Acute Health Systems Stroke System Plan

Alabama Department of Public Health

Office of Emergency Medical Services

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Stroke System

Stroke Facts

- According to the Centers for Disease Control and Prevention (CDC) - Stroke Facts, in 2020, 1 in 6 deaths from cardiovascular disease was due to stroke.
- Every 40 seconds someone in the United States has a stroke. Every 3 minutes and 14 seconds, someone dies of stroke.
- Each year, over 795,000 individuals in the United States suffer from a stroke. Of these, approximately 610,000 are first-time or new strokes.
- About 87% of all strokes are ischemic strokes, in which blood flow to the brain is blocked.
- Stroke-related costs in the United States came to nearly $56.5 billion between 2018 and 2019.
- Stroke is a leading cause of serious long-term disability. Stroke reduces mobility in more than half of stroke survivors age 65 and older.
- Stroke is a leading cause of death for Americans, but the risk of having a stroke varies with race and ethnicity. Risk of having a first stroke is nearly twice as high for Blacks as for Whites, and Blacks have the highest rate of death due to stroke.
- The death rate for stroke increased from 38.8 per 100,000 to 41.1 per 100,000 in 2021.

Reference:
https://www.cdc.gov/stroke/facts.htm (accessed 12/21/2023).

System Background

The Code of Alabama 1975, Section 22-11D-3 provided authority for the establishment of a stroke system. The statewide system was activated in October of 2017. The initial State Trauma and Health System (STHS) Stroke System Plan (SSP) contained detailed information which explained the development, function, structure, and intended operations of the statewide stroke system.

The goal of the stroke system was to reduce stroke morbidity and mortality as a result of Emergency Medical Services Personnel (EMSP) recognizing and entering patients with suspected stroke into the stroke system and transporting these patients to the nearest available stroke center for rapid evaluation, diagnosis, and treatment. Stroke system entry provided a mechanism to reduce delays by routing patients to an available stroke center that could provide a timely assessment, diagnosis and treatment, or transfer as indicated.

In 1995, tissue plasminogen activator (tPA, Activase®) became the first and only approved treatment for acute ischemic stroke (AIS), the most common type of stroke. The tPA must be administered within the first few hours of AIS onset. Other thrombolytic medication is now available and used to treat AIS, however, the window for administration remains short.

Developed upon the framework and experiences of the Birmingham Regional Emergency Medical Services System (BREMSS) stroke system started in 2000, the stroke system was activated statewide in 2017, with three stroke center levels: Comprehensive Stroke Center (CSC) (Level I), Primary Stroke Center (PSC) (Level II), and Acute Stroke Ready (ASRH) (Level III). A stroke rules change effective March 17, 2022, added a new level of stroke center: Thrombectomy-Capable Stroke Center (TSC) (Level IIa), which provides advanced-level care for AIS. The TSC has mechanical thrombectomy capability to treat large vessel occlusion (LVO) strokes.

In coordination with the addition of the new stroke center level, the 10th Edition Emergency Medical Services (EMS) Protocols effective April 29, 2022, required EMSP to use the Emergency Medical Stroke Assessment (EMSA), a severity-based stroke triage (SBST) stroke scale. The EMSA helps identify LVO stroke, which mechanical thrombectomy has been shown to be an effective treatment. The Alabama Department of Public Health (ADPH) Office of Emergency Medical Services (OEMS) Stroke Workgroup discussed current stroke routing and made a recommendation to change from routing all suspected stroke patients to the closest available stroke center to route to the most appropriate stroke center based on the EMSA scale and patient last known well (LKW) times.

Goals of the Stroke System

The primary goals of the stroke system are to reduce stroke morbidity and mortality by achieving reperfusion for ischemic stroke patients, using thrombolytics and/or endovascular interventions, when appropriate, thereby improving morbidity and mortality outcomes for patients with both ischemic and hemorrhagic strokes statewide, while complying with or exceeding all ADPH and OEMS requirements.

Need for Plan Revision

- The initial statewide stroke plan stipulated that stroke patients should be taken to the nearest available stroke center for assessment and thrombolytic therapy administration regardless of its level.

- The revised stroke plan continues support of rapid and systematic assessment and stroke system entry and incorporates advancements in stroke screening and care. Based on the stroke screening, the Alabama Trauma Communication Center (ATCC) may direct the EMSP to bypass an available lower-level stroke center and proceed directly to a higher-level stroke center if a severe stroke or LVO is suspected.

- Using the March 2021 publication "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" as a reference, the Stroke Workgroup determined that the time frame for routing a stroke patient from the field to a TSC for suspected severe stroke would be if the patient has an EMSA score of 4 or greater, is less than **60 minutes from a TSC center and within a 3.5 hour window since LKW**.

  Reference: https://www.ahajournals.org/doi/10.1161/STROKEAHA.120.033228 (accessed 1/10/2024)

Planning Assumptions

It is common for patients with acute neurological symptoms to be admitted for conditions other than stroke, which can often be treated in a non-stroke center hospital. However, stroke is an acute care condition where any delay in care, regardless of the reason, could lead to severe health complications or even death. Therefore, prioritizing the urgency of care in stroke cases should be a top priority.

The initial STHS SSP laid the groundwork for the statewide stroke system implementation. Since activating the system in 2017, advances in stroke care, for example, mechanical thrombectomy (clot removal) capability, indicate plan revisions are needed to incorporate such changes.

Acute Stroke Ready (Level III) and Primary Stroke Centers (Level II) should be able to provide care for stroke patients who do not require highly complex care. By doing so, they help support the entire system by keeping Comprehensive Stroke Centers (Level I) and Thrombectomy-Capable Stroke Centers

(Level IIa) available for patients requiring high acuity/complex stroke care such as mechanical thrombectomy, coiling, clipping, etc.

The stroke plan revision incorporates advances in stroke screening and stroke care, specifically for LVO or severe stroke, when identified. Implementation of routing stroke patients based on stroke assessment findings and regional plans will be conducted one region at time with ATCC, Regional Offices, and OEMS coordination.

