

Recommendations for

The Establishment of an Optimal System of Acute Stroke Care for Adults



Because stroke is the third leading cause of death in California and a leading cause of long-term disability.

● Prepared by

The Stroke Systems Work Group, 2009

Co-convened by:

The American Heart Association/American Stroke Association & The California Heart Disease and Stroke Prevention Program, California Department of Public Health

Acknowledgments

Staff support for the development of this publication, *Recommendations for the Establishment of an Optimal System of Acute Stroke Care for Adults*, was provided by the Preventive Health and Health Services Block Grant from the Centers for Disease Control and Prevention (CDC). Its contents are solely the responsibility of the authors and do not necessarily represent the official views of CDC.

California's Master Plan for Heart Disease and Stroke Prevention and Treatment and the *Recommendations for the Establishment of an Optimal System of Acute Stroke Care for Adults* were made possible by generous grants from the American Heart Association/American Stroke Association and Kaiser Permanente and by an unrestricted educational grant from AstraZeneca.

Design and layout by Nan Pheatt, MPH.

PREFACE

The Stroke Systems Work Group (Work Group) was co-convened by the American Heart Association/American Stroke Association (AHA/ASA) and the California Heart Disease and Stroke Prevention Program (CHDSP), California Department of Public Health (CDPH), under a provision of *California's Master Plan for Heart Disease and Stroke Prevention and Treatment*, adopted in 2007.

MISSION

The mission of the Work Group was to reduce stroke morbidity and mortality in California by:

- Establishing strategies for the development of a statewide system of care for acute stroke for adults over age 18, including: (1) recommendations for pre-hospital patient assessment and preferential transport of eligible stroke patients; (2) criteria for the designation of stroke-receiving hospitals; (3) recommendations for appropriate acute stroke treatment; and (4) continuity of care through linkages between medical facilities.
- Providing guidance as stroke systems of care are implemented in California.
- Promoting recovery from stroke, including access to stroke rehabilitation services.

BACKGROUND

Stroke is the third leading cause of death in California and a leading cause of long-term disability. Stroke, sometimes called a "brain attack," is injury to the brain, spinal cord, or retina caused by blockage or rupture of a blood vessel and/or a reduction in oxygenated blood flow. There are two major types of stroke, ischemic stroke and hemorrhagic stroke. In ischemic stroke, an occlusion in a blood vessel blocks blood flow to the brain, oxygen does not reach the brain, and tissue dies rapidly. In hemorrhagic stroke, a blood vessel ruptures, causing bleeding into or around the brain. Both types of stroke often result in disability or death.

**POSITION
STATEMENTS**

In California, stroke accounts for approximately 17,000 deaths each year, 50 deaths per 100,000 population.¹ In 2004, almost 9 percent of adults over age 65 reported that they had been given a stroke diagnosis by a doctor.¹ The annual cost of stroke exceeds \$7 billion (\$4.6 billion in medical care and \$2.6 billion in lost productivity).²

Advances in stroke care, including the introduction of time-sensitive therapies, have emphasized the critical need for optimal stroke treatment pathways.

Systemic changes in health care have been promoted by a number of advocates for improved clinical outcomes for stroke. Position statements published by these groups have shaped acute stroke treatment across the nation.

Brain Attack Coalition

In 2000, the Brain Attack Coalition (BAC), a multidisciplinary group of health professionals, conducted a comprehensive review of the medical literature and concluded that the establishment of stroke centers would improve the care of stroke patients.³ Component organizations in the BAC include the American College of Emergency Physicians (ACEP), the American Academy of Neurology, the American Association of Neuroscience Nursing, the National Institutes of Health, the AHA/ASA, and the National Stroke Association. Specifically, the BAC recommended that all Primary Stroke Centers include the following key elements: (1) acute stroke teams; (2) written care protocols; (3) emergency medical services (EMS); (4) emergency departments (ED); (5) stroke units; (6) neurosurgical services; (7) commitment and support of the medical organization, including a stroke center director; (8) neuroimaging services; (9) laboratory services; (10) outcome and quality improvement activities; and (11) continuing medical education.

In 2005, the BAC recommended the establishment of Comprehensive Stroke Centers for the delivery of specialized care for patients with complicated cerebrovascular disease.⁴ Specialized care in these centers would include: (1) health care personnel with specific expertise in multiple disciplines, including neurosurgery and vascular neurology; (2) advanced neuroimaging capabilities; (3) surgical and endovascular therapeutic capabilities; and (4) a comprehensive stroke infrastructure (e.g., stroke registry, intensive care unit).

