

Evidence-Based Strategies for Stroke Identification in the Pre-Hospital Setting with use of a Stroke Severity Tool

The Minnesota Department of Health, American Stroke Association, and the MN Stroke Advisory Group advocates these strategies for triage and assessment of suspected stroke in the pre-hospital setting. EMS agencies are encouraged to adopt a stroke severity tool for use into their stroke protocol. In Minnesota there are 3 stroke severity scales that are commonly used: Rapid Arterial Occlusion Evaluation Scale (RACE), Field Assessment Stroke Triage for Emergency Destination (FAST-ED), and Vision Aphasia Neglect (VAN). Presently, one scale has not been shown to be superior to the others. EMS agencies should communicate protocol changes to hospitals they transport to.

1. **Limit on-scene time:** Obtain vitals and provide ABC interventions. Interview witnesses and obtain phone numbers. EMS personnel should strive to be on scene for ≤ 15 minutes.
2. **Assessment:** perform physical exam, obtain POC blood glucose and perform validated prehospital stroke screen such as Cincinnati Stroke Scale etc.), document Last Known Well (LKW) and symptom discovery as clock time.
3. **Initiate stroke protocol:** perform validated stroke severity tool assessing for potential large vessel occlusion (LVO).

Stroke severity tools are a numerical scale used to determine the severity of the neurological deficits once a stroke is suspected. This may help to identify patients with large vessel occlusions that may be candidates for endovascular thrombectomy. Note there are multiple tools currently in use, yet no single tool has been shown to be superior. The following 3 scales are commonly used by EMS agencies throughout Minnesota:

- Rapid Arterial Occlusion Evaluation Scale (RACE)
 - Field Assessment Stroke Triage for Emergency Destination (FAST-ED)
 - Vision Aphasia Neglect (VAN)
4. **Pre-hospital notification and transport:** pre-notify hospital of assessment and findings and transport to most appropriate designated stroke center.
 - a. **LKW < 4.5 hours:** potential thrombolytic candidate, transport to closest designated stroke center, pre-notify with findings
 - b. **Suspected LVO & < 24 hours from LKW:**
 - i. Transport time to CSC or TSC < 30 minutes: consider direct transport, pre-notify with findings
 - ii. Transport time to CSC or TSC > 30 minutes: transport to closest designated stroke center, pre-notify with findings to support rapid interfacility transport

- c. **Wake-up with symptoms:** IV thrombolytics may be considered for some patients who awake with stroke symptoms and have an unclear time of onset. Advanced Imaging will be used to guide treatment options. Transport to most appropriate designated stroke center.

Recommendations for the Establishment of Stroke Systems of Care: A 2019 Update

Opeolu Adeoye, MD, MS, FAHA, Chair, Karin V. Nyström, RN, MSN, FAHA, Dileep R. Yavagal, MD, Jean Luciano, CRNP, Raul G. Nogueira, MD, Richard D. Zorowitz, MD, Alexander A. Khalessi, MD, MS, FAHA, Cheryl Bushnell, MD, MHS, FAHA, William G. Barsan, MD, Peter Panagos, MD, Mark J. Alberts, MD, FAHA, A. Colby Tiner, MA, Lee H. Schwamm, MD, FAHA, Edward C. Jauch, MD, MS, FAHA

