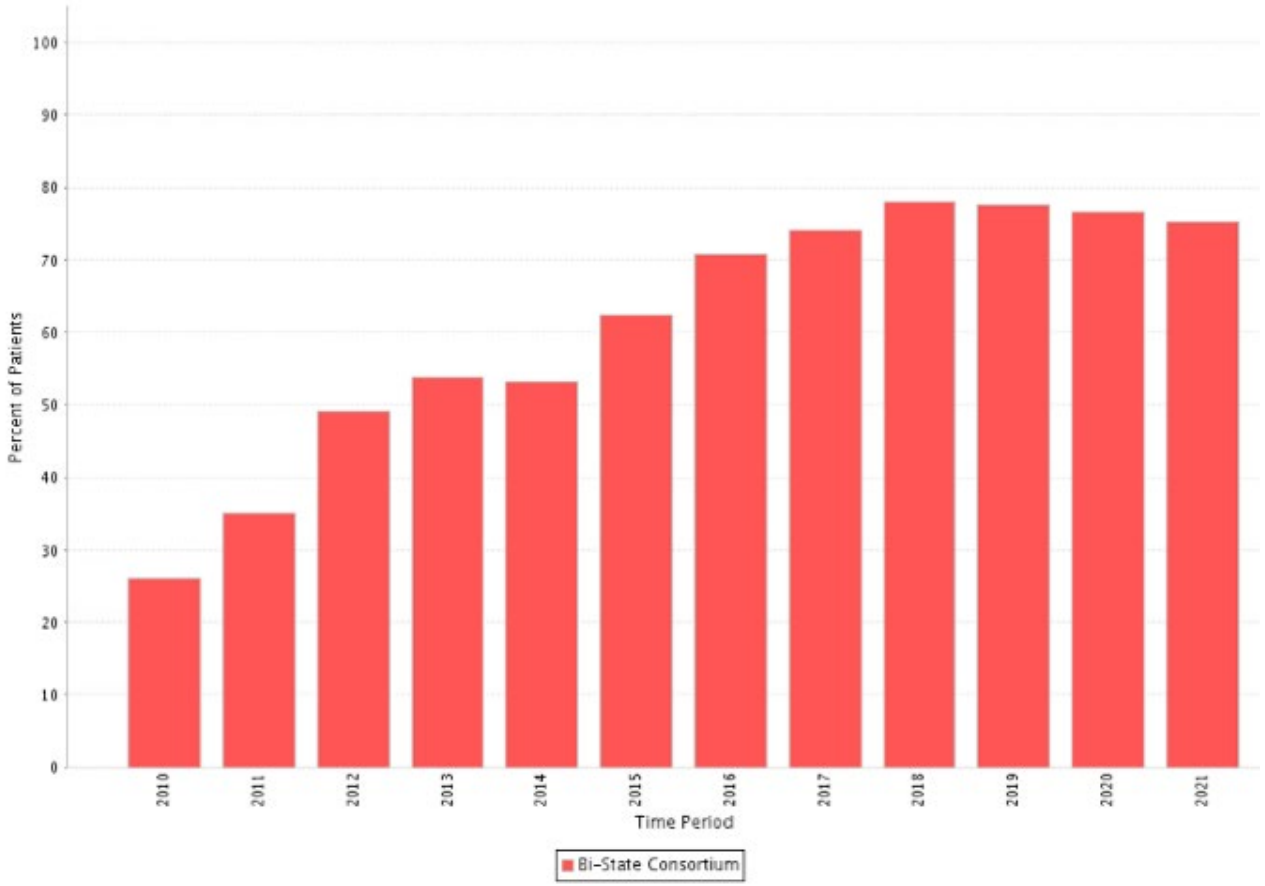


BEST PRACTICE STRATEGIES

TARGET: STROKE I

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 alteplase medication ahead of time for high likelihood candidates
8. Rapid access to intravenous alteplase 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

GWTG DATA: BISTATE <60 MIN DTN



TIMELINE OF PHASE I AND PHASE II

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

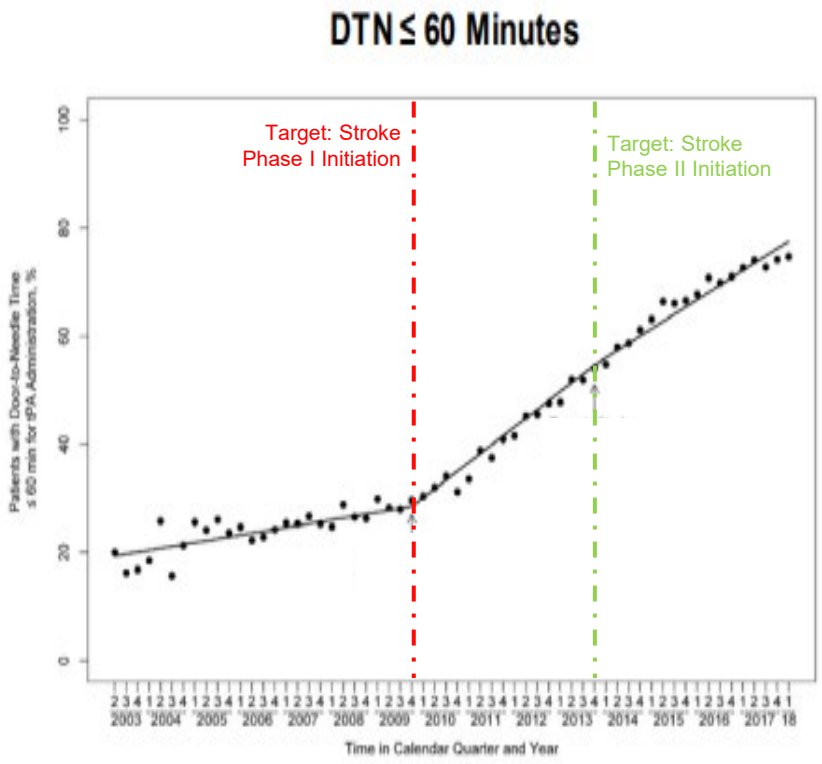
EVOLUTION OF BEST PRACTICES: TARGET STROKE II

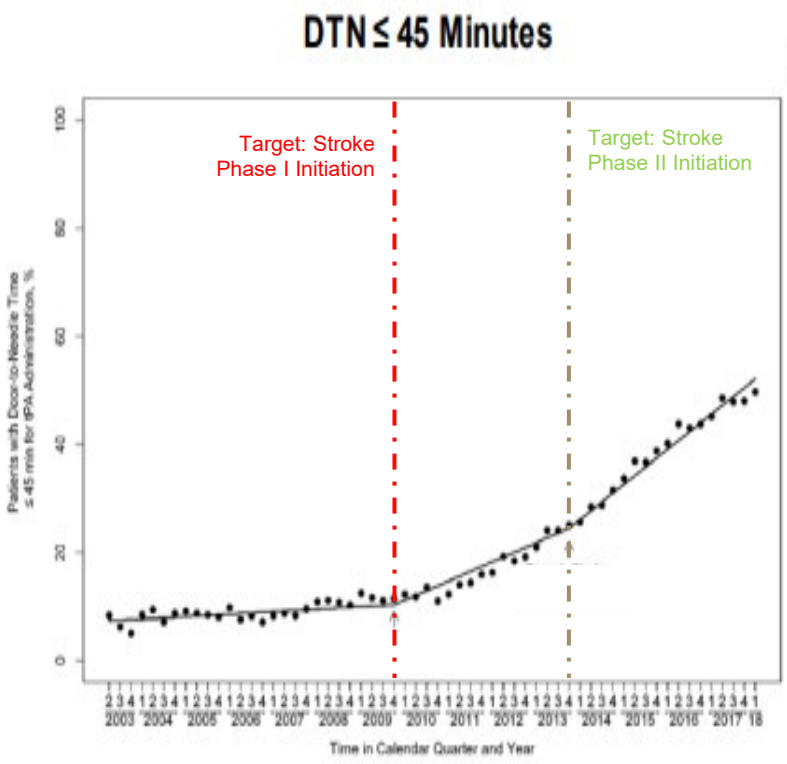
- *Launched in 2014*
- **Phase II Goals:**
  - DTN within 60 min ≥ 75% of eligible patients
  - DTN within 45 min ≥ 50% of eligible patients

