

# VIRGINIA DEPARTMENT OF HEALTH 2023 EMS STROKE INVENTORY SURVEY

A Collaboration between the Virginia Department of Health Office of Family Health Services and Virginia Department of Health Office of Emergency Medical Services with funding support from the CDC Paul Coverdell National Acute Stroke Program

*Please email [stroke@vdh.virginia.gov](mailto:stroke@vdh.virginia.gov) for any questions.*

## Table of Contents

Background .....	3
Virginia Pre-hospital Information Bridge (VPHIB) .....	3
Recommendations Identified by VDH Stroke Team .....	4
Virginia Department of Health 2023 EMS Stroke Inventory Survey Result Summary .....	5
SURVEY RESPONSE .....	5
STROKE ASSESSMENT SCALES .....	5
EMS STROKE ASSESSMENT and MANAGEMENT .....	8
EMS and EMERGENCY DEPARTMENT .....	10
QUALITY IMPROVEMENT .....	12
EMS – HOSPITAL INTEGRATION .....	14
HOSPITAL TRANSPORT .....	17
References .....	21
Appendices .....	23
Appendix A: .....	23
Appendix B: .....	24

## Background

In accordance with the *Code of Virginia* §32.1-111.15:1, the Virginia Department of Health (VDH) collected data and information from hospitals and emergency medical services (EMS) agencies through a stroke inventory survey to facilitate the evaluation and improvement of stroke care in Virginia. The results of the survey will be used to inform quality improvement initiatives, identify interventions in specific geographic areas of the Commonwealth, and support appropriate allocation of resources throughout the Commonwealth. The EMS Stroke Survey Workgroup, a subgroup of the Virginia Stroke Care Quality Improvement Advisory Group, convened in 2019 to develop the EMS Stroke Inventory Survey.

In 2021, VDH's Office of Family Health Services (OFHS) was awarded the Centers for Disease Control and Prevention (CDC) Paul Coverdell National Acute Stroke Program funding. The additional support and collaboration from this funding initiative supported VDH's efforts to launch the Virginia EMS Stroke Inventory Survey in 2022. The completion and distribution of the second annual Virginia EMS Stroke Inventory Survey was a collaborative effort between the OFHS and the Office of EMS (OEMS). The VDH Stroke Team used a new distribution list in 2023, provided by the OEMS with target recipients of EMS agency chiefs, directors, lead administrators, and CEOs.

This report includes results and recommendations provided by the VDH Stroke Team are based on responses to the EMS Stroke Inventory Survey, supplemental stroke research literature, and are accompanied by statewide pre-hospital data pulled from the Virginia Pre-Hospital Information Bridge (VPHIB).

### **Virginia Pre-Hospital Information Bridge (VPHIB)**

Data collected from the 2023 EMS Stroke Inventory Survey were compared to data pulled from the Virginia Pre-Hospital Information Bridge (VPHIB) program (Elite v3) maintained by the VDH OEMS.

VPHIB houses EMS patient care data extracted from patient medical records submitted by EMS agencies. Data summarized in this report represent EMS responses that occurred between January 1, 2022 and December 31, 2022. VPHIB v3 data are based on the National EMS Information System (NEMSIS) standards.

The dataset used from VPHIB contained 19,711 records. Data presented in this report are as of August 16, 2023 and may have changed as additional information was submitted to VPHIB. The below inclusion and exclusion criteria were applied to this data extraction:

#### Inclusion:

1. Unit Notified by Dispatch Date was between January 1, 2022 and December 31, 2022, and
2. Type of Service Requested was equal to 911 Response (Scene), and
3. Patient Disposition was equal to Patient Treated, Transported by this EMS Unit, and
4. The patient record met the August 26, 2021 NEMSIS v3 case definition for stroke (available at [https://nemsis.org/media/nemsis\\_v3/master/CaseDefinitions/Stroke.pdf](https://nemsis.org/media/nemsis_v3/master/CaseDefinitions/Stroke.pdf)).

#### Exclusion:

1. Records with a submission status of "Failed", and

2. Records with a destination name indicating transfer to another EMS unit (i.e., records that contradict with the inclusion criteria of patient disposition = patient treated and transported by EMS unit).

## Recommendations Identified by VDH Stroke Team

The VDH Stroke Team identified the following recommendations to further improve stroke care and stroke outcomes across Virginia based on the responses to the 2023 EMS Stroke Inventory Survey.

1. OEMS should include resource documents in the OEMS State Stroke Triage Plan that describe recommended stroke screening scales and stroke severity scales. The inclusion of such documents would improve stroke recognition by EMS personnel.
2. OEMS should explore barriers regarding the low blood glucose completion rates among the EMS agencies in regional councils who reported significantly lower rates compared to the rate calculated from the acquired VPHIB data (40% completion rate in some regional councils versus 87.4% completion rate calculated from VPHIB data) and provide additional education to EMS clinicians on need to complete and document point of care blood glucose.
3. Stroke education should be provided to EMS personnel regarding the 24-hour treatment window for patients with a potential large vessel occlusion (LVO).
4. A partnership between OEMS and the VDH Stroke Team should explore barriers EMS personnel face that inhibit them from taking suspected stroke patients to CT in the hospital setting. Future Virginia Stroke Coordinators Consortium (VSCC) and/or VDH Stroke Coffee Hour meetings should focus on such topic to gather input from Virginia hospital stroke coordinators.
5. The Stroke Team should investigate utilizing the OEMS and VDH Stroke Program website pages to provide state-level information regarding current stroke-related quality improvement projects related to acute stroke care assessment and treatment and how these projects are improving stroke care in Virginia.
6. The VDH Stroke Team should utilize the Virginia Stroke Systems Task Force (VSSTF) EMS Workgroup and EMS Regional Councils to look for best practices currently in place for hospital and EMS feedback regarding final diagnosis and patient outcomes, including routine stroke-focused feedback meetings.
7. OEMS should consider statewide bypass protocols for patients with a suspected LVO in regions with a thrombectomy-capable stroke center (TSC) or comprehensive stroke center (CSC) within a recommended travel distance.
8. The VDH Stroke Team should continue encouraging non-certified stroke facilities to pursue stroke certification as part of the standing VDH and Virginia Hospital and Healthcare Association (VHHA) collaboration.

# Virginia Department of Health 2023 EMS Stroke Inventory Survey Result Summary

## SURVEY RESPONSE

A total of 130 complete responses were obtained from 548 EMS agencies that received the 2023 Stroke Inventory Survey, for a total response rate of 23.7%. Table 1 shows the count (and percent) of responses by EMS Regional Council. EMS agencies operating within each Virginia EMS Regional Council responded to the survey; as such, all regional councils are represented in the analyses. Of note, some EMS agencies operate within multiple regional councils. Each report of an EMS agency operating in a regional council was tallied.

Table 1. Count of EMS Stroke Inventory Survey Responses by EMS Regional Council, Virginia, 2023

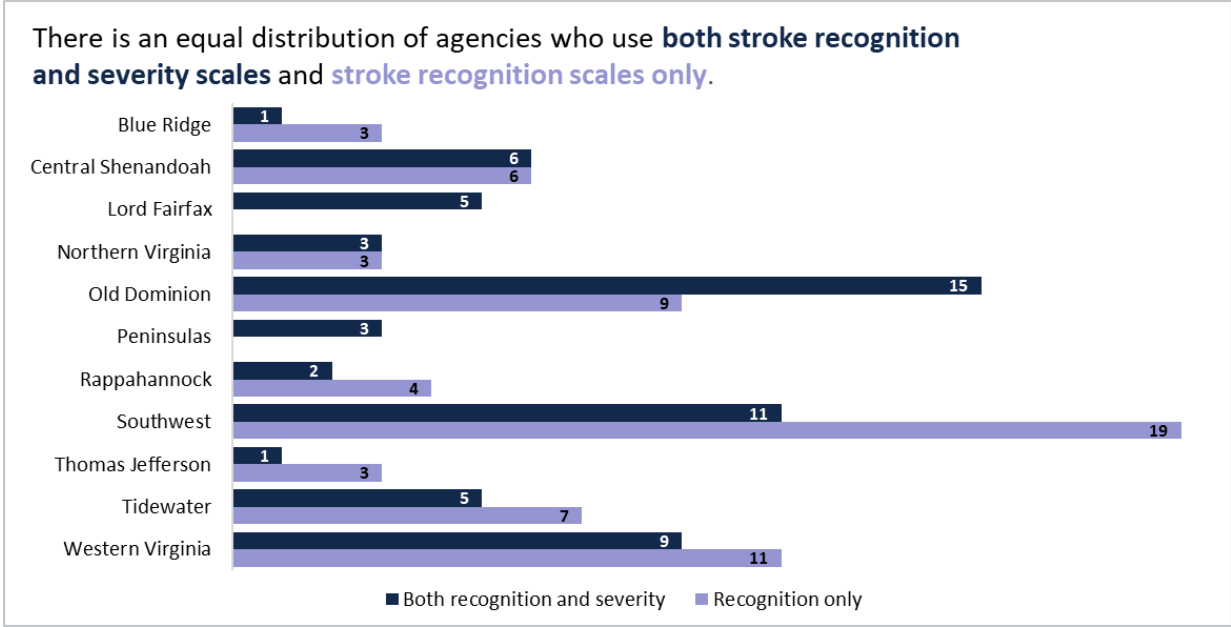
EMS Regional Council	Count of Responses (%)
Blue Ridge	4 (3.1)
Central Shenandoah	12 (9.2)
Lord Fairfax	5 (3.8)
Northern Virginia	6 (4.6)
Old Dominion	23 (17.7)
Peninsulas	5 (3.8)
Rappahannock	6 (4.6)
Southwest Virginia	31 (23.8)
Thomas Jefferson	4 (3.1)
Tidewater	14 (10.8)
Western Virginia	20 (15.4)
<b>Grand Total</b>	<b>130 (100.0)</b>