System Components and Organization

Office of EMS and EMS Regional Agencies

OEMS works closely with the EMS Regional Agencies to monitor system operations and to provide support to prehospital providers and hospitals, as needed. This includes but is not limited to monitoring for system entry, compliance, quality assurance (QA), training, etc. Significant changes in the stroke system such as a rule change, EMS Protocol change, and stroke plan revision are coordinated by OEMS and overseen by the Statewide Trauma and Health Systems Advisory Council (STHSAC) and State Committee of Public Health, as required.

The EMS Regional Agencies work with prehospital providers, hospital administrators, emergency department staff, stroke coordinators, the Regional Advisory Councils (RAC), and others to monitor the stroke system activities in their region. They are key components to the stroke system as they also monitor QA data collection and provide stroke system education.

Prehospital Component:

- To ensure rapid and evidence-based care for stroke patients, it is important that there is continuous and effective coordination of prehospital and stroke care resources across all regions. By doing this, rapid transportation of stroke patients to the most appropriate, available designated stroke center can be ensured.

- Prehospital providers have the responsibility to ensure their individual EMSP have a basic knowledge and awareness of the stroke system, including entry criteria and basic operations.

- All patients treated by EMSP using the EMS Stroke System Protocol should be entered into the stroke system. The EMS Stroke System Protocol is posted at https://www.alabamapublichealth.gov/ems/index.html

- All EMSP, including air medical, should contact ATCC for system patient entry prior to scene departure.

- If EMSP determines air medical resources are needed for transport, ground EMS should consider meeting air medical resource enroute to the destination facility, rather than waiting on the scene, in order to decrease transport time.

Hospital Component

- Hospitals desiring to be a designated stroke center in the stroke system must complete the application process. Information about the application process is posted at https://www.alabamapublichealth.gov/strokesystem/admission.html.

- Stroke center emergency departments must have protocols and procedures in place, as per stroke system requirements, to rapidly assess and provide care for stroke patients (ischemic, hemorrhagic, large vessel) that arrive by EMS or private-operated vehicle (POV).

- Stroke centers should be capable of providing immediate and comprehensive assessment, resuscitation, definitive care, and administration of thrombolytic therapy, as indicated, and coordinate transfer of select patients to higher level stroke centers for further endovascular, neurosurgical, or rehabilitation interventions, when needed.

- If the patient with stroke signs or symptoms was not entered into the stroke system by prehospital EMSP or if the patient arrived by POV, the hospital should enter the patient into the system by contacting the ATCC.

- Each stroke center is responsible for keeping required stroke resources updated in the LifeTrac workstation.

- Stroke centers are to complete and return stroke outcome data to ATCC in a timely manner. Once a stroke registry is developed, stroke data will be collected in the registry.

- The program allows for all hospitals in the region the opportunity to participate in the inclusive system and to receive stroke patients if they can meet the system requirements, operational criteria, and complete the application process. (For the hospitals that choose not to participate as a stroke center, “time to patient transfer” for any stroke patients brought to the emergency department must be established. It is recommended that the stroke patient be enroute to a stroke hospital within 30 minutes of the time of entry into the stroke referring hospital. To facilitate this, stroke referring hospitals will be able to enter stroke patients into the stroke system via ATCC. Each RAC should determine if hospitals not participating in the stroke system have a patient transfer plan.)

- Neurological leadership of hospital stroke programs is essential for participating in the stroke system. This leadership role must be clearly defined within the hospital stroke plan along with specific appropriate authority to carry out that leadership role. Evidence of continuing leadership should be demonstrated through the participation in stroke system activities and through individual hospital QA programs. In the absence of staff or on-site neurology, criteria for this component must still be met as listed in the criteria found at

https://www.alabamapublichealth.gov/strokesystem/assets/master.stroke.center.designation.criteria%20.pdf.

- ADPH will accept the stroke certifications from hospitals that are certified for stroke care by The Joint Commission (TJC), Det Norske Veritas (DNV) or equivalent certification, as deemed by the STHSAC, at their corresponding level. Hospitals certified by TJC or equivalent as Acute Stroke Ready Hospitals (ASRH) will be recognized as a Level III ASRH. TJC or equivalent certified Primary Stroke Centers (PSC) will be recognized as a Level II. Hospitals certified by TJC, or equivalent, as Thrombectomy-Capable Stroke Center will be recognized as a Level IIa TSC. TJC, or equivalent, certified Comprehensive Stroke Centers (CSC) will be recognized as a Level I CSC.

Communications Component

It is the primary responsibility of ATCC to coordinate stroke system activities by maintaining and providing information on field status and hospital availability. ATCC is managed by BREMSS, and oversight of the day-to-day operations of ATCC is the responsibility of the BREMSS Executive Director. ATCC will operate through system operations protocols. ATCC will make no primary decisions but will provide information about patient management and destination as per pre-established protocol for system function. ATCC will serve as a resource for those EMSPs that may not be familiar with the protocols or ATCC may coordinate the prehospital and hospital resources utilized for stroke management. The following list describes functions of ATCC as it relates to the Alabama Stroke System:

- Assigns a unique system identification number for each patient meeting system entry criteria for tracking throughout the system.
- Collects patient information.
- Provides information on system entry criteria based on preset protocols as requested by EMSP, when it is not clear if a patient meets stroke entry criteria.
- Maintains knowledge of the functional status of all system hospitals at all times.
- Maintains knowledge of the activity status in the prehospital setting at all times.
- Coordinates patient destination, when patient meets system entry criteria, based on preset protocols.
- Coordinates resources for optimal utilization using pre-established protocols for system function, when there are simultaneous events in the region.
- Establishes automatic communication link between EMS provider and receiving facility.
- Records and enters prehospital data for stroke system database.

The Emergency Resources Display (ERD) is a computer system that is part of the communications component. ERD has terminals at participating facilities and the ATCC, providing each with continuous real-time functional status display of all designated stroke hospitals. ERD provides a display grid reflecting each facility's current availability for both primary and individual resource components. Any change in hospital status is communicated to the central system monitoring station and recorded in the facility's ERD and at the ATCC. An example of ERD is below.

