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ISSUE BRIEF

# Time is Brain:
# Improving Rural Stroke Outcomes Through Timely Access to Care

Rural Americans have a lower life expectancy than their urban counterparts, with 7.1% of the mortality deficit attributable to stroke. In addition to having a higher overall incidence of stroke, rural counties have a 30% higher stroke mortality rate compared to urban counties.[1] **When it comes to stroke care, time is brain: for every minute that a stroke is occurring, a patient will lose two million neurons and two weeks of disability free life.**[2,3]

Timely initiation of treatment is critical to reduce morbidity and mortality and to achieve the best possible outcomes related to stroke. Not only do delays impact the amount of damage that a stroke can have on brain tissue, but many of the best stroke treatments must also be initiated within a strict time limit. Yet, rural residents face disproportionate delays in receiving treatment for stroke due to the long travel times and distances to access appropriate levels of care.

Early care for acute stroke begins in the prehospital setting with recognition of stroke symptoms, activating and dispatching EMS to the scene, EMS field assessment, and deciding the most appropriate destination (Figure 1).[4] Rural areas may lack adequate access to emergency medical services (EMS) or medical transport or have long response times due to distance, population density and lack of staffing.[1]

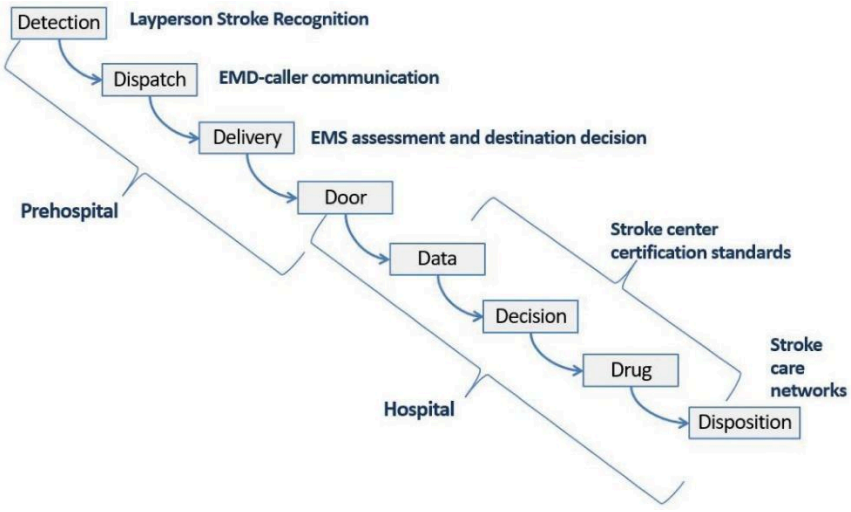


*Figure SEQ Figure * ARABIC 1: Stroke chain of survival within a systems of care framework[4] (EMD = Emergency Medical Dispatcher; EMS = Emergency Medical Services).*

Further complicating timely access to treatment, not all hospitals are equally equipped to provide stroke care. Some rural hospitals lack infrastructure for rapid imaging or may not have the capacity to provide highly specialized treatment. New York State has a three-tiered Stroke Designation System:[5] Primary Stroke Centers are capable of treating

acute ischemic strokes with clot busting medications and supportive care, Thrombectomy Capable Stroke have the same capabilities but can also treat some strokes with endovascular interventions, and Comprehensive Stroke Centers meet the previous requirements and are also capable of treating hemorrhages with neurosurgical intervention (Figure 2).[6] Many rural regions of New York, especially in the North Country region, lack any of the three types of centers. As a result, rural patients often need to be transported further or transferred from a rural center to a more distant hospital offering a higher level of stroke care.