- **Best Practices:**

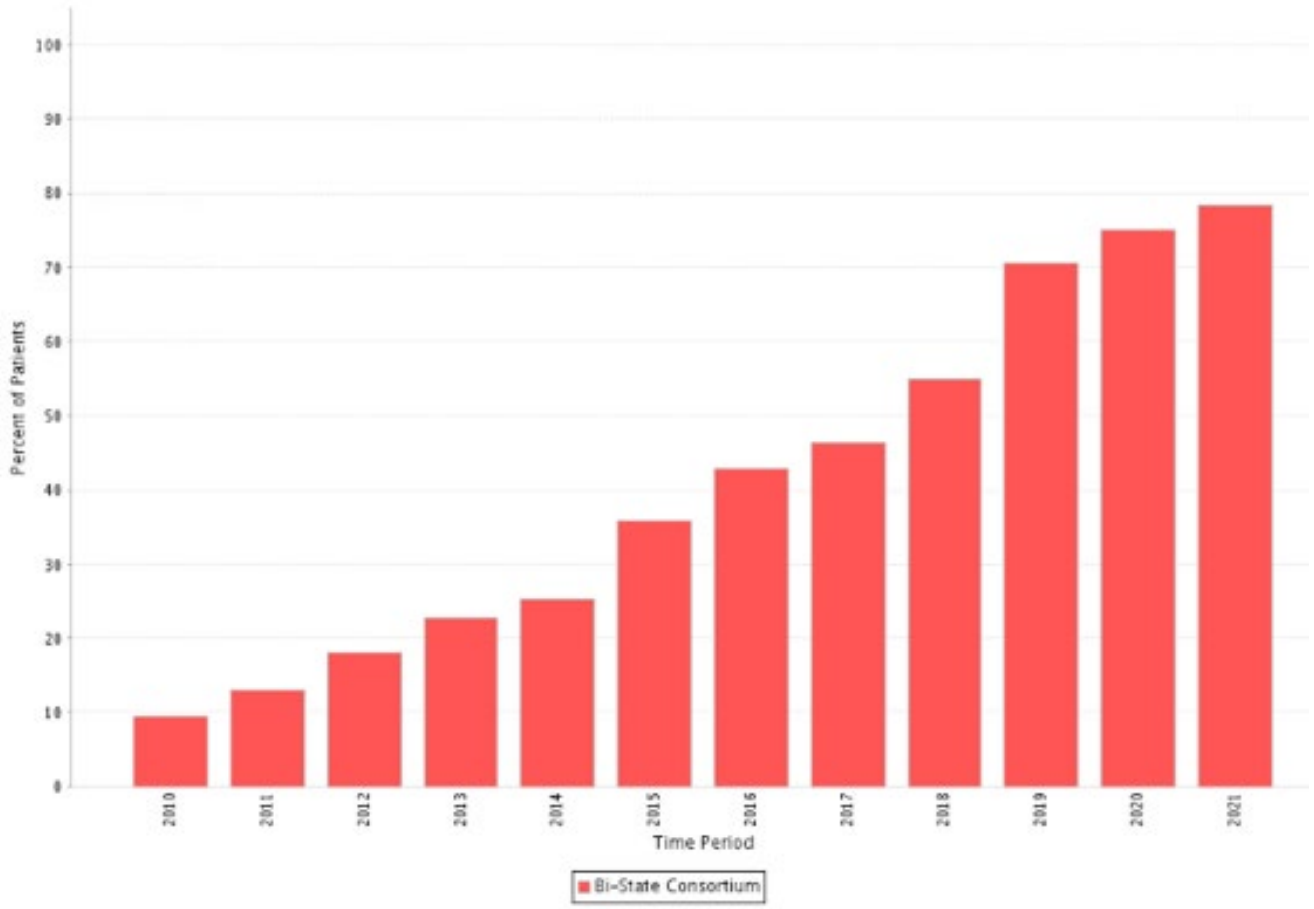
1. Hospital pre-notification by Emergency Medical Services
2. Rapid triage protocol and stroke team notification
3. Single call/paging activation system for entire stroke team
4. Use of a stroke toolkit containing clinical decision support, stroke-specific order sets, guidelines, hospital-specific algorithms, critical pathways, NIH Stroke Scale and other stroke tools
5. Timer or clock attached to cart, 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 alteplase medication ahead of time for high likelihood candidates
10. Rapid access to intravenous alteplase 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

TARGET: STROKE PHASE II NATIONAL DATE





GWTG DATA: LOCAL BISTATE <45 MIN DTN



ARE WE HARMING PEOPLE BY TREATING FASTER?

Outcome	Pre-Target: Stroke (n=24,365)	Post-Target: Stroke Phase I (n=44,257)	Post-Target: Stroke Phase II (74,447)	P value	Adjusted OR 95% CI (Phase I vs Pre Target: Stroke)	Adjusted OR 95% CI (Phase II vs Pre Target: Stroke)
In-Hospital Mortality	10.0%	8.2%	↓ 6.2%	<0.0001	0.85 (0.80-0.91)	0.72 (0.67-0.77)
Discharge Home	35.8%	41.5%	↑ 49.0%	<0.0001	1.21 (1.16-1.27)	1.35 (1.27-1.45)
Ambulatory Status Independent	41.5%	44.6%	↑ 52.7%	<0.0001	1.05 (0.99-1.22)	1.35 (1.27-1.45)
Symptomatic ICH within 36 Hours	5.7%	4.5%	↓ 3.6%	<0.0001	0.79 (0.72-0.86)	0.67 (0.61-0.73)

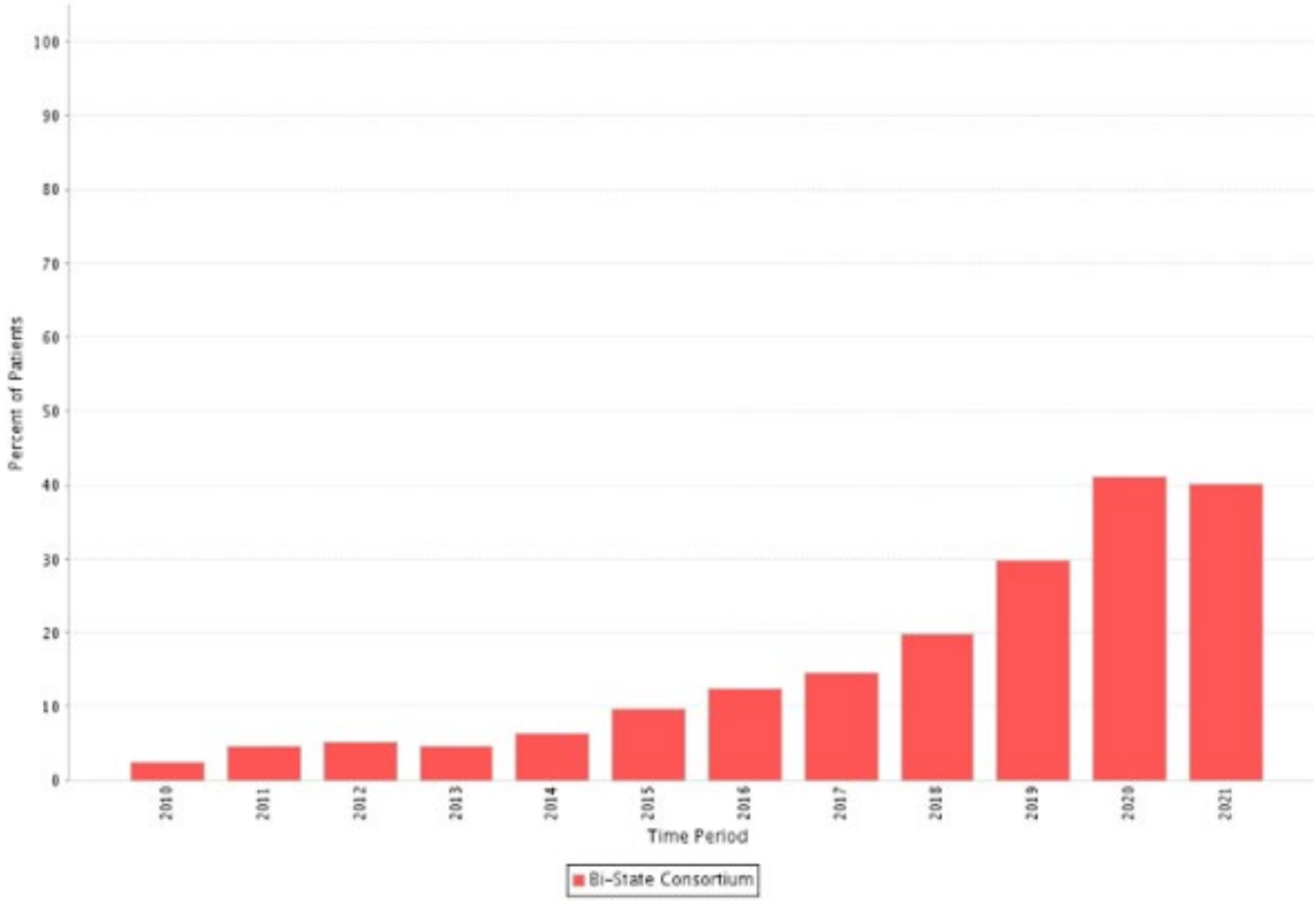
EVOLUTION OF BEST PRACTICES
TARGET: STROKE PHASE III

- *Launched in 2019*

- **PRIMARY GOALS:**
  - DTN (*IV thrombolytic*) within 60 min ≥ 85% eligible cases
  - Door-to-device times (*arrival to first pass of thrombectomy device*) ≥ 50% eligible patients:
    - **≤ 90** minutes for ED arrivals
    - **≤ 60** minutes for transfers

- **SECONDARY GOALS:**
  - DTN within 45 min ≥ 75% eligible patients
  - DTN within 30 minutes ≥ 50% eligible patients

GWTG DATA: BISTATE <30 MIN DTN

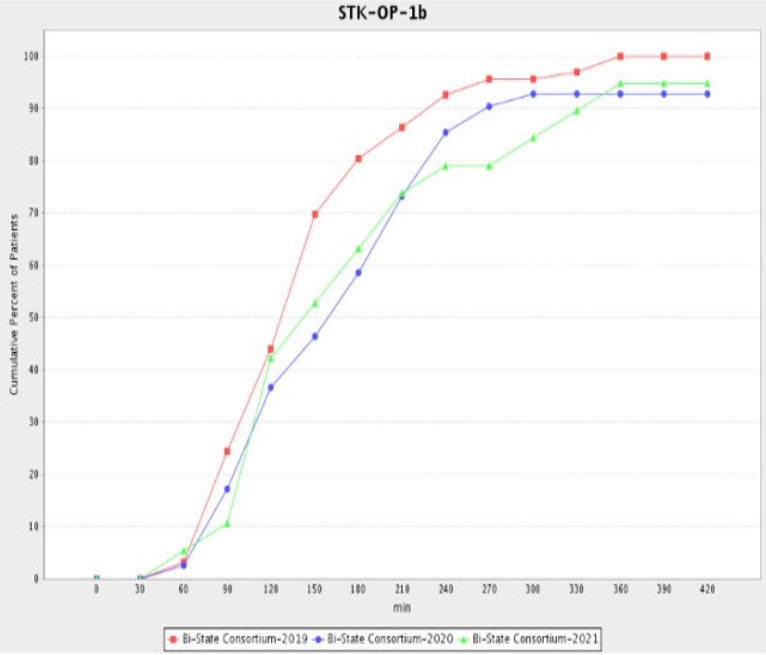


DOOR IN DOOR OUT DATA COLLECTION

- Brain Attack Coalition (BAC) recommended transfer within 2 hours in 2013 (Alberts, 2013)
- Reporting to TJC began Jan 1, 2019 discharges
  - Tracking transfer times of stroke subtypes
- Hoping to get a DIDO recommendation from AHA

