How to Solidify Door-In Door-Out and Other Inter-Hospital Transfer Practices

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Texas Stroke Institute

Saving Lives, One Stroke at a Time

Financial Disclosure

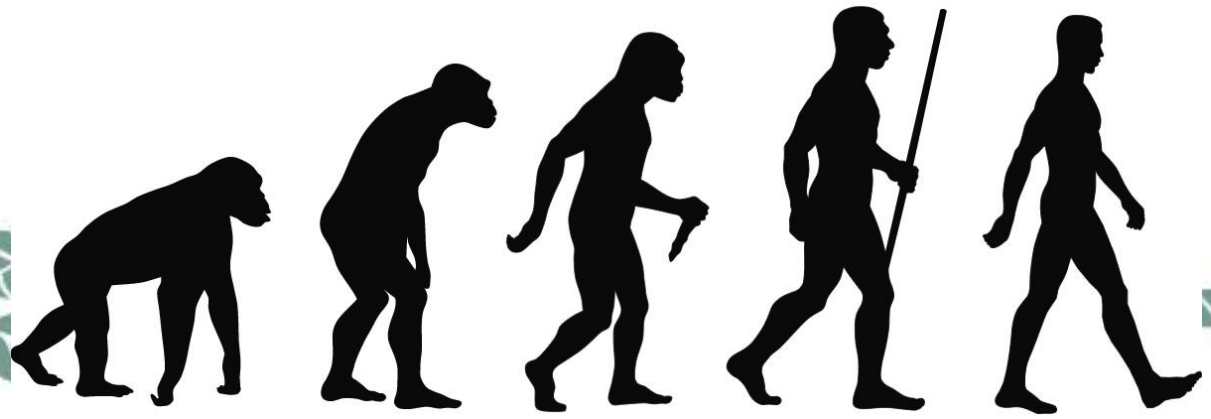
- I do not have any relevant financial interests or relationships to disclose

Objectives

- Identify advances in guidelines and evidence based care in the prevention, diagnosis, treatment of stroke in general
- Interpret which rapidly changing areas within the stroke care spectrum make rapid triage and treatment paramount
- Identify best practices for triaging all stroke patients to the most appropriate hospital, including EMS transport and inter-facility transfer algorithms

Evolution of Stroke Therapy

- Pre-1995: aspirin and observation
- 1995- NINDS stroke trial:
  - tPA was shown to be an effective tool for treating stroke within a 3 hour presentation window
  - At 3 months, 30% more likely to have minimal symptoms
- 2008- ECASS-3 stroke trial:
  - tPA can be safely administered out to 4.5 hour window



The Endovascular explosion

What's the difference?

- What separates the early "negative trials" from the most recent "positive trials" in regards to intra-arterial therapy?
  - Confirmation of large vessel occlusion prior to enrollment
  - Device efficacy
  - Operator experience
  - Systems efficiency
  - All of the above

Trial	Imaging Required to Confirm Occlusion Prior to Randomization?	Device(s) Used in Intervention Arm	TICI 2b/3 Revascularization Rate in the Intervention Arm	mRS 0-2		
				Intervention Arm	Control Arm	Odds Ratio (95% CI)
IMS III	No	IA Lytic (138), Merci Retriever® (95), EKOS (22), Penumbra (54), Solitaire FR (5)	38% ICA 44% M1 44% M2 23% multi M2	40.8% (N=415)	38.7% (N=214)	0.02 (-0.06 to 0.09)
MR RESCUE	No	Merci Retriever®, EKOS, IA Lytic, Penumbra	24% pen (n=34) 27% nonp (n=30)	21% pen (n=34) 17% nonp (n=30)	26% pen (n=34) 10% nonp (n=20)	NS
MR CLEAN	Yes	97% Stent Retrievers, 2% other Mechanical	58.7% (N=196)	33% (N=233)	19% (N=267)	2.16 (1.39-3.38)
ESCAPE	Yes	86% Stent Retriever	72.4% (n=156)	53.0% (n=164)	29.3% (n=147)	1.8 (1.4-2.4)
SWIFT PRIME	Yes	100% Stent Retriever	88.0% (n=83)	60.2% (n=98)	35.5% (n=93)	2.75 (1.53,4.95)
EXTEND-IA	Yes	100% Stent Retriever	86.2% (n=29)	71% (n=35)	40% (n=35)	4.2 (1.3-13)

All of the above!

- Confirmation of large vessel occlusion prior to enrollment
- Device efficacy
- Operator experience
- Systems efficiency

What We Know

2015 American Heart Association/American Stroke Association Focused Update of the 2013 Guidelines for the Early Management of Patients With Acute Ischemic Stroke Regarding Endovascular Treatment

Patients should receive endovascular therapy with a stent retriever if they meet all the following criteria *(Class I; Level of Evidence A)*. (New recommendation):

a. Prestroke mRS score 0 to 1,
b. Acute ischemic stroke receiving intravenous r-tPA within 4.5 hours of onset according to guidelines from professional medical societies,
c. Causative occlusion of the ICA or proximal MCA (M1),
d. Age ≥18 years,
e. NIHSS score of ≥6,
f. ASPECTS of ≥6, and
g. Treatment can be initiated (groin puncture) within 6 hours of symptom onset

Stroke 2015; 46: 3024-3039.

What We Still Don't Know

- **Class IIb recommendations for EVT** (2015 Update to the AHA Guidelines)
  - Extended time window (>6 hours)
  - Large infarcts (ASPECTS <6)
  - Mild strokes (NIHSS <6)
  - Distal (M2/M3, ACA) and posterior circulation occlusions
  - Pediatric (<18 yrs old)
  - Various procedural approaches (including aspiration catheters, anesthetic management)
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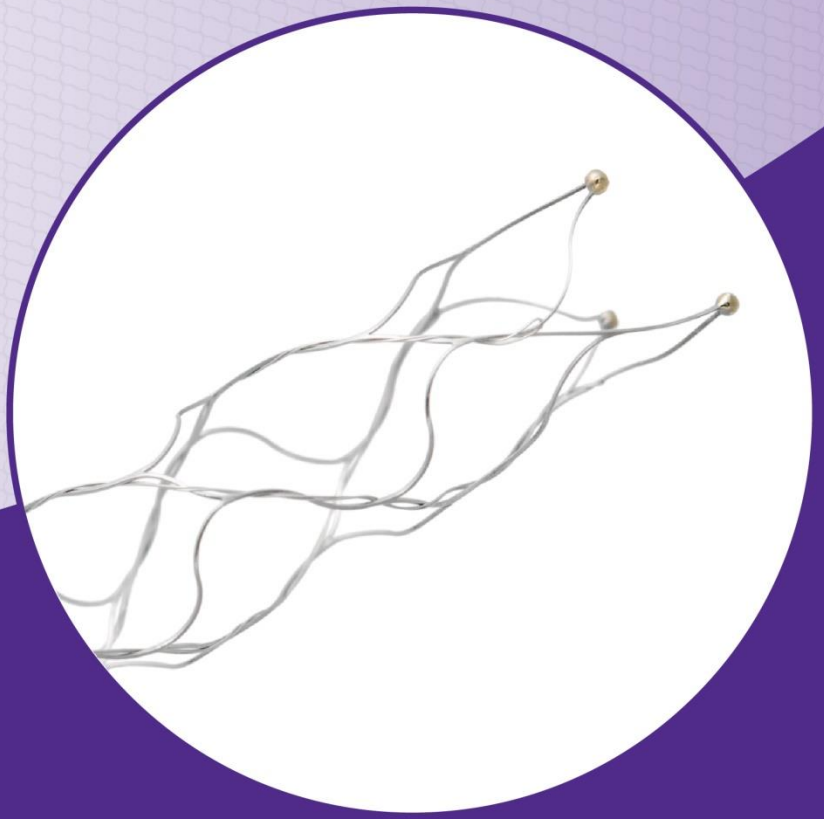
DAWN in Full Daylight

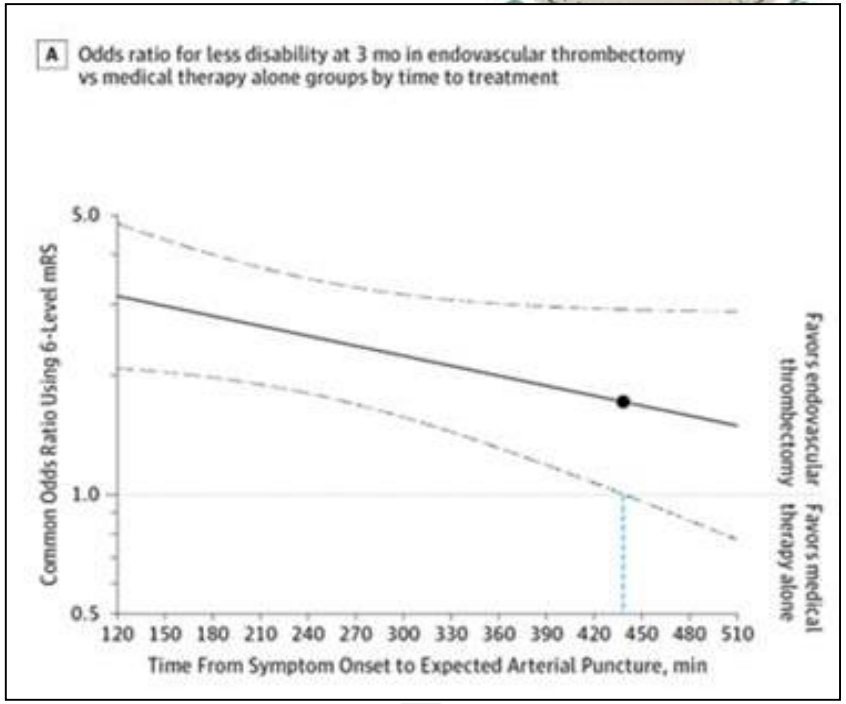
DWI or CTP Assessment with Clinical Mismatch in the Triage of Wake-Up and Late Presenting Strokes Undergoing Neurointervention with Trevo