Compared to the 2022 EMS Stroke Inventory Survey, the 2023 survey saw a 48% decrease in the number of responses received, decreasing from 251 to 130. Southwest Virginia, Western Virginia, and Old Dominion EMS councils provided the greatest number of responses across both the 2022 and 2023 implementations of the EMS Stroke Inventory Survey.

## STROKE ASSESSMENT SCALES

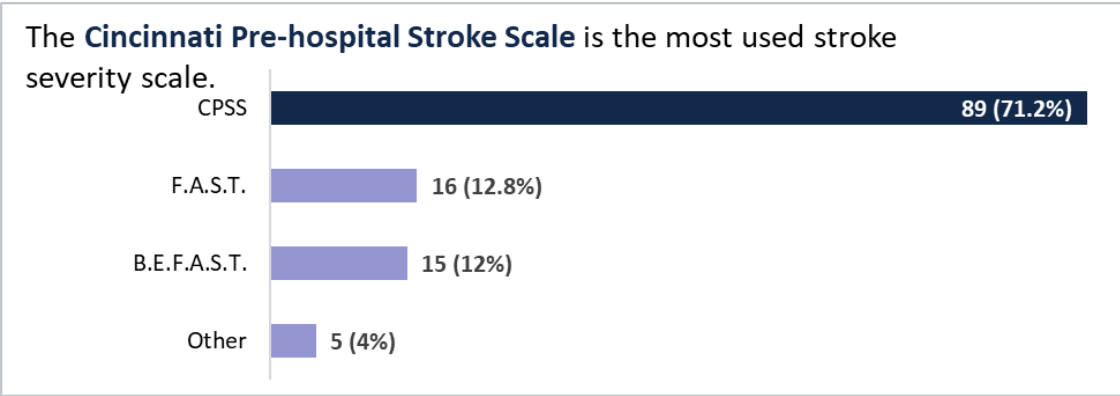
There was an almost equal distribution of Virginia EMS agencies that reported using either only stroke recognition scales (n=65, 51.6% of 126 responses) or both stroke recognition and severity scales (n=61, 48.4%). In six regions, a higher proportion of EMS agencies used only stroke recognition scales compared to agencies that used both stroke recognition and severity scales (Figure 1).

Figure 1. Stroke Scale Use by EMS Regional Council, Virginia, 2023 (n=126 responses)



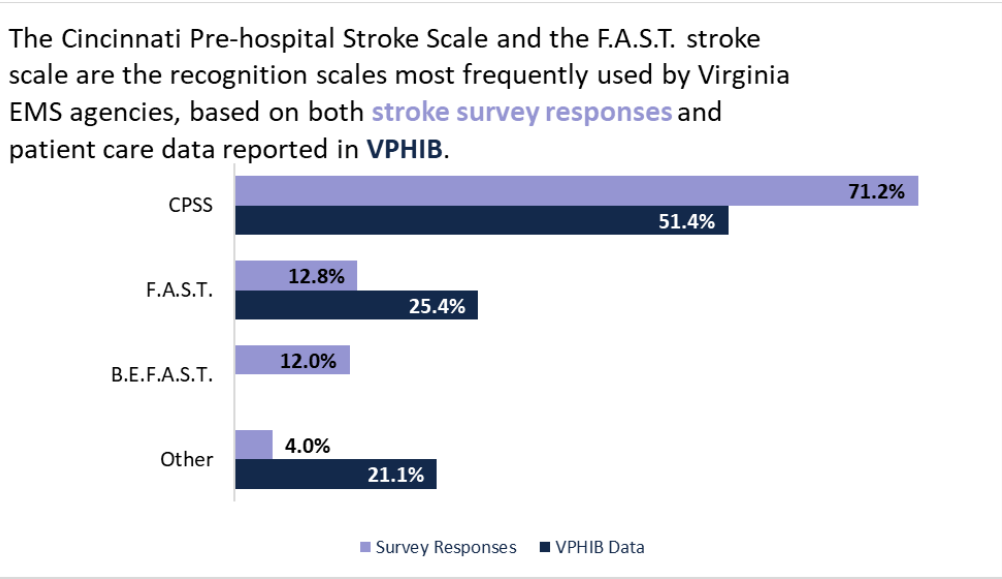
The Cincinnati Pre-hospital Stroke Scale (CPSS) is the stroke **recognition** scale Virginia EMS agencies report using most frequently (89 out of 125 responses, 71.2%) compared to other stroke recognition scales (Face, Arms, Speech, Time (F.A.S.T.) Exam: 16, 12.8%; Balance, Eyes, Face, Arm, Speech, Time (B.E.F.A.S.T.) Exam: 15, 12.0%), shown in Figure 2.

Figure 2. Stroke Recognition Scale Use by EMS Agencies, Virginia, 2023 (n=125 responses)



Consistent with the survey results, the VPHIB data also identified CPSS and F.A.S.T. as the top two stroke recognition scales used by EMS (Figure 3).

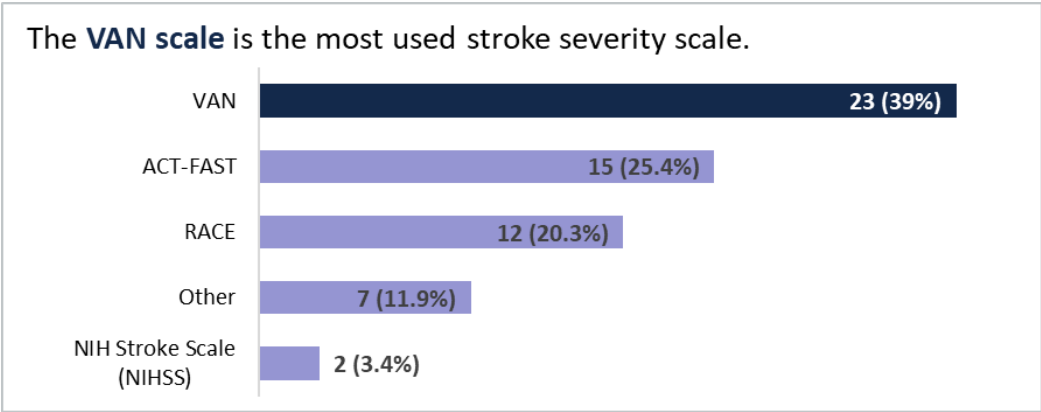
Figure 3. Stroke Recognition Scale Use Comparison Between Survey Responses and VPHIB Data, Virginia, 2023



This pattern continues when looking at individual EMS Regional Councils except for two (i.e., Tidewater and Rappahannock) where the B.E.F.A.S.T. Exam is reported to be used more often than CPSS (Tidewater: six EMS agencies use B.E.F.A.S.T., while four use CPSS; Rappahannock: three agencies use B.E.F.A.S.T., while two use CPSS).

The Vision, Aphasia, Neglect (VAN) scale is the stroke **severity** scale Virginia EMS agencies report using most frequently (23 out of 59 responses, 39.0%) followed by ACT-FAST (n=15, 25.4%) and the Rapid Arterial Occlusion Evaluation (RACE) scale (n=12, 20.3%), shown in Figure 4.

Figure 4. Stroke Severity Scale Use by EMS Agencies, Virginia, 2023 (n=59 responses)



Six (6) EMS Regional Councils (i.e., Western Virginia, Rappahannock, Old Dominion, Northern Virginia, Central Shenandoah, Blue Ridge) reported using VAN as their preferred stroke severity scale, while three (3) EMS Regional Councils (i.e., Tidewater, Thomas Jefferson, Southwest) reported using ACT-FAST most often and two (2) (i.e., Peninsulas, Lord Fairfax) reported using RACE most often.

