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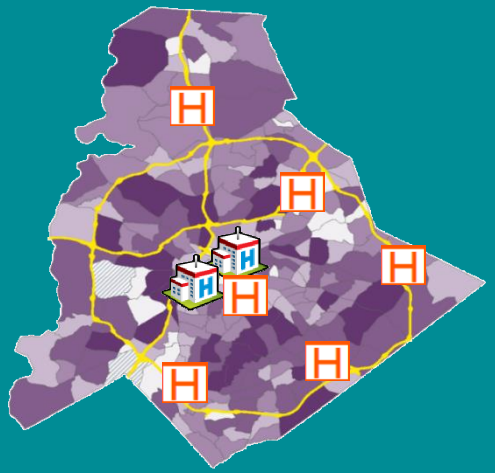
Mecklenburg County's Approach to Regionalized Acute Stroke Care



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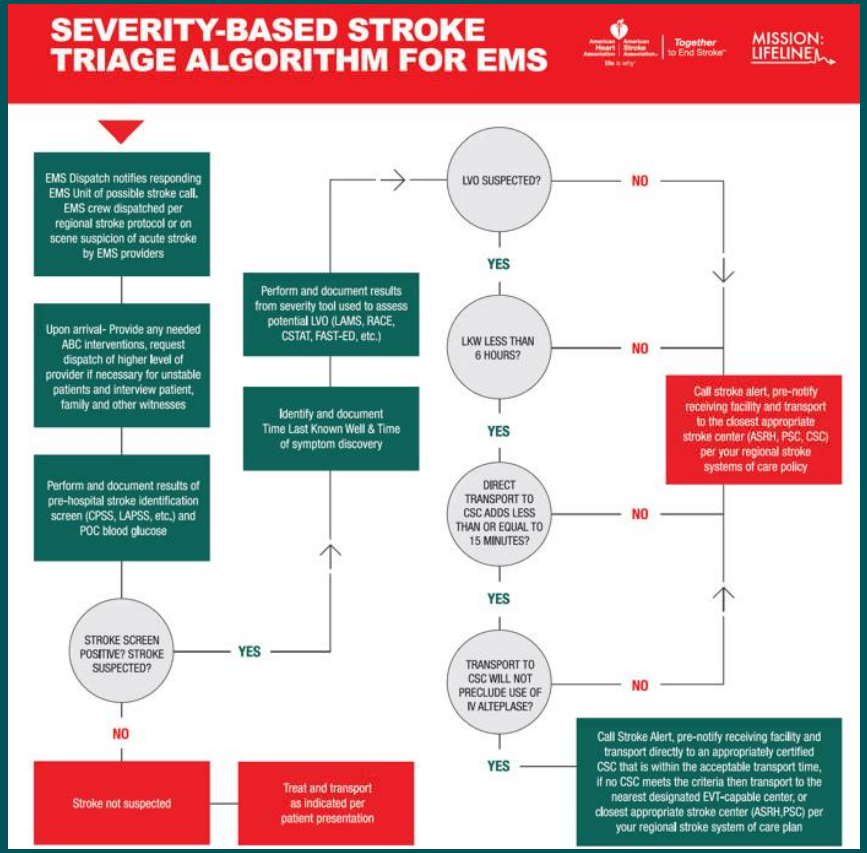
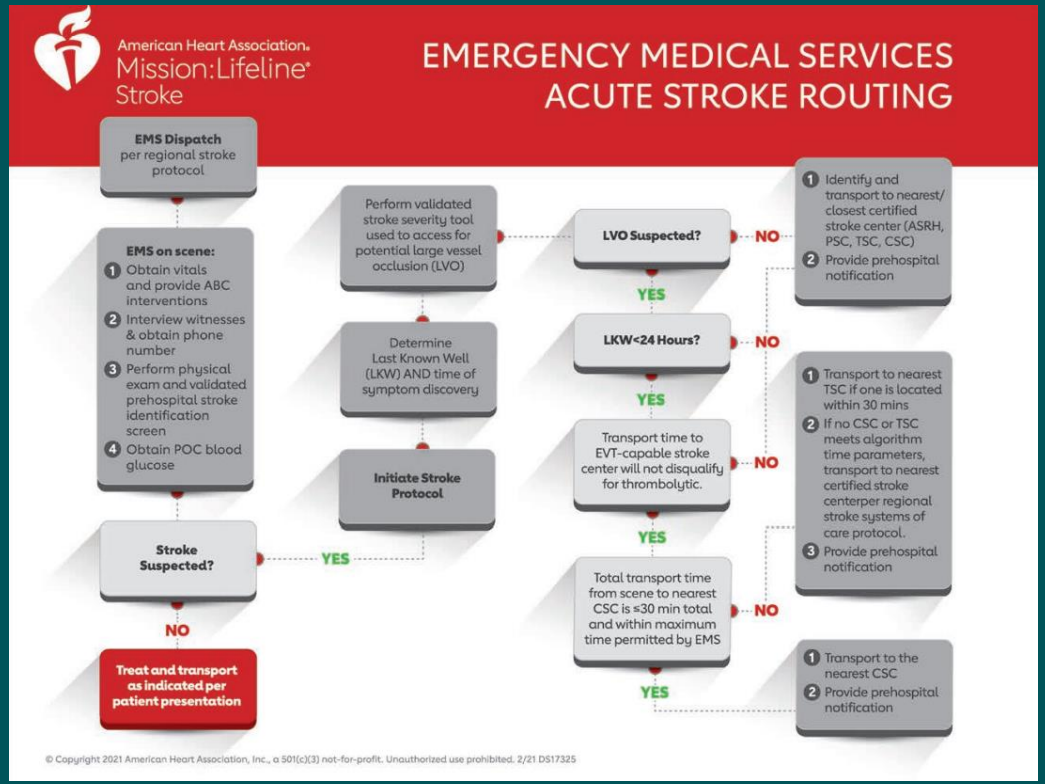
Disclosures