Tudor G. Jovin MD & Raul G. Nogueira MD on behalf of the DAWN investigators



Study background

- Current evidence suggests that **benefit of thrombectomy rapidly decays over time and may no longer exist beyond 7.3 hours from stroke onset (or TLSW)**[1]
- Indeed, the current AHA and ESO guidelines define a rigid therapeutic window of 6 hours as level 1a evidence[2,3]
- This **treatment paradigm disregards individual variations in** compensatory mechanisms for ischemia led by but not restricted to **collateral flow**.
- Growing evidence supports a physiologic rather than a purely time based approach where patients with Clinical-Core Mismatch (e.g. significant clinical deficits but still limited infarct size) may benefit from reperfusion regardless of time to treatment.[4]
- **Wake-up strokes, strokes with unclear onset time, and witnessed late** presenting strokes (> 6 hours) represent a **large proportion of LVOS (~40%)** yet no proven treatment options exist for this population.



$$\text{Outcomes} = \frac{\text{Collaterals}}{\text{Time}}$$

[1] Saver et al, JAMA. 2016 [2] Powers et al, Stroke 2015 [3] Wahlgren Int J Stroke 2016 et.al, [4] Jovin et.al, Stroke 2011

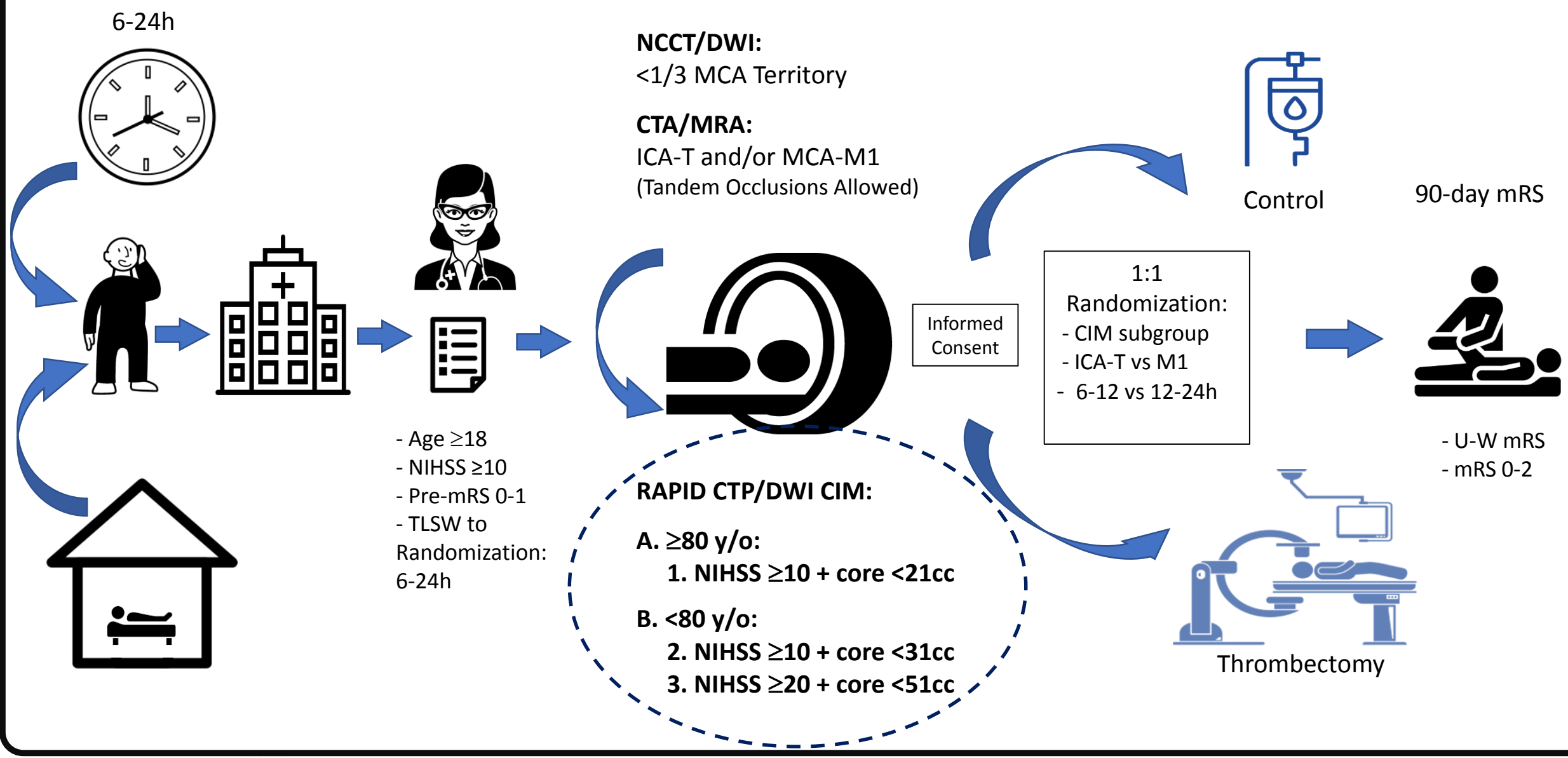
Study Objective

To demonstrate superior functional outcomes at 90 days with Trevo plus medical management compared to medical management alone **in appropriately selected patients treated six to 24 hours after last seen well**

Study Design

Study design	Global, multi-center, adaptive, population enrichment, prospective, randomized, open, blinded endpoint (PROBE), controlled **FDA** IDE trial
Patient population	• Acute ischemic stroke (AIS) with large vessel occlusion • Able to be randomized between **six to 24 hours after time last known well** • **Clinical imaging mismatch (CIM) defined by age, core, and NIHSS** → **Favorable physiology**
Target vessel	**Intracranial ICA, M1 segment of the MCA**
Randomization	**1:1 Trevo + medical management vs. medical management alone**
Sites	Up to 50 sites worldwide (30 US and 20 international)
Sample size	500 maximum subjects: 250 in the treatment arm and 250 in the control arm. Minimum sample size is 150 subjects.
Follow-up	24 hours (-6/+24), day 5-7/discharge, day 30 (± 14), and day 90 (± 14)

Study Methods: Workflow



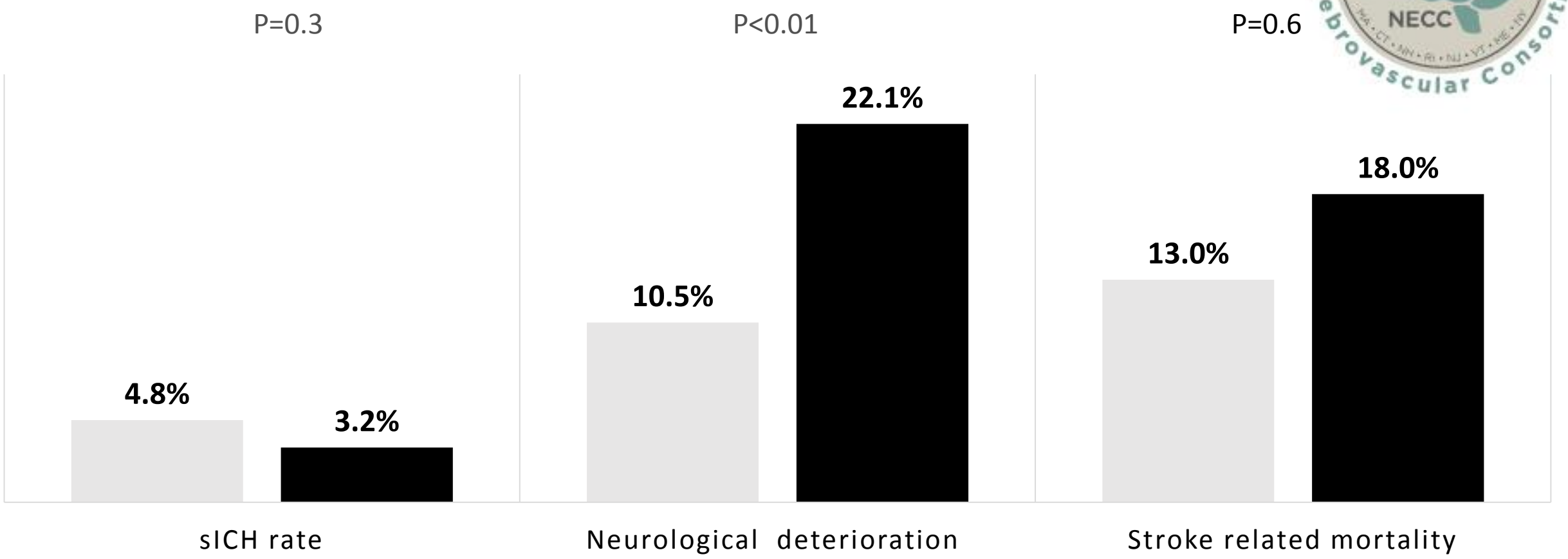
Study endpoints

Primary endpoint	**90-day disability assessed by the modified Rankin scale (mRS)** • Assessed via **Utility-Weighted mRS** • Nested **Dichotomous mRS 0-2**
Secondary endpoints	• "Early response" at day 5-7/discharge, defined as a NIHSS drop of ≥10 points from baseline or NIHSS score 0 or 1 • All cause mortality rates • Median final infarct size at 24 (-6/+24) hours from randomization • Revascularization rates at 24 (-6/+24) hours from randomization • Treatment arm: reperfusion rates post device and post procedure by angiography core lab measurement of modified TICI > 2b
Primary safety endpoint	**Stroke related mortality at 90 days**
Secondary safety endpoint	• Incidence of SICH, by ECASS III definition, within 24 (-6/+24) hours post randomization • Incidence of neurological deterioration from baseline NIHSS score through day 5-7/discharge • Incidence of procedure-related and device-related serious adverse events through 24 (-6/+24) hours post randomization