Prehospital Stroke Screening Tools

According to the Recommendations for the Establishment of Stroke Systems of Care: A 2019 Update A Policy Statement from the American Stroke Association prehospital stroke screening tools remain an important aspect of stroke care. In an Italian study of 18 231 EMS dispatches for stroke-like symptoms, the positive predictive value of the dispatch stroke/TIA symptoms being confirmed on scene by EMS providers was 34.3% (95% CI, 33.7%–35.0%; 6262 of 18 231), and the sensitivity was 64.0% (95% CI, 63.0%–64.9%; 6262 of 9791). Centers that used the Cincinnati Prehospital Stroke Scale (CPSS) more often (ie, >10% of cases) had higher sensitivity (71% [95% CI, 87%–89%] vs 52% [95% CI, 51%–54%]). In a systematic review of prehospital stroke scales performed by EMS providers in the field, both the CPSS (area under the curve, 0.813) and the Los Angeles Prehospital Stroke Screen (area under the curve, 0.964) showed better performance than 5 other field stroke recognition scales. The Los Angeles Prehospital Stroke Screen performed more consistently, but the CPSS had similar diagnostic capability. Of 184 179 US EMS transports with primary impressions of stroke, only 46% met the recommended on-scene time of <15 minutes. Furthermore, hospital prenotification occurs in only 67% of EMS transports. Stroke systems of care should endeavor to enhance recognition of stroke symptoms by dispatch and EMS providers, to reduce on-scene time in transported patients, and to improve prenotification of the receiving hospital.

Prehospital Stroke Severity Scales and Rerouting of Patients

The Stroke Systems of Care: A 2019 Update further recommends with the advent of thrombectomy for acute ischemic stroke with large vessel occlusion (LVO) of the internal carotid artery and middle cerebral artery stem (M1) and worse outcomes with delays to thrombectomy, ensuring that EMS providers transport patients with acute neurologic deficits to the right hospital for the best treatment as quickly as possible is increasingly critical. At least 6 stroke severity scales targeted at the recognition of LVO in the prehospital setting to facilitate transfer to thrombectomy centers have been published. However, all the scales were initially derived from data sets of confirmed stroke cases or selected prehospital cases. Three of the current scales have been tested in the prehospital setting in a limited fashion and without head-to-head comparisons. The Cincinnati Stroke Triage Assessment Tool, Rapid Arterial Occlusion Evaluation, Los Angeles Motor Scale, and Field Assessment Stroke Triage for

Emergency Destination are specifically named on the AHA Mission: Lifeline severity-based stroke triage algorithm for EMS.

For prehospital patients with suspected LVO by a stroke severity scale, the Mission: Lifeline algorithm recommends direct transport to a CSC if the travel time to the CSC is <15 additional minutes compared with the travel time to the closest PSC or ASRH. At this time, there is insufficient evidence to recommend 1 scale over the other or whether the proposed 15-minute specific threshold of additional travel time for bypass of a PSC or ASRH is optimal. Given the known impact on outcomes of every 15-minute delay of intravenous alteplase the known impact of delays to thrombectomy and the anticipated delays in transport for thrombectomy in eligible patients originally triaged to a non-endovascular capable center, the Mission: Lifeline algorithm is a reasonable approach. Further research is warranted, and prehospital algorithms will need to be updated periodically as new evidence emerges.”

Recommendations

1. Public health leaders along with medical professionals and others should design and implement public education programs focused on stroke systems and the need to seek emergency care (by calling 9-1-1) in a rapid manner. These programs should be repetitive and designed to reach diverse populations. Further research is needed to establish the most effective programs for diverse populations. (2019 New Recommendation)
2. EMS leaders, in coordination with local, regional, and state agencies and in consultation with medical authorities and local experts, should develop triage paradigms and protocols that ensure that all patients with a known or suspected stroke are rapidly identified and assessed with a validated and standardized instrument for stroke screening such as FAST (Face, Arm, Speech, Time), Los Angeles Prehospital Stroke Screen, or CPSS. (2019 Revised Recommendation)
 - a. In prehospital patients who screen positive for suspected stroke, a standard prehospital stroke severity assessment tool (e.g., Cincinnati Stroke Triage Assessment Tool, Rapid Arterial Occlusion Evaluation, Los Angeles Motor Scale, and Field Assessment Stroke Triage for Emergency Destination) should be used to facilitate triage. In the absence of new data, it is reasonable to adapt the Mission: Lifeline algorithm to the needs of the community. Further research is needed to establish the most effective prehospital stroke severity triage scale, which may be one of the published scales or a novel scale or device. (2019 New Recommendation)
 - b. Standardized approaches to prehospital stroke assessment, triage, and management should be encouraged for 9-1-1 call centers and EMS dispatchers. Further research is needed to establish the most effective programs for stroke recognition by 9-1-1 call centers and EMS dispatchers. (2019 New Recommendation)
3. When there are several intravenous alteplase–capable hospitals in a well-defined geographic region, extra transportation times to reach a facility capable of endovascular thrombectomy should be limited to no more than 15 minutes in patients with a prehospital stroke severity scale score suggestive of LVO. When several hospital options exist within similar travel times, EMS should seek care at the facility capable of offering the highest level

