

REGIONAL STROKE SYSTEM PLAN

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AMERICAN HEART ASSOCIATION**

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STROKE PLAN

BACKGROUND

Stroke is a serious and common illness. Data on the incidence of stroke, collected by the American Heart Association, indicated that in the United States there is a stroke about every minute and a person dies of stroke about every 3 ½ minutes. At the moment, there are 3 to 4 million Americans who had a stroke yet are still alive. The death rate is approximately 30% of all stroke victims. This rate has declined significantly over the last several decades, not due to therapy for stroke, but due to excellent treatment of the complications that occur after a stroke.

We can put the stroke problem into perspective by comparing it to other neurological illnesses. For example, Parkinson's disease affects about 50,000 new patients every year, and there are now at least 350,000 Americans with Parkinson's disease. Every year about 400,000 new cases of Alzheimer's disease are diagnosed; there are about 1 million people alive with the disease. About 125,000 new cases of epilepsy occur each year and about 2 million Americans are currently affected. Traumatic brain injury affects 300,000 cases each year; new brain tumors are found in 25,000 people each year. Clearly, stroke affects more people every year than any of these other illnesses, with Alzheimer's disease coming closest - about 400,000 new cases compared to 500,000 new cases of stroke. And in terms of survivors - patients who require care and patients who require resources - the 3 to 4 million stroke patients far and away present the biggest problem.

What happens to stroke survivors? Recent studies of acute stroke using the modified Rankin disability scale, in which the worst outcome is death (a Rankin score of 5), show that the percentage of patients who die is between 16% and 23% in the first 3 months. On the Rankin scale, a score of 0 or 1 indicates a good outcome, or normal recovery, after stroke. In these studies, only 25% of patients recover fully. Considering the 20% who die, this leaves approximately 55% of stroke patients (those with a Rankin score of 2,3, or 4) with varying degrees of disability at 3 months after stroke. These numbers are approximately the same at 1 year after the stroke. It is this group that creates an ongoing burden to society, to the patient, and to their families.

These patients are impaired in basic activities of daily living such as feeding, bathing, and grooming. What other limitations do handicapped stroke survivors face? The most interesting finding is that 40% of handicapped survivors feel they can no longer visit people. Other significant handicaps include impairments in walking, helping around the house, doing dishes, and cooking. Almost 70% of handicapped stroke survivors report that they can't read. Life for stroke survivors can be bleak: they are no longer as mobile as they once were; they can't read books or the newspaper; they can't enjoy hobbies as they once did; they can't help with the shopping or the gardening. Almost 100% can't help out with the housework. The magnitude of the problem to the individual is enormous.

Stroke can result from several different diseases. Of the 500,000 strokes that occur each year, 400,000 are caused by infarctions (most are first-time strokes, some are second time strokes), and 100,000 are hemorrhagic, either intracerebral or subarachnoid. A hemorrhagic stroke can be

a hematoma, a disease that occurs in the same age group and is associated with the same risk factors as infarction. But unlike patients with infarctions, about 60% of patients with a hematoma die. And most of the survivors are left gravely disabled. Subarachnoid hemorrhage is a disease of young and middle-aged adults. There are about 30,000 of these cases every year: 80% of them are due to a ruptured berry aneurysm, 50% of which are fatal, and half of the survivors are left disabled. These patients, since they are only 30 or 40 years old at the time of the stroke, require the same services as older stroke patients but for a much longer period of time. Serious complications of subarachnoid hemorrhage include vasospasm, which can be treated.

Stroke is a very expensive disease. Of the first-year costs, 50% accrue during inpatient hospitalization. The distribution of costs among patients, though, is skewed: 10% of people account for about 30% of the total cost. And although 80% of strokes are from infarctions, only half of the costs are due to infarction, indicating that hemorrhages account for a disproportionate share of the cost of stroke.

Medical costs for a patient with a mild stroke are approximately \$8,000. For patients with more severe strokes, including patients with intracerebral hemorrhage, the cost is approximately \$15,000 for an admission for the first year. For patients with subarachnoid hemorrhage, the cost is almost \$30,000. These patients are more seriously ill. They spend more time in intensive care units and require more care after discharge from the hospital.

Dying from a stroke doesn't save money. If a patient dies of a stroke, the cost is approximately the same as the cost of caring for a stroke inpatient. A TIA costs about \$4,000, on average, for an inpatient. A fatal intracerebral hemorrhage is slightly less expensive than a stroke, and a fatal subarachnoid hemorrhage is about \$10,000 less.

References

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2. Solomon NA, Glick HA, Russo CJ, et al. Patient preferences for stroke outcomes. *Stroke* 1994;25:1721-1725.
3. The National Institute of Neurological Disorders and Stroke rt-PA Stroke Study Group. Tissue plasminogen activator for acute ischemic stroke. *N Engl J Med* 1995;333:1581-1587.

The announcement, in late 1995, that acute ischemic stroke can be successfully treated with thrombolytic agents created the need for a national plan on how to make this treatment available to eligible patients as rapidly as possible. While thrombolytic therapy of ischemic stroke with t-PA was the impetus for care changes, it was recognized from the outset that the successful treatment of any type of stroke will require rapid response to all stroke types. Specifically:

- n *Prehospital emergency response systems* must train personnel to correctly identify potential candidates for treatment and work closely with hospital emergency departments to transport these patients rapidly to appropriate stroke centers. Thrombolytic therapy for ischemic stroke requires an especially rapid response in the first few minutes after a patient arrives at a hospital.

- n *Emergency departments* must have specialized protocols in place for identifying candidates for therapy and treating those that require therapy within a narrow therapeutic time window.
- n *Hospitals* must develop comprehensive acute stroke plans that define the specialized roles of nursing staffs, diagnostic units, stroke teams, and other treatment services such as pharmacy and rehabilitation.
- n To take full advantage of effective stroke treatment, all *health care systems* involved in managing eligible patients must be carefully integrated, taking into consideration the wide diversity of health care that exists throughout the United States, from rural settings with minimal access to specialized care to urban settings with a high volume of emergency patients.
- n *Public education* is critically important in ensuring that all of the efforts cited above are successful. The public must learn that a brain attack is a medical emergency, that a treatment is now available for some stroke patients, and that this treatment is only effective when given within a few hours of the onset of symptoms.

Prehospital Emergency Medical Care Systems:

- n EMS personnel must be trained to treat stroke as a time-dependent, urgent medical emergency, similar to acute myocardial infarction.
- n A Chain of Recovery - beginning with the identification (either by the patient or an onlooker) of a possible stroke in progress and ending with a rehabilitation plan - must be established in every community of the country.
- n New educational initiatives must be developed and implemented for all medical personnel in the Chain of Recovery, including 911 dispatchers, EMS technicians, and air medical transport personnel. This will require the creation of task forces to develop model educational initiatives, and standardized data sets to help ensure effective research and outcomes analyses.