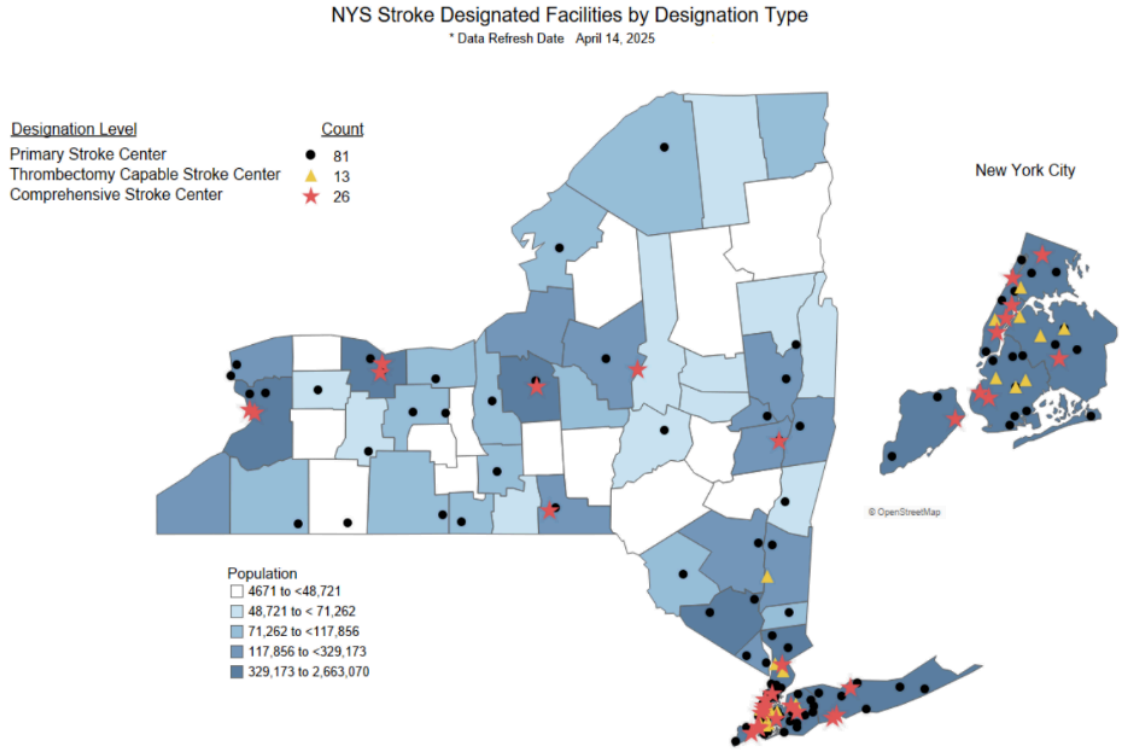


*Figure 2: NYS Stroke Designated Facilities by Designation Type*[6]

### *Time Sensitivity of Stroke Treatment*

Many of the standard of care treatments for stroke must be administered within a certain time from the last time a patient was known to be well.[7] Alteplase (Activase) and Tenecteplase (TNKase) are thrombolytic, clot busting, medications that are used to treat ischemic stroke. Patients are only eligible for this medication within 4.5 hours from the last time the person was known to be at their baseline mental state.[7] Mechanical thrombectomy, where a clot is removed from the brain using minimally invasive procedures, can be done up to 24 hours from the last time the patient was known to be well.[7] Management for hemorrhagic stroke also requires prompt management including blood pressure management, discontinuation of anticoagulation medications, platelet

transfusions, and surgical management such craniotomy or drain insertion. Stroke patients also require access to neuroimaging including MRI and CT, airway management, blood pressure management, and assessment and treatment of other symptoms.[7]

In addition to the morbidity and mortality benefits of ensuring timely access to stroke care, every minute saved during transfer from initial to definitive care yields a $1,000 saving on medical costs.[8] The total cost of caring for acute stroke in the United States is estimated to be $34 billion; it costs an average of $59,900 per patient per year for acute inpatient care, and $140,048 per person per year if inpatient rehab and follow up care is included.[9] It is therefore in the best interest of multiple stakeholders to reduce morbidity and mortality from stroke.

***Pre-Hospital Stroke Management: Reducing Delays to Accessing Care***

Emergency medical dispatch is an important piece of the puzzle in determining care.[10] Dispatchers must be able to recognize stroke symptoms quickly and efficiently. The American Heart Association (AHA) recommends that the call taker at dispatch should be able to gather the critical logistical information and determine the type of emergency within one minute.[4] This relies on both the 911 operator to recognize the symptoms of a possible stroke and the caller's ability to communicate the symptoms to dispatch. Layperson recognition of stroke and language to describe stroke is often poor and can impact these times. When dispatch is able to quickly recognize a stroke, EMS professionals are able to reduce time spent on scene, increase the likelihood of transporting the patient to the appropriate hospital or stroke center, and achieve higher and quicker rates of thrombolysis administration.[4] Despite the importance of the role of EMS dispatch, the ability of a dispatcher to recognize stroke within one minute is low, especially without access to structured stroke recognition protocols.