of stroke care. Further research is needed to establish travel time parameters for hospital bypass in cases of prehospital suspicion of LVO. (2019 New Recommendation)

- a. Protocols that include prearrival notification by EMS that a stroke patient is en route should be used in all cases.

Source: Adeoye O, Nystrom KV, Yavagal DR, Luciano J, Nogueira RG, Zorowitz RD, Khalessi AA, Bushnell C, Barsan WG, Panagos P, et al. Recommendations for the Establishment of Stroke Systems of Care: A 2019 Update. *Stroke*. 2019;50:e187-e210. <https://doi.org/10.1161/STR.0000000000000173>

Table 1. Levels and Capabilities of Hospital Stroke Certifications (Table view)

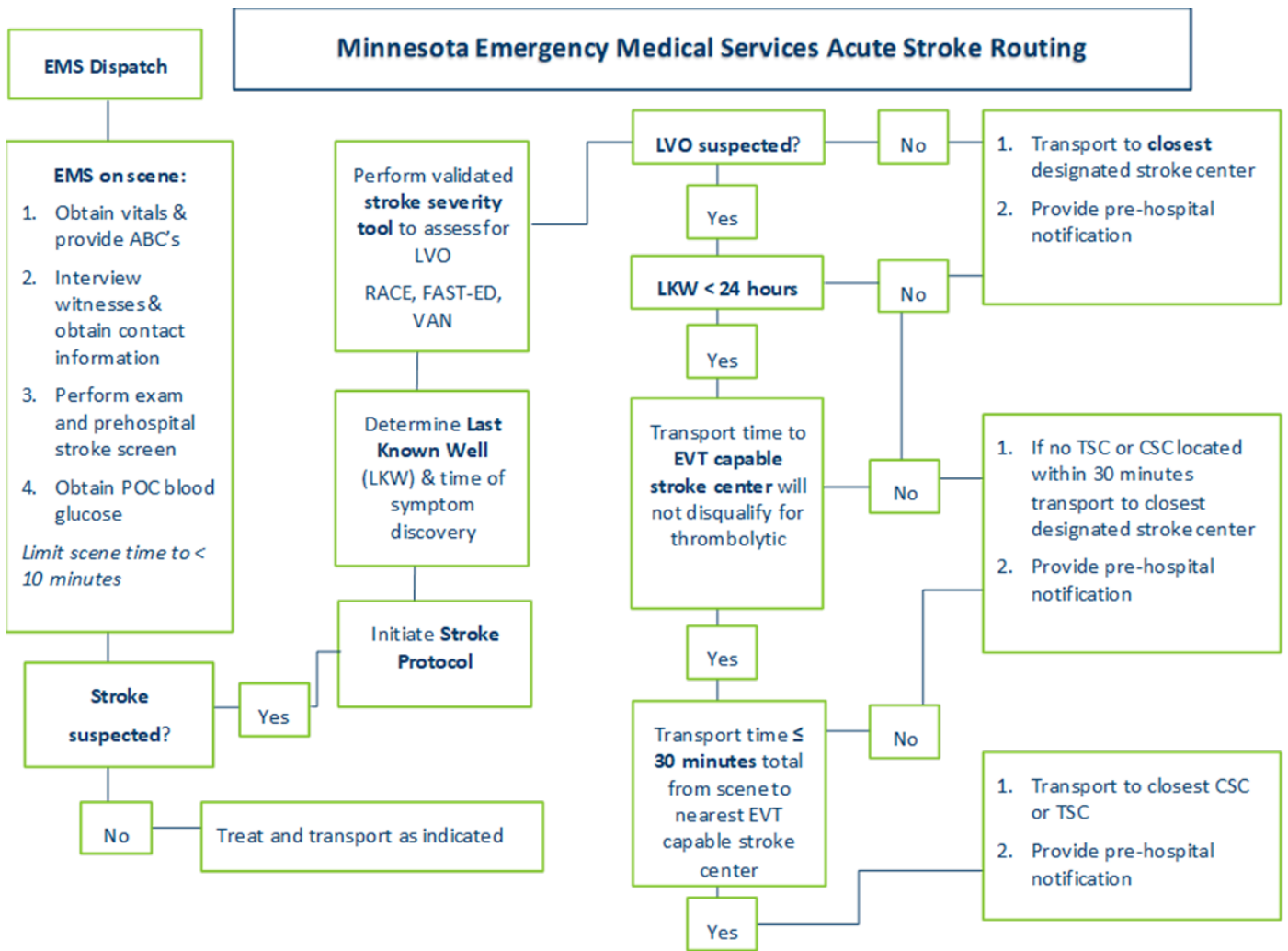
Characteristics	ASRH	PSC	TSC	CSC
Location	Typically rural	Often urban/suburban	Often urban/suburban	Typically urban
Stroke team accessible/available 24/7	Yes	Yes	Yes	Yes
Noncontrast CT available 24/7	Yes	Yes	Yes	Yes
Advanced imaging available 24/7 (eg, CTA/CTP/MRI/MRA/MRP)	No	Possibly	Yes	Yes
Intravenous thrombolysis capable 24/7	Yes	Yes	Yes	Yes
Thrombectomy capable 24/7	No	Possibly	Yes	Yes
Diagnose stroke etiology and manage poststroke complications	Unlikely	Yes, routine	Yes, complex	Yes, complex
Admit hemorrhagic stroke	No	Possibly	Possibly	Yes
Clip/coil ruptured intracranial aneurysms	No	Unlikely	Possibly	Yes
Dedicated stroke unit	No	Yes	Yes	Yes
Neurocritical care unit and expertise	No	Possibly	Possibly*	Yes
Clinical stroke research performed	Unlikely	Possibly	Possibly	Yes