National Institute of Neurological Disorders and Stroke

In 2002, the National Institute of Neurological Disorders and Stroke (NINDS) recommended: (1) development of stroke center networks; (2) improved databases for stroke; and (3) expanded education and training in stroke for both neurologists and non-neurologists.⁵

American College of Emergency Physicians

In 2002, ACEP recommended that EDs and hospitals work with EMS and the community, so that all parties are aware of a hospital's capabilities regarding acute stroke care. ACEP also stated that the decision by an ED physician to use intravenous thrombolytic (clot-dissolving) therapy for acute stroke should be supported by hospital systems that assure its safe use.⁶

American Heart Association/American Stroke Association

In 2005, the AHA/ASA issued a position statement urging the development of stroke systems of care that coordinate and promote patient access to the services associated with prevention, treatment, and rehabilitation of stroke.⁷ This policy paper describes component-specific recommendations for the implementation and establishment of stroke systems of care, including: (1) primordial and primary prevention strategies; (2) community education; (3) notification and response of EMS; (4) acute treatment; (5) subacute care and secondary prevention; (6) rehabilitation; and (7) continuous quality improvement.

CERTIFICATION

ACTION

In 2007, the AHA/ASA Expert Panel on Emergency Medical Services Systems and the Stroke Council released a policy statement titled *Implementation Strategies for Emergency Medical Services within Stroke Systems of Care*.⁸ This document provides recommendations to improve and advance pre-hospital care for stroke, including use of protocols, tools, and training necessary to deliver the highest quality of stroke care.

National Association of Emergency Medical Service Physicians

In 2007, the National Association of Emergency Medical Service Physicians released a position statement that addressed the role of EMS in the management of acute stroke, including triage, treatment, and stroke systems of care.⁹ This position paper included the following recommendations: (1) expeditious EMS dispatch and response; (2) pre-hospital stroke screening and patient assessment; (3) communication with receiving facilities; (4) local/regional strategies for stroke patient destination; and (5) alternative forms of medical transport (e.g., air).

In 2003, The Joint Commission (formerly the Joint Commission for the Accreditation of Health Care Organizations, JCAHO) developed a certification process that would allow hospitals to achieve Primary Stroke Center status. The Joint Commission set forth criteria that matched the recommendations of the BAC.

The Joint Commission has not developed a certification process for Comprehensive Stroke Centers, although there is movement in that direction.

National

Nationally, the availability of Primary Stroke Center certification by the Joint Commission initiated the development of acute stroke systems of care. Many hospitals sought Primary Stroke Center certification not only to provide

enhanced service to patients, but also to remain competitive in their markets. With the advent of Primary Stroke Center certification by The Joint Commission, health care systems could readily identify hospitals that could provide the most appropriate patient care. Across the nation, hospitals realized that without stroke center designation, EMS responders transporting stroke patients were likely to bypass them. What emerged was a stroke care model that paralleled the trauma system.

Recognizing an opportunity for the development of statewide systems of acute stroke care, state governments took action. In many states, stroke systems of care have been created either through legislation or by an edict from a State Health Commissioner. Some states (e.g., Texas) have opted to use The Joint Commission and its certification process to identify Primary Stroke Centers. Other states (New York and Massachusetts) have made the decision to use an internal certification process, with criteria for certification that are at least as stringent as The Joint Commission's. Florida's approach to stroke systems of care is unique; it allows hospitals to "attest" to compliance with criteria that match The Joint Commission's.

California

California hospitals, most notably in Santa Clara County, were among the first to seek The Joint Commission's Primary Stroke Center certification. Recognizing its role in building a stroke system of care, the Santa Clara County Emergency Medical Services (EMS) Agency developed a stroke system plan that addresses the continuum of stroke care from first symptoms to recovery. The goal of this system is to promote public awareness and improve early recognition of stroke (i.e., "the right patient to the right place within the right time"). To meet this goal, the Santa Clara County EMS Agency has developed destination policies for triaging and transporting stroke patients, preferentially to hospitals that the Agency has designated as appropriate stroke care sites. In Santa Clara,

these designated facilities are also the facilities that have been certified by The Joint Commission as Primary Stroke Centers.

This process was repeated in several other areas of California, so that by mid-2008, local EMS agencies (LEMSAs) with established or developing stroke systems of care included: Alameda, Orange, Santa Clara, San Francisco, San Mateo, and San Diego. The development of stroke systems of care has been coordinated through LEMSA policy.