### Care Guideline and Related Research:

The American Heart Association/American Stroke Association (AHA/ASA) Advanced Cardiac Life Support program, established in 2000, provides a Stroke Chain of Survival (SCOS) which outlines actions to be taken by patients, family members, and health care providers to improve survival from a stroke. The SCOS consists of four components: (1) stroke is recognized and 911 or EMS is called, (2) EMS dispatch provides early recognition and rapid priority dispatch, (3) EMS arrives at scene and provides stroke assessment, and (4) EMS provides pre-notification and rapidly transports to a hospital (Jauch, et al., 2021). Integral to the SCOS is EMS' ability to rapidly dispatch personnel, conduct early recognition, and complete on-scene stroke assessments (Jauch, et al., 2021). The 2019 *Recommendations for the Establishment of Stroke Systems of Care* recognizes the role of prehospital stroke screening tools as “an important aspect of stroke care” (Adeoye, et al., 2019, pg. e191).

The 2019 *Guidelines for the Early Management of Patients with Acute Ischemic Stroke*, herein referred to as *Acute Ischemic Stroke Guidelines*, recommend the use of a stroke recognition scale by EMS (Powers, et al.). The CPSS is the most widely used EMS stroke recognition scale (American Stroke Association, 2022; Adeoye, et al., 2019; American Heart Association, 2020). *Mission: Lifeline Stroke* recognizes several stroke recognition tools, to include the CPSS, F.A.S.T., and Miami Emergency Neurologic Deficit (MEND) exam. A 2022 systematic review and meta-analysis comparing F.A.S.T. and B.E.F.A.S.T. found that both might be useful in the diagnosis of acute ischemic stroke (AIS), but B.E.F.A.S.T. was found to have a slightly better diagnostic ability than F.A.S.T. (Chen, et al., 2022).

Once a patient has a positive stroke screen, current guidelines support the utilization of a stroke severity scale to assess for a possible large vessel occlusion (LVO), a specific type of stroke that carries a high risk of disability and mortality (American Heart Association, 2020). *Mission: Lifeline Stroke* recognizes several stroke severity scales, including the Cincinnati Stroke Triage Assessment Tool (C-STAT), RACE, Los Angeles Motor Scale (LAMS), VAN, and Facial palsy, Arm Weakness, Speech changes, Time, Eye deviation, Denial/neglect (FAST-ED) Scale (American Heart Association, 2020).

The *Acute Ischemic Stroke Guidelines* further recommend the support of local, regional, and statewide adoption of a single, valid evidence-based stroke recognition tool and severity scale by all EMS agencies (Jauch, et al., 2021). There is currently no evidence that supports one stroke recognition scale or stroke severity scale over another (American Stroke Association, 2022).

### **EMS STROKE ASSESSMENT and MANAGEMENT**

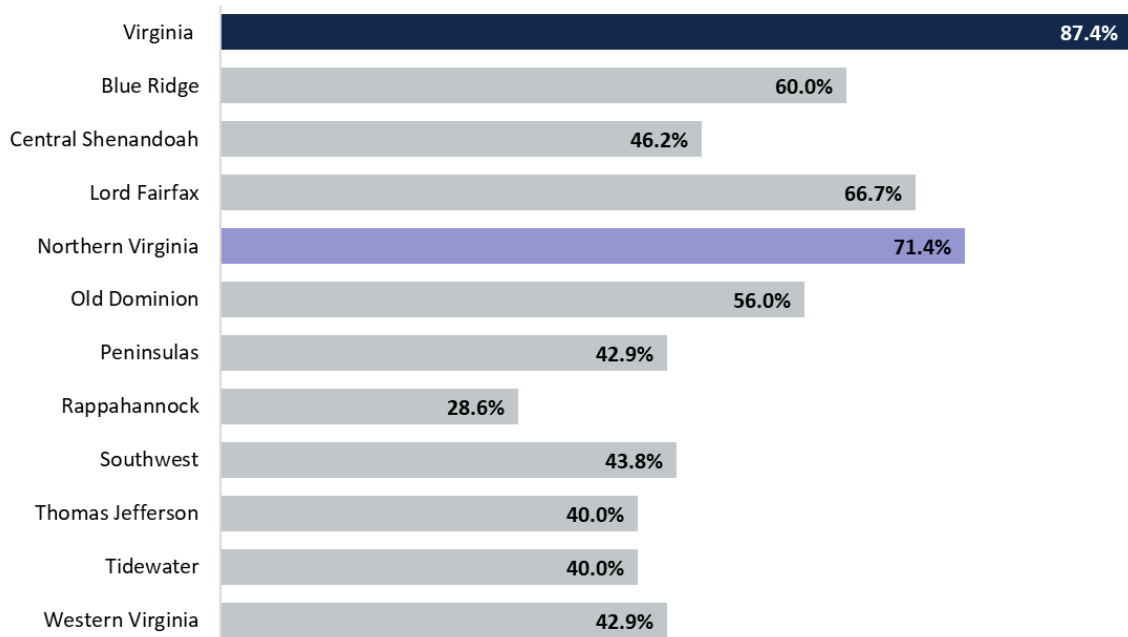
Less than half (n=56, 43.1%) of Virginia EMS agencies who responded to the survey report being aware of their current stroke scale completion percentage. Of those 56 agencies, 45 (80.4%) report having between 76-100% stroke scale completion percentage.

More than half (n=82, 63.1%) of Virginia EMS agencies report being aware of their current blood glucose test completion rate for suspected stroke patients. Of those 82 agencies, 69 (84.1%) report a completion rate greater than 75%. This completion rate is similar to the blood glucose completion rate calculated from stroke patient data reported in VPHIB (i.e., 87.4% for 2022), shown in Figure 5.

Figure 5. EMS Agency Blood Glucose Completion Rate by Virginia EMS Regional Council Compared to Statewide Completion Rate Calculated from VPHIB, Virginia, 2023 (n=82 responses).



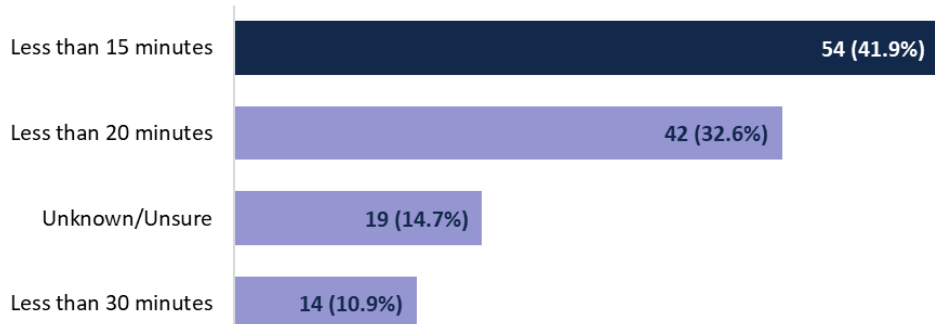
**Northern Virginia** has the highest blood glucose completion rate of all regions.



AHA/ASA recommends EMS on-scene time duration for suspected stroke patients to be less than 15 minutes. Less than half (54, 41.9% of 129 responses) of Virginia EMS agencies reported, on average, meeting that criterion in 2022 (Figure 6).

Figure 6. Average On-Scene Time for EMS Agencies Responding to Stroke Patients, Virginia, 2023 (n=129 responses)

Only 41.9% of agencies meet the recommended criterion of an on-scene time of **less than 15 minutes** for suspected stroke patients.



### Care Guideline and Related Research:

Current recommendations for EMS Stroke Assessment and Management include checking blood glucose levels, if possible, and minimizing on-scene time to 15 minutes or less (American Stroke Association, 2022; American Heart Association, 2020).

*The Recommendations for Regional Stroke Destination Plans in Rural, Suburban, and Urban Communities from the Prehospital Stroke System of Care Consensus Conference: A Consensus Statement* by Jauch, et al. (2021), herein referred to as *Recommendations for Regional Stroke Destination Plans*, provides examples of quality-based performance measures, including the following:

- 911 dispatcher use of suspected stroke patient algorithms,
- Documentation of last known well (LKW) and symptom discovery times by EMS clinicians,
- Point of care (POC) glucose performance by EMS clinicians,
- Stroke screen performance and reporting by EMS clinicians,
- Stroke severity screen performance and reporting by EMS clinicians, and
- Adherence to an on-scene time of 15 minutes or less by EMS clinicians.