Emergency Department:

- n Acute stroke patients should be classified as quickly as possible to identify those eligible for thrombolytic therapy. Although this classification will often be done by physicians in emergency departments, it may also be accomplished by others, e.g., prehospital care providers, triage nurses, or other individuals competent to apply categorization criteria. Patients deemed ineligible for thrombolytic therapy will undergo a different rapid categorization to establish what treatment they should receive.
- n Response systems, including optimal time frames, must be established, maintained, and monitored in all emergency departments. The goal should be to (a) perform an initial patient evaluation within 10 minutes of arrival in the emergency department, (b) notify the stroke

team within 15 minutes of arrival, (c) initiate a CT scan within 25 minutes of arrival, (d) Interpret the CT scan within 45 minutes of arrival, and (f) transfer the patient to an inpatient setting within 3 hours of arrival.

- n Although medical management of blood pressure remains a controversial and complex topic, general guidelines were outlined at the Symposium. For example, for acute stroke patients who are candidates for thrombolytic therapy, antihypertensive treatment should not be given if systolic blood pressure is less than 185 mm Hg or diastolic pressure is less than 105 mm Hg or diastolic pressure is less than 105 mm Hg. Acute stroke patients with a diastolic pressure greater than 140 mm Hg or a systolic pressure greater than 220 mm Hg on two readings are generally not candidates for thrombolytic therapy, although antihypertensive treatment should be given.

Acute Hospital Care:

- n Every hospital providing care to stroke patients should develop a Stroke Plan that defines the optimal treatment pathways appropriate for that particular institution.
- n Patients who meet thrombolytic treatment criteria should have access to stroke expertise within 15 minutes of hospital arrival and neurosurgical expertise within 2 hours of hospital arrival. Other timeframe recommendations are outlined above under “Emergency Department.”
- n A Stroke Toolbox containing guidelines, algorithms, critical pathways, NIH Stroke Scale training tapes, and other stroke templates should be created, updated, and made easily available through the NINDS.
- n Health professional training programs should be modified to include standards of acute stroke care and the Acute Health Care Panel endorsed specialty-specific continuing medical education related to acute stroke.
- n Criteria for primary, intermediate, and comprehensive stroke centers should be established.
- n Communities should be encouraged to create local and regional stroke networks encompassing all levels of acute stroke care.

Health Care Systems:

- n Creating an efficient stroke care delivery system should start with identifying committed prehospital and hospital leaders who will act as “champions.” The task of these champions will be to develop and sustain teams for managing stroke patients through the various phases of care. Champions should use flow-charting techniques to help them understand the current components of care, decide on necessary modifications, and implement these modifications.

- n All components of the stroke care delivery system must be integrated functionally, financially, and legally so they work together seamlessly. Those who activate the acute stroke treatment system should work with the approach that “one call does it all,” with everyone on the team linked with pagers or cellular phones.
- n Key indicators for acceptable outcomes of acute stroke care must be identified. Indicators should be established for the prehospital setting, the emergency department, and the acute stroke care unit within the hospital, as well as for the variety of discharge settings, including rehabilitation facilities.

Public Education:

- n Behavior change is achievable, as demonstrated by many past public education successes. But change occurs slowly, so those implementing public education campaigns must be persistent and patient.
- n Big, comprehensive programs that employ many communications vehicles are the most effective.
- n Motivation to change occurs when the public perceives that the benefits of change exceed the cost of change. The messages about seeking prompt health care after a stroke must be simple, clear, and repeated often.
- n We must understand our audience, which is comprised of many subgroups with different backgrounds and different methods of learning. Messages must be tailored to these various groups.
- n Success is most likely if public educators follow a Madison Avenue approach to delivering messages. In this approach, strategy always precedes execution, and the best strategy tool to use is the creative brief, a document that defines the target audience, identifies the desired actions to be taken by that audience, presents current consumer beliefs and barriers to taking action, and establishes long-term goals.

GOALS

The primary goal of this Regional Stroke System Plan is:

To develop a Stroke Emergency Care System that, when implemented, will result in decreased stroke mortality and morbidity in the region.

In order to accomplish this the Committee identified a number of specific processes deemed essential. These are:

1. The ability to rapidly and accurately identify stroke patients.

2. Patients who have sustained or are likely to sustain a stroke must receive care in a hospital that has a stroke treatment program in place (i.e. a Stroke Center) which is capable of providing immediate and comprehensive assessment, resuscitation, and definitive care, plus establishing rehabilitation access when needed.
3. There must be continuous and effective region-wide coordination of pre-hospital and hospital care resources, so that stroke patients will be most expeditiously transported to the closest stroke center, so their care can be provided in a manner that is both appropriate and timely, while establishing and maintaining continuity. To accomplish this process there must be a method of tracking the care of stroke patients.
4. The program must provide all hospitals in the region the opportunity to participate in the system (an inclusive system), and to receive stroke patients if they are willing to meet the system and operational criteria, as established by this task force.
5. The system must have an ongoing and effective QI Program, in order to assure continuing appropriate function in providing the highly specialized care necessary in the management of stroke. This program will include evaluation of pre-hospital management, hospital management, and overall system function. A standard pre-hospital dataset and hospital dataset will be required of all system participants, allowing uniform system evaluation to document the effectiveness of the function of the stroke system.

REGIONAL STROKE SYSTEM OVERVIEW

The Task Force has developed a plan for a Regional Stroke System that meets the goals set forth in the previous section. A system is a group of individual components brought together to function in a unified manner to achieve a specific end result. In this case, the end result is improvement in stroke survival and outcome in our region. The components to some degree have separate and individual identities and functions, however, there should be an understanding, a desire, and willingness to work together in a unified effort to reach the end result. Since there is no legally sanctioned mandate for development and implementation of a Regional Stroke System, the only option the Task Force had was to develop a voluntary system. A voluntary system requires a uniquely strong commitment to stroke. The Regional State System is constituted by the hospitals designated as Stroke Centers and the protocols to be implemented for pre-hospital and hospital treatment of patients that have a stroke or a high probability for stroke. These patients will be selected based upon primary triage criteria (system entry criteria) included in the Regional Stroke Plan. If patients meet the primary triage criteria for system entry, the system function protocols and specialized stroke care resources at the Stroke Centers will be implemented for their care. Patients who do not meet the primary triage protocols for entry into the system will not be Stroke System patients and any reference to **Stroke System Patients** in this document does not pertain to this group of patients.

Systems require oversight of project concept, overall responsibility, developmental aspects, implementation, and evaluation of continuing activities. Such an entity is commonly referred to as a lead agency and, in this program, the proposed lead agency is the Birmingham

Regional Emergency Medical Services System (BREMSS). This body has the responsibility for coordinating pre-hospital EMS and hospital Emergency Department activities in our region. The authority of this agency is derived from specific activity goals and plans approved by the ADPH/EMS office and the State Board of Health. Also, the willingness of pre-hospital and hospital healthcare providers in our region to allow BREMSS to serve as the lead agency so that stroke care in our region is systemically improved. The Executive Committee of BREMSS serves as the leadership body for this organization and therefore, will serve as the oversight for this program.

The Regional Stroke System basically involves the organization of already existing resources into a program providing comprehensive care for stroke patients through all phases of their management from the moment of onset through rehabilitation. The two basic patient management components of this system are the pre-hospital providers and individual hospital organizations (i.e. Stroke Centers).