DAWN Enrollment

- **Suffice it to say that demographics, history, comorbidities were controlled between the two groups**
- **If anyone wants more extensive review , there is an alternate (much longer) presentation that includes a longer section on DAWN**

CEC adjudicated safety outcomes



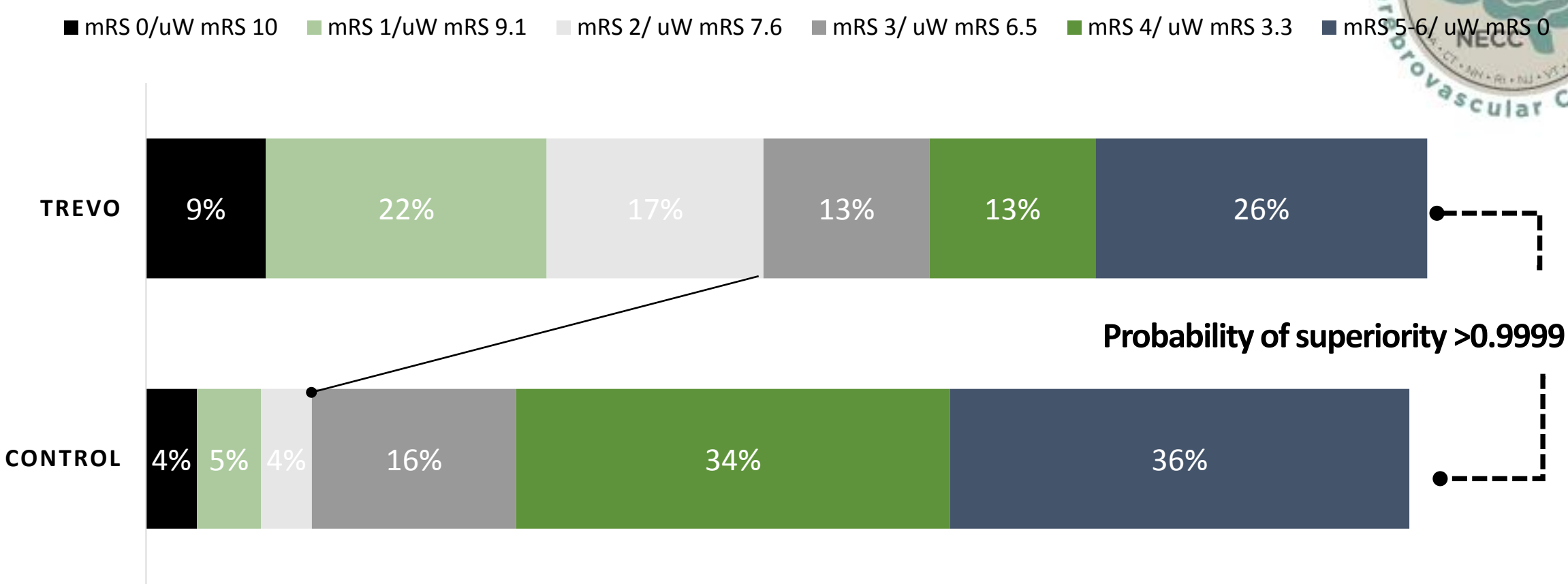
Co-primary endpoints

	Trevo	MM	Treatment benefit (95% CI)	Bayesian probability of superiority
Day 90 weighted mRS	5.5 ± 3.8	3.4 ± 3.1	2.1 (1.20, 3.12)	>0.9999*
Day 90 mRS (0-2)	48.6%	13.1%	35.5% (23.9%, 47.0%)	>0.9999*