Trauma/Stroke Emergency Resources Display																		
	Level																	
Hospital	T	S	C	ED-T	ED	ANES	OR	X-RAY	TICU	TS	OS	NS	CT	SICU	NEURO	CCU	CARD	Clab
A	1	1																
B	3	2																
C	3	2																
D	2	1																
E	1	2																
F	2	3																

Hospital (center) levels are displayed in the T (Trauma), S (Stroke), C (Stemi-future) along with the overall status of each: Green for available, yellow for conditional (accepting scene patients), red for not available. Hospital resource abbreviations are automatically color-coded for on-line status: Green for available, red for unavailable, based on individual resource availability in the hospital at that time.

The equipment for ERD consists of a color video monitor, a computer (keyboard and mouse), a printer, a UPC battery backup device, and a secure connection to ATCC. The modem requires a dedicated line which does not enter the facility through the switchboard. The software allows facility personnel to change a resource status with a click of the mouse. This change will be transmitted to the central system monitoring station at ATCC and updated immediately on all resource display monitors with the system. The central monitor station automatically polls the individual monitor stations in the system. If there is an isolated failure at a hospital resource display that was not caused by a total system fault, that hospital will show disconnected and ATCC will call to request information directly. The system integrity is not dependent upon any single station's operation.

Stroke survival and maximum outcome potential can only be achieved with efficient and rapid movement of the patient through the system. Knowledge of prehospital stroke activities and the current status of available hospital resources is vital to mitigate simultaneous stroke activities by allowing differential system resource utilization. ATCC will note the nearest, most appropriate available stroke hospital for EMSP based on database resources at the time.

It is essential to establish communications between EMSP and ATCC, after determining if a patient meets system entry criteria, as soon as possible. EMSP should contact ATCC before leaving the scene, identify themselves, and provide the following information:

1. Age and sex of patient
2. Entry criteria (EMSA stroke scale)
3. Current primary survey status airway, breathing, circulation, level of consciousness, and vital signs
4. Incident location
5. LKW time
6. Estimated scene departure time and transport time
7. Proposed mode of transport (if ground then state transporting unit number)
8. Preferred destination

ATCC will establish the communications link with the receiving designated stroke hospital and provide them with basic information. The field EMSP may receive medical direction by the receiving stroke center, if needed, through ATCC while the hospital is simultaneously activating its stroke response system. The transporting EMSP will maintain contact as appropriate with the receiving designated

stroke hospital or ATCC and provide information updates if there is a change in the patient's status or transport plan occur. EMSP are to reconfirm to the designated stroke hospital estimated time of arrival (ETA) once transport has been initiated. If communication failure occurs, direct contact between the EMS unit and their dispatch should be established, with relay of information to ATCC by phone.

Data Quality Assurance Component

- A continuous QA program is needed to ensure system-wide stroke care remains current, effective, and efficient. The program should include evaluation of prehospital management, hospital management, and ATCC management. A standard data set will be required for both prehospital and hospital participants, allowing uniform system evaluation.

- The stroke system data collection is currently limited to system entry and 24-hour outcome data. Once funded, a stroke registry will be established which will allow for the addition of hospital specific data. This addition will provide data elements needed to generate reports to determine the magnitude and severity of stroke in Alabama. The stroke registry will be used in conjunction with prehospital data and hospital evaluations in a continuous QA program to evaluate stroke care, document appropriateness and quality, and implement improvements.

- To ensure accurate data collection, the stroke system QA involves two components. The first is a standard stroke data set used to collect data. The second component is the continuous QA program that helps ensure the ongoing effectiveness of the system. As noted in the Code of Alabama 1975, Chapter 11D-6, all data collected for the QA program of the stroke system shall be held confidential pursuant to state and federal laws, rules, and policies.

- The stroke QA data set currently collected is a small data set intended to fulfill the goals of this component. Once a state stroke registry is in place, more comprehensive stroke data will be collected. A unique stroke identification number will allow integration of prehospital and hospital data. The components of the data set are listed below.

    1. Incident location
    2. Prehospital unit(s) responding
    3. Activity times
    4. Receiving hospital
    5. Patient and system demographics
    6. Prehospital outcome
    7. Hospital status/response
    8. Emergency Department disposition
    9. Initial procedures (within the first 24 hours)
    10. Hospital confirmation of stroke
    11. LKW time
    12. Stroke type (ischemic, LVO, or hemorrhagic)
    13. If ischemic, was a thrombolytic administered?
    14. Reason thrombolytic was not administered
    15. If LVO, was mechanical thrombectomy performed?

16. Reason mechanical thrombectomy not performed
17. Was patient admitted to hospital?
18. Was patient admitted to Intensive care unit, stroke unit, floor, or other?
19. Final disposition

A more thorough listing of the stroke QA data set to be used when the stroke registry is operational is listed in Appendix B.

The second entity in this component is the QA program for the stroke system. This program is necessary to the stroke system to document continuing function and allows the implementation of improvements. In a system where patients may not have the ability to make their own personal medical care choices, they depend on the system for adequacy and completeness of care. This program will be regional with individual entities doing their own QA evaluations and reporting to a regional office. The appropriateness, quality, and quantity of all activities in the system must be continuously monitored in the areas of prehospital and hospital medical care of patients and overall system function.

The basic QA process requires specific steps to be performed by each individual designated stroke hospital and prehospital provider service. These steps are below.

1. Assign a QA Manager to oversee the process in the organization.
2. Develop a written QA program to evaluate patient care with regards to appropriateness, quality and quantity, and as a part of that program, patient care guidelines should be established for use in the evaluation process. For prehospital provider services, this should follow EMS protocols and/or medical direction. These programs will be reviewed and approved by the Regional QI Committee and lead agency when applying to become a stroke system participating hospital.
3. A method for QA data collection should be established. For designated stroke hospitals, this should include a morbidity and mortality list.
4. QA evaluations should be undertaken by the individual system participants (EMS provider services and designated stroke hospitals). Specific audit filters must be determined. Mandatory designated stroke hospital audit filters include major complications and deaths. Other appropriate audit filters are also evaluated. For designated stroke hospitals, external outcome comparisons are part of the evaluation process.
5. Determine the presence of QA issues through the data evaluation process.
6. Develop a corrective action plan.
7. Re-evaluate to document the results and effectiveness of the corrective action plan. This is commonly called “closing the loop.”