Set Measure ID: STK-OP-1

Set Measure ID	Performance Measure Name
STK-OP-1a	Overall Rate (Not Reported)
STK-OP-1b	Hemorrhagic Stroke
STK-OP-1c	Ischemic Stroke; IV Alteplase Prior to Transfer (Drip and Ship) **RETIRED 7/1/2021**
STK-OP-1d	Ischemic Stroke; No IV Alteplase Prior to Transfer, LVO and MER Eligible
STK-OP-1e	Ischemic Stroke; No IV Alteplase Prior to Transfer, LVO and NOT MER Eligible
STK-OP-1f	Ischemic Stroke; No IV Alteplase Prior to Transfer, No LVO
STK-OP-1g	Ischemic Stroke; IV Alteplase Prior to Transfer, LVO and MER Eligible
STK-OP-1h	Ischemic Stroke; IV Alteplase Prior to Transfer, LVO and NOT MER Eligible
STK-OP-1i	Ischemic Stroke; IV Alteplase Prior to Transfer, No LVO



STK-OP-1b
Note: Time periods/Categories at the end of the graph and data table have been omitted because there were no patient records during that time.

Benchmark Group	Time Period	0	30	60	90	120	150	180	210	240	270	300	330	360	390	420	Total	Mean	Standard Deviation	Median	Range
Bi-State Consortium	2019	0 (0%)	0 (0%)	2 (3%)	16 (24.2%)	29 (43.9%)	46 (69.7%)	53 (80.3%)	57 (86.4%)	61 (92.4%)	63 (95.5%)	63 (95.5%)	64 (97%)	66 (100%)	66 (100%)	66 (100%)	66	136.9	65.8	129.5	33 - 352
	2020	0 (0%)	0 (0%)	1 (2.4%)	7 (17.1%)	15 (36.6%)	19 (46.3%)	24 (58.5%)	30 (73.2%)	35 (85.4%)	37 (90.2%)	38 (92.7%)	38 (92.7%)	38 (92.7%)	38 (92.7%)	38 (92.7%)	41	276.6	693.1	158	55 - 4622
	2021	0 (0%)	0 (0%)	1 (5.3%)	2 (10.5%)	8 (42.1%)	10 (52.6%)	12 (63.2%)	14 (73.7%)	15 (78.9%)	15 (78.9%)	16 (84.2%)	17 (89.5%)	18 (94.7%)	18 (94.7%)	18 (94.7%)	19	185.3	115.9	144	58 - 560

DIDO RESEARCH

Stroke
Volume 50, Issue 10, October 2019, Pages 2829-2834
https://doi.org/10.1161/STROKEAHA.119.025838

American Heart Association.

CLINICAL SCIENCES

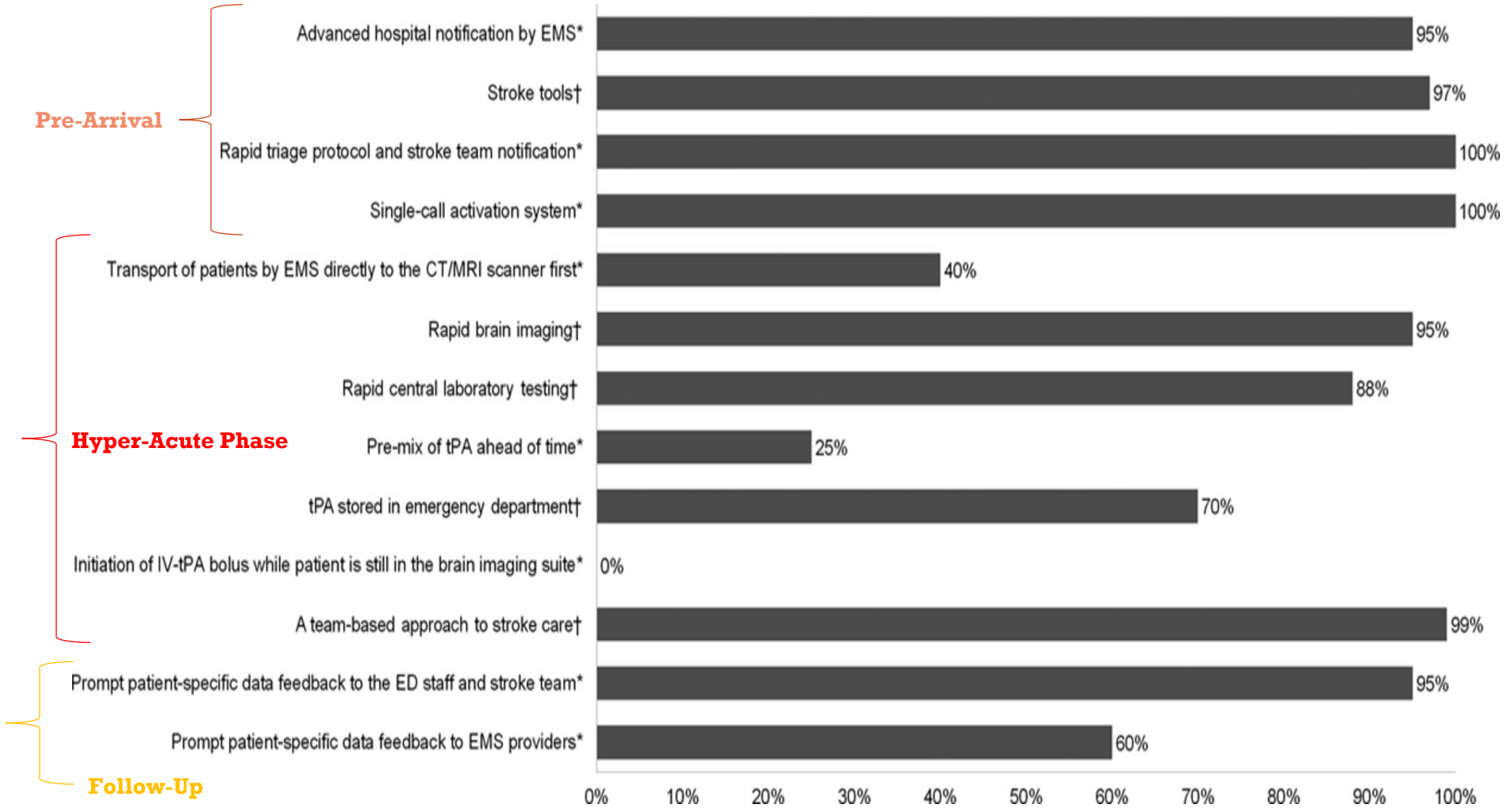
Door-in-Door-Out Time of 60 Minutes for Stroke With Emergent Large Vessel Occlusion at a Primary Stroke Center

Philip M.C. Choi, FRACP, Andrew H. Tsoi, MD, Alun L. Pope, PhD, Shelton Leung, MD, Tanya Frost, RN, Poh-Sien Loh, FRACP, Ronil V. Chandra, FRANZCR, Henry Ma, PhD, Mark Parsons, PhD, Peter Mitchell, FRANZCR, and Helen M. Dewey, PhD

Conclusion: A median DIDO time of < 60 minutes can be achieved at a primary stroke center.

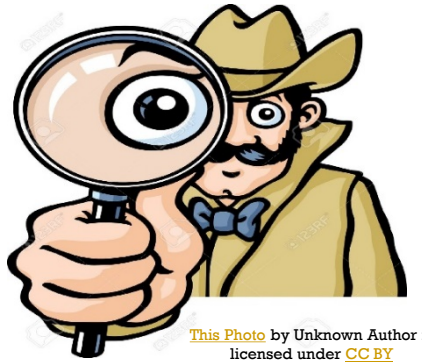
BEST PRACTICES/TIPS FOR SUCCESS

BEST PRACTICES



PRE-ARRIVAL/ EMS ACTIONS ON SCENE

EMS CHECKLIST



EMS Stroke Protocol should Include:

- Pertinent medical history, meds, baseline function, and family contact number
  - ***Purpose**: Expedites alteplase administration & screening for endovascular treatment*
- Placement of 2 PIVs (*at least 1 AC*)
  - ***Purpose:** Expedites alteplase treatment & advanced imaging*
- Prenotification of hospital with FAST/CPSS positive and LVO positive patient en route
  - ***Purpose**: Gives information if patient may transfer*
- Guidance for where to transfer patient

EMS Stroke Protocol Checklist

Adults

- Potential IV alteplase candidates
  - Last seen well < 4.5 hrs from presentation
- Potential endovascular candidates
  - Last seen well < 24 hrs from presentation, unknown onset or wake-up
- Stroke specific clinical questions
  - Last seen well, pertinent medical history, anticoagulants, family contact number, baseline functional status
- Clinical management
  - ABCs – goal O2 sats > 94%
  - Treat hypoglycemia per protocol
  - Blood Pressure
    - Avoid hypotension
    - Don't treat BP unless > 220/120 mmHg or according to HTN Crisis Protocol
      - Labetalol, Hydralazine (what's available in formulary)
  - Field Assessment – BE FAST/Cincinnati exam & if positive, perform FAST-ED LVO screen
  - ECG
  - IV access – 1-2 20 g or larger, preferably 1 AC
  - Pre-notify receiving hospital (include if LVO screen +)
  - Drip & ships
    - Verify pump settings/infusion with RN prior to departure
    - Vitals & neuro checks Q15 min
    - Maintain BP <180/105 mmHg, but keep SBP > 100 (treatment options established prior to departure)
    - Stop infusion if sudden changes in baseline mental status, acute HA, or vomiting
    - Pre-notify receiving hospital

2019 STROKE GUIDELINES

3. Patients with a positive stroke screen or who are strongly suspected to have a stroke should be transported rapidly to the closest healthcare facilities that are able to administer IV alteplase.	I	B-NR	Recommendation reworded for clarity from 2013 AIS Guidelines. See Table XCV in online Data Supplement 1 for original wording.
The 2013 recommendation referred to initial emergency care as described elsewhere in the guidelines, which specified administration of IV alteplase as part of this care. The current recommendation is unchanged in intent but reworded to make this clear.			
4. When several IV alteplase–capable hospital options exist within a defined geographic region, the benefit of bypassing the closest to bring the patient to one that offers a higher level of stroke care, including mechanical thrombectomy, is uncertain.	IIb	B-NR	New recommendation.
5. Effective prehospital procedures to identify patients who are ineligible for IV thrombolysis and have a strong probability of large vessel occlusion (LVO) stroke should be developed to facilitate rapid transport of patients potentially eligible for thrombectomy to the closest healthcare facilities that are able to perform mechanical thrombectomy.	IIb	C-EO	New recommendation.