The system function involves the establishment and implementation of the protocols included in this Plan. Based upon need, modifications and additions may be developed by the Stroke Implementation Committee and the Stroke Operations Committee for system operations. The entry criteria are intended to select patients with actual or a high potential for having a stroke. It is estimated that four to five patients per a 24-hour period will be entered in the system. Upon determination that a patient has had or has a high probability for a stroke and would benefit from specialized Stroke Center management, specific entry into the Stroke System will be automatically accomplished and resource availability will be surveyed. Entry into the system means that a patient meets specific triage criteria indicating an actual or high probability of a stroke and the specialized Stroke System resources will be used in their care. Protocol directed Stroke Center destination will be determined and the care of these patients will be evaluated through the QI Program. A Stroke System which reports stroke patients into a centralized facility enables the most appropriate resource utilization and the most appropriate care to be provided.

Once a stroke patient is entered into the System, the closest system hospital (i.e. Stroke Center) with available resources matching the level of need can then be selected as the appropriate destination for that patient, using the Regional Stroke Plan criteria and protocols. Hospitals participating in this system and receiving stroke patients will have organized response systems, including 1) equipment and facilities 2) trained and committed personnel 3) organized management protocols such as that in the Advanced Cardiac Life Support. A regional stroke database will be established, which will allow generation of overall knowledge of the magnitude and scope of stroke in our region, determination of teaching and training needs in stroke, and will be used in conjunction with other ambulance services and hospital evaluations in a continuous quality improvement program to evaluate the stroke care and be able to document appropriateness and quality, with implementation of improvements utilizing this evaluation process. The Task Force recommends a specific Stroke Implementation Committee to actually establish the program and then a Stroke Operations Committee to oversee the program during its continuing function. These committees will be directly responsible to the lead agency. They will make recommendations regarding the Stroke System to the lead agency for action. The

Stroke Operations Committee will specifically review the continuing function of the Stroke System and prepare routine reports regarding system function and QI review summaries for the lead agency.

Finally, it is important to emphasize that Stroke is a neurological disease. The Emergency Department plays a critical role in stroke management, but Neurological and Neurosurgical Care are absolute pivotal services in determining the survival and recovery of stroke patients. Neurological leadership of hospital stroke programs is, therefore, essential in order for hospitals to participate 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 neurologist's participation in the Regional Stroke System activities and through the individual hospital QI programs.

COMPONENTS AND ORGANIZATION

The Regional Stroke System is comprised of a number of separate components, which are organized and work together as a system. The individual components and elements which make up the system will be described in this section.

I. PRE-HOSPITAL COMPONENT

EMS Units are an integral part of the Regional Stroke System. However, their organization will not be changed by the Regional Stroke System. Conversely, changes in the make up of EMS Units will not affect the functional status of the Regional Stroke System. There is, nevertheless, a specific issue regarding the pre-hospital component of the Regional Stroke System:

All EMT Intermediates and Paramedics need to have a basic knowledge and awareness of the Regional Stroke System elements and system function. This specifically refers to the entry criteria and communications. If they are unclear about entry criteria or system function this information can be easily obtained on a 24 hour a day basis from the Trauma/Stroke Communications Center so that they can then apply the system stroke protocols in field care situations.

II. HOSPITAL COMPONENT

Hospitals will be able to participate in this system on a voluntary basis. Standards have been developed by the Stroke Task Force. These are present in Appendix A. Each hospital will be able to determine whether they are on-line (have adequate resources currently available and receive patients based on system operations protocols) or are off-line (do not have adequate resources currently available and do not receive patients per the Stroke System). The participating hospitals (i.e. Stroke Centers) will be able to go on-line and off-line at will.

Each hospital must have a Neurologist primarily responsible for oversight of the Stroke Program. This responsibility includes:

1. Working with administration to maintain the resources necessary to be a designated Stroke Center.
2. Assuring that call schedules that provide physician availability are prepared on a monthly basis.
3. Establishing maintaining basic stroke care protocols for the hospital.
4. Oversight responsibility for the Hospital Stroke QI Program per Plan standards, and participation in Regional Stroke System administrative and QI activities as per the Regional Stroke Plan, including data collection and reporting to BREMSS.

Participation in the Regional Stroke System is accomplished as follows:

1. The decision to participate must be made jointly by both Hospital Administration and Medical Staff, under the commitment of human and physical resources.
2. An application is obtained from BREMSS, completed and returned, documenting the hospital's desire to participate.
3. An on-site orientation meeting at each applying facility is to be held to review the system design and function, plus the requirements to assure there is a full and complete understanding on the part of the hospital and the medical staff. This meeting must be attended by a minimum of the Neurologist leader of the stroke program in that hospital, the Medical Director of Emergency Department and the Hospital Administrator.
4. The Stroke Operations Committee will review the application and on site visit report to document compliance with requirements and knowledge of system design and function and provide a report to the BREMSS Executive Committee.
5. The BREMSS Executive Committee will make the final decision regarding hospital participation as a Stroke Center in the System. If approved, the hospital will become part of the System by executing a contract with BREMSS documenting their willingness to actively participate in the System.

Hospitals, therefore, must elect whether or not to participate in this system based upon their individual ability to meet the standards for a Stroke Center, the desire of the Medical Staff to participate and support this program, and the willingness of the Hospital Administration to support the Regional Stroke Program.

III. COMMUNICATIONS COMPONENT

Communications are critical to the function of the Stroke System. Communications provide (1) essential knowledge of the overall status of pre-hospital stroke activities and hospital resource availability on a continuous basis, (2) access to system organization and function protocols whenever such information is requested by pre-hospital personnel or hospital based personnel, (3) a link between the field and Stroke Centers for the rapid exchange of information resulting in efficient pre-hospital care

provision and hospitals being able to best prepare for stroke patient arrival, (4) collection of uniform System-wide data for both QI activities and development of a Regional Stroke database. Providing all of these functions to the entire System on a continuous basis requires a central communications facility with constant communications capabilities to all pre-hospital units and participating hospitals, plus the ability to immediately and directly link the pre-hospital providers to the Stroke Centers. This central communications will be the existing Alabama Trauma Communications Center (ATCC). This decision is made because of an already existing funded infrastructure which may be utilized.

The ATCC is staffed 24 hours a day by personnel who will be provided with specific in-depth knowledge of the Regional Stroke System design, function, and protocols. It will be the primary responsibility of the ATCC to coordinate the Regional Stroke System activities by maintaining and providing information whenever needed on the field status and hospital status so this data can be used by the pre-hospital and hospital personnel in providing care to patients meeting system entry criteria. The ATCC, a part of the Regional Stroke System, will be managed by BREMSS, and oversight of the day-to-day operations of the ATCC are the responsibility of the BREMSS Executive Director. The ATCC will operate through the system operations protocols. The ATCC will make no primary decisions themselves, but provide information about patient management and destination as per pre-established protocols for system function. The ATCC will serve as a resource for such protocol information to EMTs that may not be familiar with the protocols or the ATCC may simply provide the coordination of pre-hospital and hospital resource utilization for stroke management. Therefore, the general functions of the Stroke Communications Center are:

1. Assigns unique system I.D. number for each patient meeting system entry criteria for tracking throughout the system.
2. Collects brief pre-hospital database?
3. Provides information on system entry criteria based on preset protocols as requested by EMTs when it is not clear if a patient meets Stroke entry criteria.
4. Maintains knowledge of the functional status of all system hospitals at all times.
5. Maintains knowledge of the activity status in the pre-hospital setting at all times.
6. Coordinates patient destination, when patient meets system entry criteria, based on preset protocols as to the closest currently operational Regional Stroke Center.
7. Coordination for optimal resource utilization using pre-established protocols for system function when there are multiple simultaneous events in the region (which, of course, neither EMTs or individual hospitals could know about).
8. Establishes automatic communication link between EMS provider and receiving facility.
9. Records and enters pre-hospital data for Regional Stroke database.