Adequate documentation of these activities is essential. In designated stroke hospitals, a multi-disciplinary peer review process must occur. In their QA programs, both medical care and hospital function should be evaluated.

The primary goal of the Regional Quality Assurance Committee (RQAC) is to review the activities of the stroke system for appropriateness and quality of activities. This review is to include system administration and organization activities, prehospital care, and hospital care. The RQAC will document the effectiveness of hospital and EMS service QA through routine reports of QA activities provided by

each participating entity. The RQAC will perform focused review of specific items as determined appropriate, but these reviews will include evaluation of both prehospital and hospital activities. It is expected that most issues will be resolved by developing an action plan in conjunction with various stroke system entities. A re-evaluation for results is to be undertaken. If it is determined that a change in system configuration or function should occur, a recommendation will be sent to the Stroke Subcommittee of the RAC for evaluation and reported to the lead agency. A more detailed outline of the QA program is available in Appendix C.

Stroke centers will maintain a 95 percent submission rate of stroke Hospital Outcome Reports (HOR) forwarded to ATCC for distribution to RQACs for review. Each report will be reviewed by the regional office for thrombolytic administration compliance. All HORs which fall below the thrombolytic administration benchmark will be forwarded to the State Stroke QA Committee/STHSAC for review and follow-up.

The RQAC will specifically review the continuing function of the stroke system and prepare routine reports regarding system function and the QA review summaries for the lead agency.

System Operations

System operations refers to the activities that occur once it is determined a patient meets system entry criteria and communications have been established within the system. These activities include designated stroke hospital destination determination, continuing communications, provision of field care, patient transport, and care of the patient at the designated stroke hospital.

Hospital Destination

Hospital destination for patients entered into the stroke system will be the closest appropriate and available designated stroke hospital based on stroke assessment findings, the patient's choice, or secondary triage guidelines. In the event a patient or family member requests transport to a specific facility that does not meet system guidelines, efforts to clarify the established stroke system will be made with the patient and family. The patient's preference will be considered when most appropriate.

- Patients entered into the stroke system **without** indications of an LVO (EMSA <4) will be routed to the closest available stroke center. Patients entered into the stroke system that indicate a potential LVO (EMSA of 4 or greater) will be transported to the closest available Level IIa or Level I stroke center if travel time is less than 60 minutes and the LKW time is less than 3.5 hours; if transport time is greater than 60 minutes or LKW is greater than 3.5 hours, the patient will be routed to the closest appropriate and available stroke center.

- If the patient is unstable and cannot be effectively ventilated by EMSP, the patient should be transported to the closest hospital with full time emergency physician coverage as coordinated by ATCC. However, no Rescue Stop is available for unstable stroke system patients.

- In a situation where ATCC notification has occurred and no medical direction is needed, ATCC will notify the receiving hospital of the patient transport and provide information of condition, estimated arrival time, etc.

Hospital stroke status is tracked by ERD at ATCC. That equipment is described in the Communications Component and details the status of individual resources in the hospital and, therefore, the activity status of the hospital. A hospital will be either green (available), yellow (conditional), or red (unavailable) status.

Green status means the hospital has all resources available and may receive stroke patients. Green status requirements involve the following:

1. All levels must have essential resources active and available at the time as pertains to their designated stroke hospital status.
2. A list of stroke center designation criteria listed by stroke center level is available in Appendix A.

Yellow status indicates that some stroke resources are unavailable, however, the hospital is still accepting some patients based on assessment findings. Yellow status results when one of the following resources is not available:

1. Neurosurgery
2. SICU (Level 1 stroke center)
3. A Level I stroke center with no SICU available can elect to accept transfers through ATCC for patients likely to need Level I invasive treatment modalities if a SICU bed will likely be available after the invasive procedure or if the transferring hospital is able to accept a "reverse-transfer" where the patient is returned to the originating hospital upon agreement of the physicians at the Level I stroke center and the physician at the original transferring hospital. The reverse transfer process will occur in the following manner:

    a. Level I stroke hospital has determined that all care/interventions available at the Level I stroke hospital have been accomplished and the patient can be appropriately cared for at the transferring hospital and notifies ATCC of such via phone.
    b. Original transferring hospital is contacted by ATCC and informed the correct physician of this need. ATCC then links the two physicians together and the transfer is negotiated.
    c. If the original transferring hospital refuses the patient for any reason, a QA is generated to ADPH/OEMS who will determine if a Stroke System issue is present and then provide action as necessary.

Red status indicates at least some stroke care resources in the hospital are not actively available and the hospital is not ready to receive stroke patients at that time. Red status results when one of the following resources is not available:

1. ED
2. SICU
3. CT scan
4. Neurologist or physician with experience and expertise in diagnosing and treating stroke

Secondary Triage

Level III stroke hospitals will be considered red status if one of the following service lines are unavailable: ED, CT, Neurologist.

Level II stroke hospitals will be considered red status if one of the following service lines are unavailable: ED, CT, Neurologist, SICU.

Level IIa stroke hospitals will be considered red status for Mechanical Thrombectomy if the following service line is unavailable: Mechanical Thrombectomy. Level IIa will also be considered red for other stroke system patients if ED, CT, Neurologist, or SICU is red.

Level I stroke hospitals will be considered red status if one of the following service lines are unavailable: ED, CT, Neurologist.

In the event a patient or family member requests transport to a specific facility that does not meet system guidelines, efforts to clarify the established stroke system will be made with the patient and family.

Because there is no Rescue Stop available for stroke system patients if a patient is unstable and cannot be effectively ventilated by EMSP, the patient should be transported to the closest hospital with full time emergency physician coverage as coordinated by ATCC.

In a situation where ATCC notification has occurred and no medical direction is needed, ATCC will notify the receiving hospital of the patient transport and provide information of condition, estimated arrival time, etc.