CLASS I (STRONG) — Benefit >>> Risk

Suggested phrases for writing recommendations:
- Is recommended
- Is indicated/useful/effective/beneficial
- Should be performed/administered/other
- Comparative-Effectiveness Phrases†:
  - Treatment/strategy A is recommended/indicated in preference to treatment B
  - Treatment A should be chosen over treatment B

CLASS IIa (MODERATE) — Benefit >> Risk

Suggested phrases for writing recommendations:
- Is reasonable
- Can be useful/effective/beneficial
- Comparative-Effectiveness Phrases†:
  - Treatment/strategy A is probably recommended/indicated in preference to treatment B
  - It is reasonable to choose treatment A over treatment B

CLASS IIb (WEAK) — Benefit ≥ Risk

Suggested phrases for writing recommendations:
- May/might be reasonable
- May/might be considered
- Usefulness/effectiveness is unknown/unclear/uncertain or not well established

LEVEL (QUALITY) OF EVIDENCE‡

LEVEL A
- High-quality evidence‡ from more than 1 RCT
- Meta-analyses of high-quality RCTs
- One or more RCTs corroborated by high-quality registry studies

LEVEL B-R (Randomized)
- Moderate-quality evidence‡ from 1 or more RCTs
- Meta-analyses of moderate-quality RCTs

LEVEL B-NR (Nonrandomized)
- Moderate-quality evidence‡ from 1 or more well-designed, well-executed nonrandomized studies, observational studies, or registry studies
- Meta-analyses of such studies

LEVEL C-LD (Limited Data)
- Randomized or nonrandomized observational or registry studies with limitations of design or execution
- Meta-analyses of such studies
- Physiological or mechanistic studies in human subjects

LEVEL C-EO (Expert Opinion)

Consensus of expert opinion based on clinical experience

PROPOSED TIMES ARE MEANT TO SERVE AS STARTING POINTS FOR LOCAL DISCUSSION AND THESE SHOULD BE DETERMINED IN THE FUTURE BY SPECIFIC PERFORMANCE DATA FROM STROKE CENTERS WITHIN THE SSOC

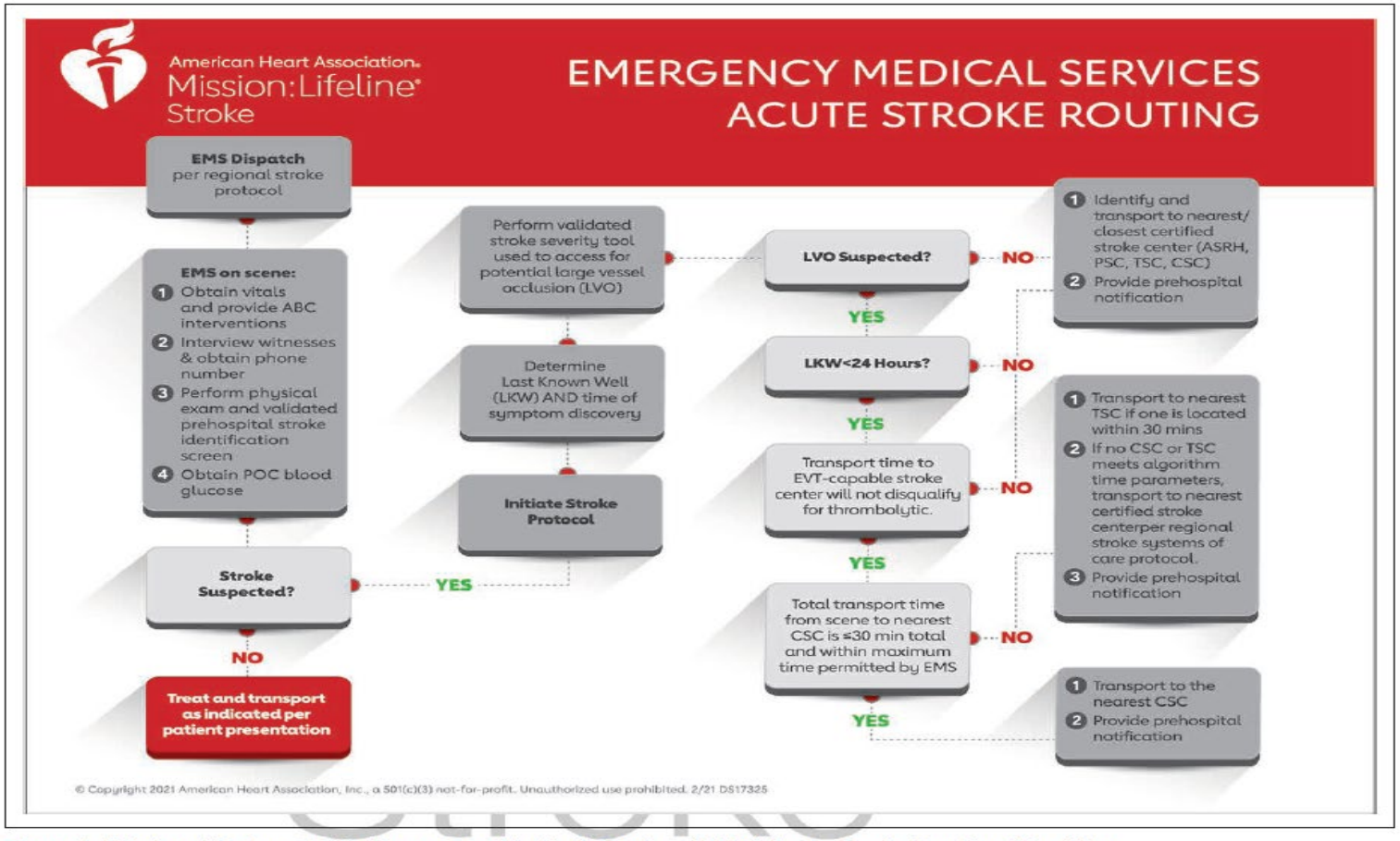
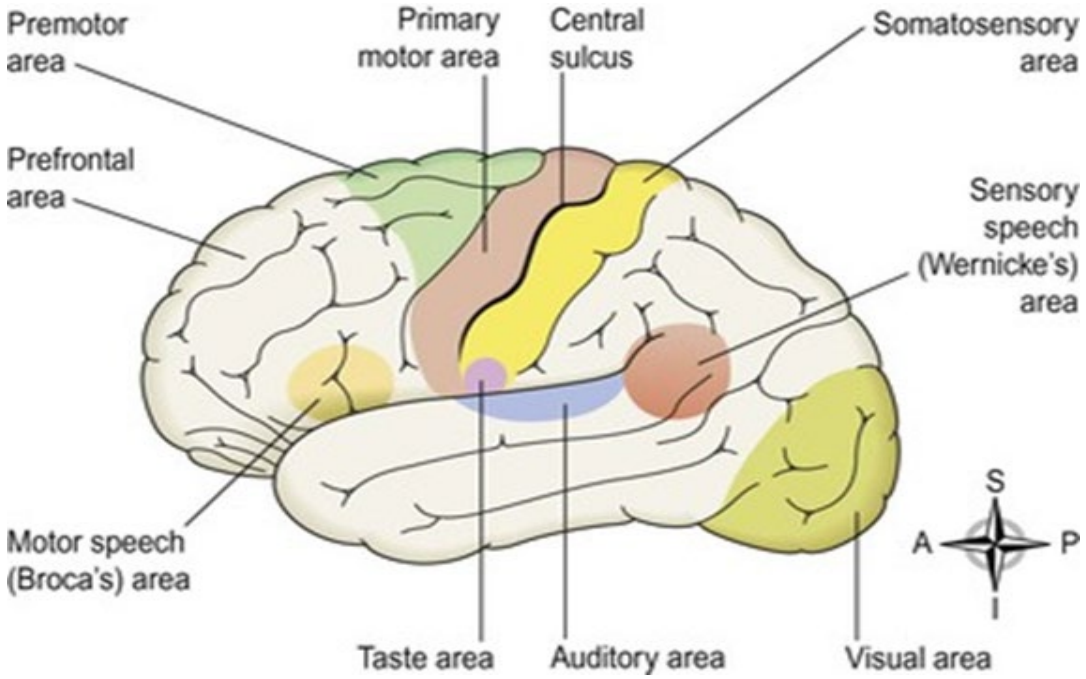


Figure 1. Mission: Lifeline Stroke Emergency Medical Services (EMS) Acute Stroke Routing Algorithm.
ABC indicates airway, breathing and circulation; ASRH, acute stroke-ready hospital; CSC, comprehensive stroke center; EVT, endovascular therapy; LKW, last known well; LVO, large vessel occlusion; POC, point of care; PSC, primary stroke center; and TSC, thrombectomy-capable stroke center. Reprinted from the American Heart Association with permission. Copyright ©2021.