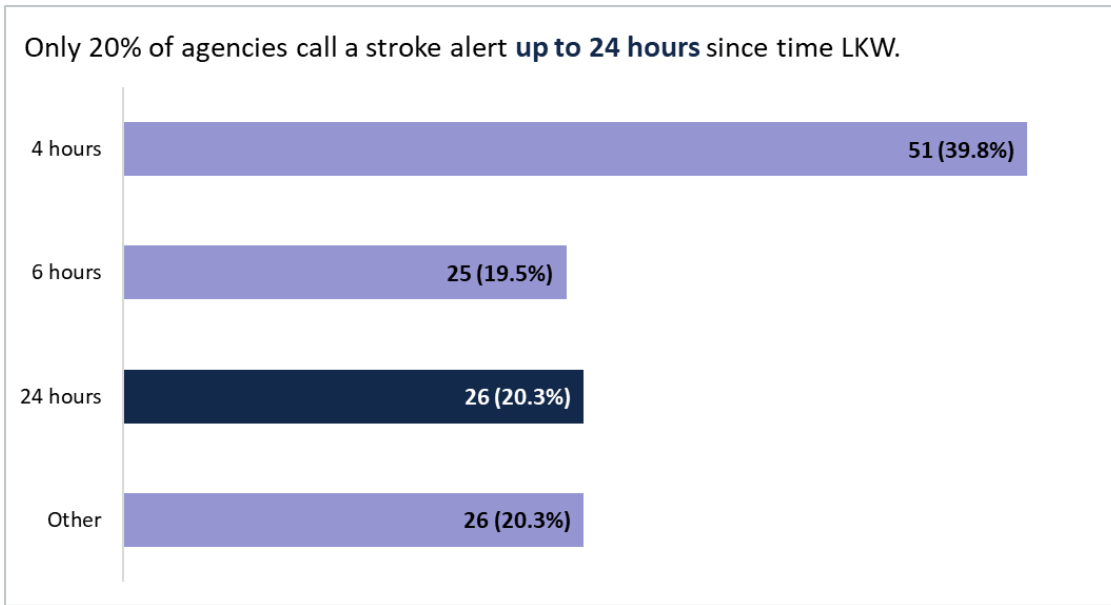
Retrospective analysis from Florida's Emergency Medical Services Tracking and Reporting System database found that two pre-hospital EMS stroke interventions seemed to reduce prehospital time for patients with a suspected stroke: (1) stroke notification reported by the dispatch center and (2) use of a stroke severity scale by EMS personnel (Heemskerk, et al., 2021).

The 2023 EMS Stroke Survey inquired about the completion rate of blood glucose testing by EMS with only one region reporting a completion rate of greater than 70%. Low blood glucose is a common stroke mimic and EMS assessment prior to hospital arrival assists in stroke recognition and treatment options (Powers, et al, 2019).

### **EMS and EMERGENCY DEPARTMENT**

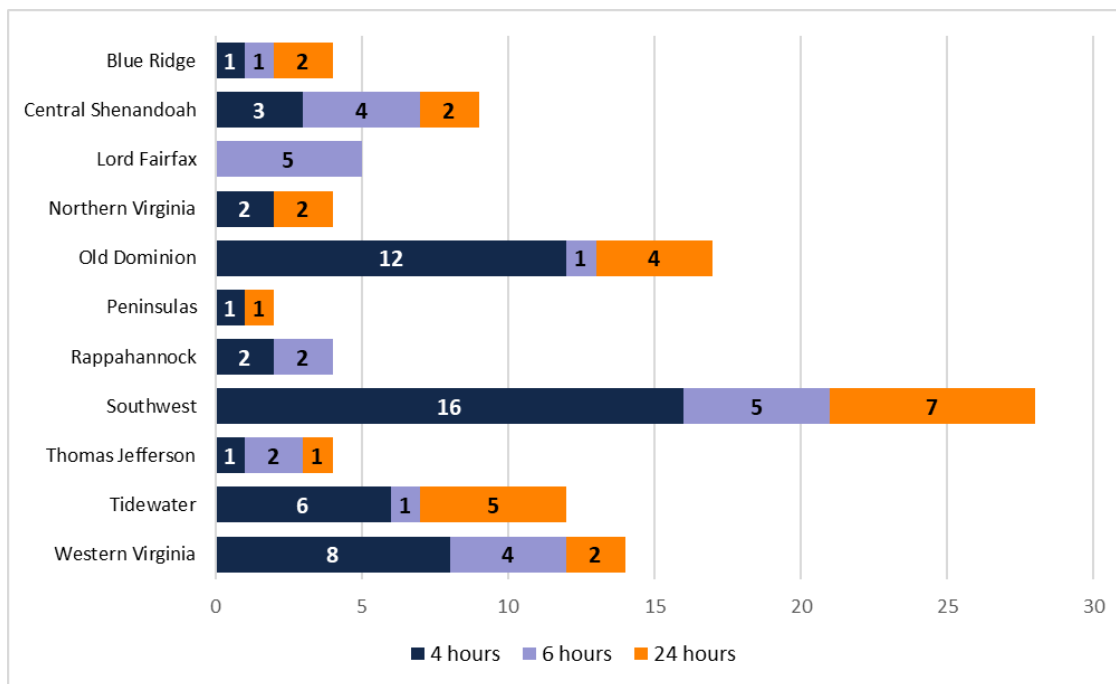
Of the 130 Virginia EMS agencies that responded to the survey, 26 (20.0%) EMS agencies reported calling a stroke alert up to 24 hours past a suspected stroke patient's time of last known well (LKW). This metric, updated by AHA/ASA in 2018, allows many patients to receive thrombectomy treatment, if eligible. This is a slight decrease from the 22.0% of EMS agencies that reported calling a stroke alert up to 24 hours since time LKW in the 2022 EMS Stroke Inventory Survey. Most agencies (51, 39.2%) report calling a stroke alert up to 4 hours past a suspected stroke patient's time of LKW.

Figure 7. Time Since LKW EMS Agencies Call a Stroke Alert, Virginia, 2023 (n=128 responses)



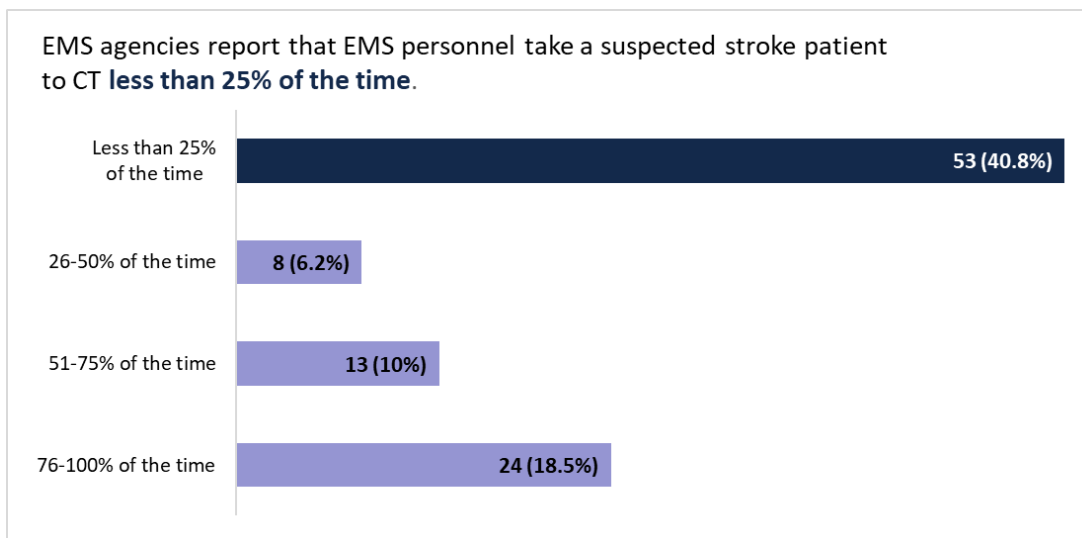
When analyzed by region, four EMS Regional Councils (i.e., Old Dominion, Southwest, Tidewater, Western Virginia) have a larger number of EMS agencies that report calling stroke alerts up to 4 hours past LKW time. Three EMS Regional Councils (i.e., Central Shenandoah, Lord Fairfax, Thomas Jefferson) have a larger number of EMS agencies that report calling stroke alerts up to 6 hours past LKW time. One EMS Regional Council (i.e., Blue Ridge) has most agencies that report calling stroke alerts up to 24 hours past LKW time.

**Figure 8. Time Since LKW EMS Agencies Call a Stroke Alert by EMS Regional Council, Virginia, 2023 (n=128 responses)**



The majority of EMS agencies report that EMS personnel report taking suspected stroke patients directly to the CT scanner upon hospital arrival less than 25% of the time (Figure 9). The remaining 32 survey respondents answered with “Unknown/Unsure”.