- None





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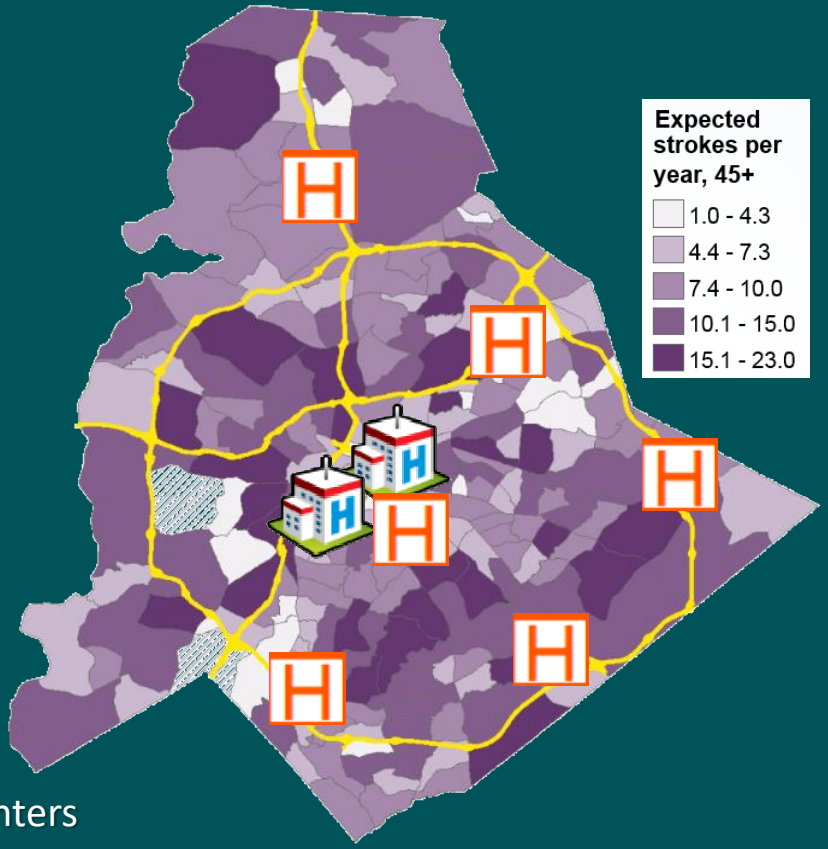
Regionalized Stroke Care within Mecklenburg County



IV tPA Capable Hospitals

Comprehensive Stroke Centers

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Questions we needed to answer before implementing a regional “routing” protocol

- What data supports routing suspected strokes to CSC’s?
- What data supports serial use of a stroke detection and severity screen?
- What rates of suspected severe stroke over-/undertriage are acceptable regionally?
- What is the prevalence of LVO and/or ICH in the population that our EMS agency transports for suspected acute stroke?
- When performed by our paramedics, what is the inter-rater reliability and accuracy of our chosen stroke severity screen for identifying LVOs (and ICHs)?
- How should we determine time stipulations within a severity-based triage protocol?
  - Time since LKW for screening eligibility
  - Maximum added allowable transport time for routing


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MEDIC

The PLUMBER Study

The Prevalence of Large vessel occlUsion stroke in MecklenBurg County Emergency Response

- Cross-sectional study of all patients transported by the Mecklenburg county EMS agency who were either
  - Dispatched as a possible stroke and/or
  - Primary impression of stroke recorded by prehospital providers

Carolinas HealthCare System

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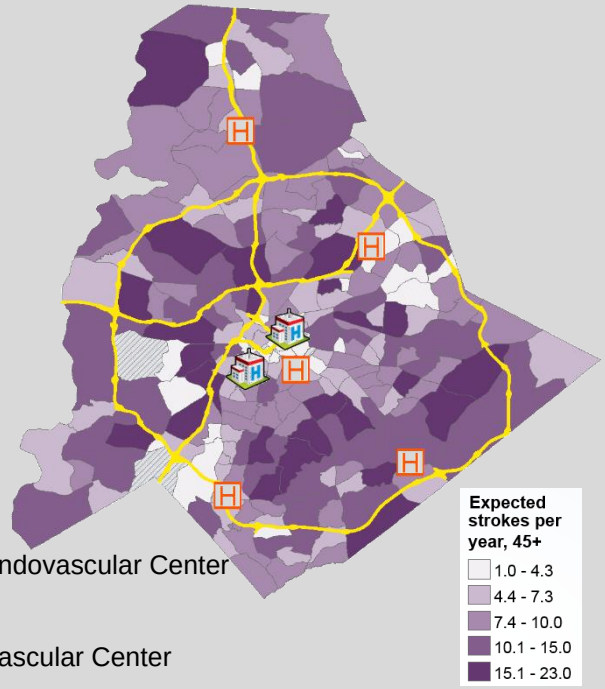
Medical Excellence. Compassionate Care.