System Activities

1. Prehospital System Activities

    a. Prehospital care will be carried out following the guidelines of the Stroke System Plan. ADPH/OEMS prehospital care protocols will be used for primary guidance in prehospital stroke management. Patients entered into the stroke system will receive their medical direction from the stroke receiving hospital which will be immediately accessible through the communications link between ATCC and that destination hospital.

b. Any significant patient condition changes are to be communicated directly to the receiving designated stroke hospital, as those changes may result in updating the orders and altering the destination hospital stroke team activation. Field time should be kept to a relative minimum. Stroke patients are best served by rapid transport to the most appropriate facility.

2. Hospital System Activities

a. Hospital stroke management is an essential part of any stroke system. This phase of stroke care requires adequate resources (equipment and facilities) and personnel with adequate training and commitment to carry out rapid initial assessment, stabilization, and definitive care including invasive treatment plus critical care and recuperative care as necessary. In addition, rehabilitation services should be initiated as appropriate. Resources necessary to provide care are documented through the designated stroke hospital guidelines.
b. Once a patient has been assessed and treated acutely, the patient will be cared for at the receiving facility or transferred to the next higher-level stroke designated hospital for further care.

System Compliance, Evaluation, and Action

This stroke system is designed to provide specialized care to patients with actual or a significant probability of stroke. The system is based on hospital requirements and system function protocols to be designated as a stroke ready hospital. Adherence with the requirements and protocols are essential for proper stroke patient management. Therefore, a specific program for monitoring requirements and function protocols will be a part of the stroke system. This will be a function of the Stroke Workgroup with oversight from OEMS. Reports regarding compliance issues will be made to the regional EMS agency that will follow the plan developed by OEMS and ADPH. Maintenance of compliance with requirements, guidelines, and system function protocol activities for individual personnel and agencies involved in the stroke system means:

A. Maintaining component and organizational guidelines as established by SSP.

1. Prehospital Component

a. Prehospital entities have the responsibility to assure their individual EMSP have a basic knowledge and awareness of the stroke system including entry criteria and basic operations.

2. Hospital Component

a. Continue to meet all designated stroke hospital resource requirements for their status.
b. Maintain evidence of neurological leadership

c. On-Call coverage by a neurologist or a physician with experience and expertise in diagnosing and treating stroke should be established. This can be accomplished through a neurologist telemedicine consultant if necessary.

3. Communications Component

    a. Each entity is responsible for maintaining communications equipment used in the stroke system in proper working order.

4. Data/QA Component

    a. Each entity is responsible for maintaining and providing data to the stroke system as indicated in SSP. For prehospital EMS services, this means providing data to ATCC which is then placed in the stroke system database. For hospitals, this means maintaining and providing the hospital-based information in the stroke QA data set (see Appendix B).
    b. Participating entities should maintain their individual QA program as specified in SSP. They are to provide reports of these activities to the Stroke Hospital Quality Assurance Program (SCQA) on a timely basis.
    c. Active continuing participation in the QA program is required from participating organizations. Organizations must attend at least 75 percent of the regional focused review of individual topics by providing data and participating in the evaluation process.
    d. TJC or equivalent stroke hospital certification is encouraged.

5. Personnel from prehospital and hospital organizations are to participate in RQAC activities per membership responsibilities. It is required that there will be 75 percent attendance of meetings by members.

B. Maintaining system function as noted in SSP.

1. System entry criteria as specifically defined in SSP or currently active protocols are to be used by EMSP to determine patient entry into the stroke system.
2. Communications as outlined in SSP and currently approved protocols are to be initiated and maintained by EMSP. This involves initiating communications, providing information, and participating in the use of prehospital stroke care activities. This includes patient entry into the system, determination of designated stroke hospital destination, and medical control orders for provision of care using OEMS approved prehospital care protocols.
3. System operations are provided by individual entities as per SSP including approved protocols.

Failure to comply with contract performance criteria or requirements, guidelines, or adherence to system function protocols, as stated in the most current version of the written SSP, will result in specific actions to be taken by RAC. Questions of adherence to guidelines will be generated by system oversight

review by OEMS compliance staff. Issues regarding adherence to guidelines, when brought to the attention of the regional EMS agency, will be directed to RAC and OEMS for evaluation. OEMS will evaluate questions of compliance and if a compliance infraction has occurred, a report will be forwarded to RAC.

C. Prehospital component requirements and system function protocols are part of the stroke system. Deviation from that plan will result in the following actions by RAC:

1. First breach of activity guidelines will result in a letter to the prehospital service indicating there has been a breach of activity agreement with an explanation of the situation and an indication of the need for corrective action to be taken. There will be a 1-month time period for implementation of the corrective action.
2. The second breach of agreement will result in another letter to the prehospital service with a copy to OEMS compliance staff indicating that a second breach has occurred and again allowing a 1-month period for corrective action.
3. A third breach of the same activity will result in a letter to ADPH and OEMS for evaluation and action.

D. Hospital participation in the system is governed by the Memorandum of Understanding (MOU) between ADPH and each hospital. Deviations from requirements, guidelines, or system function protocols governed by the MOU may result in the following actions by ADPH:

1. The first breach of any activity agreement will result in a letter indicating that there has been a breach of an activity standard with an explanation and an indication that there is a need for corrective action. A 1-month period for corrective action will be allowed.
2. If a second breach of the same activity occurs, a letter will be sent to the responsible entity indicating that a second breach has occurred, with a warning that a third breach in that activity will result in suspension from the stroke system for a 30-day period of time. A 1-month period for corrective action implementation will occur.
3. A third breach of the same activity will result in MOU failure and suspension of that facility from the stroke system for a period of 30 days as per decision of OEMS, with the suspension time doubled for subsequent deviations of the same standard.

It will be the duty of the OEMS to carry out these pre-determined actions in cases of violation of requirements, guidelines, or failure of adherence to system function protocols for remediation recommendations.