Figure 9. EMS Agencies Report EMS Personnel Taking Suspected Stroke Patients to the CT Scanner, Virginia, 2023 (n=130 responses)



#### Care Guideline and Related Research:

Prior to 2018, the window to administer stroke therapy was up to 4.5 hours for thrombolytic therapy and capped at 6 hours for thrombectomy (Powers, et al., 2019). In 2018, the window for stroke treatment was extended to 24 hours for a select number of patients who are suffering from a LVO (Nogueira, et al., 2018). The *Acute Ischemic Stroke Guidelines* further support this expanded window and recommend that stroke systems of care should be developed to address screening for protentional thrombolytic and thrombectomy treatment, as well as pre-alerting the hospital so that hospital resources can be available when the patient arrives (Powers, et al.). Jauch, et al. (2021) recommend the development of “uniform and integrated pre-hospital stroke notification protocols with their receiving stroke hospitals” (pg. E141).

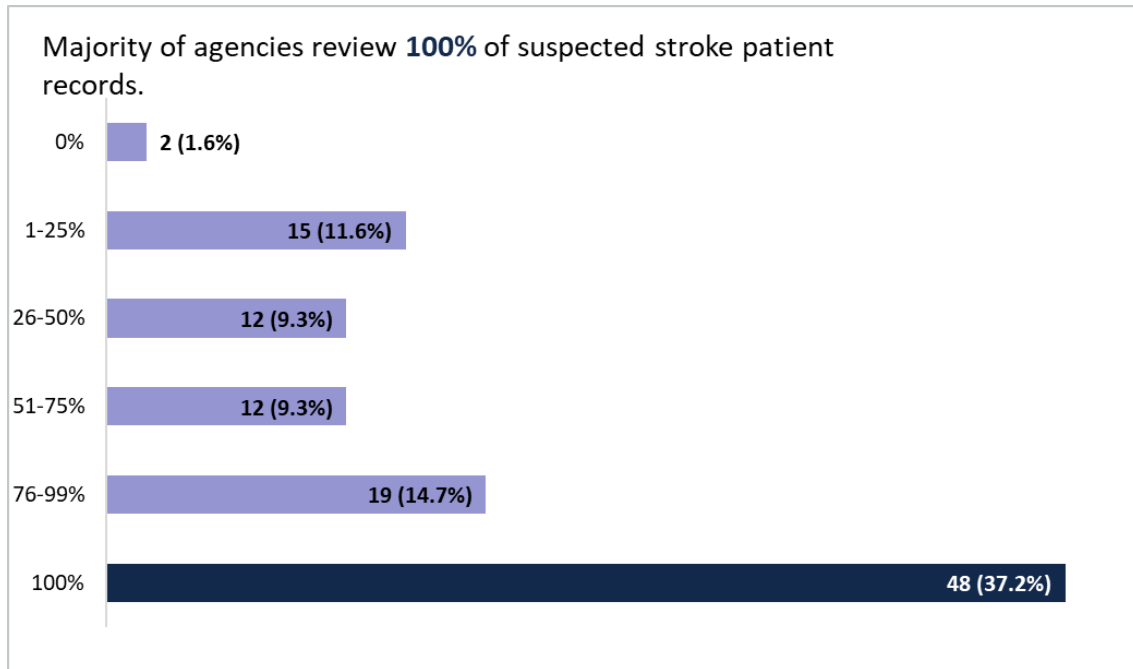
*Target: Stroke Phase II* (2017) suggests the rapid assessment of a potential stroke patient by an emergency department (ED) physician while remaining on the EMS stretcher as a recommended strategy for best practice. A related strategy also suggests subsequent transport to the CT scanner by EMS personnel after a physician’s initial assessment. Additionally, the *Recommendations for Regional Stroke Destination Plans* recommend parallel strategies, such as EMS direct transport to the CT scanner as a method of rapid evaluation and decision making for the stroke patient (Jauch, et al., 2021).

#### **QUALITY IMPROVEMENT**

The majority of Virginia EMS agencies (n=67, 51.9% of 129 responses) reported EMS clinicians submit over 75% of suspected stroke patients’ records to the agency for quality improvement purposes. Forty-

eight of those agencies reported EMS clinicians submit 100% of suspected stroke patients' records for quality improvement purposes, shown in Figure 10.

Figure 10. Frequency of EMS Agency Review of Stroke Patient Records, Virginia, 2023 (n=129)



Half of the EMS agency survey respondents (n=65, 50.0%) shared topics of their agency's on-going stroke-related improvement projects, shown below in Table 2.

Table 2. Most Frequently Reported On-Going Stroke-Related Quality Improvement Projects Implemented by EMS Agencies, Virginia, 2023

Project Topic	Number of Responses
Training drills & stroke education	13
Improving the use of stroke scales	11
Symptom recognition (i.e., quick, subtle, abnormal)	9
Quick Transfer	9
Stroke alerts to hospitals	9
LKW time documentation	9
Record documentation improvement	6
Use of air transport	5
Reducing on-scene times	4
EMS to CT scanner	4

Less than a third (n=35, 26.9%) of agencies have implemented changes or additions to stroke care practices or patient care protocols within the past year based on previous improvement projects, shown below in Table 3.

Table 3. Most Frequently Reported Themes of Changes to Stroke Care Practices or Patient Care Protocols Implemented by EMS Agencies, Virginia, 2023

<b>Common Themes of Changes to Stroke Care Practices or Patient Care Protocols</b>	<b>Number of Responses</b>
Interagency training & education	7
Less on-scene time	5
Glucose check requirement	5
Adding a secondary stroke screening	4

Care Guideline and Related Research:

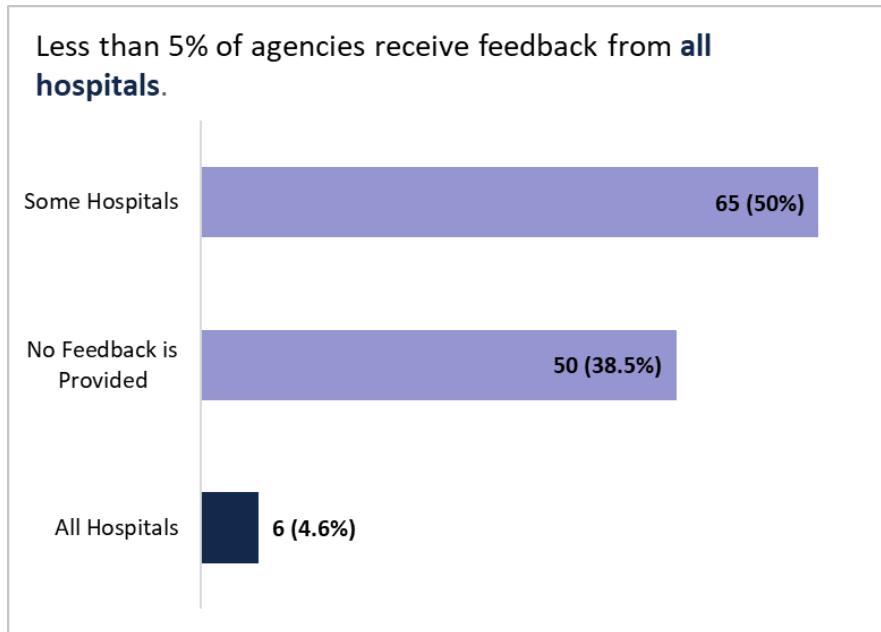
In the *Recommendations for Regional Stroke Destination Plans*, Jauch et al. (2021) recommend that EMS agencies participate in stroke-focused quality improvement projects with an emphasis on dispatch, response, field triage, and transition of care; as well as state participation in standardized data collection and reporting of acute stroke measures. This consensus statement lists 13 examples of quality improvement or performance measures for the assessment of the acute phase of stroke care (complete list provided in Appendix A). Recommended quality improvement projects for suspected stroke patients include:

1. 911 dispatcher use of suspected stroke patient algorithms,
2. Identification of a suspected stroke,
3. Documentation of last known well and symptom discovery times by EMS clinicians,
4. Evaluation of blood glucose by EMS clinicians,
5. Stroke screen performance and reporting by EMS clinicians,
6. Stroke severity score performance and reporting by EMS clinicians,
7. Advance hospital notification with stroke scale results by EMS clinicians, and
8. Adherence to on-scene time of 15 minutes or less for suspected stroke by EMS clinicians.