NNT for 90-day functional independence = 2.8

*Similar to p<0.0001

Primary outcome



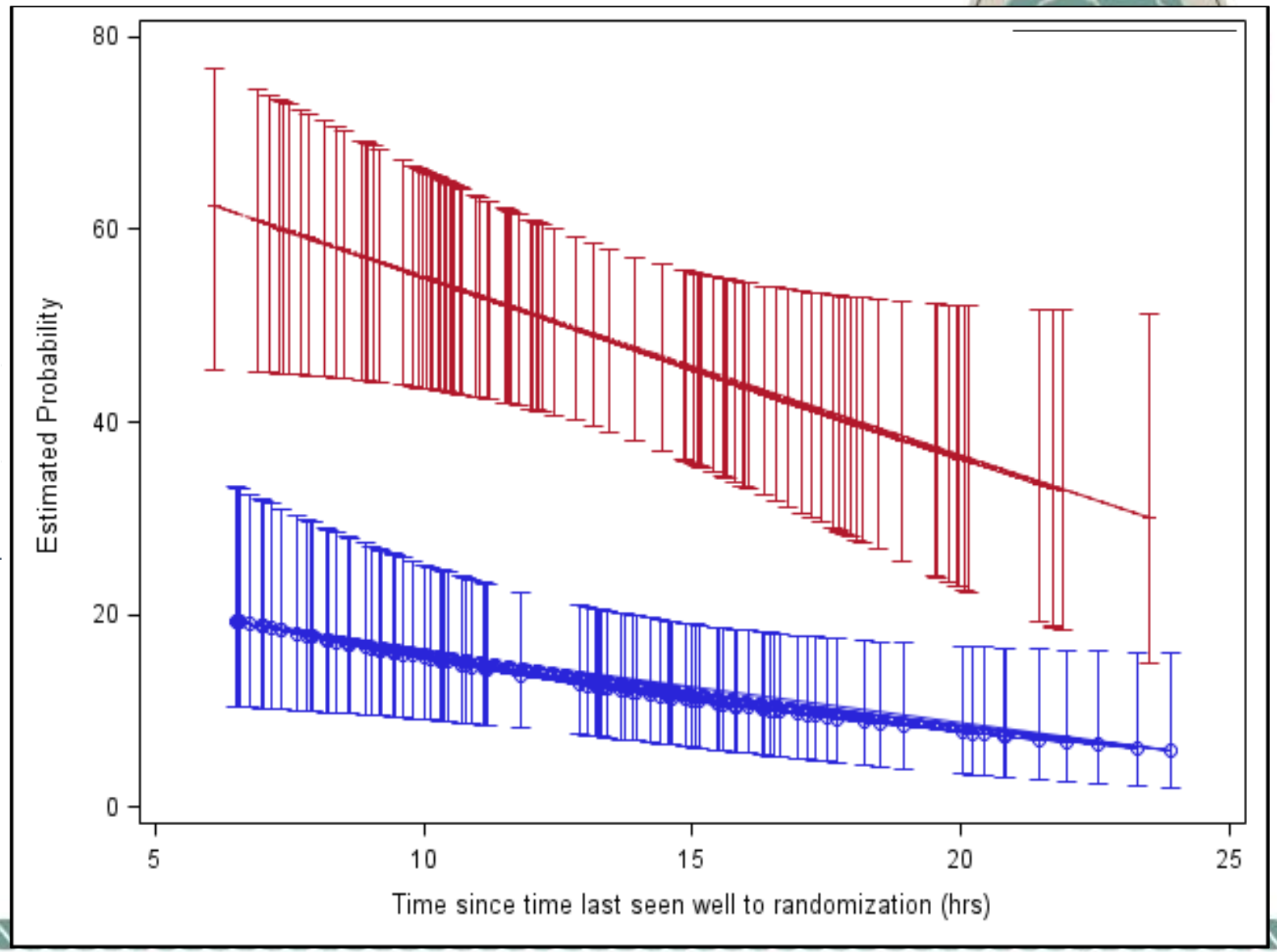
Probability of superiority >0.9999

73% relative risk reduction of dependency in ADL's

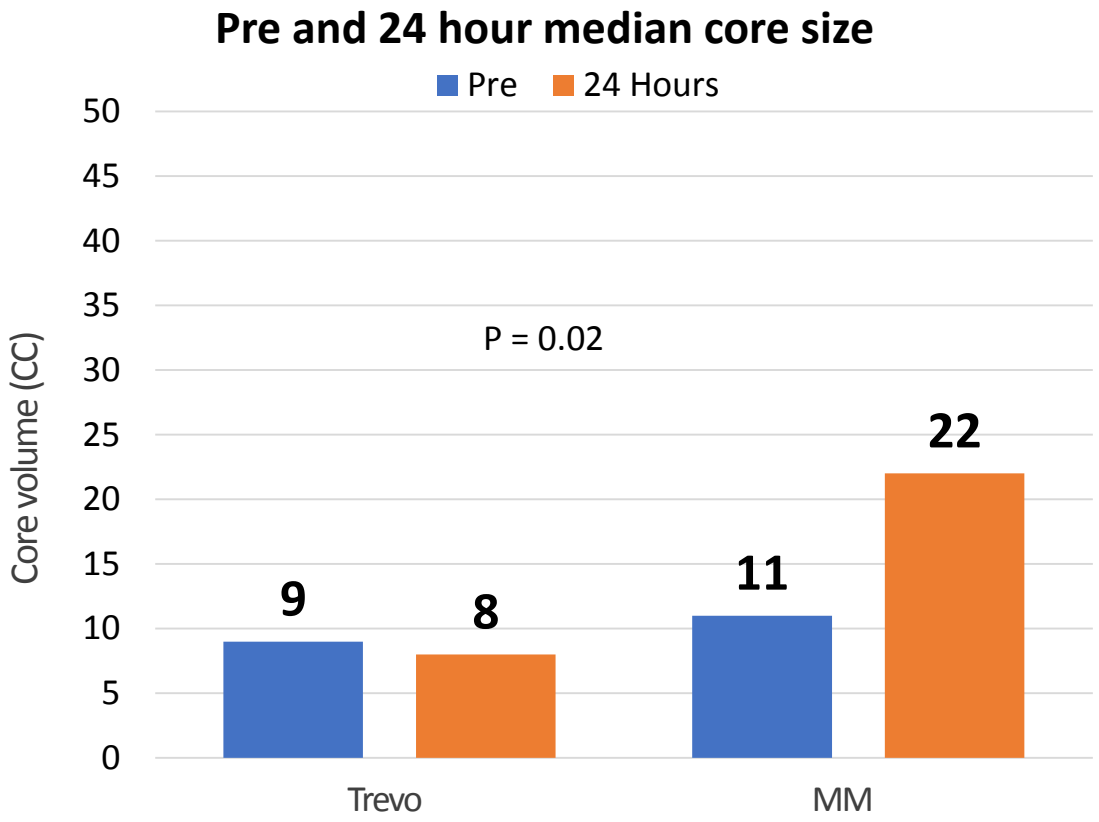
NNT for any lower disability 2.0

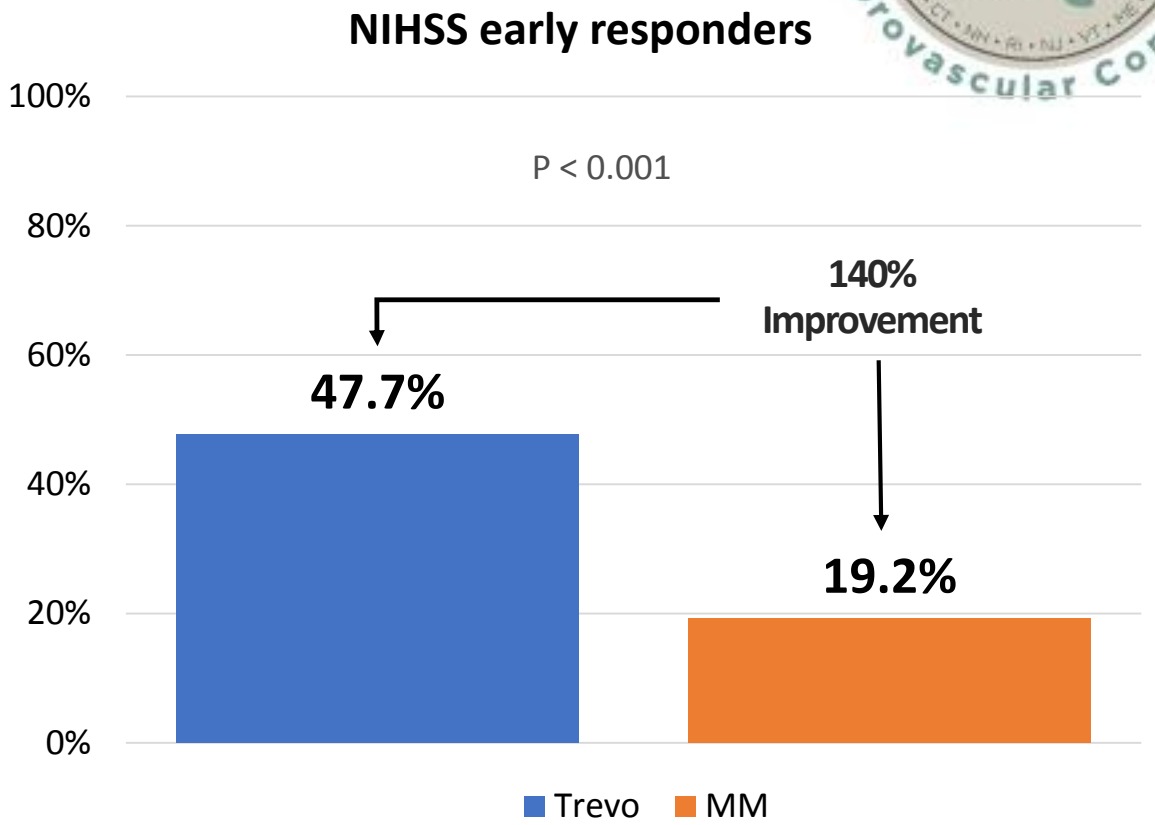
90 Day mRS 0-2 by TLSW to Randomization

	Trevo	MM	P-value
6-12h	55.1%	20.0%	<0.001
12-24h	43.1%	7.4%	<0.001



Secondary effectiveness endpoints





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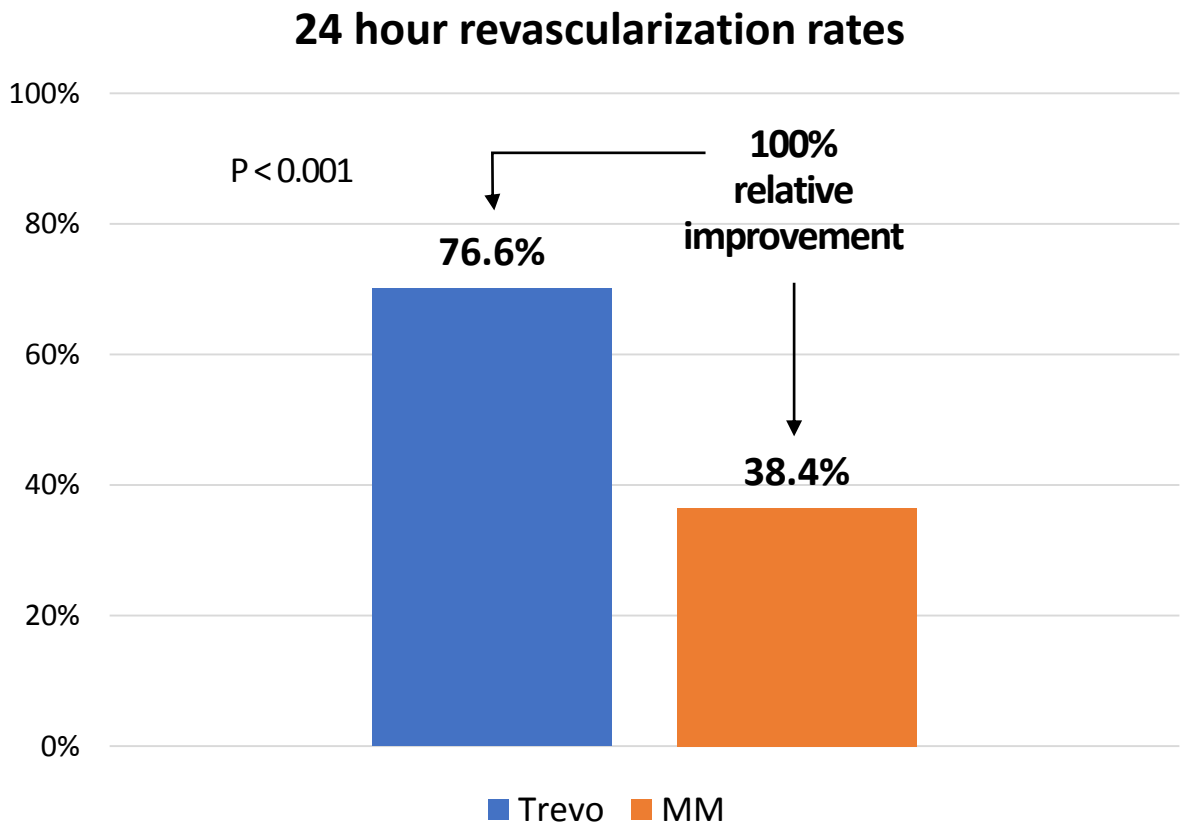