Dozois AR, Hampton L, Kingston CW, Lambert G, Porcelli TJ, Sorenson D, Templin M, VonCannon S and Asimos AW. *Stroke* 2017;48:3397–9.

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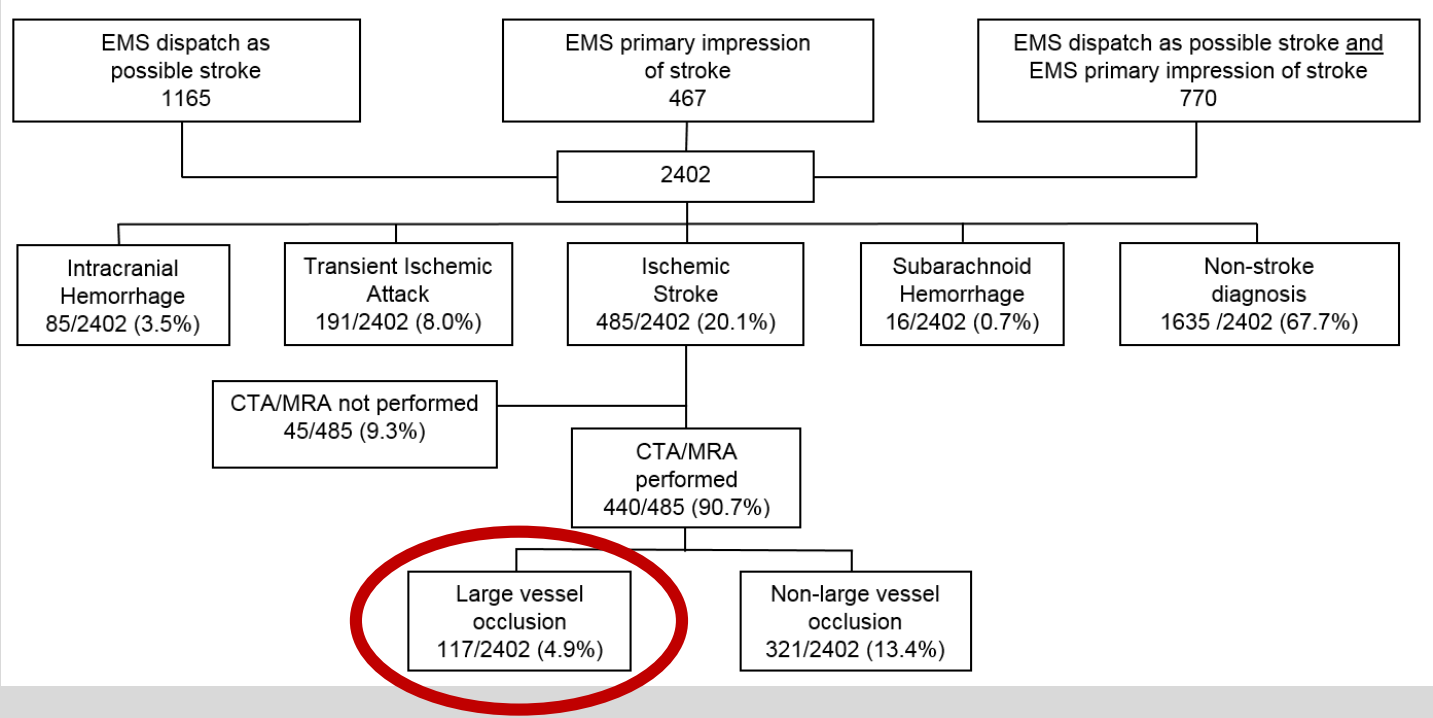
LVO Prevalence in PLUMBER



Dozois AR, Hampton L, Kingston CW, Lambert G, Porcelli TJ, Sorenson D, Templin M, VonCannon S and Asimos AW. *Stroke* 2017;48:3397–9.