An Emergency Resources Display is also part of the communications component. The Emergency Resources Display provides each participating hospital and the Stroke

Communications Center with the continuous real-time functional status display of all Stroke Centers. The Emergency Resources Display is a simple computer system with terminals at each participating facility and the ATCC. This system will provide a display grid listing each individual hospital, and the primary resource components indicating the availability or non-availability of these individual components in each hospital. Therefore, their current stroke activity status. Each system hospital will maintain the status notation of the primary stroke resources in that hospital and therefore, their overall stroke activity level. The Stroke Centers will be able to change their resource availability status and activity level at any time. A record of stroke hospital activity status for the entire system will be maintained through the Emergency Resources Display at the ATCC. Any change in hospital status as made by hospital personnel at its own display terminal will be automatically communicated to the central system monitoring station at the ATCC. The ATCC maintains a consolidated system wide display status indicating the individual resource availability at the Stroke Centers and their overall functional status at any given time. This consolidated information table will be transmitted back to hospitals. The system is maintained automatically by computers with automatic polling and display refresh. The consolidated status display would be similar to the following example:

EMERGENCY RESOURCES DISPLAY

<u>HOSP.</u>	<u>T.C./STROKE LEVEL</u>	<u>E.D.*</u>	<u>ANES.</u>	<u>O.R.</u>	<u>X-RAY</u>	<u>ICU*</u>	<u>TS</u>	<u>SS</u>	<u>OS</u>	<u>NS</u>	<u>CT*</u>	<u>NEURO*</u>
A	1 Stroke	1 2	3	4	5	6	7	8	9	10	11	12
B	3 Stroke	1 2	3	4	5	6	7	8	9	10	11	12
C	1 Stroke	1 2	3	4	5	6	7	8	9	10	11	12
D	2 Stroke	1 2	3	4	5	6	7	8	9	10	11	12
E	3 Stroke	1 2	3	4	5	6	7	8	9	10	11	12
F	4 Stroke	1 2	3	4	5	6	7	8	9	10	11	12

Numbers are color coded - green for available, red for not available

Hospital abbreviations are automatically color coded for on-line status (green-active, red-inactive) based on individual resource availability in the hospital at that time. (See page 27)

* Resources available for stroke system patient

The equipment for the Emergency Resources Display will consist of a color video monitor, a computer and a modem connected to a dedicated line which does not enter the facility through the switchboard. The software will allow simple keystroke change of resource status by the Stroke Center personnel and this change will be transmitted to the central system monitoring station at the ATCC with this information then being immediately updated on all resource display monitors in the system. The central monitor station automatically polls the individual

monitor stations in the system. If a station's computer fails to acknowledge the poll, that hospital's information will be blanked out on all resource display monitors in the system. If there is an isolated failure at a resource display at a hospital that will not cause a total system fault, that hospital will be blacked out and the ATCC will call requesting the information directly. The system integrity is not dependent upon any single station's operation. The communications component's options are detailed in Appendix ___.

IV. DATA QUALITY IMPROVEMENT COMPONENT

This component is absolutely essential for function of the Regional Stroke System. In virtually any serious stroke emergency, the patient has a very limited ability to meaningfully select pre-hospital, hospital and physician care. The efficacy of the initial care in these patients may have a pivotal role in determining their outcome. Therefore, there is a need to evaluate the system functioning to determine continuing effectiveness in the management of stroke. This component uses a system-wide stroke database, which would provide an overall look at stroke emergencies, care and outcomes, provide information for use in determining and developing stroke teaching programs, provide information able to be used in potential stroke studies, and utilization in evaluation of system function in the QI Program. There are two basic elements of this component. The first is a standard stroke dataset that will be used to establish a regional stroke database. The second element is the continuous quality improvement program of the Stroke System.

The Stroke QI Dataset is designed as a small dataset, with only 10 fields, and it is intended to fulfill the goals of this component as stated in the previous paragraph. A unique stroke identification number will allow uniting pre-hospital and hospital data which will increase the data usefulness. The data fields are noted in the following list:

1. Incident location
2. Pre-hospital unit(s)
3. Activity times
4. Receiving hospital
5. Patient and system demographics
6. Pre-hospital outcome
7. Hospital status/response
8. Emergency Department disposition
9. Initial (within the first 24 hours) procedures
10. Final disposition

A more thorough listing of the Stroke QI Data set is present in Appendix ___.

The second entity in this component is the quality improvement (QI) 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 the patients may not have the ability to make their own personal medical care choices and

depend on the system for adequacy and completeness of care. This program will be system-wide with the individual agencies basically doing their own QI evaluations and reporting to a regional oversight committee. The appropriateness, quality and quantity of all activities in the system must be continuously monitored in the areas of pre-hospital care, medical care of the patients in the hospitals and overall system function.

The basic QI process involves specific steps to be performed by each individual entity. These steps are:

1. Assignment of a QI manager to oversee the process in the organization.
2. Develop a written QI program to evaluate patient care with regard to appropriateness, quality and quantity and as part of that program, patient care standards are established for use in the evaluation process. For pre-hospital programs this simply may be the regional pre-hospital protocols. These programs are reviewed and approved by the Regional QI Committee and lead agency as part of becoming a Stroke System participating hospital.
3. A method for QI data collection is established. For Stroke Centers this must include a morbidity and mortality list.
4. QI evaluations are undertaken by the individual system participants - EMS providers or Stroke Center hospitals. This first involves the determination of specific audit filters. Mandatory Stroke Center audit filters include major complications and deaths. Other appropriate audit filters are also evaluated. For Stroke Centers, external outcome comparisons are part of the evaluation process.
5. Determine the presence of QI issues through the data evaluation process.
6. Discussion of QI issues at the formal QI Conference of each individual system participant - EMS provider or Stroke Center.
7. Develop a correction action plan. In general, action activities can be placed under the categories of professional resolution or administrative resolution.
8. Re-evaluation must occur 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 Stroke Centers a multi-disciplinary peer review process must occur. In Stroke Center QI programs both medical care and Stroke Center function must be evaluated.