**EMS - HOSPITAL INTEGRATION**

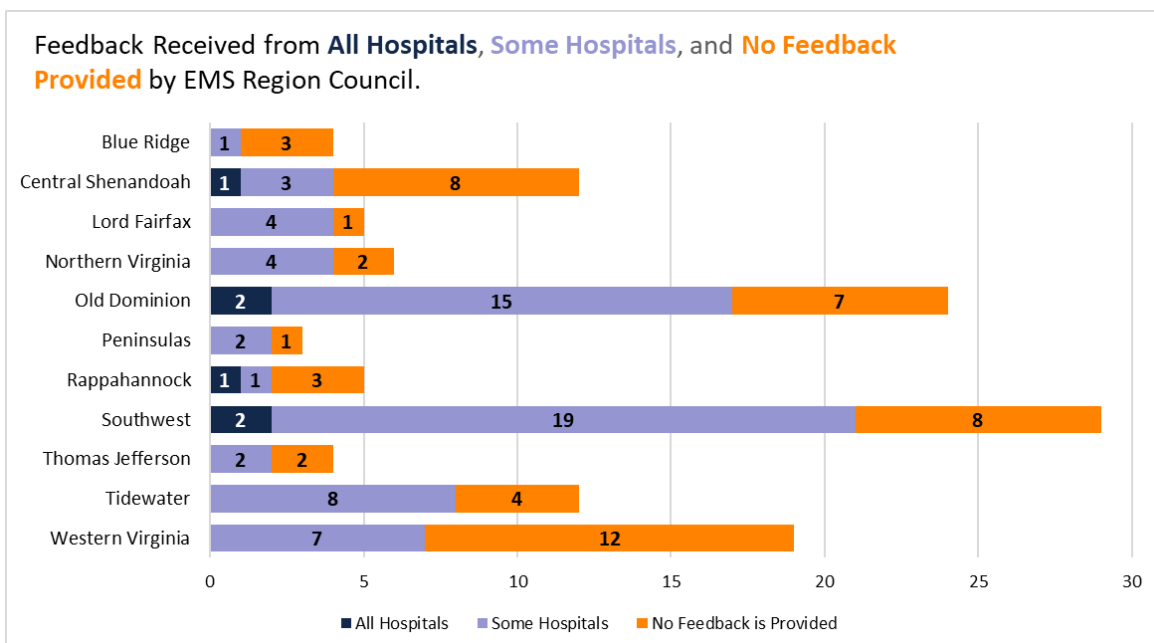
Over half (n=71, 54.6%) of Virginia EMS agencies that responded to the 2023 EMS Stroke Inventory Survey reported receiving feedback on suspected stroke patients from hospitals. Six (8.5%) of those agencies reported receiving feedback from all hospitals to which they take patients, shown in Figure 11. The remaining nine survey respondents answered with “Unknown/Unsure”.

Figure 11. EMS Agencies Receiving Feedback from Hospitals, Virginia, 2023



Four EMS Regional Councils contain the six EMS agencies receiving feedback from all hospitals (Figure 12). All eleven EMS Regional Councils contain agencies receiving feedback from some or no hospitals.

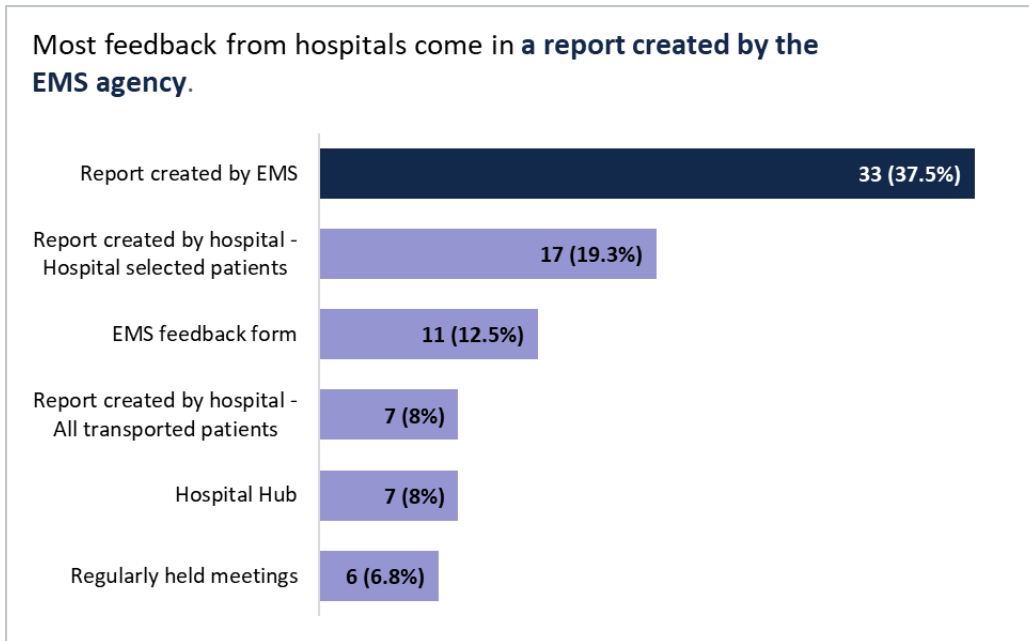
Figure 12. EMS Agencies Receiving Feedback from All, Some, or No Hospitals by EMS Regional Council, Virginia, 2023 (n= 132)



The majority of EMS agencies (n=33, 37.5% of 88 responses) create their own reports to share with hospital partners. Almost a quarter of agencies (n=17, 19.3%) receive reports created by the hospital

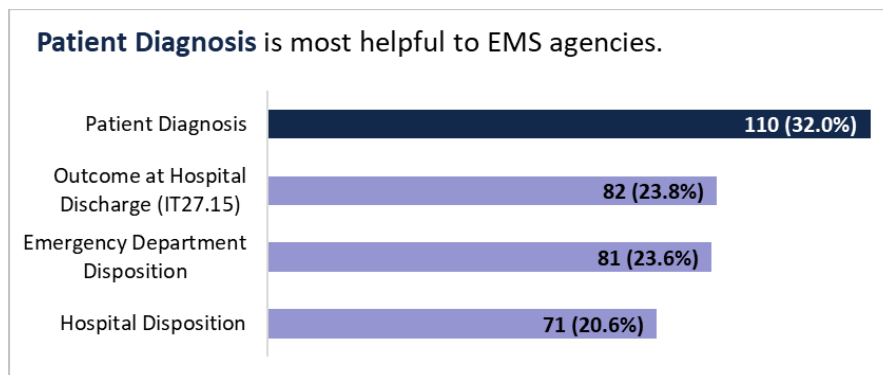
containing feedback on selected patients, shown in Figure 13. The remaining seven survey respondents answered with “Other”.

**Figure 13. Method of Feedback Received by EMS Agencies from Hospitals, Virginia, 2023 (n=88)**



Of the patient outcome information EMS agencies receive from hospitals, patient diagnosis is reported to be the most useful (n=110, 32%), followed by the patient’s outcome at hospital discharge (n=82, 23.8%) and emergency department disposition (n=81, 23.6%). Hospital disposition was found to be the least helpful out of the provided choices (n=71, 20.6%), shown in Figure 14.

**Figure 14. Patient Hospital Outcomes Reported to be Most Helpful to EMS Agency Personnel, Virginia, 2023 (n=344)**



**Care Guideline and Related Research:**

Collaboration between hospitals and EMS clinicians is a crucial element of improving stroke patient outcomes. This can only be accomplished when data is shared between EMS and receiving hospitals.



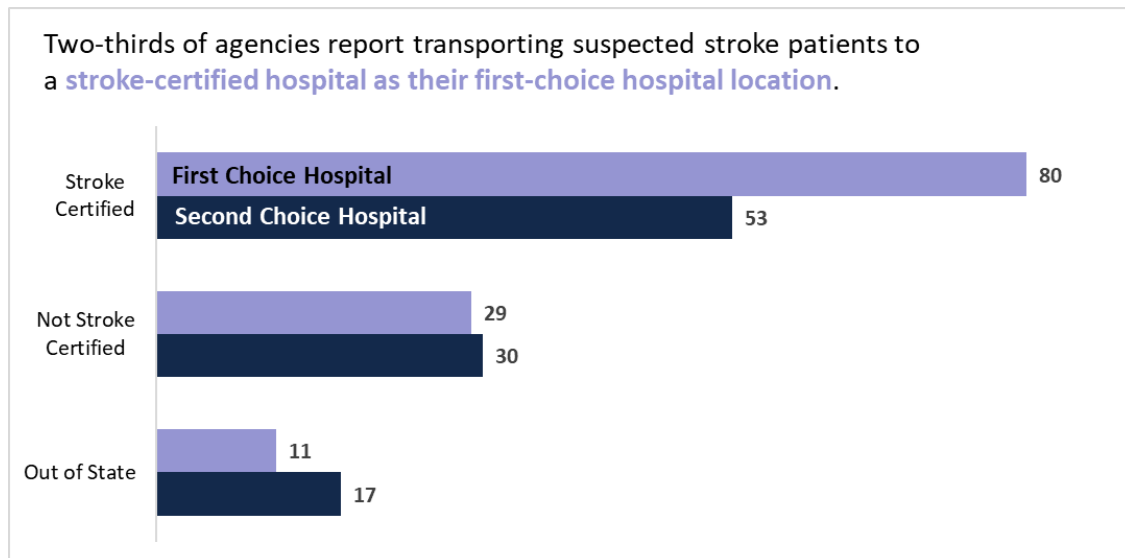
Currently, it is unknown how many EMS regional councils routinely integrate feedback and stroke confirmation from hospitals into their data metrics.