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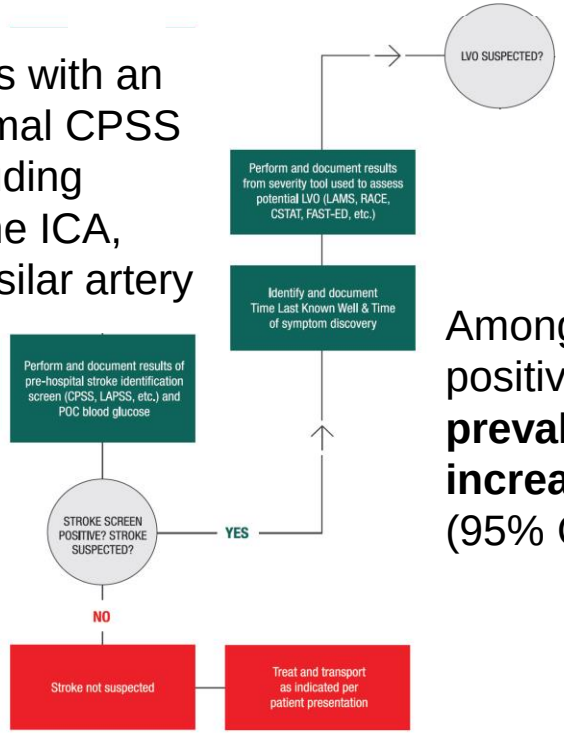
Serial Use of Stroke Screens

The PLUMBER Experience

2.7% of patients with an LVO had a normal CPSS (n=3/113), including occlusions of the ICA, M1, and the basilar artery



Among patients with a positive CPSS, the **prevalence of LVO increased to 11.2%** (95% CI 9.3%-13.3%)

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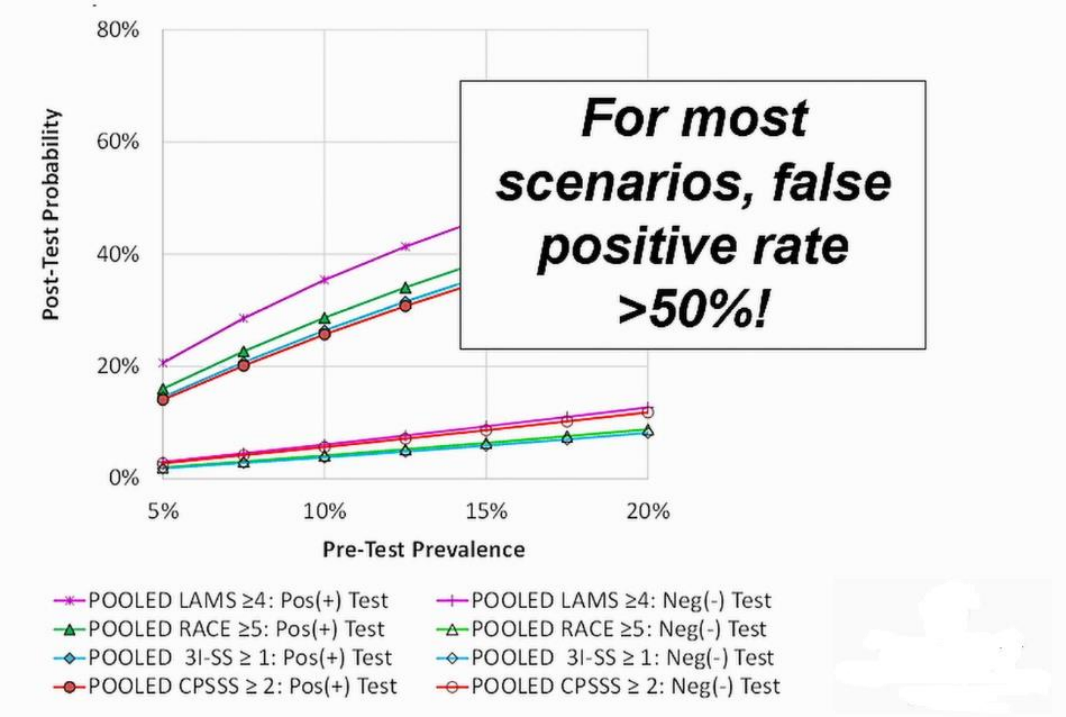
Suspected Stroke: PPV and FNR



Smith EE et al. *Stroke* 2018:49:DOI: 10.1161/STR.0000000000000160.

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AHA/ASA Systematic Review

Accuracy of Prediction Instruments for Diagnosing Large Vessel Occlusion in Individuals With Suspected Stroke

A Systematic Review for the 2018 Guidelines for the Early Management of Patients With Acute Ischemic Stroke

Reviewed for evidence-based integrity and endorsed by the American Association of Neurological Surgeons and Congress of Neurological Surgeons

Endorsed by the Society for Academic Emergency Medicine and Neurocritical Care Society

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

Eric E. Smith, MD, MPH, FAHA, Chair; David M. Kent, MD, MS, Vice Chair; Ketan R. Bulsara, MD; Lester Y. Leung, MD, MS; Judith H. Lichtman, PhD, MPH, FAHA; Mathew J. Reeves, PhD, DVM; Amytis Towfighi, MD; William N. Whiteley, BM, BCh, MSc, PhD; Darin B. Zahuranec, MD, MS, FAHA; on behalf of the American Heart Association Stroke Council

Conclusions—No scale predicted LVO with both high sensitivity and high specificity. Systems that use LVO prediction instruments for triage will miss some patients with LVO and milder stroke. More prospective studies are needed to assess the accuracy of LVO prediction instruments in the prehospital setting in all patients with suspected stroke, including patients with hemorrhagic stroke and stroke mimics. **(*Stroke*. 2018;49:e111-e122. DOI: 10.1161/STR.0000000000000160.)**

New Guidelines Initially Published January, 24, 2018

AHA/ASA Guideline

2018 Guidelines for the Early Management of Patients With Acute Ischemic Stroke

A Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association

Reviewed for evidence-based integrity and endorsed by the American Association of Neurological Surgeons and Congress of Neurological Surgeons

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

Medscape Emergency Medicine

AHA Rescinds Large Sections of New Stroke Guidelines

In a somewhat bizarre turn of events, the American Heart Association (AHA)/American Stroke Association (ASA) has rescinded its recently released stroke guidelines, publishing a "correction" in which large parts of the document have been deleted.