The Regional QI Committee has the goal of reviewing the entire Regional Stroke Program activities for appropriateness, quality, and quantity of activities. That review is to include system administration/organization activities, pre-hospital care and hospital care. The Regional Committee will document effectiveness of hospital and EMS Service QI evaluations through routine reports of these QI activities provided by each participating entity. The Regional Committee will perform focused review of specific items as determined appropriate, but these reviews will include evaluation of both pre-hospital and hospital activities. It is expected that most issues will be resolved by

developing an action plan in conjunction with the various Stroke System entities. A re-evaluation for results is to be undertaken. If it is determined that a change in system configuration or standard function should occur, a recommendation will be sent to the Stroke Operations Committee for evaluation and report to the lead agency. A more detailed outline of the Regional Quality Improvement Program is available in Appendix 13.

V. STROKE IMPLEMENTATION COMMITTEE

The Stroke Implementation Committee (SIC) will be established by the lead agency for the purpose of implementation of the Stroke Plan. This is done under the authority of the lead agency with action plans developed and presented as recommendations to the lead agency. As part of the implementation plan, operational protocols for the Stroke System will be developed and forwarded to the lead agency. This committee will function only during the implementation period.

Committee development will occur in the following manner.

- A. A chairman and vice-chairman will be chosen by the chairman of the Executive Committee from a list of candidates offered by all hospitals in the region. The chairman and vice-chairman of the SIC will be physicians and they will continue on as the initial chairman and vice-chairman of the Stroke Operations Committee in order to maintain continuity through initial system implementation and activity. The hospital and the candidate must jointly understand that the chairman and vice-chairman positions will require an estimated four to six hours a week work effort, and a commitment to availability for that time must be made by the hospital and the candidate. Requirements for chairman:
 1. Neurologist with significant past experience in direct medical management of stroke cases.
 2. Knowledge of BREMSS structure and function.
 3. Ability to commit an average of four hours a week to this project.

The vice-chairman is to be an Emergency Medicine physician.

- B. Hospitals and other agencies/groups will provide committee membership nominations as per the following groups:
 1. Hospitals
 - a. Hospital Administration
 - b. Emergency Nursing
 - c. Stroke Nursing
 - d. Neurologist (primary stroke call)
 - e. Surgeon, Neurological
 - f. Emergency Medicine Physician

- g. Anesthesiology
- 2. Non-Hospital Agencies/Group
 - a. EMT - Transporting/Non-transporting
 - b. Fire Service Administration
 - c. Ambulance Service Administration
- 3. MCAC Chairman (or designee)

SIC membership nomination form is Appendix E.

- C. The SIC chairman and vice-chairman will select a proposed committee from the nominations received encompassing members from the groups. There will be 12 to 16 members on the committee.
- D. The Chairman of the BREMSS Executive Committee will appoint the SIC membership.
- E. BREMSS will staff the SIC (inclusive of the Regional Medical Director).

At the initial meeting the SIC will draw up an implementation schedule and provide that schedule along with at least monthly progress reports to the BREMSS Executive Committee.

VI. STROKE OPERATIONS COMMITTEE (SOC)

Monitoring and primary management of system function during the continuing operation of the Stroke System will be the responsibility of the Stroke Operations Committee. This committee will be directly responsible and report to the lead agency. The committee will have a specific accountability for direct ongoing system governance which will occur by evaluation of issues/situations/ideas and standard system data regarding operations and configuration. Recommendations for action will be developed by the committee based on analysis of data/information evaluated during committee function.

A. Membership

- 1. The chairman and vice-chairman shall serve for two year terms. The first chairman and vice-chairman shall be the chairman and vice-chairman of the Stroke Implementation Committee. Future chairman and vice-chairman of the Stroke Operations Committee shall be appointed by the Chairman, BREMSS Executive Committee from nominations provided by hospital, actively participating in the Stroke System. Requirements for the chairman of this committee include:

- a. Neurologist with significant past experience in direct medical management of stroke patients.
- b. Adequate knowledge of BREMSS structure and function.
- c. Ability to commit an average of four hours a week to this project.

The vice-chairman is to be an Emergency Medicine Physician. Nominees for the chairman and vice-chairman positions of the Stroke Operations Committee and their sponsoring institutions must understand the expected 4-6 hours per week time availability for carrying out the duties this position.

Responsibility of the chairman include:

- a. Serve as leader for committee meetings.
- b. Responsibility for carrying out the assigned duties of the Stroke Operations Committee.
- c. Report to the BREMSS Executive Committee regarding overall system function plus system monitoring activities, suggestions, problems, QI activities, and other issues as deemed appropriate.

The vice-chairman is to actively assist the chairman as appropriate in carrying out the committee responsibilities.

- 2. General membership will be constituted from the following groups making nominations for specific membership positions (although not all nominees will necessarily become committee members).
 - a. Hospitals actively participating in the Stroke System.
 - 1) Hospital Administration
 - 2) Emergency Nursing
 - 3) Stroke Nursing
 - 4) Neurologist (primary Stroke call)
 - 5) Surgeon, Neurological
 - 6) Emergency Medicine Physician
 - 7) Anesthesiologist
 - 8) Stroke Prevention personnel
 - 9) Stroke Registry personnel
 - b. Hospital not directly involved in the Stroke System.
 - 1) Physician - Neurologist/Internal Medicine or Emergency Medicine physician
 - c. Pre-hospital members

- 1) EMT-Transporting or non-transporting
 - 2) Fire service administration
 - 3) Ambulance service administration
- d. A community member will be requested by the BREMSS Executive Committee to be a member.
- e. A local government official will be requested by the BREMSS Executive Committee to be a member.
- f. BREMSS will staff the SOC to include participation of the Regional Medical Director.

The general membership term is for two years and the committee will be constructed so there is a one-half turnover each year. There will be 17 to 24 committee members.

B. Duties

The duties of the Stroke Operations Committee include the review of the overall function of the stroke program including hospital and pre-hospital activities. This includes review of criteria, data, or reports. This information will be evaluated regarding adequacy of these various activities and for development of system function reports and recommendations regarding the hospital or pre-hospital components or functions, including responsibilities, standards, and activities. If recommendations directly involve pre-hospital aspects of the stroke program they will be referred to the MCAC for review and comment and then re-evaluated by the SOC regarding the MCAC input and then, the recommendation in final form will be sent to the Executive Committee for action. Areas of responsibilities include:

1. Stroke Center resource requirements criteria
2. Stroke Center membership in the System
3. Stroke Center removal from the System
4. Communications within the System
5. Pre-hospital and hospital dataset
6. Pre-hospital and hospital quality improvement programs
7. Patient entry criteria into the Stroke System
8. Pre-hospital activities in the System
9. Monitoring of ongoing system requirements/standards/activities and use of system function protocols

STROKE SYSTEM FUNCTION

General function of the System will follow the scenario of:

1. Stroke occurs or warning signs/symptoms are present.
2. Field evaluation done by EMT who determines if the patient meets the system criteria (if EMT is unsure of entry criteria, that information may be immediately obtained from the ATCC).
3. Communication is established with the ATCC with brief basic information provided to the ATCC on all stroke patients transported to a hospital.
4. The triage status and the current Stroke Center activity status (from the Emergency Resources Display) determine hospital destination.
5. A direct patched communications link to the closest active Stroke Center is provided by the ATCC to the field EMT.
6. Medical control is established with the receiving Stroke Center by the communications link; orders are provided as needed.
7. Pre-hospital care is completed and transport to the destination Stroke Center is initiated.