There are 31 LEMSAs covering California; some have single-county jurisdictions, and others have jurisdiction over multiple counties. State statutes and regulations empower the California Emergency Medical Services Authority (EMSA) to provide oversight to LEMSAs based upon regulations and guidelines, upon review and approval of the Commission on EMS. The LEMSAs develop and implement the local EMS process. This includes establishing EMS dispatch for the purpose of triaging requests for service and coordinating available and appropriate response. The LEMSA also provides oversight of certification, accreditation, and education of pre-hospital care providers; development of patient care and destination policies; and designation of specialty care centers. These responsibilities empower LEMSAs to develop acute stroke systems of care.

Although the progress made by the LEMSAs toward improved stroke care in California has been encouraging, public health professionals in both the public and private sectors realized that unless the development of stroke systems of care was guided at the outset on a statewide basis (in much the same way that the trauma system was developed), there would be service gaps that would become progressively more difficult to overcome. A fragmented system of care is a significant obstacle to reducing morbidity and mortality from stroke. Strategic planning is needed not only for the coordination of existing and developing local systems of stroke care, but also

for future integration of Comprehensive Stroke Centers into local EMS stroke systems.

This sort of planning was advocated by the California Heart Disease and Stroke Prevention and Treatment Task Force (Task Force), an advisory group that was convened in 2006 under a law (AB 1220) passed in 2003. The Task Force was charged with writing *California's Master Plan for Heart Disease and Stroke Prevention and Treatment* (Master Plan). The Master Plan was adopted in 2007.

The stroke system of care proposed by the Master Plan is consistent with the position statements of the BAC and other expert groups, as well as with the vision being realized by other states across the nation. The Master Plan's proposed system requires identification of eligible stroke patients in the field and direct transport to designated stroke centers. To provide maximum access to California residents, the designated stroke centers would form partnerships with hospitals that could not achieve stroke center status. These partnerships would be formalized by written agreements and protocols.

The Task Force members recognized the many technical and policy issues inherent in the development of an acute stroke care system and recommended the establishment of a Stroke Systems Work Group (Work Group). In 2007, the AHA/ASA and CDPH convened a Work Group composed of statewide stakeholders. The Work Group was charged with establishing implementation strategies and providing continuing guidance as the system is developed in California. This document reports the findings and recommendations of the Work Group.

In recent years, telemedicine, the transfer of medical information using real-time, two-way audio and video technology, has successfully brought neurological expertise to remote areas and other areas lacking access to on-call

STROKE SYSTEM CHALLENGES

specialists. Research supports the superiority of telemedicine over simple telephone consultations, demonstrating that stroke telemedicine consultations result in more accurate decision-making.¹⁰ Telemedicine has enabled the development of “spoke and hub” stroke systems of care that link hospitals that lack 24/7 stroke expertise to hospitals with this resource. This has increased the likelihood that all Californians, regardless of place of residence, will receive the same high standard of acute stroke care.

California’s size and diversity (population distribution and resources) have an important impact on stroke care, as does the management of EMS systems at the local level. There are significant differences in dispatch capabilities, EMS response, availability of neurological expertise, and hospital services across the State.

- Some rural areas have 911 dispatchers who are not specifically trained in emergency medical dispatching. These individuals may be volunteers, and there can be considerable turnover. This makes sustaining a trained workforce difficult.
- EMS responders in rural areas may face distance and weather challenges. These conditions contribute to delay in patient transport.
- Some hospitals in rural areas lack the necessary personnel, equipment, and protocols required to treat stroke patients rapidly and well. At a minimum, a facility must have an emergency department, scanning capabilities to distinguish between ischemic and hemorrhagic stroke, and the capacity to administer intravenous thrombolytic therapy to eligible patients. This may require consultation with a neurologist, but neurological expertise is often lacking in rural areas.
- Approximately, one-half of the people who have a stroke are driven to the nearest hospital by family members or friends. This means that the patient misses the opportunity to be triaged and transported to a stroke center, as determined by LEMSA policy.