A new paper, published online in *Stroke* on April 18, states: "Based on recent feedback received from the clinical stroke community...the American Heart Association/American Stroke Association has reviewed the guideline and is preparing clarifications, modifications, and/or updates to several sections in it. Currently, those sections, listed here, have been deleted from the guideline while this clarifying work is in process."

The AHA/ASA adds: "After review, a revised guideline, with consideration given to the clarifications, modifications, and/or updates of the sections noted above, will be posted over the coming weeks."

Guideline "Corrections" Published a few months later

Correction

Correction to: 2018 Guidelines for the Early Management of Patients With Acute Ischemic Stroke: A Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association

Based on recent feedback received from the clinical stroke community related to the article by Powers et al, "2018 Guidelines for the Early Management of Patients With Acute Ischemic Stroke: A Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association," which published ahead of print January 24, 2018, and appeared in the March 2018 issue of the journal (*Stroke.* 2018;49:e46–e110. DOI: 10.1161/STR.0000000000000158), the American Heart Association/American Stroke Association has reviewed the guideline and is preparing clarifications, modifications, and/or updates to several sections in it. Currently, those sections, listed here, have been deleted from the guideline while this clarifying work is in process:

Section 1.3 EMS Systems Recommendation 4
Section 1.4 Hospital Stroke Capabilities Recommendation 1
Section 1.6 Telemedicine Recommendation 3
Section 2.2 Brain Imaging Recommendation 11
Section 3.2 Blood Pressure Recommendation 3
Section 4.3 Blood Pressure Recommendation 2
Section 4.6 Dysphagia Recommendation 1
Section 6.0 All subsections (11)

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Deleted in the Corrected Guideline

1.3. EMS Systems

1.3. EMS Systems	COR	LOE	New, Revised, or Unchanged
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. Further research is needed.	**IIb**	**B-NR**	New recommendation.
At least 6 stroke severity scales targeted at recognition of large vessel occlusion (LVO) in the prehospital setting to facilitate transfer to endovascular centers have been published.[24–29] The performance of all available scales based on published literature was recently compared.[3] All the scales were initially derived from data sets of confirmed stroke cases or selected prehospital cases, and there has been only limited study of their performance in the prehospital setting. For prehospital patients with suspected LVO by a stroke severity scale, the Mission: Lifeline Severity–based Stroke Triage Algorithm for EMS[30] recommends direct transport to a comprehensive stroke center if the travel time to the comprehensive stroke center is <15 additional minutes compared with the travel time to the closest primary stroke center or acute stroke-ready hospital. However, at this time, there is insufficient evidence to recommend 1 scale over the other or a specific threshold of additional travel time for which bypass of a primary stroke center or acute stroke-ready hospital is justifiable. Given the known impact of delays to IV alteplase on outcomes,[31] the known impact of delays to mechanical thrombectomy on outcome,[32] and the anticipated delays in transport for mechanical thrombectomy in eligible patients originally triaged to a nonendovascular center, the Mission: Lifeline algorithm may be a reasonable guideline in some circumstances. Customization of the guideline to optimize patient outcomes will be needed to account for local and regional factors, including the availability of endovascular centers, door in–door out times for nonendovascular stroke centers, interhospital transport times, and DTN and door-to-puncture times. Rapid, protected, collaborative, regional quality review, including EMS agencies and hospitals, is recommended for operationalized bypass algorithms.			See Table V in online Data Supplement 1.

Powers WJ et al. *Stroke* 2018:49:e46-e99.