Appendix A

Statewide Trauma and Health Systems – Stroke Center Designation Criteria

These items have been deemed Essential per the Statewide Stroke System Plan	Level IIa	Level II	Level III
	TSC	PSC	ASRH
HOSPITAL ORGANIZATION			
Stroke Service or Equivalent	E	E	
Stroke Program Director: Physician with neurology background, extensive expertise, and ability to provide clinical and administrative guidance to program	E		
Stroke Service Director: Physician with training and expertise in cerebrovascular disease		E	
Physician Medical Director for stroke services: Physician with sufficient knowledge of cerebrovascular disease			E
Stroke Coordinator	E	E	E
Hospital Departments/Sections			
Neurology	E	E	
Neurosurgery			
Neurointerventional	E		
Neurocritical Care			
Critical Care	E		
Emergency Medicine	E	E	E
CLINICAL CAPABILITIES			
Specialty availability upon notification of patient need			
Emergency Medicine – Physician Staffed (10 minutes)	E	E	E
Neurologist 24/7	E		
24/7 on-call neurology OR a neurologist by telemedicine		E	
24/7 on-call neurology OR a physician with expertise and experience in diagnosing and treating stroke OR a neurologist by telemedicine			E
Physician or nurse with ability to evaluate patient for tPA use			E
Neurosurgeon within 2 hours	E	E	
Neurosurgery Transfer Plan - timely transfer (may use ATCC) *			E
Neurointerventionalist** availability at least 70% of time	E		
Intensivist coverage 24/7	E		
Consultants availability			
Internal Medicine	E	E	
Critical Care	E	E	
Cardiology	E	E	
Neuroimaging	E	E	
FACILITIES AND RESOURCES			
Emergency Department (ED)			
Physician staffed ED (must be in hospital)	E	E	E
Nursing Personnel (continuous monitoring until admission or transfer)	E	E	E
Emergency Department available 24/7	E	E	E
Stroke Treatment Protocols in place that define tPA administration	E	E	E
Pharmacy with tPA in stock 24/7	E	E	E
Written plan for higher level of care for patients who require it	E	E	E
Equipment			
Airway control and ventilation equipment	E	E	E
Pulse oximetry	E	E	E
End-tidal CO2 determination	E	E	E
Suction devices	E	E	E
Electrocardiograph	E	E	E

Standard intravenous fluid administration equipment	E	E	E
Sterile sets for percutaneous vascular access (venous and arterial)	E	E	E
Gastric decompression	E	E	E
Drugs necessary for emergency care	E	E	E
X-ray availability	E	E	E
CT availability and interpretation in 45 minutes	E	E	E
Catheter Angiographic suite available 24/7	E		
Two-way communication with emergency vehicles	E	E	E
Sterile ventriculostomy tray readily available if NS coverage	E	E	
Operating suites adequately staffed (within 30 minutes of stroke alert)	E	E	
Post anesthetic recovery room available	E	E	
Dedicated neurointensive care beds for stroke patients	E		
Intensive Care Unit or dedicated beds for stroke patients (stroke unit)	E	E	
Personnel of intensive care unit or stroke unit			
Designated Medical Director	E	E	
Dedicated neurointensivists/proxy in-house			
Dedicated intensivists/proxy in-house	E		
Specialists with privileges in critical care in-house or on-call		E	
Monitoring equipment			
Telemetry	E	E	E
Pulse Oximetry	E	E	E
Neuroimaging special capabilities			
In-house radiology technical personnel capable of brain CT	E	E	E
Catheter angiography	E		
CTA and MRA	E	E	
Carotid duplex ultrasound and transcranial Doppler	E		
Carotid duplex ultrasound		E	
Computed tomography (emergent and routine)	E	E	E
Magnetic Resonance Imaging (MRI)	E	E	
Rehabilitation			
Rehabilitation services protocol for stroke patients	E	E	
Clinical laboratory services			
Standard analyses of blood, urine, etc	E	E	E
Blood typing and cross-matching	E	E	
Comprehensive blood bank or access to equivalent facility	E	E	
Blood gases and pH determination	E	E	
CSF examination capabilities	E	E	
Comprehensive coagulation testing	E	E	E
CONTINUING EDUCATION			
At least 8 hours annual program education are provided for:			
Stroke Program Director/ Stroke Service Director	E	E	
At least 4 hours annual program education are provided for:			
Physician Medical Director for stroke services			E
At least 2 hours annual program education are provided for:			
Staff Physicians who care for stroke patients	E	E	E
At least twice a year stroke program education is provided for:			
All other staff members who care for stroke patients	E	E	E
Stroke Prevention Program Coordinator	E	E	D
Annual Acute Health Systems Training:			
Physicians	E	E	E
Emergency Department staff	E	E	E
PERFORMANCE IMPROVEMENT			
Does hospital track patient outcomes?	E	E	E
Perform on-going evaluations?	E	E	E

Strive for improvement?	E	E	E
Community outreach/public education?	E	E	E
RESEARCH AND REGISTRIES			
Participate in a stroke registry	E	E	D
PROCEDURAL VOLUME REQUIREMENTS			
Organization performs 15 mechanical thrombectomies over 1 year (or 30 over 2 years)	E		
Neurointerventionalist** performs 15 mechanical thrombectomies over 1 year (or 30 over 2 years)	E		

*ATCC can be used to coordinate transfers within the stroke system.
**Physician with neurology, neurosurgery, or radiology background with 1-year formal training or experience in performing intracranial cerebrovascular procedures, including minimum 15 mechanical thrombectomy during this period.

Level I Comprehensive Stroke Center Guidelines

To be recognized as a Level I Comprehensive Stroke Center, a hospital must be certified by The Joint Commission as a Comprehensive Stroke Center, or equivalent, and maintain status with ATCC.

Appendix B

Prehospital and Stroke Hospital QA Data Set

1. Identification number provided by ATCC upon initial contact by prehospital provider or hospital (the same number would follow the patient through the system)

2. Location of the incident (city or county possibly information from a city map grid)

3. Prehospital unit(s) responding

4. Times
   a) Prehospital
      1) Incident
      2) Unit dispatch
      3) Unit scene arrival
      4) Extrication ended (if applicable)
      5) Unit scene departure
      6) Unit hospital arrival

   b) Communication
      1) Initial contact
      2) ATCC contact/link to receiving designated hospital
      3) Additional contacts to ATCC by EMSP

5. Receiving hospital or stroke hospital

6. System entry data
   a) Primary entry triage criteria and EMSA
   b) Co-morbid criteria and patient history
   c) EMSP discretion
   d) Patient age
   e) Patient sex
   f) AVPU (alert, voice, pain, unresponsive)
   g) EMSA Scale
   h) Scene vital signs

7. Prehospital outcome
   a) Loss of vital signs and time
      1) Lived
      2) Expired (time)

8. Hospital readiness
    a) Physician arrival time in ED
        1) ED attending physician
        2) Neurologist
        3) Neurosurgeon
        4) Other: State_____

9. Procedures done within the first 24 hours (includes all procedures performed by initial receiving hospital or stroke hospital or receiving stroke hospital if patient is transferred.