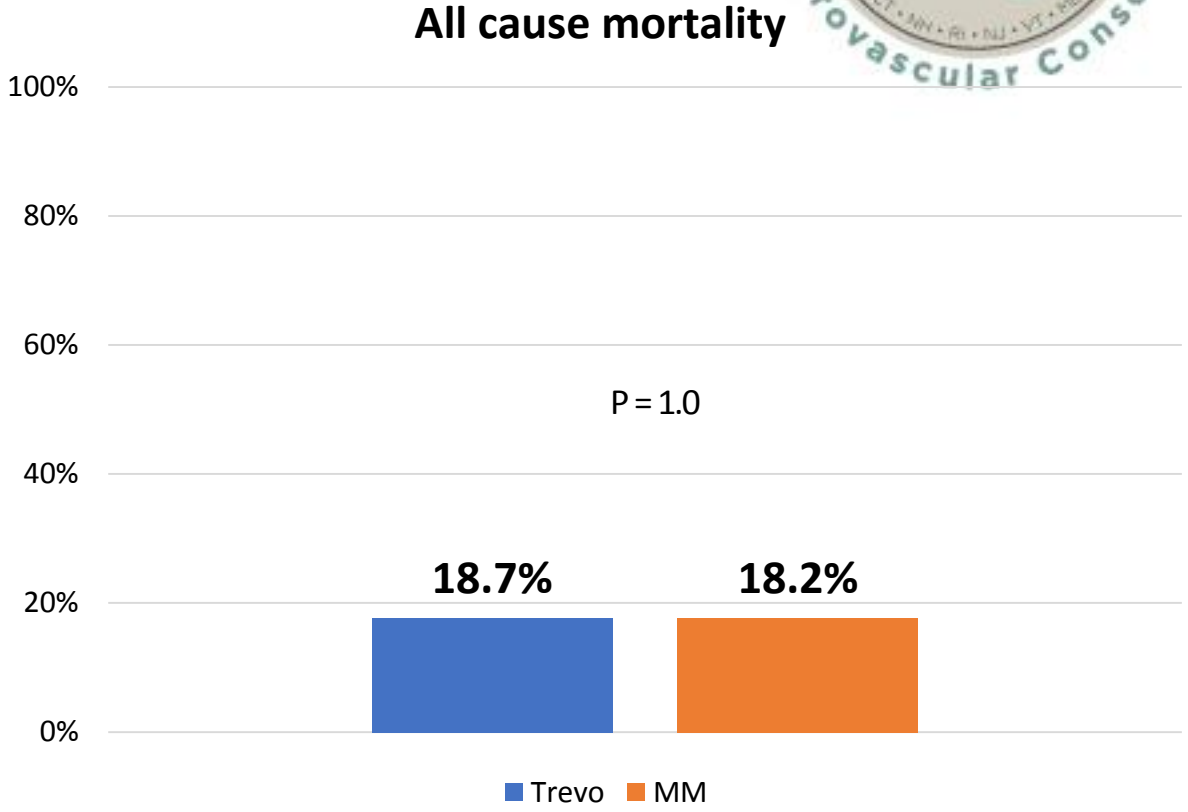

Conclusions

- Thrombectomy with Trevo in DAWN-eligible patients is associated with improvement in clinical outcomes across the entire range of utility weighted mRS and with higher rates of functional independence (mRS 0-2) compared to standard medical therapy (48.6% vs 13.1%, probability of superiority >0.999, NNT = 2.8)

- **For every 100 patients treated with endovascular therapy, 49 will have a less disabled outcome as a result of treatment, including 36 who will be functionally independent**

- The treatment effect size in DAWN is the highest out of any stroke trials to date and suggests that the presence of Clinical-Core Mismatch is a critical predictor of treatment effect independent of time to presentation

- Treatment effect persisted throughout 24 hours from TLKW; however, earlier treated patients do better

- **Thrombectomy with the Trevo device in patients presenting beyond 6 hours of TLSW had comparable safety profile to thrombectomy performed within 6 hours**

Open door for further expansion of time windows?

Physiological definition of eligibility vs time-based definition of eligibility

What We Still Don't Know

- **Class IIb recommendations for EVT** (2015 Update to the AHA Guidelines)
  - **Extended time window (>6 hours)**
  - Large infarcts (ASPECTS <6)
  - **Mild strokes (NIHSS <6)**
  - Distal (M2/M3, ACA) and posterior circulation occlusions
  - Pediatric (<18 yrs old)
  - Various procedural approaches (including aspiration catheters, anesthetic management)
  - Appropriate triage mechanisms (including bypass of PSCs for high suspicion LVO patients)

ORIGINAL RESEARCH

Too good to intervene? Thrombectomy for large vessel occlusion strokes with minimal symptoms: an intention-to-treat analysis

Diogo C Haussen, Mehdi Bouslama, Jonathan A Grossberg, Aaron Anderson, Samir Belagage, Michael Frankel, Nicolas Bianchi, Leticia C Rebello, Raul G Nogueira

- A small study published by Dr. Raul Nogueira's department at Emory evaluated 32 consecutive LVO patients with presenting NIHSS ≤ 5. They were divided into a medical arm (22) vs interventional arm (10).
- All patients had a MRS 0-2 making them all good IA candidates other than the low NIHSS
- Rescue thrombectomy was performed on 9 of the medical arm patients due to rapid late deterioration
- In the patients who crossed over, median time to deterioration was 5.2 hours

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Table 2 Outcome data of the studied groups

Outcomes	Thrombectomy (n=10)	Medical (n=22)	p Value*
Parenchymal hemorrhages	0 (0)	0 (0)	1.00
NIHSS score			
NIHSS score at discharge, median (IQR)	1 (0–3)	2 (0.5–4.5)	0.31
NIHSS score worsening >4/death	1 (10)	5 (23)	0.63
NIHSS shift	−2.5	0	**0.01**
90-Day mRS†			0.19
0	4 (40)	5 (23)	
1	3 (30)	7 (32)	
2	3 (30)	5 (23)	
3	0 (0)	1 (5)	
4	0 (0)	0 (0)	
5–6	0 (0)	4 (18)	
90-Day mRS 0–2	10 (100)	17 (77)	0.15
90-Day mortality	0 (0)	3 (14)	0.53
Discharge home	9 (90)	16 (73)	0.38

Results are shown as number (%) unless stated otherwise.
*Significant p values are shown in bold.
†The last observation carried forward was used formissing final scores on the mRS.[13] Only one patient (10%) of the interventional group and one (4%) of the medical therapy group had mRS carried from discharge to 90 days (both with mRS=0 at discharge).
mRS, modified Rankin Scale; NIHSS, National Institutes of Health Stroke Scale.

CONCLUSIONS

We demonstrate a shift towards a lower NIHSS in patients with a LVO stroke presenting with mild symptoms who underwent primary thrombectomy as compared with those who received best medical therapy alone. Despite the overall perception that this condition is benign, nearly a quarter of patients primarily given medical treatment did not achieve independence at 90 days. Further studies evaluating the role of endovascular reperfusion for acute ischemic stroke with mild symptoms are warranted.

What We Still Don't Know

- **Class IIb recommendations for EVT** (2015 Update to the AHA Guidelines)
  - **Extended time window (>6 hours)**
  - Large infarcts (ASPECTS <6)
  - **Mild strokes (NIHSS <6)** further RCT will be necessary
  - Distal (M2/M3, ACA) and posterior circulation occlusions
  - Pediatric (<18 yrs old)
  - Various procedural approaches (including aspiration catheters, anesthetic management)
  - **Appropriate triage mechanisms (including bypass of PSCs for high suspicion LVO patients)**

Appropriate stroke triage

- "Getting the *right patients* to the *right places*"

Identifying LVO patients

- Definitive diagnosis requires vessel imaging (CTA, MRA)

- Until mobile imaging, the clinical exam is the best proxy in the field
  - More severe the stroke → greater likelihood of LVO
  - *Prehospital prediction score needs:*
    - **Fast and easy**
    - **Reliable in the field**
    - **Acceptable prediction of LVO**

3-item stroke scale

Cortical signs

TABLE 1. The 3-Item Stroke Scale*

Item		Score
Disturbance of consciousness	no	0
	mild	1
	severe	2
Gaze and head deviation	absent	0
	incomplete gaze/head deviation	1
	forced gaze/head deviation	2
Hemiparesis	absent	0
	moderate	1
	severe	2
Score (total)		0–6

Stroke. 2005;36:773-6.

LA motor score (LAMS)

Table. The Los Angeles Motor Scale (LAMS)	
Facial droop	
Absent	0
Present	1
Arm drift	
Absent	0
Drifts down	1
Falls rapidly	2
Grip strength	
Normal	0
Weak grip	1
No grip	2

Stroke. 2008;39:2264-7.

RACE scale

Cortical signs

Table 1. RACE Scale

Item	RACE Score	NIHSS Score Equivalence
Facial palsy		
Absent	0	0
Mild	1	1
Moderate to severe	2	2–3
Arm motor function		
Normal to mild	0	0–1
Moderate	1	2
Severe	2	3–4
Leg motor function		
Normal to mild	0	0–1
Moderate	1	2
Severe	2	3–4
Head and gaze deviation		
Absent	0	0
Present	1	1–2
Aphasia* (if right hemiparesis)		
Performs both tasks correctly	0	0
Performs 1 task correctly	1	1
Performs neither tasks	2	2
Agnosia† (if left hemiparesis)		
Patient recognizes his/her arm and the impairment	0	0
Does not recognized his/her arm or the impairment	1	1
Does not recognize his/her arm nor the impairment	2	2
Score total	0–9	

Stroke. 2014;45:87-91.

LEGS score

Leg Strength	0 = No drift 1= Drift 2= Some effort against gravity 3= No effort against gravity 4= No Movement UN= Amputation or Joint Fusion	
	RIGHT	
	LEFT	
Eyes/Visual Fields	0 = No Visual Loss 1= Partial Hemianopia 2= Complete Hemianopia 3= Bilateral Hemianopia (blind including cortical blindness)	
Gaze	0 = Normal 1 = Partial gaze palsy 2 = Forced deviation	
Speech/Language	0 = No aphasia, Normal 1 = Mild-to-moderate aphasia 2 = Severe aphasia 3 = Mute, global aphasia	

Cortical signs

CPSSS

Cortical signs

Cincinnati Prehospital Stroke Severity Scale

2 points: Conjugate gaze deviation (≥ 1 on NIHSS item for Gaze)

1 point: Incorrectly answers at least one of two level of consciousness questions on NIHSS (age or current month) **and** does not follow at least one of two commands (close eyes, open and close hand) (≥ 1 on the NIHSS item for Level of Consciousness 1b and 1c)

1 point: Cannot hold arm (either right, left or both) up for 10 seconds before arm(s) falls to bed (≥ 2 on the NIHSS item for Motor Arm)

Stroke. 2015; 46:1508-12.