Specific functions relative to the Stroke System are described in the following sections.

I. SYSTEM ENTRY CRITERIA

Patients are to be entered into the Stroke System following a stroke incident based on the following criteria:

If the patient is unresponsive **and** there is no history of trauma:

- A. Glasgow Coma Score
- B. Any Evidence of weakness of either side of the body

If the patient is able to respond and follow commands.

- A. Facial Droop (have patient show teeth or smile):
 - Normal - both sides of face move equally well
 - Abnormal - one side of face does not move as well as the other side
- B. Arm Drift (patient closes eyes and holds both arms out):
 - Normal - both arms move the same or both arms do not move
 - Abnormal - one arm does not move or one arm drifts down compared with the other
- C. Speech (have the patient say "you can't teach an old dog new tricks"):
 - Normal - patient uses correct words with no slurring
 - Abnormal - patient slurs words, uses inappropriate words, or is unable to speak

D. EMT Discretion:

1. If the EMT is convinced the patient is likely to have a stroke, which is not yet obvious, the patient may be entered into the Stroke System.
2. The EMT's suspicion of stroke may be raised by the following factors (but these situations alone do not constitute reason for Stroke System entry):
 - a. Symptoms of stroke occurred and disappeared within a few minutes, even if the patient is presently normal.
 - b. Awake patient with spontaneous inability to remember, to understand what is said or to express himself.
3. The EMT is to immediately inform the ATCC when a decision is made to enter a patient into the Stroke System using discretion and inform the ATCC of the reason for that decision.
4. It is to be specifically noted in the run report that EMT discretion is being used to enter a patient into the Stroke System and the reason or basis for that decision is to be written on the Pre-hospital Patient Care Report (PHPCR).

II. COMMUNICATIONS

Maintenance of adequate and prompt communications are essential to function of the Stroke System. In all instances stroke survival or maximum outcome potential can only be achieved with efficient and rapid movement of the patient through the system of pre-hospital assessment and treatment, transport, and hospital resuscitation, evaluation and definitive care. Communication throughout the system is vital to this activity occurring in a most efficient and complete manner. Knowledge of the system-wide pre-hospital stroke activities and the current (and possibly changing) status of the functional capabilities of the various hospitals in the system is important at all times as it is possible multiple stroke activities are occurring simultaneously. Communications allow differential system resource utilization when there are multiple stroke activities ongoing simultaneously. The key to system function is full knowledge of ongoing activities in all parts of the system at all times.

In order to maintain the goal of decreased stroke mortality and morbidity in the region and a program having continuous and effective region-wide system status, knowledge and coordination of the continuous status of stroke activity must be monitored. This is a function of the ATCC. All stroke patients requiring transport are to be called in to the ATCC. The ATCC notes the date and time. The responding EMT provides the following data.

1. Age and sex
2. Entry criteria (signs/symptoms)
3. Estimated Time of Onset (ETO)
4. Major obvious problems
5. Confirmation that the patient does or does not meet system entry criteria

6. Level of care provided, that is actually used for this patient
- ALS vs. BLS
7. Hospital destination

ATCC will note the closest hospital for the EMT from the database.

It is essential to establish radio communications as soon as possible in patients meeting system entry criteria to provide a baseline level of the patient's status. After determination that a patient meets system entry criteria, the highest level EMT should contact the ATCC at the earliest practical time to enter the patient into the system. The reporting EMT should identify himself/herself and provide the following information:

1. Basic patient data - age, and sex.
2. Entry criteria (signs/symptoms).
3. Current primary survey status - airway, breathing, circulation, level of consciousness, and vital signs.
4. Incident location.
5. Estimated Time of Onset (ETO).
6. Estimated scene departure time.
7. Proposed mode of transport; if ground state transporting unit number.

The ATCC will establish a direct patched communications link with the receiving Stroke Center hospital, and provide them with the basic information. The field EMT will then be able to communicate any additional pertinent data and receive medical control while the hospital is simultaneously activating its stroke response system. The transporting EMT will maintain contact as appropriate with the receiving Stroke Center hospital, and provide information updates if changes in the patient's status or transport plan occur. The EMTs are to reconfirm Stroke Center ETA once transport has been initiated. If radio failure occurs, direct contact between the EMS unit and their dispatch should be established with relay of information to the ATCC by phone.

III. SYSTEM OPERATIONS

System operations refers to the activities that occur once it is determined a patient meets system entry criteria and communications has been established within the system. These activities include Stroke Center destination determination, continuing communications, provision of field care, patient transport, and Stroke Center management.

1. Hospital Destination

Hospital destination will be determined by the closest available Stroke Center or the patient choice. The hospital status is traced by the Emergency Resources Display at the 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. Hospitals will usually be either at a green (active) or red (inactive) status.

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

1. All levels must have the following resources (which are on the Emergency Resources Display grid) active and available at that time as pertains to their Stroke Center status:
2. The primary call neurologist must be actively available.

Red status indicates at least some primary stroke care resources in that hospital are not actively available and the hospital is not to receive stroke patients at that time. Red status criteria are:

1. If any of the following resources is unavailable: Emergency Department, ICU, CT Scan, or Neurologist.

HOSPITAL DESTINATION NOTES

- A. Hospital destination for patients entered into the System will be the closest appropriate stroke receiving facility based on Stroke Center availability.
- B. In the event a patient or family member requests transport to a specific facility that does not meet system guidelines, efforts will be made to clarify and encourage the advantage of using the Stroke System and a specific request to follow the established Stroke System Plan will be made of the family. The patient's or family members' wishes will, however, ultimately prevail.
- C. If the patient is unstable (cannot be effectively ventilated by the EMT or needs volume replacement, but an IV sufficient to provide volume resuscitation cannot be established/maintained) and is over 40 minutes transport time from a green Stroke facility, the patient should be transported to the closest hospital with full time Emergency Physician coverage as coordinated by the ATCC.
- D. In a situation where ATCC notification has occurred and no medical direction is needed, the ATCC will notify the receiving hospital of the patient transport and provide information of condition, estimated arrival time, etc.

1. Pre-hospital System Activities

Pre-hospital care will be carried out following the guidelines of the Regional Medical Control Plan. The ADPH/EMS pre-hospital care protocols will be used for primary guidance in pre-hospital stroke management. Patients entered into the Stroke System will receive their medical control from the stroke receiving

hospital, which will be immediately accessible through the communications link between the ATCC and that destination hospital. Any significant patient condition changes are to be communicated directly to medical control at the receiving

Stroke Center 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

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 Stroke Center standards.

IV. 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 to participate as a Stroke Center and system function protocols. Compliance with the requirements and protocols is essential for proper stroke victim management. Therefore, a specific program for monitoring compliance with requirements and function protocols will be a part of the Stroke System. This will be a function of the Stroke Operations Committee. Reports regarding compliance issues will be made to the BREMSS Executive Committee. Maintenance of compliance with requirements, standards, and system function protocol activities for individual personnel and agencies involved in the Stroke System means:

A. Maintaining component and organization standards as established by the Plan.

1. Pre-hospital

- a) Pre-hospital entities have the responsibility to assure their individual EMTs have a basic knowledge and awareness of the Stroke System including entry criteria and basic operations.