EMS STROKE RECOGNITION EDUCATION

- Include Large Vessel Occlusion (LVO) recognition with screening tool and scripting



- Multiple validated LVO screening tool
  - These look for large vessel deficits (AKA *cortical findings)*
    - Gaze, Aphasia, Paralysis, Neglect, Vision

LARGE VESSEL OCCLUSION (LVO) SCREENING TOOLS

- ✓ **CPSSS Cincinnati Prehospital Stroke Severity Scale**
- ✓ **RACE Rapid Arterial Occlusion Evaluation Scale**
- ✓ **FAST-ED Field Assessment Stroke Triage for Emergency Destination**
- ✓ **Los Angeles Motor Scale (LAMS)**
- ✓ **Vision Aphasia Neglect (VAN)**

STROKE SCREENING TOOLS
CINCINNATI PRE-HOSPITAL STROKE SCALE (CPSS)
LOS ANGELES PRE-HOSPITAL STROKE SCALE (LAPSS)
STROKE SEVERITY TOOLS
CINCINNATI STROKE TRIAGE ASSESSMENT TOOL (CSTAT)
FIELD ASSESSMENT STROKE TRIAGE FOR EMERGENCY DESTINATION (FAST-ED)
LOS ANGELES MOTOR SCALE (LAMS)
RAPID ARTERIAL OCCLUSION EVALUATION SCALE (RACE)

Algorithm available at: Heart.org/MissionLifelineStroke

SCALE	ACCURACY SCORE
NIHSS	0.799
FAST-ED	0.813
RACE	0.771
CPSS	0.752

ZOOM POLL: DO EMS IN YOUR AREA USE A LVO SCREENING TOOL?

- A. Yes
- B. No
- C. I don't know

EMS CAN IMPACT DIDO:

- EMS prehospital stroke screening tool
  - *0.9 min savings*
- EMS direct transport to scanner
  - *0.7 min savings*
- Prompt data feedback to EMS providers
  - *1 min savings*

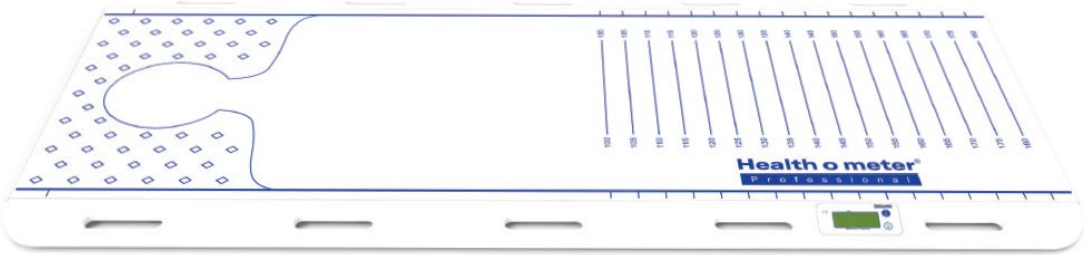
(Xian et al., 2017)

HYPER-ACUTE PHASE/ARRIVAL OF PATIENT

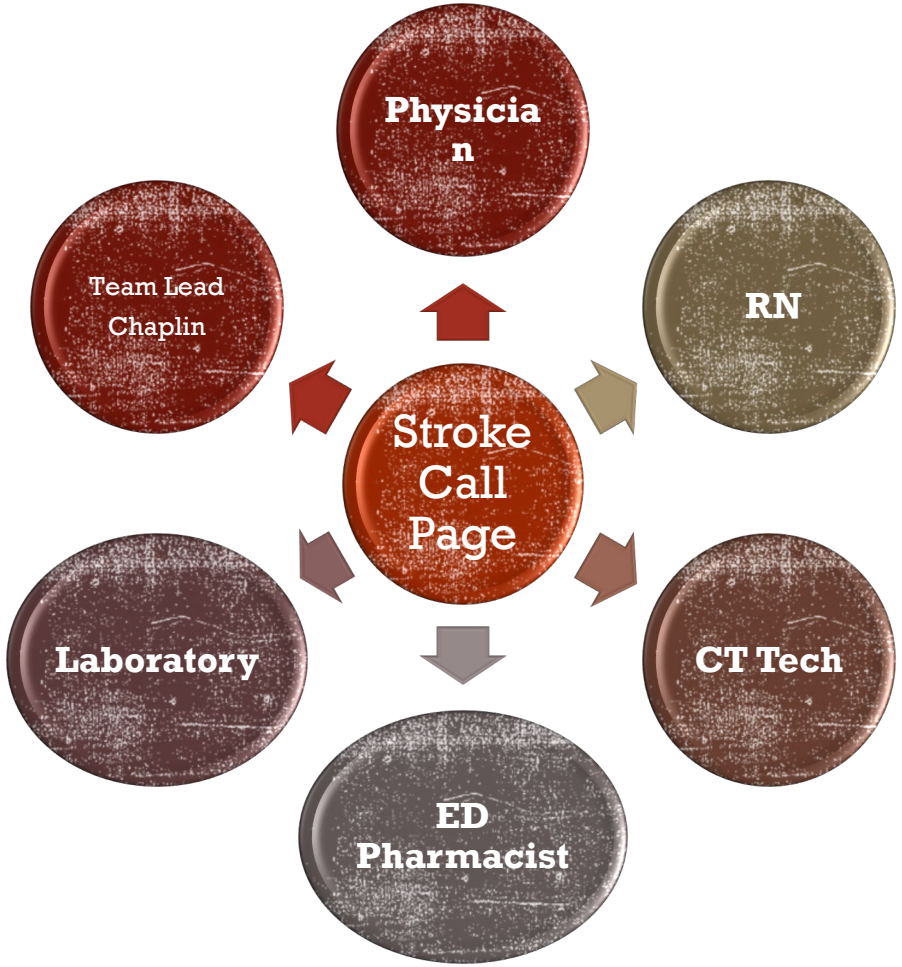
ZOOM POLL: HOW DOES YOUR FACILITY OBTAIN A WEIGHT ON STROKE PATIENTS IN THE ED?

- A. Stretcher Scale
- B. Slideboard Scale
- C. Hoyer Life Scale
- D. We estimate weights only

OBTAINING WEIGHTS



SINGLE CALL ACTIVATION SYSTEM



USING TIMERS OR STOP WATCHES

DOOR IN TIME: 1015

GOAL TIME: 1045

EMS HANDOFF

EMS Stroke Agency_____

t-PA Drug Window is up to 4.5 hours

Intracranial Intervention Window is up to 24 hours

Last Seen Well/Onset		AM PM	Weight	
Name			Loaded cot	KG
DOB		S/S#	Empty cot	KG
Allergies		Blood Sugar	Pt Wt	KG

Patient History (Circle if Any)			
Stroke/TIA	CAD/CABG		A-Fib
Diabetes	Kidney	COPD	Smoker

Home Blood Thinners (Circle if Any)		
Aspirin	Coumadin (warfarin)	Pradaxa (dibigatran)
Eliquis (apixaban)	Xarelto (rivaoxaban)	Plavix (clopidogrel)
Effient (prasugrel)	Brilinta (ticagrelor)	

Mental Status	✓ if Abnormal
Level of Consciousness (A V P U)	☐
Speech (repeat "You can't teach an old dog new tricks") **Aphasia** = wrong words or no speech **Dysarthria** = slurred speech	☐
Questions (age, month)	☐
Commands (close, open eyes)	☐

Cranial Nerves	R	L
Facial Droop (show teeth or smile) Abnormal = one side does not move as well as the other	☐	☐
Visual Fields (4 quadrants)	☐	☐
Horizontal Gaze (follow finger side to side)	☐	☐

Limbs	R	L
Motor – Arm (close eyes and hold out both arms) Abnormal = arm can't move or drifts down	☐	☐
Motor – Leg (open eyes and lift each leg separately)	☐	☐
Sensory – Arm (close eyes and touch, pinch)	☐	☐
Sensory – Leg (close eyes and touch, pinch)	☐	☐
Coordination – Arm (finger to nose) (**ataxia**)	☐	☐
Coordination – Leg (heel to shin) (**ataxia**)	☐	☐

V.S. Pulse	R/R	B/P	ETCO2	Sat

Family Contact #			
F.W.E.D. Red Pod	417.347.6656	F.W.E.D. Charge Nurse	417.347.3373

* E D M *

01.70000.71600.CLOP.0007.0516 Pg. 2 of 2

EMS handoff to hospital staff including if LVO screen positive

Standardizes EMS to RN/MD Handoff

AIS ORDERS & TRANSPORT PROTOCOL

KISS ACUTE ISCHEMIC STROKE ORDERS & TRANSPORT PROTOCOL

STROKE WORKUP

- ☒ Date / Time patient last known well: _____
- ☒ Vital Signs: Minimum of every 15 minutes (with continuous O2 and cardiac monitoring)
- ☒ O2 at 2 liters per nasal cannula: titrate for SpO2 of 94% or greater
- ☒ **Two peripheral IV's** (18 gauge preferable, one in AC)
- ☒ Labs: CBC, BMP, PT/INR, PTT, Blood Glucose, Troponin, and pregnancy test if applicable (*to save door to needle time, you may give tPA prior to the lab results back if patient has no Hx of major liver, renal or bleeding issues and is not on Warfarin or NOAC) POC labs acceptable

- ☒ Diagnostic: CT Head Without Contrast (notify radiologist for STAT read); EKG
- ☒ Strict NPO
- ☒ NIH Stroke Scale Score: _____
- ☒ Complete tPA Checklist:
  - ☐ Patient meets tPA criteria, proceed with tPA orders below. __Consult with Stroke Specialist obtained
  - ☐ TPA contraindicated due to _____ (cross through tPA orders)
- ☒ Notify Dispatch / Transport Team
  Best Family Member Phone Number – cell -- --

PRE TPA

- ☒ Monitor BP every 15 minutes. **Keep BP < 185/110mmHg**
  - Labetalol 10 mg IVP (may repeat x 1). (Hold for HR < 60)
  - Nicardipine gtt. 5 mg/hr to max of 15 mg/hr
  - Or Antihypertensive agent of your choice
- ☒ Start Normal Saline IVF drip at 75 mL per hour
- ☒ Obtain signed informed consent.
- ☒ Weight in kilograms (if unable to weigh, obtain from patient/family or average 2 estimated weights)

TPA (Activase/Alteplase) **PREP / ADMINISTRATION** Calculations Checked by: (2 initials)_____ & _____

- ☒ Mix tPA with sterile water as provided by manufacturer to a concentration of 1 mg/mL

- ☒ Calculate Total Dose (will be the bolus + infusion):
  - **Total Dose**: (0.9mg/kg) = _____ (**max of 90 mg**)

- ☒ Waste unneeded tPA portion.
  - **Waste**: (100mg – total dose) = _____ mg.