TELEMEDICINE CHALLENGES

- In some areas of the State, 911 calls made from cell phones are routed to a central location instead of the closest Public Safety Answering Point (PSAP). The result may be a delay in response. Efforts by LEMSAs in collaboration with other stakeholders to direct all wireless 911 calls directly to the nearest PSAP should be encouraged.
- The costs associated with implementing a stroke system of care (e.g., data monitoring, accreditation of EMDs and paramedics in stroke, and establishment of a Stroke Oversight Committee) may require that LEMSAs seek funding from external sources.
- Hospital diversion practices may impede optimum stroke care. Since stroke care includes the use of time-sensitive therapies, there is a need for LEMSAs to: (1) establish policies that minimize diversion of stroke patients; (2) create a real-time stroke-readiness tracking system (possibly web-based) that identifies temporary resource failures (e.g., nonfunctioning computed tomography (CT) scanner or magnetic resonance imaging (MRI) at a Primary Stroke Center); and (3) provide contingency plans that help EMS responders identify the “next-best” destination for stroke patients during temporary resource saturation. Cost may be a barrier to establishing and maintaining the real-time stroke-readiness tracking system.
- Telemedicine makes it possible for hospitals without on-site neurological expertise (spoke hospital) to collaborate with hospitals that can provide the needed neurological expertise (hub hospitals) to determine whether a patient is a candidate for thrombolytic therapy. When thrombolytic therapy is started at a spoke hospital and a patient is then transferred to a hub hospital, neither hospital is eligible for the higher rate of reimbursement that Medicare provides for the delivery of this therapy. The financial incentives that Medicare provides to implement best practices

for stroke care within a single hospital should be generalized to provide both the spoke and hub facilities with prorated payments that reflect the costs of care for severe stroke patients. The AHA/ASA is working with the Centers for Medicare and Medicaid Services (CMS) to collect data that would permit consideration of such a change in policy.

- When telemedicine enables a “hub and spoke system,” neurologists in the hub facility need to be credentialed by the spoke facilities so they may practice as consultants. Multiple credentialing is time-consuming and expensive. Other states have established a uniform, single credentialing process for rural hospital networks and telemedicine hospital networks.¹³ The Nevada rural telemedicine system is an example. Neurologists in this network provide telestroke support to more than 20 hospitals in Northern Nevada and more than 10 hospitals in California (eastern Sierra). The physicians complete a single credentialing form, accepted at all participating Nevada hospitals, but must complete different forms for each participating California hospital.
- The cost associated with buying and maintaining telemedicine equipment may be challenging for hospitals.
- Telemedicine requires robust cooperative agreements between the spoke and the hub hospitals. The stroke system of care must monitor these agreements and verify that such arrangements are actually accomplishing their stated goals.
- Many spoke hospitals may not have the patient volume to gain adequate experience with acute stroke management, and there may be inadequate support at these facilities to provide good stroke care, even with telemedicine.

WORK GROUP

The Work Group that authored these recommendations was co-convened by the CHDSP of CDPH and the AHA/ASA to implement the stroke recommendations of *California's Master Plan for Heart Disease and Stroke Prevention and Treatment (2007—2015)*.

This is a multidisciplinary Work Group that includes experts in emergency medical services, emergency medicine, neurology, hospital administration, telemedicine, public health, and rural health care. The Work Group includes representation from the major public and private organizations that are active in promoting quality stroke care, including the California Conference of Local Health Officers (CCLHO); the California Hospital Association; California Emergency Nurses Association; California Chapter, American College of Emergency Physicians (CalACEP); California Emergency Medical Services Authority; Emergency Medical Services Administrators Association of California (EMSAAC); Emergency Medical Directors Association of California (EMDAC); the National Stroke Association; the Stroke Awareness Foundation; and the Western States Stroke Consortium. These organizations were asked to select the representatives that served on this Work Group.

As part of their effort, the Work Group has developed this document, the *Recommendations for Establishing a Statewide System of Optimal Stroke Care (Recommendations)*. The intent of these Recommendations is to develop a system of care that promotes the safe use of effective therapies for stroke, and assures that all Californians, regardless of place of residence, receive the highest level of stroke care. These Recommendations are consistent with position statements offered by major stroke care advocates, including the BAC, NINDS, ACEP, AHA/ASA, and the National Association of EMS Physicians.

The Work Group met in person on June 18, 2006, October 24, 2007, and May 8, 2008, and electronically throughout the work

period. To assure that the Recommendations are consistent with current EMS policies practices, meetings were held on November 8, 2008, November 9, 2008, and February 27, 2009, with EMSA to review and revise this document.