Emergency Medical Technicians (EMTs) play a critical role in early pre-hospital management of stroke, performing on-scene assessment and ongoing monitoring of airway, breathing, circulatory status, blood glucose, and vital signs. They also perform a review of medications, establish IV access, determine stroke severity and perform the initial neurological exam.[8] EMTs care for stroke patients while transporting them to the most appropriate hospital to obtain optimal levels of care.

The highest pre-transportation stroke death rates in New York are primarily in rural regions of the state, including central and western regions (Figure 3).[11] It is therefore critical to address the gap in mortality for rural stroke patients in regions that have less access to Stroke Designated Hospitals.

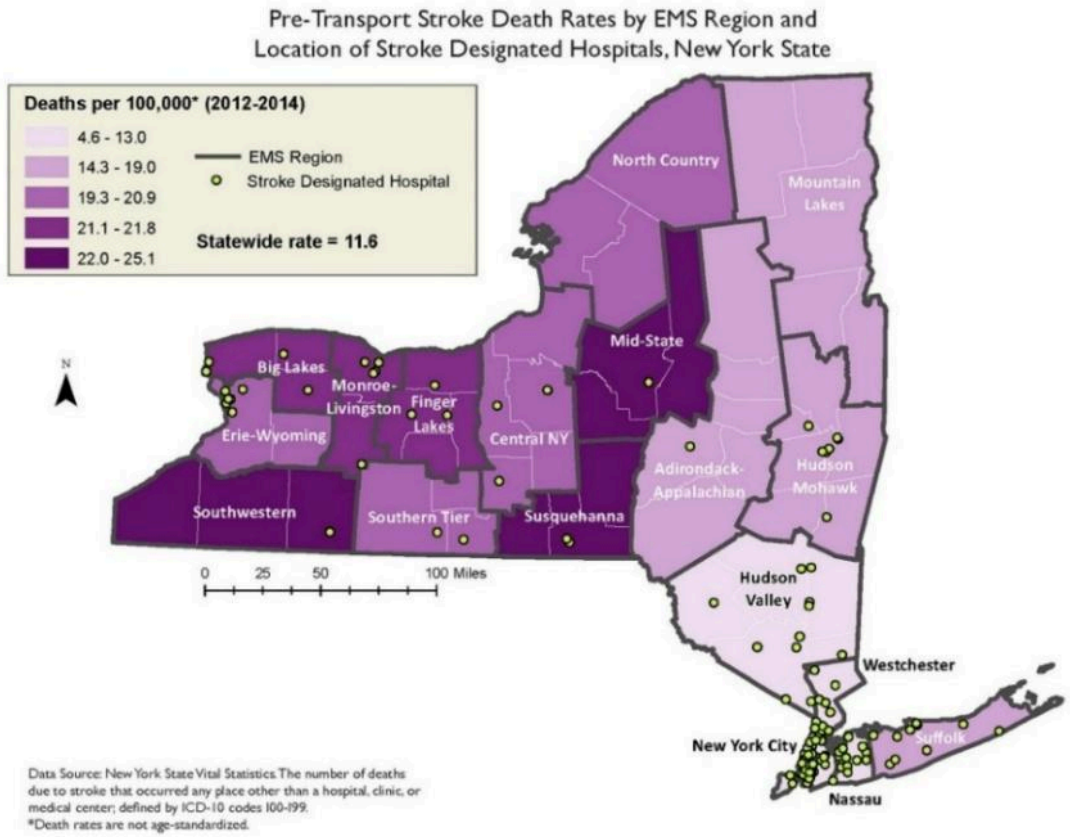


*Figure 3: Pre-transport stroke death rates by EMS region and Location of Stroke Designated Hospitals*[11]

## Statement of the Issue

Early identification and rapid treatment are keys to reducing morbidity and mortality from stroke. Rural strokes can be particularly devastating because of the time and distance required to access definitive care. Delays of care can begin in the prehospital setting, resulting from a lack of access to prehospital stroke assessment tools, lack of real-time routing and bypass data, and variability in accessibility of EMS and training of EMTs.