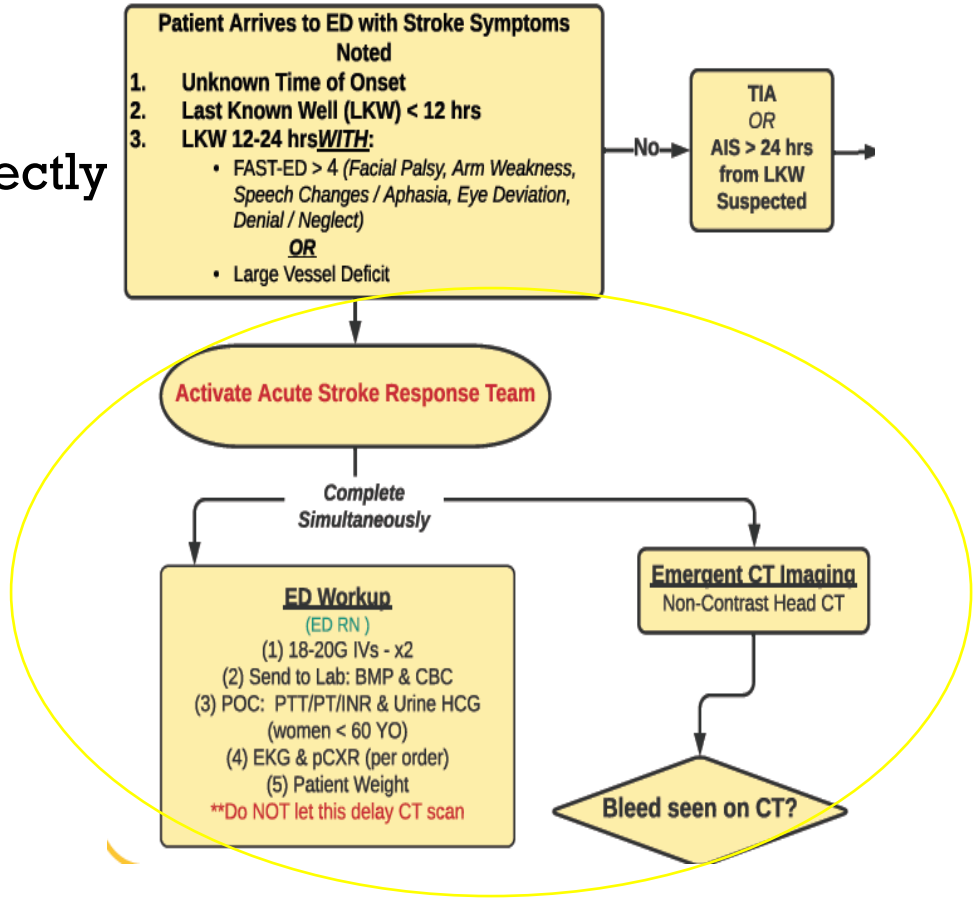
- ☒ Administer Bolus over 1 minute IV push
  - **Bolus Dose:** 10% of total dose (total dose x 0.1) = _____ mg. / **Time Given**: _____

- ☒ Administer Infusion Dose as a secondary infusion over 1 hour.
  - **Infusion Dose**: 90% of total dose (total dose x 0.9) = _____ mg. / **Time Started:** _____

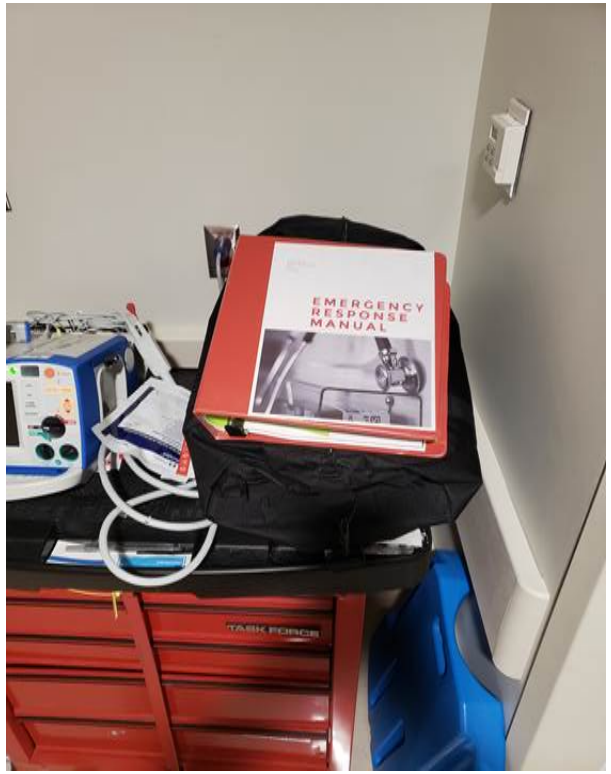
- ☒ Flush tPA remaining in IV tubing with NS – use same rate as tPA infusion.

RAPID IMAGING & LAB TESTING

- Transport of patients by EMS directly to the CT/MRI scanner first
- Rapid Brain Imaging
- Rapid central laboratory testing



ALTEPLASE & RESOURCES STORED IN THE ED



MIX ALTEPLASE AHEAD OF TIME

- Rule out contraindications and blood on CT Head, then mix!

https://www.activase.com/ais/dosing-and-administration/product-return.html

Spoiled product

The Genentech Spoilage Replacement Program provides for the replacement of infused, injected, and self-administered products, which are prescribed and prepared for a labeled indication, yet not administered due to unforeseen patient clinical circumstances, subject to certain limitations and conditions set forth by Genentech.

You can obtain additional information about the program and request replacement of spoilage product by visiting www.spoilage.gene.com or by calling Genentech Customer Service at (800) 551-2231.

To request replacement product:

- When Genentech product is prescribed for a labeled indication is spoiled and unable to be administered, the product might be eligible for replacement through the Genentech Spoilage Replacement Program.
- You may complete your request for spoilage replacement online at www.spoilage.gene.com or by calling Genentech Customer Service at (800) 551-2231.
- Up to date information on product returns is available on the Genentech Customer Service website

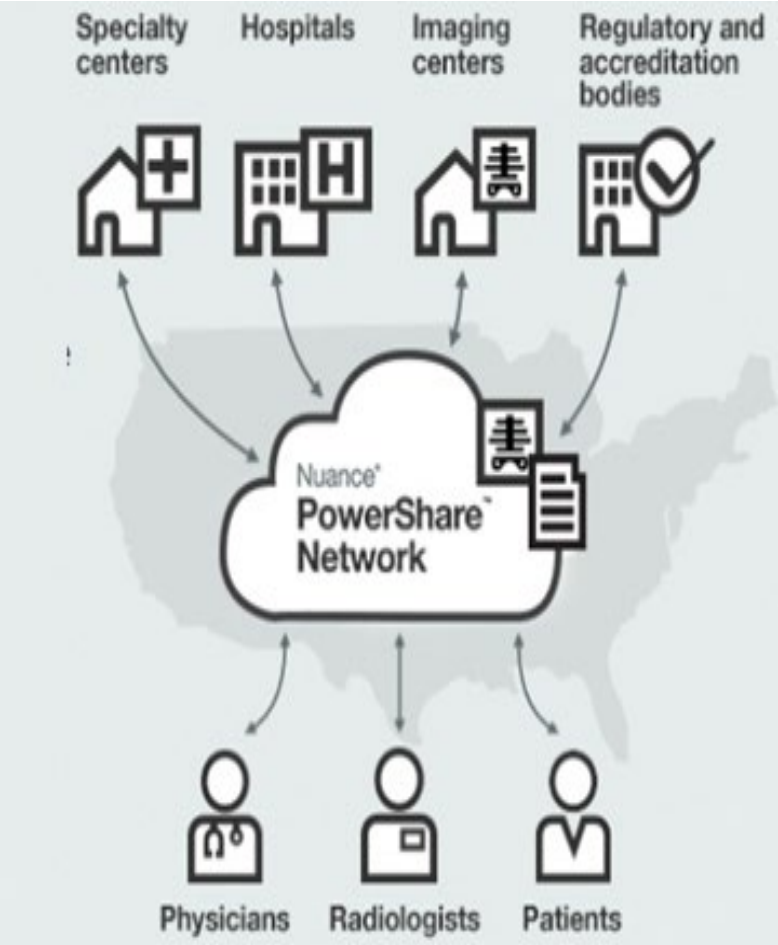
CONSISTENT LOCATION FOR STROKE RESPONSE & ALTEPLASE ADMINISTRATION

- Find a location that works well for your hospital that is consistently used to administer alteplase and do majority of the Hyper-Acute Stroke Work-up
- **Should be close to the CT Scanner**
- Examples Include:
  - Launch Pad
  - Trauma Bay
  - Activation in the CT Scanner