In its deliberations, the Work Group prioritized the safe use of effective therapies, including organized care and thrombolytic therapy. The Task Force determined that, although there are some reservations among individual members of the California emergency medical community, there is overwhelming national and worldwide acceptance of the benefit of thrombolytic therapy. That acknowledgment of benefit comes from neurology experts in California, national emergency and neurological societies participating in the Brain Attack Coalition, and independent regulatory authorities. In 2008, ACEP, AHA/ASA, and the American Academy of Neurology (AAN) released an educational tool for patients and family indicating that, when given promptly, thrombolytic therapy resolves or significantly improves symptoms in one in three patients.¹¹ Although not every patient may ultimately decide to undergo thrombolytic therapy, the patient and his/her family deserve the opportunity to make an informed decision. One reason for establishing a stroke system of care is to create an environment that minimizes the risks of a thrombolytic intervention. The stroke system will enable providers to: (1) identify patients who are most likely to benefit from thrombolytic therapy; (2) deliver thrombolytic therapy within the therapeutic time-window; and (3) provide appropriate support and follow-up for patients after thrombolysis. An equally compelling reason for establishing a stroke system of care is so that patients not treated with thrombolytics can receive organized supportive stroke care, which has also been established by controlled trials to substantially improve outcome. The Recommendations of the Work Group reflect a desire to improve the overall quality of care for stroke patients, from the prevention of risk factors to the final stroke outcome. This Statewide Plan reflects the majority viewpoint of the Stroke Work Group members.

Table of Contents

● <i>Pre-Hospital Stroke Care</i>	19
● <i>Hospital Stroke Care</i>	31
● <i>Community Stroke Education</i>	43
● <i>Policy Recommendations</i>	47
● <i>Appendices</i>	55

Pre-Hospital Stroke Care



Because stroke is the third leading cause of death in California and a leading cause of long-term disability.

● **Goal:**

Development of a pre-hospital system that provides rapid identification and transport of suspected acute stroke patients to the most appropriate care center.

Pre-Hospital Stroke Care

Since stroke treatment is time-sensitive, recommendations for pre-hospital care include: (1) dispatch of Emergency Medical System (EMS) responders at the highest level of response, using the most appropriate resources that are in close proximity to the patient (EMS resources should be dispatched with the same urgency customary for trauma or acute myocardial infarction [AMI]); (2) limited on-scene time with directed intervention (oxygenation, capillary glucose determination, and IV access, according to local scope of practice); and (3) expeditious transportation to the closest, most appropriate medical facility.

The EMS system is the “gatekeeper” in a system of care for acute disease. The EMS system is responsible for the entry of an acute stroke patient into the health care system and for the transport of stroke patients between medical facilities; thus, it is appropriate that the Local Emergency Medical Services Agencies (LEMSAs) develop acute stroke systems of care. This approach is consistent with the current systems of stroke care that have been developed in California and allows LEMSAs, the entities in California that have the authority to develop systems of care, the opportunity to implement local plans.

EMERGENCY MEDICAL DISPATCH

Optimal stroke care begins with the receipt of the 911 call. Call centers in most urban areas include Emergency Medical Dispatchers (EMDs), who are specifically trained and/or certified to field calls of a medical nature. EMDs typically operate in a “prioritized dispatch system,” which enables the assignment of appropriate resources and a level of urgency for each medical call. EMDs use a caller interrogation/EMS response tool (there are several proprietary products available in both card and computer formats) to help identify a caller’s medical condition based on the information provided by the caller. For any given medical condition, the caller interrogation/EMS response tool provides information to EMDs on the general level of EMS response that is needed, as well

as the advice that should be given to the patient, family, and/or bystanders. The caller interrogation/EMS response tool may be customized by the LEMSAs to reflect the response needs and capabilities of a local area. Vendors of the caller interrogation/EMS response tools may require that EMDs receive periodic training in their use in order to become “certified.”

In contrast, 911 calls made to rural call centers are sometimes received by dispatchers whose role is limited to deciding whether a call requires a law enforcement, fire, or medical response. If a medical response is needed, it is sent at the highest priority level.

As LEMSAs develop stroke systems of care, they should adopt standardized written protocols for dispatch that recognize the emergent nature of stroke. At all 911 call centers, dispatch for stroke should be with the same urgency as trauma or AMI. In environments that are suitable for prioritized medical dispatch, the LEMSA should require the use of a caller interrogation/EMS response tool that meets current standards of care for EMD practice. EMDs may be required to be certified by the vendor of the tool or otherwise prove competence in its use. LEMSAs may also choose to “accredit” EMDs as a means of verifying their competence. In customizing the EMS response for stroke, LEMSAs should develop protocols that deliver the highest priority level of response.