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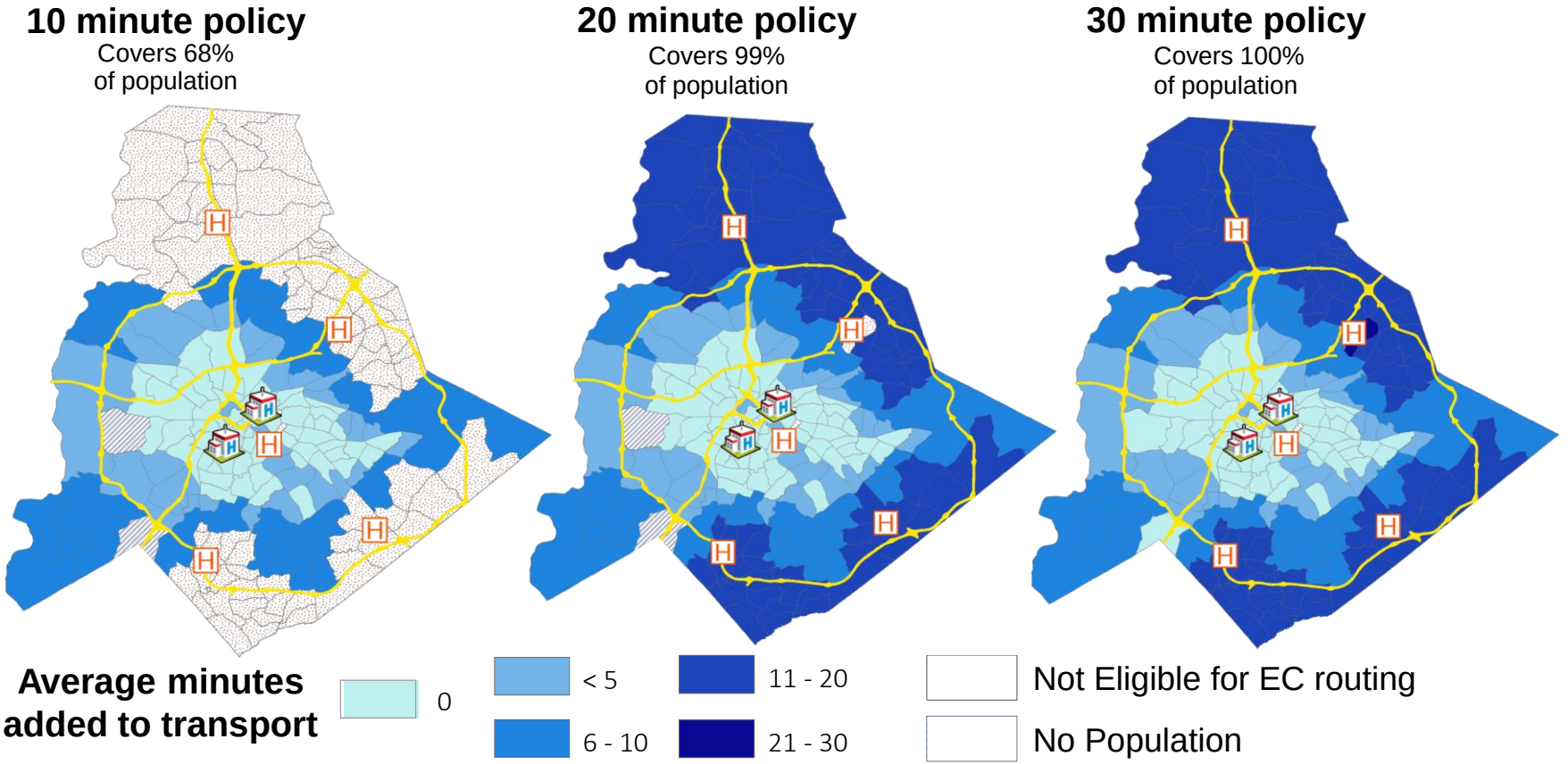

Bogle BM, Asimos AW and Rosamond WD. *Stroke* 2017;48(10):2827-2835.

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Discrete Event Simulation to Assess the Impact of the AHA/ASA Stroke Severity Algorithm for EMS on Patient Outcomes and Overtriage

AHA/ASA EMS Triage Algorithm Implementation Protocol	EMS Stroke Severity Screening Tool	Los Angeles Motor Scale (LAMS)			Rapid Arterial Occlusion Evaluation Scale (RACE)			Cincinnati Stroke Triage Assessment Tool (C-STAT)		
	Additional Transport Time Permitted to Endovascular Stroke Center (minutes)	10	20	30	10	20	30	10	20	30
Overtriage (N, %)		105 (47%)	172 (51%)	177 (51%)	301 (69%)	503 (72%)	507 (72%)	559 (79%)	939 (80%)	961 (80%)
Large vessel occlusion stroke patients (N=172)										
Directly transported to endovascular stroke center (%)		58%	84%	85%	60%	87%	88%	58%	85%	86%
Receives IV-tPA within 4.5 hours (%)		69%	68%	66%	69%	66%	66%	68%	66%	65%
Receives endovascular thrombectomy within 6 hours (%)		53%	62%	61%	54%	63%	63%	54%	62%	63%
Survive to 90 days (%)		81%	84%	83%	83%	83%	83%	82%	84%	80%
Favorable neurological outcome (Modified Rankin Score ≤2) (%)		38%	41%	40%	38%	41%	40%	37%	42%	40%
Non-large vessel occlusion, acute ischemic stroke patients (N=556)										
Directly transported to endovascular stroke center (%)		26%	29%	30%	35%	46%	46%	49%	67%	69%
Receive IV-tPA within 4.5 hours (%)		69%	67%	68%	68%	67%	68%	69%	67%	68%
Survive to 90 days (%)		90%	88%	90%	89%	89%	91%	91%	89%	89%
Favorable neurological outcome (Modified Rankin Score ≤2) (%)		49%	48%	49%	49%	49%	49%	50%	49%	49%

Bogle BM, Rosamond WD, and Asimos AW. *Stroke* 2018;9:A93.