ADVANCING IMAGING GUIDELINES

- EARLY and real-time communication between transferring physician and accepting Neurologist
- Some have recommended calling transferring facility before **advanced imaging** has been done to give a heads-up
- Goal: CTA acquisition with interpretation by Radiology ≤ 20 min & clouded quickly
  - If not possible, consult with 24/7 stroke support line to see if it would be better option to **send patient** for Advanced Imaging*
- Use cloud-based image sharing, if available

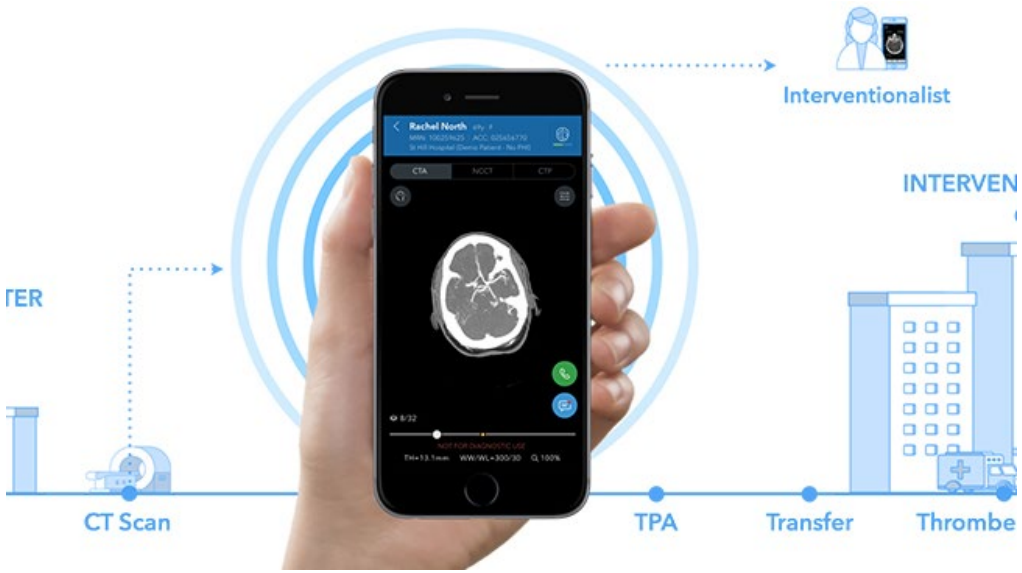
**These times may be slightly adjusted during peak COVID times and receiving facility may wait longer for Advanced Imaging due to bed shortage*



COMMUNICATION TOOLS

IN-APP COMMUNICATION TOOLS

- Efficient Coordination across teams & sites:
  - Team members can message one another within the apps to streamline care coordination
  - Case events and team messages are organized in centralized lists to provide quick access to patient status
    - Scan events are automatically displayed
    - Messages appear in a chronological feed
    - Time sent and sender details are included with messages



COMMUNICATION TOOLS- STANDARD REPORT SHEETS FOR TEAM

KISS Stroke Patient Presentation

Sending Physician: _____
Sending Physician Phone Number:
_____--_____--_____
NOTE: PLEASE DON'T WAIT FOR LABS BEFORE CALLING STROKE SERVICE/24hr Help Line
Name of Patient: _____
Age: _____
Sex: _____
Symptoms: _____
_____
_____
_____
_____

Time of Onset: _____
Last known well: _____
Wake Up Stroke/Time indeterminate: _____
NIHSS: _____
Previous Stroke: _____
Old Deficits: _____
_____
(Subtract the old deficit points from the total NIHSS to get the ACUTE score)

B/P: _____
Anticoagulated: _____
Antiplatelet Meds: _____
_____
_____

Novel Oral Anticoagulants: _____
_____
_____
_____

Patient has the following Modifiable Risk Factors for Stroke:
Smoker ☐ HTN ☐ CAD ☐
A-Fib ☐ DM ☐ HLD ☐
OSA ☐
Past Medical History:

Migraines ____Recent Head trauma_____
Cancer _____Seizure HX _____
Recent Surgeries_____
Kidney Problems _____
Recent illness or infection: _____

Head CT Results: _____
12 lead EKG: _____

Recent hospital admissions:
_____
_____
_____

Hyper-acute Lab results if available:
FSBS: _____Cr: _____
INR/PT/PTT: _____
Platelets: _____

Do you feel the patient is a tPA candidate: ____
Endovascular candidate: _____
AHA/ASA recommendations for endovascular intervention for large vessel occlusions include:
NIHSS: equal to or greater than 6_____
ASPECT score: equal to or greater than 6 _____
Hyper-dense MCA sign
Prior to event-mRS—0-1 _____

Additional Patient Notes:_____
_____
_____
_____
_____
_____
_____

KISS Stroke Team Patient Evaluation

Today's Date: _____	DATE/TIME LAST KNOWN WELL_____

NIH Stroke Scale

Category	Description	Score	Score
Level of Consciousness	0=Alert 1=Not Alert but arousable by mild stimulation 2=Not alert; Requires repeated stimulation to attend 3=Responds only with reflex motor or autonomic reflex or unresponsive		
Level of Consciousness Questions	0= Answers both month and age correctly 1=Answers one question correctly 2=Answers neither question correctly		
LOC-Commands	0= Performs both tasks correctly 1= Performs one task correctly 2=Performs neither task correctly		
Gaze	0= Normal 1= Partial Gaze Palsy 2= Forced Deviation		
Visual Fields	0= No visual loss 1= Partial Hemianopia 2= Complete Hemianopia 3= Bilateral Hemianopia		
Facial Movement (Facial Paresis)	0= Normal symmetrical movements 1= Minor paralysis 2= Partial paralysis 3= Complete paralysis of one or both		
Motor Function-Arms (Right and Left)	0= No drift 1= Drift 2= Some effort against gravity 3= No effort against gravity 4= No movement UN= Amputation or joint fusion	R / L	R / L
Motor Function-Legs (Right and Left)	0= No drift 1= Drift 2= Some effort against gravity 3= No effort against gravity 4= No movement UN = Amputation or joint fusion	R / L	R / L
Limb Ataxia	0= Absent 1= Present in one limb 2= Present in two limbs UN= Amputation or joint fusion, explain		
Sensory	0= Normal; no sensory loss 1= Mild to moderate sensory loss 2= Severe to total sensory loss		
Best Language	0= No aphasia 1= Mild to moderate aphasia 2=Severe Aphasia 3= Mute		
Dysarthria	0= Normal 1= Mild to moderate dysarthria 2= Severe dysarthria UN=Intubated, or other physical barrier, explain		
Extinction & Inattention (formerly Neglect)	0= No abnormality 1= Visual, tactile, auditory, spatial, or personal inattention 2= Profound hemi-inattention/extinction		
	Total Score		

Plan of Care Discussed:
- ED Provider _____
- Other Hospital: _____
- KU Stroke Service: _____

IVtPA (Activase/Alteplase)-Treatment Plan
☐ Contraindicated per Dr._____
☐> 4.5 hour window
☐BP > 185/110
☐Intracerebral Hemorrhage
☐Other_____
_____
_____
_____
_____
☐ Indicated per Dr._____

Notes: _____

Nurse Signature	Date/Time /
Provider Signature	Date/Time /

ACUTE STROKE RESPONSE

TEAM FORM | PATIENT IDENTIFICATION

EMS TRANSFER

- Call EMS **early** for suspected transfer or encourage EMS who brought patient to facility to wait around to transfer
  - *"Waste gas not brain"*
- If authorized, auto-launch interfacility transport to referring hospitals for select presumed LVO. Have criteria available to start process.
  - Ex:
    - NIHSS ≥6 with LVO positive screen
    - Last Known Well ≤24 hours
    - CTA Head/Neck with ASPECT Score ≥6
    - LVO studies shared on cloud-based sharing platform

EMS TRANSFER

PROTOCOL TO MANAGE HYPERTENSION IN FIELD, POST-ALTEPLASE CARE

DURING INFUSION / POST INFUSION / TRANSPORT PREPARATION:

☒ Monitor Vital Signs every 15 minutes.

- Keep **SBP <180mmHg, DBP <105 mmHg**, (stop tPA if unable to maintain SBP <180 or DBP <105 constantly with Antihypertensive agents)
  - Labetalol 10 mg IVP (may repeat x 1). (Hold for HR < 60)
  - Nicardipine gtt. 5 mg/hr to max of 15 mg/hr
- Keep SBP > 100: May try NS 500ml IVF bolus as an initial option
- Monitor Neuro Checks every 15 minutes.
- If sudden change in baseline mental status, acute headache, or vomiting, STOP t-PA infusion. Call Med Control

☒ Monitor for Adverse Reactions e.g. Angioedema (may follow anaphylactic management or protocol) or Hemorrhagic Complications (Abdominal and/or flank pain, hemoptysis, hematemesis, shortness of breath/rales/rhonchi) STOP tPA infusion; Call Medical Control

CAUTIONS

- NO Anticoagulation or Antiplatelet Therapy for 24 hours
- No Foley insertion/re-insertion, central venous line placement or arterial puncture at a non-compressible site for at least 24 hours after tPA
- Avoid insertion of nasogastric tube for 6-8 hours after tPA administration

☒ Send copy of CT Head Scan (do not delay transport-report can be faxed)

☒ Send patient records with documentation of allergies, current medications, past medical history (can be faxed)