2. Hospital Component

- a) Continue to meet all Stroke Center resource requirements for their status.

- b) Maintain a designated Neurologist as the Stroke Program leader with written responsibilities as indicated in the Regional Stroke System.
 - 3. Communications Component - Each entity is responsible for maintaining communications equipment used in the Stroke System in proper working order.
 - 4. Data/QI Component
 - a) Each entity is responsible for maintaining and providing data to the Stroke System as indicated in the Regional Stroke System Plan. For pre-hospital EMS services this means providing data to the Stroke Communications Center which is then placed in the Stroke System Database. For hospitals this means maintaining and providing the hospital based information in the Stroke QI dataset.
 - b) Participating entities need to maintain their individual Stroke QI Programs as specified in the Regional Stroke System Plan. They are to provide reports of these activities to the Regional Stroke QI Committee on a timely basis.
 - c) Active continuing participation in the Regional Stroke QI program is expected (all individual personnel from participating organizations must attend at least 75% of the Regional QI meetings). Individual entities are to support the regional focused review of individual topics by providing data and participating in the evaluation process.
 - 5. Personnel from pre-hospital and hospital organizations are to participate in Stroke Operations Committee activities per membership responsibilities. It is expected there will be 75% attendance of meetings by members.
- B. Maintaining system function as noted in the Regional Stroke System Plan.
- 1. System entry criteria as specifically defined in the Plan or currently active protocols are to be used by EMTs to determine patient entry into the Stroke System.
 - 2. Communications as outlined in the Plan and currently approved protocols are to be initiated and maintained by EMS units. This involves initiating communications, providing information and participating in the use of the system operations protocols along with the ATCC for coordination of pre-hospital stroke care activities including patient entry into the system, determination of Stroke Center destination, and in conjunction with

medical control orders for provision of care using the MCAC ADPH approved pre-hospital care protocols.

3. System operations are provided by individual entities as per the Regional Stroke System Plan including currently approved protocols.

Failure of compliance with contract performance criteria or requirements, standards, or adherence to system function protocols as stated in the most current version of the written BREMSS Regional Stroke System Plan will result in specific actions to be taken by the BREMSS Executive Committee. Questions of compliance will be generated by system oversight review by the Stroke Operations Committee. Issues regarding a question of compliance when brought to the attention of BREMSS will be directed to the Stroke Operations Committee for evaluation. The Operations Committee will evaluate questions of compliance and if a compliance infraction has occurred a report will be forwarded to the BREMSS Executive Committee.

- C. The pre-hospital component requirements, standards, and system function protocols are part of the Regional Medical Control Plan and deviation from that plan will result in the following actions by the BREMSS Executive Committee
 1. First breach of activity standards will result in a letter to the pre-hospital service indicating there has been a breach of activity standards with an explanation of the situation and an indication of the need for corrective action to be taken. There will be a one month time period for implementation of the corrective action.
 2. The second breach of the same activity will result in another letter to the pre-hospital service with a copy to the local credentialing or regulatory authority indicating that a second breach has occurred and again allowing a one month period for corrective action.
 3. A third breach of the same activity will result in a letter to the ADPH/EMS Office for evaluation and action.
- D. Hospital participation in the System is governed by the contract between BREMSS and each hospital. Deviations from requirements, standards or system function protocols governed by the contract may result in the following actions by the BREMSS Executive Committee:
 1. The first breach of an activity standard will result in a letter indicating there has been a breach of an activity standard with an explanation and an indication that there is a need for corrective action. A one month period for corrective action implementation will be allowed.

2. If a second breach of the same activity occurs a letter to the responsible entity indicating that a second breach has occurred with a warning that a third breach in that activity standard will result in suspension from the Stroke System for a 30 day period of time. A one month period for corrective action implementation will occur.

3. A third breach of the same activity will result in contract failure and suspension of that facility from the Stroke System for a period of 30 days as per decision of the BREMSS Executive Committee with the suspension time doubled for subsequent deviations of the same standard.

It will be the duty of the BREMSS Executive Committee to carry out these pre-determined actions in cases of violation of requirements, standards, or failure of adherence to system function protocols.

APPENDIX A

STROKE CENTER STANDARDS

A hospital to be recognized as a Stroke Center must have available the following minimum personnel, facility, and plans:

A. HOSPITAL ORGANIZATION

1. Stroke Service or Equivalent
2. Stroke Service Director
3. Hospital Department/Sections
 - a. Neurology
 - b. Neurologic Surgery, or Transfer Agreement
 - c. Emergency Medicine
4. Stroke treatment protocols in place

B. CLINICAL CAPABILITIES

1. Specialty availability (means contact made and care plan determined) upon notification of patient need:
 - a. Emergency Medicine (10 minutes)
 - b. Neurology (15 minutes after notification by Emergency physician, or by hospital plan)
 - c. Neurologic Surgery, or Transfer Agreement
2. Consultants availability (on-call):
 - a. Internal Medicine
 - b. Critical Care
 - c. Cardiology
 - d. Neuroimaging

C. FACILITIES & RESOURCES

1. Emergency Department
 - a. Personnel
 - 1) Designated Physician Director
 - 2) Emergency Medicine Specialists present
 - 3) Nursing personnel with expertise to provide continuous monitoring to stroke victims until their admission to a hospital unit
 - b. Equipment
 - 1) Airway control & ventilation equipment
 - 2) Pulse oximetry
 - 3) End-tidal CO₂ determination
 - 4) Suction devices
 - 5) Electrocardiograph
 - 6) Standard intravenous fluid administration equipment

- 7) Sterile sets for percutaneous vascular access (venous & arterial)
 - 8) Gastric decompression
 - 9) Drugs necessary for emergency care
 - 10) X-Ray availability
 - 11) CT availability and interpretation in 45 minutes
 - 12) Angiographic suite available
 - 13) Two-way communication with emergency vehicles
 - 14) Sterile ventriculostomy tray readily available in facilities with NS coverage.
2. Operating Suites Adequately Staffed
 3. Postanesthetic Recovery Room Available
 4. Intensive Care Unit-bed for Stroke Patients
 - a. Personnel
 - 1) Designated medical director
 - 2) Specialists with privileges in critical care, in-house or immediately available
 - b. Equipment
Appropriate monitoring equipment
 5. Neuroimaging Special Capabilities
 - a. In-house radiology technical personnel capable of brain CT imaging
 - b. Angiography
 - c. Neurovascular sonography
 - d. Computed tomography
 - e. Magnetic Resonance Imaging (not time specific)
 6. Rehabilitation
 - a. Rehabilitation services protocol appropriate for stroke patients
 - b. Full in-house service or transfer agreement with rehabilitation facility
 7. Clinical Laboratory Services
 - a. Standard analyses of blood, urine, etc.
 - b. Blood typing and cross-matching
 - c. Comprehensive blood bank or access to equivalent facility
 - d. Blood gases and pH determinations
 - e. CSF examination capabilities
 - f. Comprehensive coagulation testing

D. CONTINUING EDUCATION

Formal programs provided for

1. Staff physicians
2. Nurses

3. Allied health personnel
4. Community physicians

E. STROKE SERVICE SUPPORT PERSONNEL

Stroke coordinator

APPENDIX B.