The *Acute Ischemic Stroke Guidelines* recommend developing stroke advisory committees involving multiple stroke care provider representatives, such as EMS personnel, EMS medical directors, hospitals of all certification levels, and representatives from local and state government (Powers, et al., 2019). Data sharing is critical for improving communication and performance improvement projects. In the *Recommendations for Regional Stroke Destination Plans*, Jauch et al. (2021) listed examples of performance measures for stroke systems of care, of which six of them recommend creating a percentage of confirmed stroke patients to use as a benchmark to validate and support delivery of care. The full measure examples can be found in Appendix A.

### HOSPITAL TRANSPORT

Of the 130 agencies that responded to the 2023 EMS Stroke Inventory Survey, 80 (66.7%) reported transporting suspected stroke patients to a stroke-certified hospital as their first-choice hospital location, shown in Figure 15. Eleven (9.2%) agencies report transporting suspected stroke patients to an out-of-state hospital as their first choice. Just over half (53, 53.0%) of the agencies report transporting suspected stroke patients to a stroke-certified hospital as their second choice and 17 (17.0%) EMS agencies report transporting suspected stroke patients out-of-state as their second choice (out of 100 responses).

Figure 15. Stroke Certification Status of EMS Agency First and Second Choice Hospitals, Virginia, 2023 (n=120)



Figures 16a and 16b show the stroke certification status of EMS agencies' first hospital choice by EMS Regional Councils. EMS agencies in the Southwest Regional Council are more likely to transport suspected stroke patients to a non-certified hospital or an out-of-state hospital (reported by 15 and 8 EMS agencies, respectively) than to an in-state stroke-certified hospital (reported by 6 EMS agencies). This is likely due to the scarcity of stroke-certified facilities present in the Southwest region. In the

Rappahannock Regional Council, there is an equal chance a suspected stroke patient will be transported to a stroke certified or non-certified hospital (reported by three EMS agencies each). Many regional councils are affected by resource deserts (i.e., the absence of stroke-certified facilities or increased distance to a stroke-certified facility) and may impact whether EMS agencies within those regional councils have the ability to take suspected stroke patients to a certified facility as their first hospital choice.

Figure 16a. Stroke Certification Status of EMS Agencies' First Hospital Choice by EMS Regional Council, Virginia, 2023 (n=120)

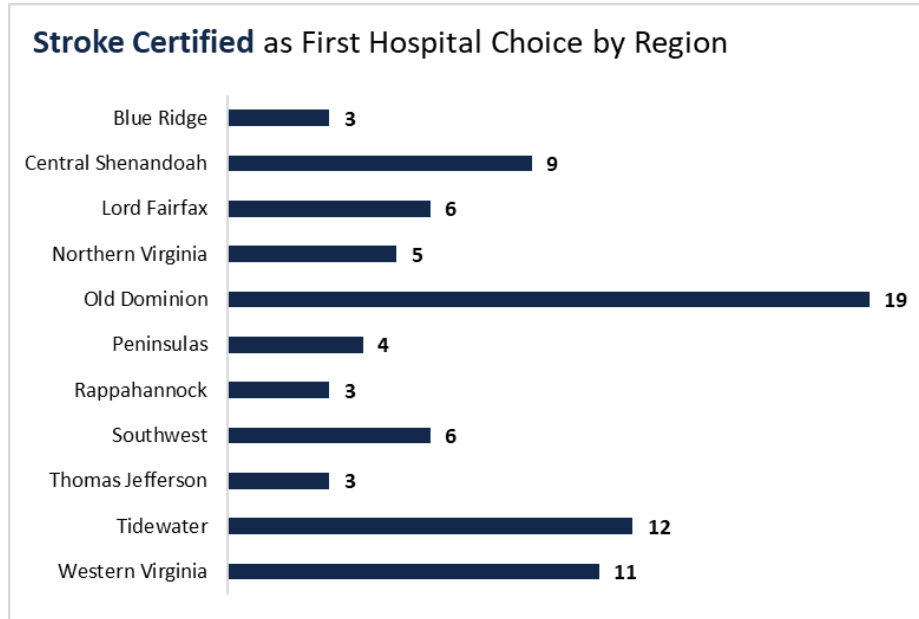
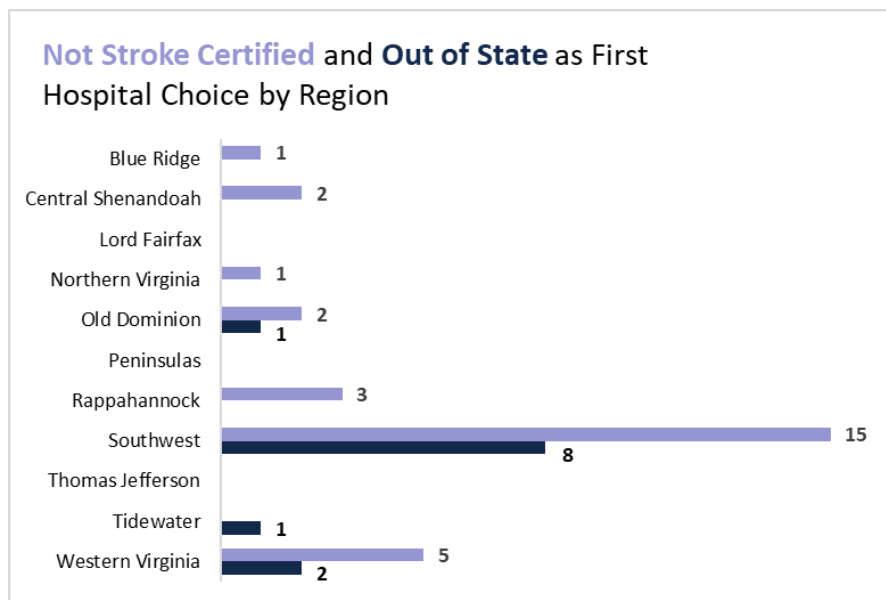


Figure 16b. Stroke Certification Status of EMS Agencies' First Hospital Choice by EMS Regional Council, Virginia, 2023 (n=120)



Approximately 70% of EMS agencies (n=90, 70.3% of 128 responses) report transporting over half their suspected stroke patients to a stroke center. Ten EMS Regional Councils report taking 100% of suspected patients to a stroke center, while one (i.e., Old Dominion) reports taking between 76-99% of suspected stroke patients to a stroke center.

#### Care Guideline and Related Research:

By obtaining stroke center certification, an outside certifying body recognizes a hospital's commitment to improving stroke outcomes for their patients and their community through adherence to a recognized set of standardized care measures based upon recommended Clinical Practice Guidelines (Centers for Disease Control and Prevention, 2022; Powers, et al., 2019). Jasne et al. (2019) found that stroke-certified facilities followed evidence-based care guidelines more closely when compared to non-certified stroke facilities. Towfighi, et al. (2023) recognized stroke certification as a needed strategy to reduce inequities in health care delivery for those at highest risk for stroke.

In the *Recommendations for the Establishment of Stroke Systems of Care*, Adeoye, et al. reinforce the idea that EMS clinicians need to transport patients with acute neurologic deficits to the right hospital for the best treatment as quickly as possible to avoid worse outcomes by delaying treatment (2019, pg. e192). The *Acute Ischemic Stroke Guidelines* recommend that regional systems of care should be developed containing a list of hospitals by level of capability, ability to deliver thrombolytics, and those facilities capable of endovascular stroke treatment (Powers, et al.). *Mission: Lifeline Stroke* recommends preference given to routing to the closest Acute Stroke Ready certified facility or Primary Stroke Center if transport time to the nearest comprehensive stroke center (CSC) or thrombectomy-capable stroke center (TSC) would make them ineligible for treatment upon arrival due to longer transport time; however, recognition is given to the fact that no randomized trial data exists to support an acceptable additional transport time (American Heart Association, 2020). To address longer transport times experienced by EMS agencies, Jauch, et al. recommends that stroke advisory committees develop regional and state pre-hospital destination plans tailored to local geography and available resources (2021). Both *Mission: Lifeline Stroke* and Jauch, et al., provide the following recommendations:

- EMS clinicians should consider eligibility for thrombolytics when determining hospital destination.
- Suspected LVO patients within a LKW of 24 hours should be prioritized to a nearby CSC over other facilities when a CSC is within acceptable transport times.
- Maximum recommended transport times are 60 minutes for rural areas, 45 minutes in suburban areas and 30 minutes for urban areas. These are proposed times for starting points and local and regional circumstances may require modification of destination and transport times.
  - If no CSC or TSCs exist within 60 minutes of total travel time, then EMS should go to the nearest ASR or PSC.
  - In rural communities where large distances separate stroke centers, additional transport time, including air medical transport of up to 60 minutes may be reasonable.
  - EMS should alert the receiving hospital of the presence of a potential LVO to facilitate subsequent rapid interfacility transport if the initial hospital is not thrombectomy capable.