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Evaluation of the FAST-ED in the prehospital setting

Patricia L. Dowbiggin MPH EMT-P, Allison I. Infinger MSPH, Gabrielle T. Purick MPH EMT-B, Douglas R. Swanson MD FACEP FAEMS, Andrew Asimos MD, Jeremy Rhoten RN BSN, Shellie VonCannon MSN RN CPHQ, Melissa Dometrovich DNP RN CNN, Jonathan R. Studnek PhD NRP

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Mecklenburg EMS Agency

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Inter-rater Reliability of the FAST-ED in the Out-of- Hospital Setting

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

Item	Percent Agreement	Kappa	95% Confidence Interval
Facial Score	90.13%	0.76	(0.67-0.86)
Arm Score	87.89%	0.80	(0.71-0.82)
Speech Score	89.69%	0.84	(0.83-0.85)
Eye Score	90.13%	0.72	(0.64-0.89)
Denial Score	82.51%	0.65	(0.60-0.65)
Total Score	70.40%	0.66	(0.61-0.69)
Cumulative Score (≥4)	92.20%	0.81	(0.73-0.90)

- Paramedic/EMT crews (92.5%; Kappa=0.82)
- Paramedic/paramedic crews (91.2%; Kappa=0.80)

Dowbiggin PL et al. *Prehosp Emerg Care* 2021 Jan 12;1-8. doi: 10.1080/10903127.2020.1852350

Test Characteristics of FAST-ED to Identify LVOs when used as a secondary stroke screen

Score	Sensitivity	Specificity	Correctly Classified	LR+	LR-
FAST-ED ≥0	100.00%	0.00%	11.10%	1.0000	-
FAST-ED ≥1	99.46%	4.82%	15.38%	1.0506	0.0000
FAST-ED ≥2	94.77%	24.90%	32.66%	1.2619	0.2100
FAST-ED ≥3	84.97%	50.20%	54.06%	1.7063	0.2994
FAST-ED ≥4	77.78%	65.88%	67.20%	2.2794	0.3373
FAST-ED ≥5	62.09%	78.45%	76.63%	2.8811	0.4832
FAST-ED ≥6	50.98%	87.51%	83.45%	4.0818	0.5602
FAST-ED ≥7	35.29%	92.16%	85.85%	4.5037	0.7021
FAST-ED ≥8	20.26%	95.67%	87.30%	4.6831	0.8334
FAST-ED ≥9	6.54%	98.201%	88.03%	3.6393	0.9517

Dowbiggin P et al. *Prehosp Emerg Care* 2021;25(1):132.

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RACECAT
Transfer to the Local Stroke Center
versus Direct Transfer to Endovascular Center
of Acute Stroke Patients with
Suspected Large Vessel Occlusion
in the Catalan Territory (RACECAT)
ClinicalTrials.gov Identifier: NCT02795962
Pérez de la Ossa N, Abilleira S, , Jiménez X, Cardona P, Cocho D,
Purroy F, Serena J, San Román L, Urra X, Chamorro A, Gallofré M,
Jovin T, Molina C, Cobo E, Dávalos A, Ribo M.

Results: Primary Efficacy Outcome

	n	OR, 95% CI
Odds ratio[1] adjusted	949	1.029 (0.818, 1.295)
Odds ratio unadjusted	949	0.990 (0.789, 1.243)

[1]OR adjusted for stratified factors, age and RACE

Pérez de la Ossa N and Ribo M, ESOC-WSO Virtual Conference, November 11, 2020

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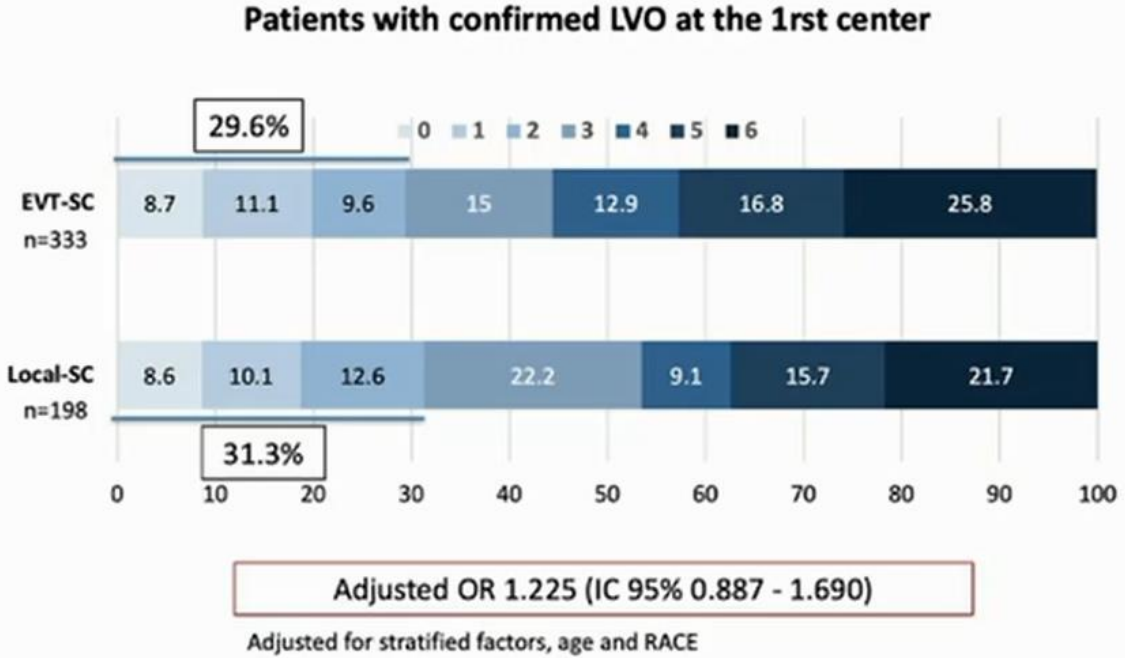
Secondary analysis of the RACECAT trial: benefit of direct transfer to an endovascular stroke center according to the presence of large vessel occlusion and the transfer time to the endovascular center.