**all that is needed is the EMTALA paperwork with patient—DO NOT DELAY TRANSFER FOR COPY OF RECORDS

☐ Telephone order from Dr. _____

Nursing signature/RAV: _____ Date: _____ Time: _____

Provider Signature: _____ Date: _____ Time: _____

PATIENT IDENTIFICATION

TEMPLATE

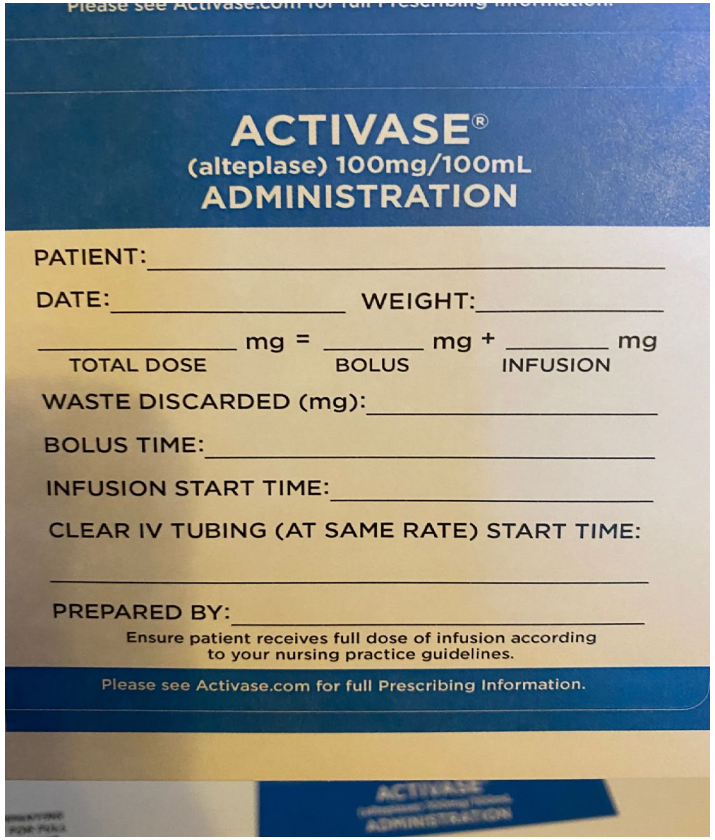
EMS TRANSFER

VERIFICATION PROCESS FOR MEDICATIONS

Medication Infusion Report for EMS

Date:_____ Run#:_____

Medication Infusing	Name: Time Started: Dose: Volume TBI:
Flow Rate at time of Transfer	
Titration Instructions	Amount: Amount Remaining at Destination: Time Finished:
Volume in Bag at time of Transfer	
Nurse Signature	
Paramedic Signature	



POST-STROKE FOLLOW-UP

TIMELY INTERNAL FEEDBACK

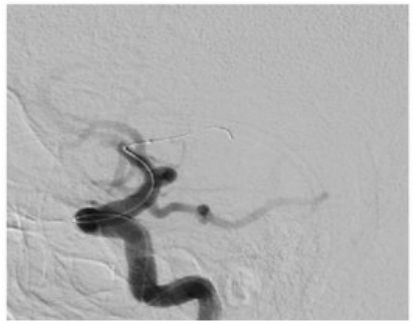
ED EV TREATMENT DOOR TIME GOALS							
ASRT Arrival Goal: 5 min	Advanced Imaging Initiated Goal: 20 min	Advanced Imaging Interpreted Goal: 30 min	Advanced Imaging Interpreted to Arrival to IR Goal: 15 min	IR to Puncture Goal: 30 min	Puncture to Device Goal: 15 min	Door to Puncture Goal: 75 min	Door to Device Goal: 90 min

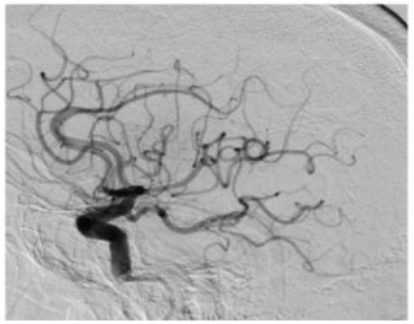
Intervention Date:
Acct Number:
MR Number:
Last Name:
First Name:
Arrival Type:
Intervention Type:
Thrombectomy:
IA tPA:
Angioplasty:
Stent:
Angiogram Only:
IV tPA:
IV Tenecteplase:
Research Study:
EMS Pre-Notified:
OSH:
In House:
Last Known Well:
Symptom Onset:
Arrived to KU:
Arrival Method:
ASRT Paged:
ASRT Arrival:
CT Initiated:
CT Interpreted:
Advanced Imaging Initiated:
Advanced Imaging Interpreted:
Decision to IR:
IV tPA Given:
IV tPA in Scanner:
IV Tenecteplase Given:
IA tPA Given:
Arrival to IR:
Skin Puncture:
Recanalization 1:
Recanalization 2:

Saint Luke's
MARION BLOCH
NEUROSCIENCE INSTITUTE

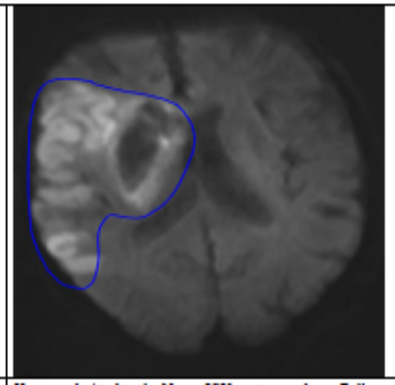
August 2021 SLH Code Stroke Team of the Month

Date	
ED Encounter	Arrived by POV to ____ after falling at home and experiencing right facial sensory changes. NIH-7: Visual cut, facial weakness, ataxia, aphasia, dysarthria and neglect. CT: negative for acute findings. Cardene infusion started for HTN (234/140!!!) NIH worsened to an 18 to include gaze preference, worsened facial weakness, profound left sided weaknesses. Labetalol given due to persistent HTN, weight based IV t-PA given when B/P came below 185/110. CTA was obtained while adjusting medications for HTN. CTA revealed occlusion of right MCA. Patient transferred via ground EMS to SLH for further stroke care
ED Staff at ___	
Transferring EMS	
SLH ED arrival	NIH-9 upon arrival: gaze preference, visual cut, facial weakness bilat arm weakness, sensory loss, dysarthria and neglect. CT repeated. Small area of early gray-white loss right temporal lobe, right MCA acute thrombus. Taken to IR
SLH ED/CNN staff	
IR Staff	
Intervention	Successful mechanical thrombectomy of right MCA M2 occlusion using both aspiration and stent retriever. Patient admitted to NSICU post IR
Outcome	24 hours post IR NIH had improved to a 0. TEE revealed a PFO, patient started on Aspirin and Apixaban, will require better HTN control and Statin will be continued. 30 day event monitor ordered to rule out Afib. MRI: patchy infarcts both left and right side and multiple lobes. No rehab needs were identified, patient was able to discharge to home on 8/19/2021

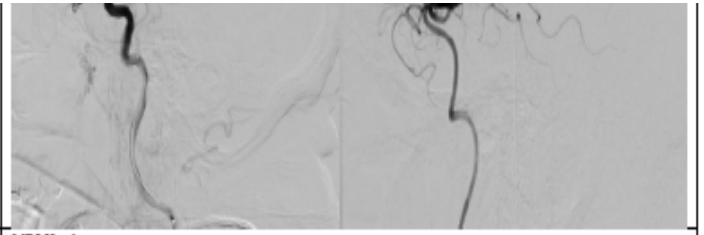




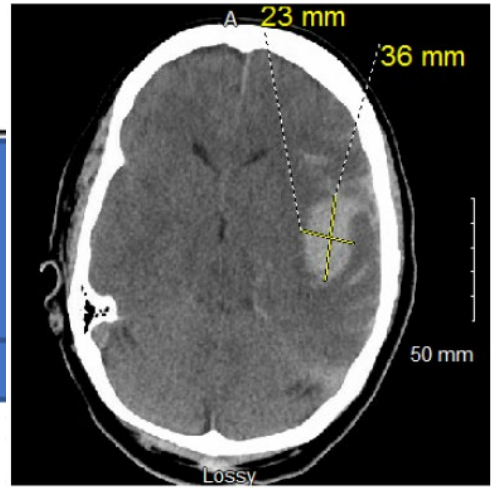
TIMELY EXTERNAL FEEDBACK

	
Clinical Outcome	He was admitted to the Neuro ICU post procedure. Follow up MRI the next morning showed hemorrhagic conversion within the stroke area. He was clinically stable with no changes in exam. The next day there was some concern he was having increased weakness and ptosis of the left eye along with left facial droop. Head CT was obtained but was relatively stable regarding the hemorrhage and slight increase in mass effect. He was watched another day the ICU but the exam remained stable and 5/23 he progressed to floor status. Pallative Care was consulted for goals of care discussion with patient and family. On 5/28, family made decision to transfer patient back to Skilled Nursing Facility with Hospice orders. Current NIHSS: 16
Discharge Disposition	[redacted]
Neurovascular Attending	[redacted]
Neuro-Interventionalist	[redacted]

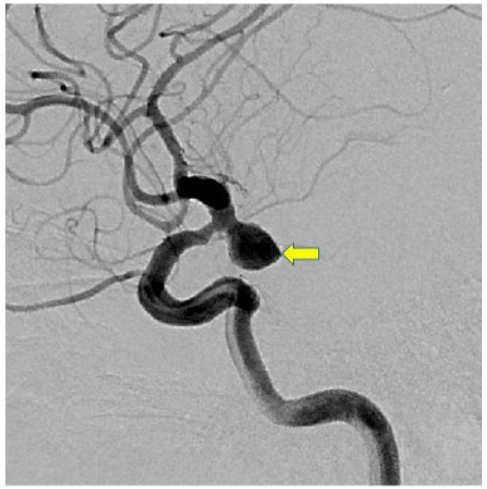
Peer Review: Privileged and Confidential Pursuant to KS 65-4915 & KSA 65-4922 et seq

	
Follow-up Imaging	MRI Head: Moderate to large right MCA acute to subacute infarct with superimposed areas of hemorrhagic conversion predominating in the basal ganglia with smaller areas of petechial hemorrhagic conversion in temporal and inferior right frontal lobe cortices.

CT



IR view of aneurysm



aneurysm post coil intervention

View of flow post intervention

QUESTIONS?

- Contact Information:
  - Email Matt Lammers (mlammers@saint-lukes.org)
  - Email Sarah Langston (scarter2@kumc.edu)

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