## Analysis of Current Policy

### *New York State Policy*

NYS DOH manages the Stroke Designation Program,[5] classifying qualified hospitals into the three types of stroke centers previously discussed.[12] Hospitals can be designated within the state system provided that they are certified by a national accrediting body (such as the Joint Commission on Accreditation of Healthcare Organizations, JCAHO).[12] To be certified as a Primary Stroke Center, the lowest level of designation, hospitals must have

certain technological and procedural capabilities and must meet several requirements relating to minimum staffing. Minimum staffing requirements are barrier to certification for many rural hospitals that struggle to recruit and maintain healthcare professionals in all roles and responsibilities. Stroke centers are required to report performance measures to the NYS DOH as outlined in the NYS Stroke Center Guidance Document.[12]

EMS practice is regulated through the Education and Certification Unit of the NYS Bureau of EMS[13] which ensures that educational programs meet the standards set forth by the National Highway Traffic Safety Administration's (NHTSA) National Standard Curriculum.[14] This standard curriculum for the nation does not explicitly cover the issue of rural stroke, nor does it teach EMS professionals how to select the most appropriate facility for optimal stroke care.

New York State Department of Health (NYS DOH) maintains Statewide Adult and Pediatric Treatment Protocols which outline the procedures for management of acute conditions including stoke.[15,16] According to these protocols, suspected stroke patients should receive an initial neurological assessment by EMS and to determine the patient's time of symptom onset. If the patient can arrive at a NYS DOH Designated Stroke Center within 3.5 hours of their symptoms beginning, EMS should select that destination hospital.[15,16] However, the guidance also allows for local medical control to select an alternative destination facility if regionally appropriate. While allowing for locally-determined destination decisions helps to account for regional differences in access to care, the lack of clear, specific and organized statewide guidelines may create confusion and introduce ambiguity in determining the most appropriate destination. These protocols also do not agree with national guidance from the American Stroke Association, as discussed below.[17]

***National Policy***

Federal EMS oversight and funding comes from the Office of EMS under the National Highway Traffic Safety Administration within the US Department of Transportation. NHTSA creates minimum standards for scope of practice and gives federal funding to agencies.[14] The majority of EMS regulation and funding is not done at the federal level; rather, the Office of EMS supports and promotes state and local EMS agencies.

National accrediting bodies have a different stroke designation program from that used by New York State. For example, the Joint Commission, American Heart Association, and American Stroke association provides certifications for four types of acute stroke centers: Comprehensive Stroke Centers, Thrombectomy-Capable Stroke Centers, Primary Stroke Centers, and Acute Stroke Ready Hospitals.[18] While this partially aligns with the three-tiered New York State system, the "Acute Stroke Ready Hospital" is a lower level of stroke care than the lowest tier in our state. This designation does not require a dedicated stroke unit or beds, but does require a 24/7 acute stroke team, a knowledgeable program

medical director, 24/7 CT imaging, and written protocols for neurological services and neurointerventional services.[19] Many rural hospitals that do not meet the Primary Stroke Center standards set out by New York State do have the capabilities required of Acute Stroke Ready Hospitals.

The American Stoke Association's Prehospital Stroke System of Care Consensus Conference provided recommendations for selecting the most appropriate destination[17] which differ from the New York State protocols. They recommend that unless there is a Comprehensive Stroke Center within 60 minutes transport time from the scene, EMS should transport to the nearest Primary Stroke Center. If transportation to the Primary Stoke Center would take more than 30 minutes beyond the time it would take to deliver the patient to the nearest Acute Stroke Ready Hospital, then the closest hospital should be selected (Figure 4)[17].