FAST-ED scale

Cortical signs

Table 1. The FAST-ED Scale and Its Correspondence to the NIHSS

Item	FAST-ED Score	NIHSS Score Source
Facial palsy		
Normal or minor paralysis	0	0–1
Partial or complete paralysis	1	2–3
Arm weakness		
No drift	0	0
Drift or some effort against gravity	1	1–2
No effort against gravity or no movement	2	3–4
Speech changes		
Absent	0	0
Mild to moderate	1	1
Severe, global aphasia, or mute	2	2–3
Eye deviation		
Absent	0	0
Partial	1	1
Forced deviation	2	2
Denial/Neglect		
Absent	0	0
Extinction to bilateral simultaneous stimulation in only 1 sensory modality	1	1
Does not recognize own hand or orients only to one side of the body	2	2

FAST-ED indicates Field Assessment Stroke Triage for Emergency Destination; and NIHSS, National Institutes of Health Stroke Scale.

Stroke. 2016;47:1997-2002.

Which Pre-Hospital Scale is Best?

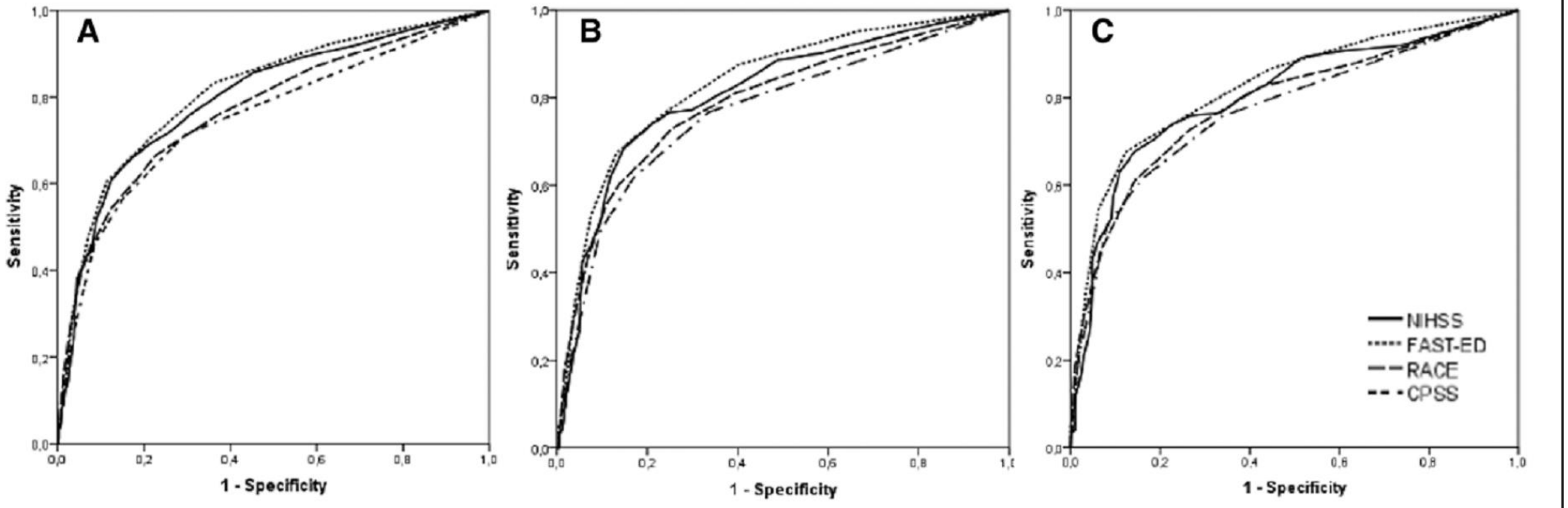
- 3- ISS
- LAMS
- RACE
- LEGS
- CPSSS
- FAST-ED

LVO prediction: Diagnostic performance

Study	N	Sensitivity	Specificity	Accuracy	PPV	NPV	+LR	-LR
3I SS (≥4)	171	0.67	0.92	0.86	0.74	0.89	8.37	0.36
LAMS (≥4)	119	0.81	0.89	0.85			7.36	0.85
RACE (≥5)	357	0.85	0.68	0.72	0.42	0.94	2.65	0.22
LEGS (≥4)	175	0.70	0.81	0.78	0.59	0.88	3.75	0.37
CPSSS (≥2)	303	0.83	0.40	0.71	0.79	0.46	1.40	0.40
FAST-ED (≥4)	741	0.60	0.89	0.79	0.72	0.82		

- **RACE: only score validated in prehospital setting by EMS**

+LVO ≤24 hrs ≤12 hrs ≤6 hrs



SCALE	AUC	SE	p*	AUC	SE	p*	AUC	SE	p*
NIHSS	0,799	0,018	0.28	0.811	0.021	0.17	0.806	0.025	0.26
FAST ED	0,813	0,018	reference	0.834	0.019	Reference	0.827	0.023	Reference
RACE	0,771	0,020	0.02	0.791	0.022	0.03	0.787	0.025	0.08
CPSS	0,752	0,021	0.002	0.769	0.023	0.001	0.772	0.026	0.02

* all individual curves presented a p value < 0.001

Any of the scores is sufficient!

Stroke. 2016;47:1997-2002.

Appropriate stroke triage

- "Getting the *right patients* to the *right places*"

Reperfusion approaches for LVO

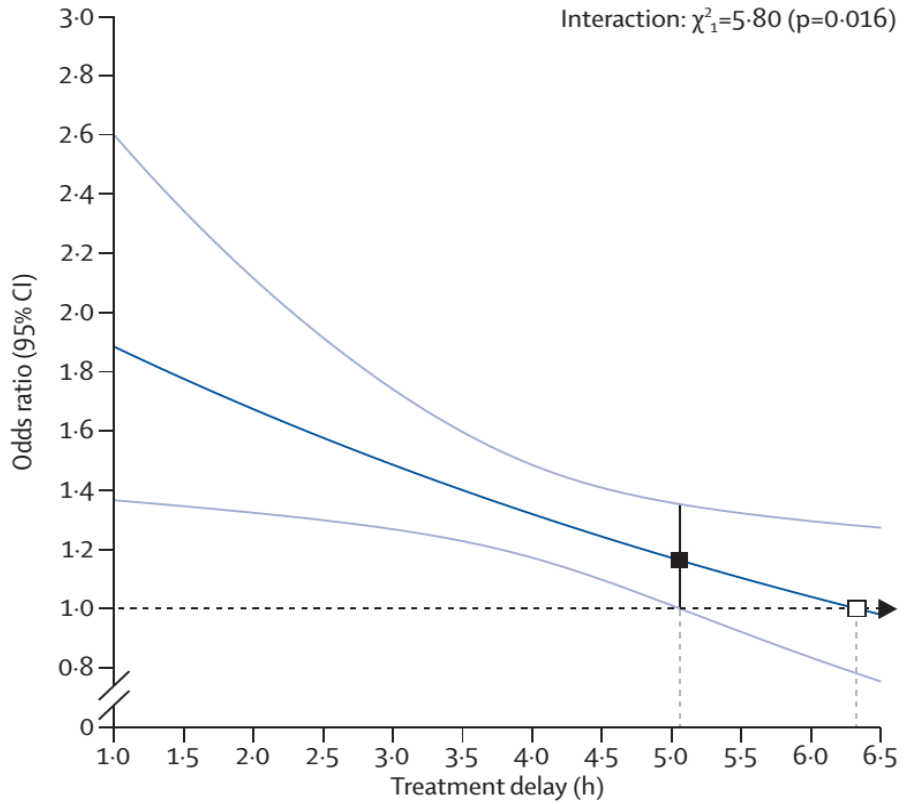
- IV r-tPA
  - "Patients eligible for intravenous r-tPA should receive intravenous r-tPA even if endovascular treatments are being considered." (**Class I, LOE A**)
  - ESCAPE control: **mAOL 37.3% IV tPA vs. 7% no IV tPA** (median 7 hrs)

ASRH, PSC, or CSC

- Intra-arterial therapy → **CSC**
  - Mechanical thrombectomy within 6 hrs & after IV r-tPA (**Class I, LOE A**)
  - Mechanical thrombectomy within 6 hrs and ineligible for IV r-tPA (**Class IIa, LOE C**: MR CLEAN, ESCAPE, REVASCAT)