10. Hospital has confirmed stroke? If not, explain system entry.

11. LKW

12. Stroke type (LVO, ischemic or hemorrhagic)

13. If ischemic, was thrombolytic administered? If not, indicate reason.

14. IF LVO, location, was mechanical thrombectomy performed?

15. Was patient admitted to stroke hospital?

16. Disposition
    a) ED disposition
        1) Disposition time-when patient goes to the initial hospital care location (not just leaving the ED, i.e., to CT scan)
        2) Disposition location
            a. Discharged-ICU, Stroke Unit, OR, or floor
            b. Admitted
                - Higher level designated stroke hospital
                - Equal level designated stroke hospital
                - Lower level designated stroke hospital
                - Reason: _____

    b) Final stroke hospital disposition/date/location
        1) Home
        2) To rehabilitation center
        3) To another acute care facility
        4) To extended care facility
        5) Expired

Appendix C

Continuous Quality Assurance

A. Quality assurance is a vital part of a stroke system. It is used to document continuing function of the system and evaluation of that function to implement improvements in system function and stroke patient management. In a stroke system, patients have virtually no time to make specific choices regarding acute and critical medical care and, therefore, the system itself has a responsibility to perform evaluation functions to ensure that the highest level of care is being provided and that improvements are implemented whenever possible in a timely manner.

B. Such a program will be system wide. There will be individual agency efforts on the part of all participating organizations in addition to oversight by the RAC QA subcommittee.

C. The appropriateness, quality, and quantity of all activities of the system must be continuously evaluated. Items evaluated are reflected in Appendix B (Prehospital and Stroke Hospital QA Data Set).

    1. Medical care
    2. Prehospital care
    3. System function (dispatch activities, scene time, triage process and destination, response level, etc.)
    4. RQAC will report findings to RAC on a regular basis.

D. Prehospital and inter-hospital care

    1. Items evaluated
        a. Patient assessment
        b. Protocol adherence (when applicable)
        c. Procedures initiated/completed
        d. On-scene time
        e. Medical control interaction
        f. Transport mode (ground/air)
        g. Resource availability/needs match
        h. Arrival report
        i. Record/documentation
        j. Inter-facility care/transport

    2. Process-primarily performed by EMS organizations
        a. Each organization assigns a QA Manager to oversee process
        b. Guidelines established-regional/authorized
        c. Determine audit filters
        d. Collect data

e. Evaluate data
f. Determine QA issues present
g. Develop corrective action plan
    1) Professional resolution
    2) Administrative resolution
h. Re-evaluation to document results/effectiveness of corrective action plan

E. Stroke Hospital QA

1. Medical care
    a. Complications
    b. Blood pressure protocol violations in thrombolytic treated patients
    c. Thrombolytic treatment rates in association with symptomatic intracerebral hemorrhage rate
    d. Deaths
    e. Outcome review
        1) Internal review
        2) External comparison
    f. Process for medical care QA (performed by each institution)
        1) Establish written care guidelines
        2) Collect data
            a) Stroke data elements
            b) Complications of events list
        3) Data QA evaluation
            a) Establish audit filters (indicators)
            b) Determine presence of potential QA issue
            c) Primary review (permissible)
            d) Multi-disciplinary peer review of QA issue
        4) Corrective action
            a) Professional resolution
            b) Administrative resolution
        5) Re-assess for effectiveness of corrective action
        6) Documentation is essential utilizing QA tracking flow sheet

2. Designated stroke hospital function
    a. Designated stroke hospital operations via audit filter review
        1) Continuous
        2) Intermittent
        3) Focused audit filter review
    b. Specific event evaluation when event problem noted by stroke team member
    c. Medical nursing audit
    d. Utilization review
    e. Divert utilization review

f. Process same as for Medical Care Review with the addition of some form or method for noting events that occur that need evaluation to try to improve designated stroke hospital functions

F. Regional system function

1. Primarily performed by RAC
2. Evaluation of overall regional system function
3. Process
   a. Establish standard
   b. Collect data
   c. Evaluate data-determine audit filters
   d. Devise plan of corrective action for QA issues
   e. Re-evaluate to determine effectiveness of corrective action
   f. Participation in SCQA program

G. SCQA program (staffed by regional EMS agency)

1. Goals review entire stroke system
   a. System administration/organization/activities
   b. Prehospital care
   c. Hospital care
2. Members
   a. OEMS staff
   b. Prehospital provider representation--the designated QA coordinator for each county (from an EMS organization)
   c. Participating provider representation
      1) Stroke Director
      2) Stroke Coordinator
3. Process
   a. Brief report of QA activities from each participating county/EMS organization and hospital
   b. General system information
   c. Focused review of items of major concern/impact including selected cases
   d. Develop consensus of issues that represent QA concerns
   e. Develop action plan
   f. Have re-evaluation process to determine effectiveness of action plan results
   g. Complete documentation of all activities including any recommendations for change or action to OEMS and RAC
4. Regional Hospital Medical Care Review Subcommittee
   a. Members
      1) Stroke Director from each participating designated stroke hospital
      2) ED Medical Director from each active Stroke Operations Committee
      3) Regional EMS Medical Director

4) The chairman of this committee will be the chairman of the Stroke Subcommittee of RAC

b. Activities are to review the stroke medical care issues including specific death audit review and major complications review as determined by the committee chairman. Other QA issues will be reviewed as deemed appropriate.
c. The process used will be the same process as outlined in the QA section of the STHS Stroke System Plan.
d. Reports of a summary nature will be made to the SCQA program. Individual physician medical care issues will initially only be reported to the stroke director of the facility providing care in the situation and be made by personal communication. In general, discussions at the subcommittee will fulfill this notification requirement. If a persistent individual problem trend occurs, this situation will be referred to the appropriate hospital QA committee.