STROKE QI DATA SET

1. Identification number - provided by the ATCC upon initial contact by prehospital provider. The same number would follow the patient through the System.
2. Location of the incident - City, County - possibly information from a city map grid (needs further investigation).
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 with ATCC
 - 2) ATCC contact/link to receiving Stroke Center
 - 3) additional contacts to ATCC by EMTs
5. Receiving hospital
6. System entry data:
 - a. primary entry triage criteria
 - b. co-morbid criteria
 - c. EMT discretion - Narrative field for why
 - d. patient age
 - e. patient sex
 - f. GCS
 - g. scene vital signs
7. Prehospital outcome:
 - a. loss of vital signs and time
 - 1) lived
 - 2) expired (time)

8. Hospital readiness:
 - a. hospital stroke score
 - b. physician arrival time in E.D.
 - 1) ED attending
 - 2) Neurologist
 - 3) Neurosurgeon
 - 4) Orthopedist
 - 5) Other: state _____
9. Procedures done within the first 24 hours (includes all procedures performed by initial receiving hospital or receiving hospital if patient is transferred).
10. Disposition
 - a. Emergency Department disposition
 - 1) disposition time - patient goes to initial hospital care location (not just leaves ED - i.e. to CT)
 - 2) disposition location
 - a) discharged
 - b) admitted - ICU, OR, Ward
 - c) transferred - higher level Stroke Center
 - equal level Stroke Center
 - lower level Stroke Center
 - reason _____
 - d) expired
 - b. Final 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 IMPROVEMENT

- A. Quality improvement is a vital part of a Stroke System. It is used to document continuing proper function of the system and evaluation of that function to implement improvements in system function and stroke victim 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 moral responsibility to perform evaluation functions to assure 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 agencies, plus a Regional Oversight Committee is necessary for overall review of system function. Every participating facility or organization will be represented on the Regional QI Committee and continuing participation of all the various entities involved in stroke care is mandatory.

- C. The appropriateness, quality, and quantity of all activities of the System must be continuously evaluated.
 - 1. Medical Care
 - 2. Prehospital care
 - 3. System function (dispatch activities, scene time, triage process and destination, response level, etc.)

- D. Prehospital 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 QI person to oversee process
 - b. Standards established - regional/authorized

- c. Determine audit filters
- d. Collect data
- e. Evaluate data
- f. Determine QI 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. Hospital Care QI

1. Medical care

- a. Complications
- b. Deaths
- c. Outcome Review
 - 1) internal review
 - 2) external comparison
- d. Process for medical care QI (performed by each institution)
 - 1) Establish written care standards
 - 2) Collect data
 - a) stroke data elements
 - b) complications or events lists
 - 3) Data QI evaluation
 - a) establish audit filters (indicators)
 - b) determine presence of potential QI issues
 - c) primary review (permissible)
 - d) multi-disciplinary peer review of QI issue
 - 4) Corrective action
 - a) professional resolution
 - b) administrative resolution
 - 5) Re-assess for effectiveness of corrective action
 - 6) Documentation essential utilizing QI tracking flow sheet

2. Stroke Center function

- a. Stroke Center 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
- a. 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 Stroke Center functions.

F. Regional System Function

- 1. Primarily performed by Regional EMS staff QI individual
- 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 QI issues
 - e. Re-evaluate to determine effectiveness of corrective action
 - f. Participation on Regional Stroke QI Committee

G. Regional QI Committees (staffed by BREMSS)

- 1. Goals - review entire Regional Stroke Program
 - a. System administration/organization/activities
 - b. Prehospital care
 - c. Hospital care
- 2. Members
 - a. EMS Office
 - 1) Regional EMS Off-Line Medical Director
 - 2) Regional EMS Executive Director
 - 3) Regional EMS Office QI Coordinator
 - 4) Regional EMS Office Data Coordinator
 - b. Prehospital provider representation - the designated QI coordinator for each county, (from an EMS organization)
 - c. Participating hospital representation
 - 1) Stroke Director
 - 2) QI Coordinator
- 3. Process
 - a. Brief report of QI 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 QI 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 the Stroke Operations Committee and the BREMSS Executive Committee
4. Hospital Medical Care Review Sub-Committee
- a. Members
 - 1) Stroke Director from each participating Stroke Center
 - 2) Emergency Department Medical Director from each active Stroke Center
 - 3) Regional EMS Medical Director
 - 4) The chairman of this committee will be the chairman of the Stroke Operations Committee
 - 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 QI issues will be reviewed as deemed appropriate.
 - c. The process used will be the same process as outlined in the QI Section of the Regional Stroke System Plan.
 - d. Reports of a summary nature will be made to the Regional QI Committee. Individual physician medical care issues will initially only be reported to the stroke director of the facility providing care in that situation and be made by personal communication. In general, discussions at the sub-committee meeting will fulfill this notification requirement. If a persistent individual problem trend occurs, this situation will be referred to the appropriate hospital QI Committee.
5. All members are expected to attend at least 75% of the Regional QI Committee meetings and the Hospital Medical Care Review subcommittee meetings.

APPENDIX D

**STROKE IMPLEMENTATION COMMITTEE
NOMINATION FORM**

◆ Hospital committed to Stroke System participation

Name _____, application for Level I, II, III, IV

<u>Area of Representation</u>	<u>Name of Nominee</u>
Hospital Administration	_____
Emergency Nursing	_____
Neurologist	_____
Surgeon, Neurological	_____
Emergency Medicine Physician	_____
Anesthesiologist	_____

◆ Hospital not directly involved in Stroke System

Name _____

<u>Area of Representation</u>	<u>Name of Nominee</u>
Physician	_____
Administrator	_____

◆ Prehospital provider agency

Name _____

<u>Area of Representation</u>	<u>Name of Nominee</u>
EMT-Transporting/Non-transporting	_____
Fire service administration	_____
Ambulance Service administration	_____

APPENDIX E

**SROKE OPERATIONS COMMITTEE
NOMINATIONS FORM**

◆ Hospital participating in System as Stroke Center

Name _____

<u>Area of Representation</u>	<u>Name of Nominee</u>
Hospital Administration	_____
Emergency Nursing	_____
Neurologist	_____
Surgeon, Neurological	_____
Emergency medicine Physician	_____
Anesthesiologist	_____
Stroke prevention personnel	_____
Stroke registry personnel	_____

◆ Hospital not participating in system as Stroke Center

Name _____

<u>Area of Representation</u>	<u>Name of Nominee</u>
Physician - Internist or E.M. Physician	_____

◆ Prehospital provider agency

Name _____

<u>Area of Representation</u>	<u>Name of Nominee</u>
EMT - Transporting or Non-transporting	_____
Fire service administration	_____
Ambulance service administration	_____