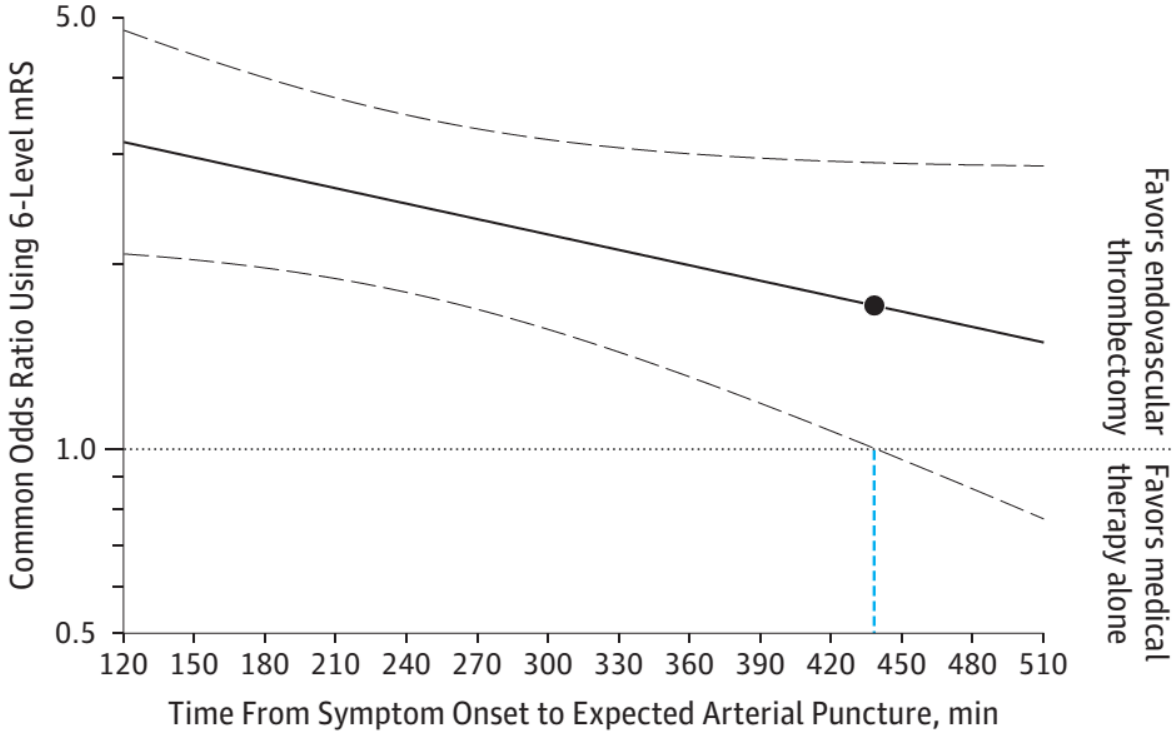
Both are time dependent

IV tPA



Lancet. 2014; 384:1929-1935.

Intra-arterial therapy



JAMA. 2016; 316:1279-1288.

“The right place”: Critical factors

- Time
- Distance
- Eligibility
- Quality

Who should go directly to CSCs?

Time **Distance** **Eligibility**

Suspected LVO in the field

>4.5 hrs **to 24 hrs** (IAT only)

<4.5 hrs (IV and IAT)

CSC equidistant

CSC remote (e.g., >30 min Δ)

Non IV tPA candidate

IV tPA candidate

???

CSC

PSC

EMS triage: <4.5 hrs

PSC

Early IV tPA

Evaluation & imaging → +LVO
Telestroke consultation
Interfacility transfer

Suspected LVO

Late/No IV tPA,
Early IAT

CSC

40% decrease in chance of good outcome

- **Emory University**: Transferred vs. Direct Presentation

  Outside transfers → ~2hr transfer delay

  - Transfer delay → fewer pts with favorable core infarct size and lower rate of good outcome (29% vs. 51%; p=0.003)

- **Rush University**: Transfer delay vs. IAT

  - Median between-hospital distance=14.7 miles → median transfer time=104 minutes
  - Adjusted odds of IAT decrease 2.5% per minute of transfer time

EMS triage: <4.5 hrs

- Struggle between Class I therapies
  - **PSC first**: Early IV r-tPA + Late IAT

    versus
  - **CSC first**: Late (or no) IV r-tPA + Early IAT
- The "right place":
  - RCT necessary (RACECAT trial) → generalizable?
  - Quality is variable:
    - Relative distance and travel time to and between hospitals
    - Door-to-needle times at PSC and CSC
    - Door in-door out times at PSC
    - Door-to-reperfusion times at CSC

Determine the relative delays to IV tPA & IAT, and the proportion who can be treated

Measure & improve quality

- Registry of standardized performance measures
  - Clinical and safety outcomes (sICH, INT, mortality)
  - **Time measures**
- Process improvement initiatives:
  - **Door to needle**
  - **Door in-door out**
  - **Door to puncture/reperfusion**

Table 2. Performance Measures and Benchmarks Offered by Professional Societies

Measure Title	Additional Description
American Heart Association/American Stroke Association[20]	
Percentage of ischemic stroke patients seen within 6 h who have endovascular recanalization performed or was considered not to be appropriate	A reason should be documented if an endovascular procedure was not performed
Median time from arrival to start of treatment	
Percentage who develop SICH within 36 h of treatment	SICH defined as hemorrhage on CT or MRI in association with clinical deterioration without other cause
Percentage for whom there is documentation of a 90-day mRS score	
The Joint Commission Comprehensive Stroke Center Program[21]	
Median time to revascularization	Revascularization defined as time of first infusion of lytic or first pass of mechanical device
TICI post-treatment reperfusion grade	
Multisociety Consensus Quality Improvement Guidelines for Intra-Arterial Therapy[22]	
Indication for treatment	≥90% should meet institutional selection criteria
Door to puncture	≥75% should have door-to-puncture <2 h
Puncture time to start of revascularization	≥50% with time from puncture to start of lytic or first pass of mechanical device <45 min
Puncture time to revascularization	≥50% with TIMI grade 2 or TICI grade 2a within 90 min
Recanalization/reperfusion	≥60% with TIMI grade 2 or TICI grade 2/3 within 90 min
Post-procedure CT/MR	≥90% should have brain CT or MR within 36 h after procedure
SICH	≤12% should have SICH
Clinical outcome	≥30% should have mRS 0–2 at 90 days

Stroke. 2015; 46:1462-7.

PSC: Door In – Door Out Time

- **Analysis of 3 high-volume PSCs → CSC[1]**
  - Median DIDO: 106 min (IQR 86-143) → **64% of total time from FMC to arterial puncture**
  - Suggested best practices:
    - Initiate transfer based on accepted criteria (without waiting for CSC approval)
    - Having initial ambulance crew standby for transfer
    - Predicted 30 minute improval in DIDO
- **Analysis of PSC protocol to improve DIDO[2]**
  - Patients with LAMS score 4+
  - Notify CSC on arrival and dispatch CSC transport team (prior to imaging)
  - CTA performed concurrently with NCCT → transmitted to CSC
  - +LVO → immediate transfer
  - **Full adherence to protocol: median DIDO 64 min (vs. 104.5 min)**, P<0.001

[1]*Stroke*. 2017; 48:1976-9.
[2]*JAMA Neurol*. 2017; 74:793-800.

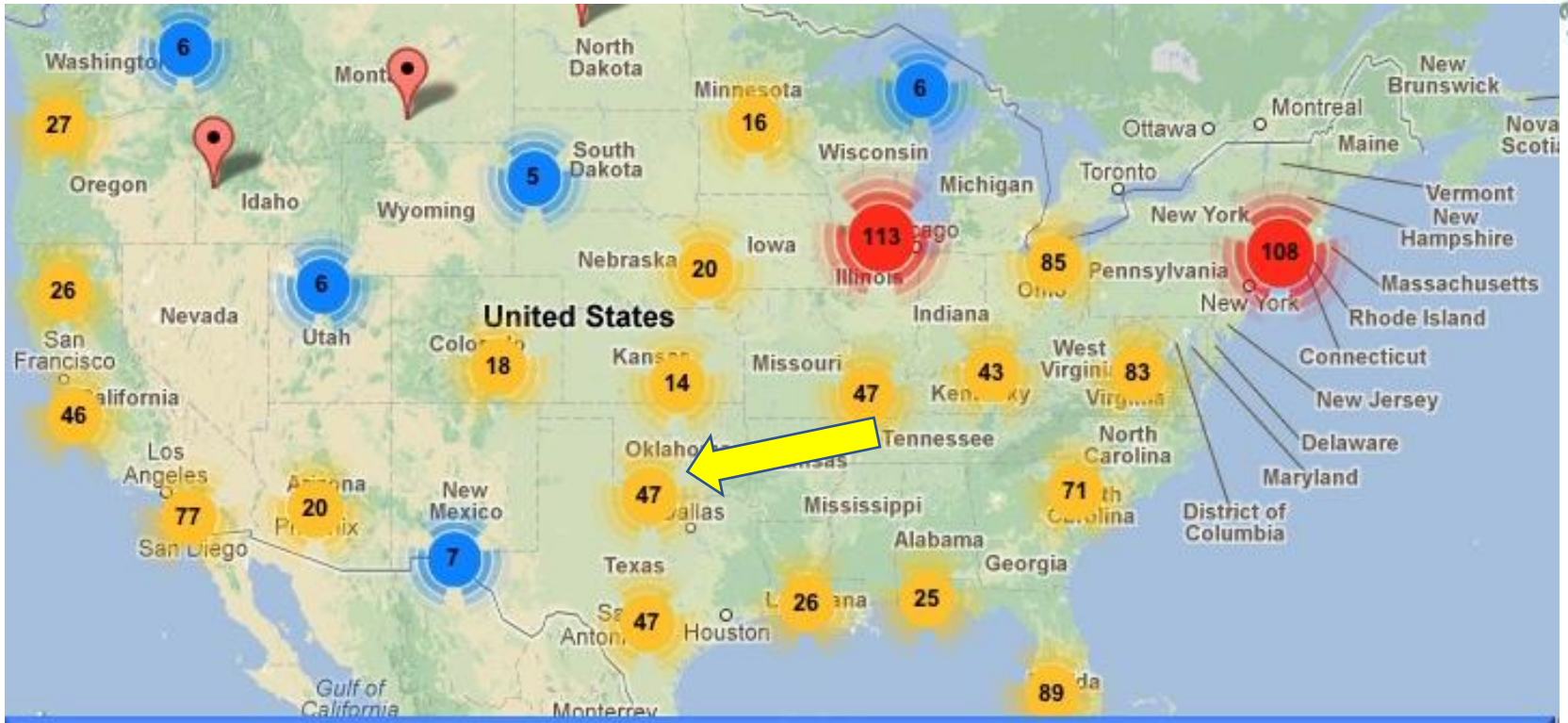
Most Effective DIDO reduction?