ClinicalTrials.gov Identifier: NCT02795962

Pérez de la Ossa N, Abilleira S, , Jiménez X, Cardona P, Cocho D, Purroy F, Serena J, San Román L, Urra X, Chamorro A, Gallofré M, Jovin T, Molina C, Cobo E, Dávalos A, Ribo M.

Results 1: LVO patients



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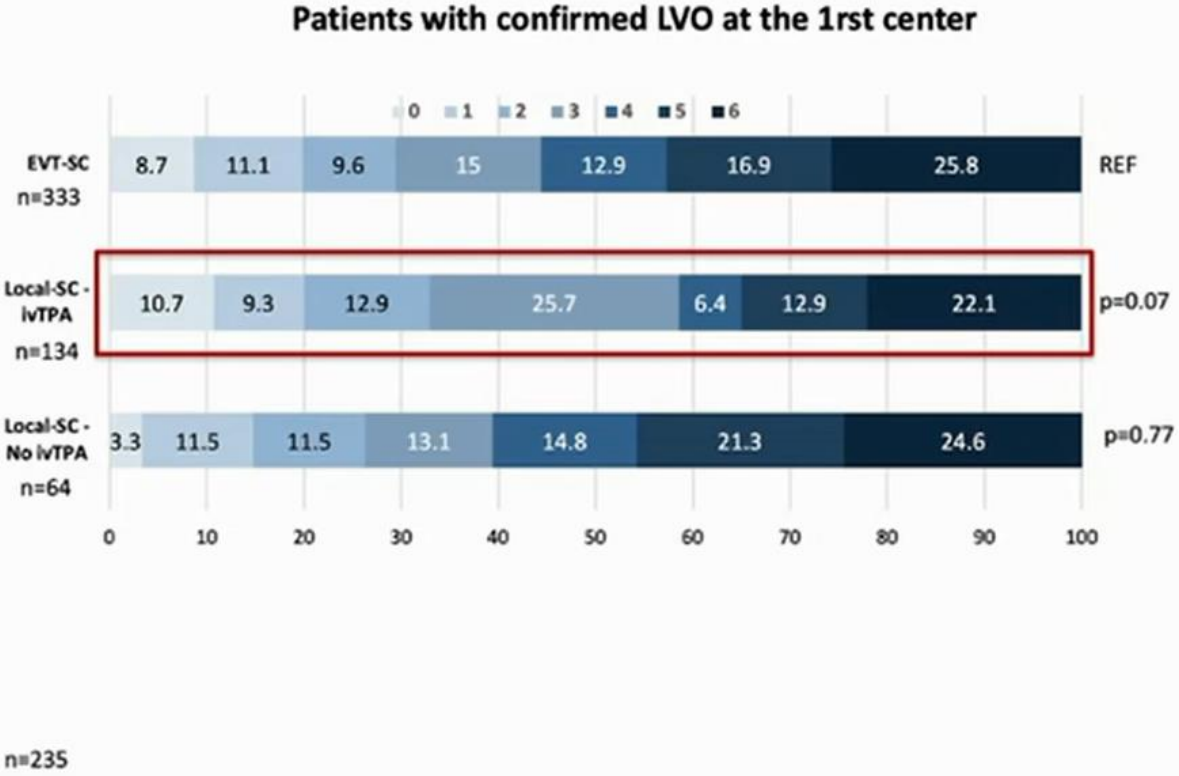

Results 1: EVT patients

Patients treated with EVT

	Transfer to Local-SC n=184	Direct transfer to EVT-SC n=235
NIHSS baseline	19 (15, 21)	18 (14, 21)
TICI 2b-3	83.2%	85.9%
Onset to 1rst center	21 (13, 32)	61 (35, 86)
Door to needle (iv-tPA)	33 (25, 48)	30 (22, 40)
DIDO	78 (63, 97)	NA
Door to EVT access	43 (32, 59)	71 (49, 97)
Onset to EVT access	**270 (215, 347)**	**214 (172, 230)**

Time in minutes: median (IQR)

Questions

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