Source: American Heart Association, Inc.⁵ ASRH indicates acute stroke-ready hospital; CSC, comprehensive stroke center; CT, computed tomography; CTA, computed tomography angiography; CTP, computed tomography perfusion; MRA, magnetic resonance angiography; MRI, magnetic resonance imaging; MRP, magnetic resonance perfusion; PSC, primary stroke center; and TSC, thrombectomy-capable stroke center. *Access to neurocritical care expertise required and may be provided by telemedicine. *Stroke* Volume 52, Issue 5, May 2021; Pages e133-e152 <https://doi.org/10.1161/STROKEAHA.120.033228>

References

1. Powers WJ, Rabinstein AA, Ackerson T, Adeoye OM, Bambakidis NC, Becker K, Biller J, Brown M, Demaerschalk BM, Hoh B, 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](https://doi.org/10.1161/STR.0000000000000158); *Stroke*. 2018;49:e46–e99; <https://doi.org/10.1161/STR.0000000000000158> (<https://www.ahajournals.org/doi/10.1161/STR.0000000000000158>)
2. Powers WJ, Rabinstein AA, Ackerson T, Adeoye OM, Bambakidis NC, Becker K, Biller J, Brown M, Demaerschalk BM, Hoh B, et al. Guidelines for the Early Management of Patients With Acute Ischemic Stroke: 2019 Update to the 2018 Guidelines for the Early Management of Acute Ischemic Stroke: A Guideline for Healthcare Professionals From the American Heart Association/[American Stroke Association](https://doi.org/10.1161/STR.0000000000000211). *Stroke*. 2019;50:e344-e418. <https://doi.org/10.1161/STR.0000000000000211> (<https://www.ahajournals.org/doi/10.1161/STR.0000000000000211>)