- Appropriate triage that avoids the second transfer in the first place!
- 90-120 minute reduction in FMC to groin puncture times based on available studies

How do we do it?

- Hospital mechanisms to improve DIDO
  - Door to needle/door to reperfusion monthly meetings (ED, radiology, pharmacy, neuro, neuro IR, EMS, administration, nursing)
  - CTA on front end to identify transfers
  - Shared imaging for interventionalist review
  - Immediate accept (“just say yes” policy)
  - Stroke champion/navigator
  - Stopwatch with each patient
  - Close interaction between CSC and various PSCs for education
  - Goal of 60 min DIDO (45 min door to needle + transfer)
  - Results in our experience, **45-90 min in network**, **60-120 min out of network**
  - Special case of inpatient to inpatient transfer
- Statewide Guidance in Texas
  - Governor’s Emergency and Trauma Advisory Coucil (GETAC) – meets quarterly to set statewide goals in line with best practices and guidelines
  - Regional Advisory Councils (RACs) – empowered to guide EMS regionally to meet the proposed guidelines, coordinate with member hospitals, report back to GETAC

Proliferation of Stroke Centers

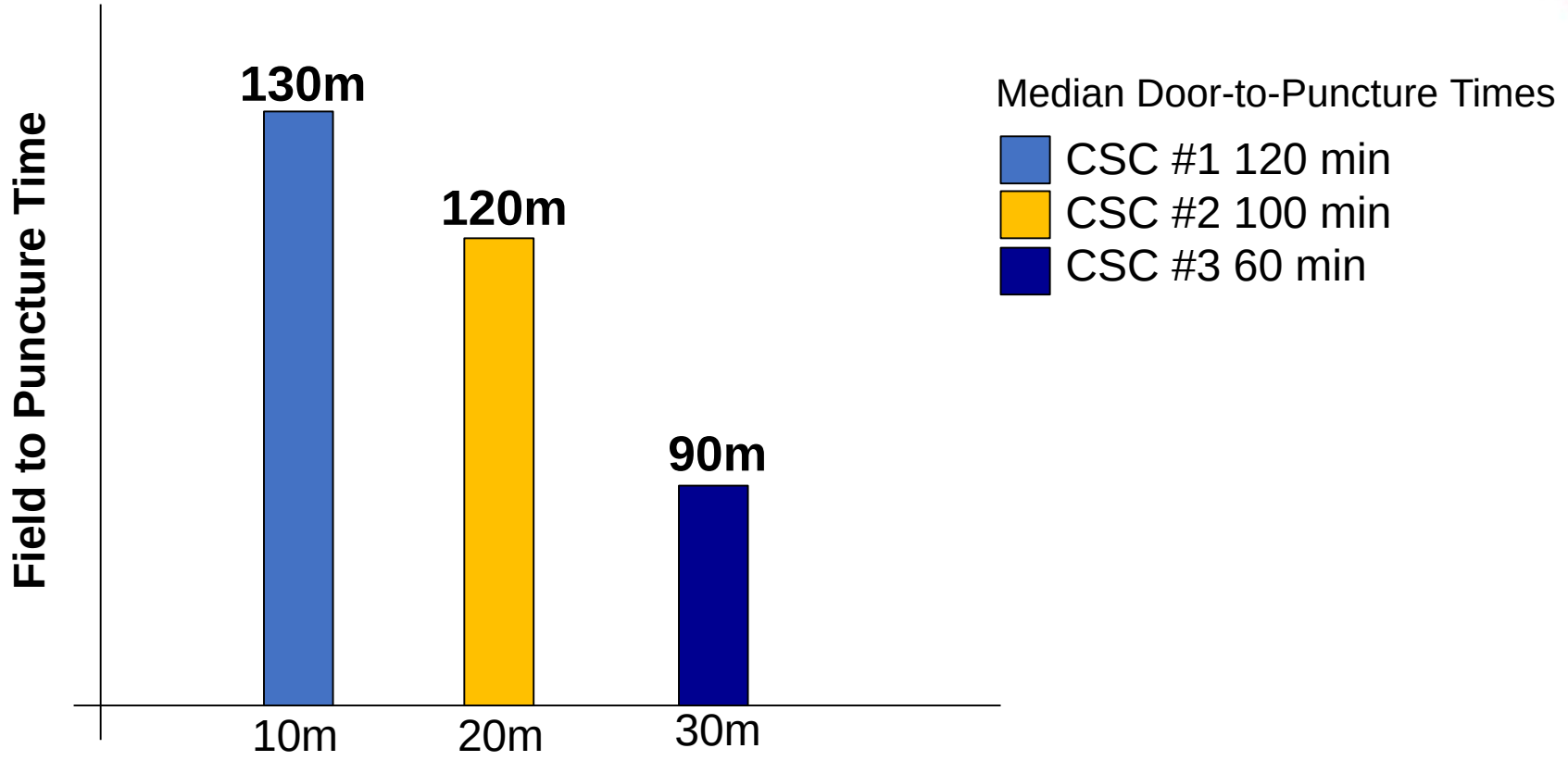


1476 Primary Stroke Centers (up 6.4% since 2014)
170 Comprehensive Stroke Centers (up 26% since 2014)

Source: JCAHO (www.jointcommission.org) ; DNV (www.dnvaccreditation.com); HFAP (www.hfap.org); & State Department of Public Health websites & www.strokecenter.org
Last accessed: October 1st, 2015

Thought Experiment Based on Transparency

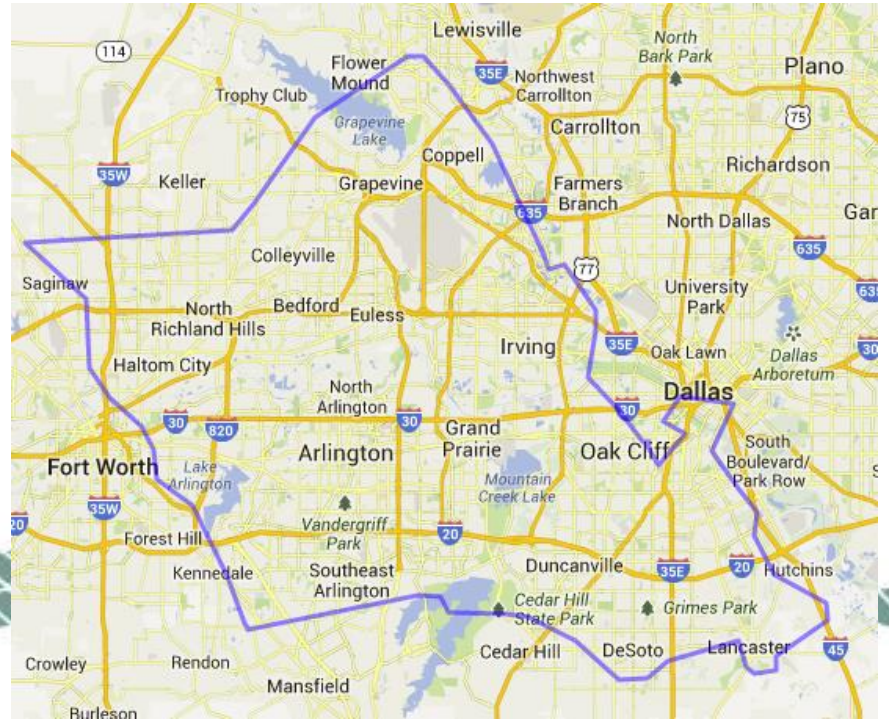
Triage Based on Distance + In-Hospital Process



Courtesy of Dr. Brijesh Mehta (Memorial Hospital, South Florida)

Food for Thought – DFW vs Rhode Island

- Dallas – Ft. Worth Metroplex
  - Population – 7.1 million
  - Size – 9,286 mi^2 (Dallas county alone is 909 mi^2)
  - 13 counties
  - 9 CSCs
  - 31 PSCs



- Rhode Island
  - Population – 1.1 million
  - Size – 1,212 mi^2
  - 5 counties, 1 CSC, 10 PSCs

Why Is This Important?

- DAWN and low NIHSS severity trials demonstrate that there are more candidates for intra-arterial therapy than are currently being treated. Variations in vascular reserve argue for using time based cutoffs for guidance, but physiology for absolute inclusion/exclusion.
- The landmark trials demonstrate that there is a life changing treatment which currently can only be offered at certain centers. The right place matters.
- DIDO and continuing process improvement is paramount. Faster is always better to increase the number of patients who could benefit from treatment, <u>the closest center may not always be best</u>.

Conclusions

- DAWN, low NIHSS studies
  - Current guidelines too restrictive → must expand the eligible patient population
  - **Triage algorithms must consider extend the CSC time criteria to up to 24 hours (? Of EMS vs PSC based triage)**
- Appropriate patient triage for IAT
  - Utilize pre-hospital scales for identifying high suspicion LVO patients, pre-hospital notification reduces response times
  - **Must capture, report and improve time and quality metrics** to guide triage decisions and that information **must be** available to EMS
  - **Various DIDO improvement mechanisms can be successful, continuous process streamlining** and data collection are necessary

Thank you!