As of December 2023, there are currently 51 certified stroke centers in Virginia out of 83 total hospitals. This leaves EMS clinicians in some regions with the choice of taking a suspected stroke patient to a non-certified stroke center or to an out-of-state certified center. The *State Stroke Triage Plan* recommends that the “default destination for acute stroke patients should be a certified stroke center”; but allows that “consideration may be given to transport to a closer hospital” (Virginia Office of Emergency Medical Services, 2017, pg. 4.). The *State Stroke Triage Plan* also recognizes the need for regional considerations where certified stroke centers may not be readily available, as well as the need for medical air transport (Virginia Office of Emergency Medical Services, 2017).

## References

- Adeoye, O., Nystrom, K. V., Yavagal, D. R., Luciano, J., Nogueira, R. G., Zorowitz, R. D., . . . Jauch, E. J. (2019). Recommendations for the Establishment of Stroke Systems of Care: A 2019 Update. *Stroke*, *50*, e187-e210. doi:10.1161/STR.000000000000173
- American Heart Association. (2020). *American Heart Association Mission: Lifeline Stroke*. Retrieved from Emergency Medical Services Acute Stroke Routing: [media/Files/Professional/Quality-Improvement/Mission-Lifeline/2\\_25\\_2020/DS15698-QI-EMS-Algorithm\\_Update-2142020.pdf](https://www.heart.org/-/media/Files/Professional/Quality-Improvement/Mission-Lifeline/2_25_2020/DS15698-QI-EMS-Algorithm_Update-2142020.pdf)
- American Heart Association/American Stroke Association. (2017). *12 Key Best Practice Strategies: Target: Stroke Phase II, January 2017*. Retrieved from heart.org: [https://www.heart.org/-/media/Files/Professional/Quality-Improvement/Target-Stroke/Target-Stroke-Phase-II/TargetStrokeBestPractices\\_ucm\\_470145.pdf](https://www.heart.org/-/media/Files/Professional/Quality-Improvement/Target-Stroke/Target-Stroke-Phase-II/TargetStrokeBestPractices_ucm_470145.pdf)
- American Stroke Association. (2022, May). *Stroke Training for EMS Professionals*. Retrieved from stroke.org: <https://www.stroke.org/-/media/Stroke-Files/EMS-Resources/Stroke-Training-for-EMS-Professionals.pdf>
- Centers for Disease Control and Prevention. (2022). *Best Practices for Heart Disease and Stroke: A Guide to Effective Approaches and Strategies*. Centers for Disease Control and Prevention. doi:10.15620/cdc:122290
- Chen, X., Zhao, X., Xu, F., Guo, M., Yang, Y., Zhong, L., . . . Liu, X. (2022, January 28). A Systemic Review and Meta-Analysis comparing FAST and BEFAST in Acute Stroke Patients. *Frontiers in Neurology*, *12*. doi:10.3389/fneur.2021.765069
- Heemskerk, J. L., Domingo, R. A., Tawk, R. G., Vivas-Buitrago, T. G., Huang, J. F., Rogers, A., . . . Freeman, W. D. (2021). Time is Brain: Prehospital Emergency Medical Services Response Times for Suspected Stroke and Effects of Prehospital Interventions. *Mayo Clinical Proceedings*, *96*(6), 1446-1457. doi:10.1016/j.mayocp.2020.08.050
- Jasne, A. S., Sucharew, H., Alwell, K., Moomaw, C. J., Flaherty, M. L., Adeoye, O., . . . Kleindorfer, D. (2019). Stroke Center Certification is Associated with Improved Guideline Concordance. *American Journal of Medical Quality*, *34*(6), 585-589. doi:10.1177/1062860619835317
- Jauch, E. C., Schwamm, L. H., Panagos, P. D., Barbazzeni, J., Dickson, R., Dunne, R., . . . Yallapragada, A. (2021). Recommendations for Regional Stroke Destination Plans in Rural, Suburban, and Urban Communities From the Prehospital Stroke System of Care Consensus Conference: A Consensus Statement. *Stroke*, *52*, e133-e152. doi:10.1161/STROKEAHA.120.033228
- Nogueira, R. G., Jadhav, A. P., Haussen, D. C., Bonafe, A., Budzik, R. F., Bhuva, P., & Hassan, A. E. (2018). Thrombectomy 6 to 24 Hours after Stroke with a Mismatch between Deficit and Infarct. *The New England Journal of Medicine*, *378*, 11-21. doi:10.1056/NEJMoa1706442
- Powers, W. J., Rabinstein, A. A., Ackerson, T., Adeoye, O. M., Bambakidis, N. C., Becker, K., & Tirschwell, D. L. (2019, October). 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. *Stroke*, e344–e418. doi:10.1161/STR.000000000000211

Towfighi, A., Boden-Albala, B., Cruz-Flores, S., El Hussein, N., Odonkor, C. A., Ovbiagele, B., . . . Thrift, A. G. (2023). Strategies to Reduce Racial and Ethnic Inequities in Stroke Preparedness, Care, Recover, and Risk Factor Control: A Scientific Statement from the American Heart Association. *Stroke*, 54, e371-e388. doi:10.1161/STR.0000000000000437

Virginia Department of Health. (2023). *Virginia Department of Health 2023 Hospital Stroke Inventory Survey*. Retrieved from <https://www.vdh.virginia.gov/stroke/paul-coverdell-national-stroke-program/>: <https://www.vdh.virginia.gov/content/uploads/sites/133/2023/11/2023-Hospital-Stroke-Survey-Summary-Report.pdf>

Virginia Office of Emergency Medical Services. (2017, November 30). *Virginia Office of Emergency Medical Services, Division of Traum and Critical Care, Prehospital and Inter-hospital State Stroke Triage Plan*. Retrieved from VDH.Virginia.gov: <https://www.vdh.virginia.gov/content/uploads/sites/23/2018/08/Virginia-Stroke-Triage-Plan-July-2018.pdf>

## Appendices

### Appendix A:

Examples of Consensus-Based Quality Improvement or Performance Measures for Assessment of the Acute Phase of Stroke Systems of Care from *Recommendations for Regional Stroke Destination Plans in Rural, Suburban, and Urban Communities From the Prehospital Stroke System of Care Consensus Conference* (Jauch, et al., 2021)

1	911 dispatcher use of suspected stroke algorithms: percentage of confirmed stroke patients transported to a hospital by EMS and in whom stroke dispatch algorithm was used.
2	Identification of suspected strokes: percentage of confirmed stroke patients transported to a hospital by EMS and identified as suspected strokes.
3	Documentation of last known well and symptom discovery times: percentage of confirmed stroke patients transported to a hospital by EMS for whom a last-known-well time or time of discovery of stroke symptoms was documented.
4	Evaluation of blood glucose: percentage of confirmed stroke patients transported to a hospital by EMS for whom blood glucose was evaluated by EMS.
5	Stroke screen performed and reported: percentage of confirmed stroke patients transported to a hospital by EMS for whom a validated regional or national stroke screen tool was used with documentation of the result.
6	Stroke severity score performed and reported: percentage of confirmed stroke patients transported to a hospital by EMS for whom a validated regional or national stroke severity tool was used to identify suspected LVO with documentation of the result.
7	Advanced notification with triage findings: percentage of stroke transports in whom EMS provided a stroke alert prenotification to the receiving hospital and provided additional information about a patient's status.
8	EMS use of regional destination protocol: percentage of stroke transports in whom EMS triaged the patient according to their approved regional triage protocol.
9	On-scene times for suspected stroke: distribution of times for suspected stroke patients transported to a hospital by EMS with a goal for on-scene time $\leq 15$ min.
10	DIDO at the first hospital before transfer: distribution of times for confirmed stroke patients transported to a hospital by EMS who were transferred to a higher-level stroke center for time-critical therapy, with a goal for DIDO $\leq 60$ min.
11	Time from EMS first medical contact to stroke alert notification: distribution of times for confirmed stroke patients transported to a hospital by EMS from the time from first medical contact to initiation of stroke alert notification to the receiving hospital.
12	Time from EMS first medical contact to brain imaging: distribution of times for confirmed stroke patients transported to a hospital by EMS from the time from first medical contact to start of first brain imaging.
13	Time from first medical contact to EVT: distribution of times for confirmed stroke patients transported to a hospital by EMS from the time from first medical contact to the first pass of endovascular thrombectomy device.

DIDO indicates door-in door-out; EMS, emergency medical services; EVT, endovascular therapy; and LVO, large vessel occlusion.

**Appendix B:**

Emergency Medical Services Acute Stroke Routing flowchart.