3. Adeoye O, Nystrom KV, Yavagal DR, Luciano J, Nogueira RG, Zorowitz RD, Khalessi AA, Bushnell C, Barsan WG, Panagos P, et al. [Recommendations for the Establishment of Stroke Systems of Care: A 2019 Update. Stroke. 2019;50:e187-e210.](#)
<https://doi.org/10.1161/STR.000000000000173>
[\(https://www.ahajournals.org/doi/10.1161/STR.000000000000211\)](https://www.ahajournals.org/doi/10.1161/STR.000000000000211)
4. Jauch EC, Schwamm LH, Panagos PD, Barbazzeni J, Dickson R, Dunne R, Foley J, Fraser JF, Lassers G, Martin-Gill C, et al. Recommendations for Regional Stroke Destination Plans in Rural, Suburban, and Urban Communities From the Prehospital Stroke System of Care Consensus Conference: A Consensus Statement From the American Academy of Neurology, American Heart Association/[American Stroke Association, American Society of Neuroradiology, National Association of EMS Physicians, National Association of State EMS Officials, Society of NeuroInterventional Surgery, and Society of Vascular and Interventional Neurology: Endorsed by the Neurocritical Care Society; Stroke. 2021;52:e133–e152.](#)
<https://doi.org/10.1161/STROKEAHA.120.033228>[\(https://www.ahajournals.org/doi/10.1161/STR.000000000000211\)](https://www.ahajournals.org/doi/10.1161/STR.000000000000211)
5. [Minnesota Stroke System Designated Hospitals](#)
[\(https://www.health.state.mn.us/diseases/cardiovascular/stroke/designationlist.html\)](https://www.health.state.mn.us/diseases/cardiovascular/stroke/designationlist.html)



Minnesota Emergency Medical Services Acute Stroke Routing Narrative

1. EMS Dispatch
2. EMS on scene:
 - a. Obtain vitals & provide ABC's.
 - b. Interview witness & obtain contact information.
 - c. Perform exam and prehospital stroke screen.
 - d. Obtain POC blood glucose.
 - i. *Limit scene time to <10 minutes.*
3. Is a stroke suspected?
 - a. If no, treat and transported as indicated.
 - b. If yes, proceed to step #4.
4. Initiate stroke protocol.
5. Determine Last Known Well (LKW) & time of symptom discovery.
6. Perform validated stroke severity scale to asses for LVO (ex. RACE, FAST-ED, VAN).
7. LVO suspected?
 - a. If no, proceed to step #12.
 - b. If yes, proceed to step #8.
8. Last Known Well < 24 hours.
 - a. If no, proceed to step #12.
 - b. If yes, proceed to step #9.
9. Transport time to EVT capable stroke center will not disqualify for thrombolytic.
 - a. If no, proceed to step #13.
 - b. If yes, proceed to step #10.
10. Transport time ≤ 30 minutes total from scene to nearest EVT capable stroke center.
 - a. If no, proceed to step #12.
 - b. If yes, proceed to step #11.
11. Transport to closest CSC or TSC and provide pre-hospital notification.
12. Transport to closest designated stroke center and provide prehospital notification.

13. If no TSC or CSC located within 30 minutes, transport to closest designated stroke center.
Provide prehospital notification.

Minnesota Department of Health
Stroke Program
PO Box 64882
St. Paul, MN 55164-0882
health.stroke@state.mn.us
www.health.state.mn.us

12/20/2022

To obtain this information in a different format, email health.stroke@state.mn.us.