5. All members are required to attend at least 75 percent of the SCQA program meetings and the Hospital Medical Care Review subcommittee meetings.

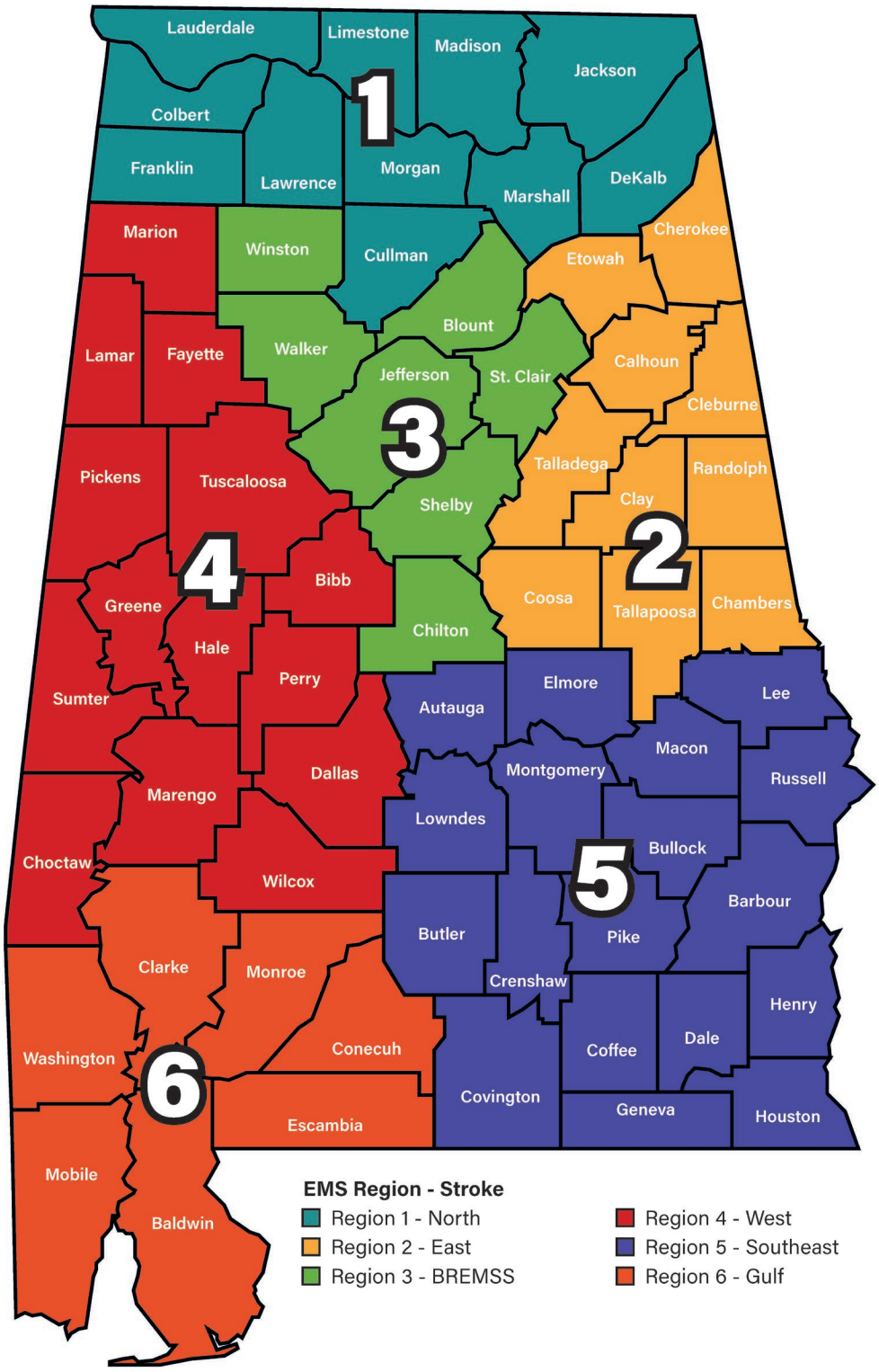
Appendix D

Acronyms

ADPH: Alabama Department of Public Health
AIS: Acute Ischemic Stroke
ASRH: Acute Stroke Ready Hospital
ATCC: Alabama Trauma Communication Center
BREMSS: Birmingham Regional Emergency Medical Services System
CDC: Centers for Disease Control and Prevention
CSC: Comprehensive Stroke Center
DNV: Det Norske Veritas
EMS: Emergency Medical Services
EMSP: Emergency Medical Services Personnel
EMSA: Emergency Medical Stroke Assessment
ERD: Emergency Resources Display
ETA: Estimated Time of Arrival
HOR: Hospital Outcome Reports
LKW: Last Known Well
LVO: Large Vessel Occlusion
MOU: Memorandum of Understanding
OEMS: Office of Emergency Medical Services
PSC: Primary Stroke Center
QA: Quality Assurance
RAC: Regional Advisory Council
RQAC: Regional Quality Assurance Committee
SBST: Severity-Based Stroke Triage
SCPH: State Committee of Public Health
SICH: Symptomatic Intracerebral Hemorrhage Rate
STHS: Statewide Trauma and Health Systems
SSP: Stroke System Plan
STHSAC: State Trauma and Health System Advisory Council
TJC: The Joint Commission
tPA: Tissue Plasminogen Activator
TSC: Thrombectomy-Capable Stroke Center

Appendix E

EMS Regional Map



Appendix F

Acute Health Systems Authority Process For Rules/Plan Development

(Trauma, Stroke, and Cardiac)

RULES

- Statute
- ADPH
- OEMS/AHS
- STHSAC
- SCPH
- Public Comment
- SCPH

PLANS

- Statute
- ADPH
- OEMS/AHS
- Workgroup/Regions
- STHSAC
- SCPH, if indicated

Acute Health Systems Operational Flowchart

(Trauma, Stroke, and Cardiac)

ATS Operational Flowchart