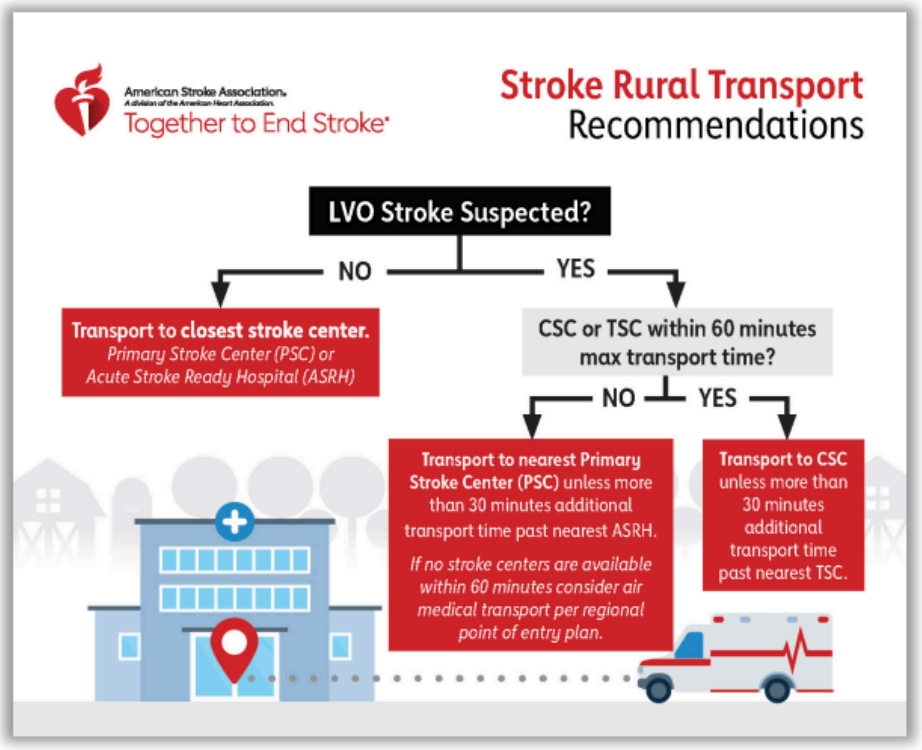


*Figure 4: Stroke Rural Transport Recommendations*[17]

## Opportunities for Improving Timely Access to Care in the Pre-Hospital Period

### I. Improving Identification and Assessment of Stroke

**a.** Design and implement public health campaigns to educate laypersons about recognizing and communicating stroke symptoms

**i.** *Similar to F.A.S.T. or Back to Sleep, funding should be allocated to the development and creation of a public health awareness campaign that is more expansive than F.A.S.T. and includes awareness of the time sensitive nature of stroke care.*

**ii.** *Layperson education on the language and symptomology of stroke can facilitate 911 dispatch information gathering and improve EMS outcomes. This should be adapted to rural areas.*

b. Improve 911 dispatch training for the recognition of stroke via layperson stroke language.

i. *Require 911 dispatcher training to include strategies for effective recognition of layperson language for stroke and to optimize the national algorithm for EMS dispatcher recognition to emphasize stroke symptoms such as asymmetric motor deficits.*[10]

c. Reduce variations in pre-hospital stroke care by standardizing the adoption of a single stroke assessment tool and providing more nuanced care pathways to select the most appropriate destination hospital.

*i. Develop clear algorithms for medical decisions in the field, including the implementation of a single stroke assessment scale statewide (NYSDOH currently recommends the Cincinnati Prehospital Stroke Scale; FAST-ED may provide a more sensitive assessment*[20,21]*).*

*ii. Implement routing and bypass decisions based on standardized interpretation of stroke scale tools.*

II. **Improve Selection of the Most Appropriate Facility for Stroke Care**

1. Acknowledging the sparsity of Stroke Designated Hospitals in rural areas of the state, include non-stroke designated hospitals in the algorithms for selecting the most appropriate destination hospital for stroke patients.

**2.** Facilitate adoption of live mapping capabilities for EMS and hospitals to use for thrombectomy-capable centers including traffic and weather conditions as well as operator availability and hospital capacity

***1.*** *EMS professionals would be able to utilize the map in conjunction with medical decision making and dispatch instruction in order to optimize*

*patient transport to the appropriate level of care while balancing the impact of travel time on patient care and outcomes.*

2. *Local agencies would be given grants through the Department of Transportation to cover the cost for implementing tracking and transmitting capabilities for ambulances and paramedic cars*
3. *Data would be sent to a statewide live map managed by the Department of Transportation with independent agencies having some management capabilities.*
4. *Private companies such as Angel Track and LiveViewGPS have similar technology that can be utilized in implementing tracking capabilities and building of a statewide, standardized live map.*

3. Require hospitals to participate in real time data sharing for stroke capabilities, wait-times, and door to care times.
    1. *Hospitals that receive Medicare and Medicaid funding or participate in other government funding programs and are also certified stroke centers would be required to participate in real time data sharing with 911 dispatch, the EMS live map for stroke care, local EMS agencies and other stroke centers in order to facilitate medical decision making in the field and the transfer of patients to higher levels of care.*
    2. *This data would be combined with the live map to optimize medical decision making for transportation to appropriate level of care for suspected strokes. This can be further utilized for other time sensitive conditions such myocardial infarctions.*

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