The stroke system of care should include quality improvement measures to ensure that dispatchers consistently and correctly follow written protocols.

Procedures

The dispatch response to stroke should include appropriate processes that ensure rapid access to treatment.

Pre-Hospital Stroke Care

1. Use of a formal caller interrogation/EMS response tool

- a. LEMSAs should identify and authorize the uniform use of a caller interrogation/EMS response tool for prioritized emergency medical dispatch. This tool should include a specific algorithm for the identification of suspected stroke.
- b. LEMSAs should require that EMDs prove competence in the use of the tool (i.e., vendor certification or LEMSA accreditation).
- c. LEMSAs may customize the tool to reflect the resources available in their region.

2. Training of dispatchers

- a. In areas that use prioritized dispatch, LEMSAs should require that EMDs receive adequate education on the use of the caller interrogation/EMS response tool that includes identification of suspected stroke. Education may be provided by the vendor, by the EMD provider agency, by the LEMSA, or by the LEMSA's designee.
- b. LEMSAs should consider adopting an accreditation process that verifies the EMDs' competence in use of the tool that incorporates identification of suspected stroke.

3. Dispatch

- a. In areas that use prioritized dispatch, dispatchers should provide instructions for patients, family and/or bystanders as they wait for EMS, as determined by the LEMSA.
- b. EMS responders should be dispatched by protocols requiring the highest level of response for suspected stroke with the closest most appropriate resources available.

are fully equipped, at a minimum, for basic life support, including ventilation and oxygenation capabilities.

LEMSAs should develop pre-hospital protocols to assure that EMS responders are able to appropriately discharge their responsibilities in the continuum of acute stroke care. These responsibilities are:

- early recognition of signs and symptoms of stroke,
- determination of time “last seen without stroke symptoms,”
- rapid determination of blood glucose level,
- establishment of IV access,
- oxygenation,
- rapid transport to the most appropriate care facility with early notification to the receiving facility.

For appropriate and time-sensitive triage, first responders should be trained to recognize the signs and symptoms of stroke. To promote competency in this area, all EMS responders should be encouraged to participate in periodic pre-hospital stroke recognition and treatment education. EMS providers should be required to use a validated pre-hospital stroke screening tool. National guidelines now urge that when EMS responders screen patients for stroke, they err on the side of over-identification (over-triage) rather than under-identification (under-triage).⁸ Trauma triage experience has shown that in the absence of over-triage, under-triage occurs.¹² Under-triage could be a detrimental to stroke patient care because it may delay or even rule-out receipt of time-sensitive therapies. Over-triage, however, can contribute to scarce specialty resource overuse, increased cost, long transport times, and limitation of operational EMS resource availability without direct patient benefit.

Procedures

The EMS response to stroke should include appropriate processes that ensure rapid access to treatment. In a stroke

Pre-Hospital Stroke Care

system of care established by a LEMSA, the pre-hospital system of care should include the following:

1. Training of all EMS responders

EMS responders should receive training in the recognition of stroke, including stroke signs and symptoms and use of a validated stroke scale such as the Cincinnati Pre-hospital Stroke Scale or the Los Angeles Pre-hospital Stroke Scale (see Appendix A), as well as treatment of stroke, including proper documentation of time of symptom onset (time “last seen without stroke symptoms”) and field management of stroke patients. The goal should be to train 100 percent of EMS responders, including emergency medical technicians (EMTs) and paramedics, in stroke recognition and treatment.

To assure that EMS responders are appropriately trained, LEMSAs should ensure that:

- paramedics receive pre-hospital stroke treatment training as part of accreditation,
- providers of ambulance services offer pre-hospital stroke treatment training as part of their contractual service agreements,
- hospitals that have been designated by LEMSAs as stroke-receiving centers provide pre-hospital stroke training for EMS responders,
- stroke training and triage outcomes are identified as part of a continuing quality improvement process.

TRANSPORT

LEMSA-designated stroke systems of care should have established policies and protocols for assessment, triage, and rapid transport of stroke patients to the most appropriate care center. Transport policies may: (1) take into account the suspected stroke patient’s eligibility for time-sensitive treatment, (2) emphasize direct transport of patients to minimize the need for interfacility transfer, and (3) emphasize the importance of notifying hospitals, either directly through the EMS or the base hospital, that a suspected stroke patient is being transported. This will enable the transport of a

patient to a facility that is prepared to receive an acute stroke patient.

Procedures

In stroke systems of care, stroke patients should be transported to the most appropriate facility staffed and equipped to manage an acute stroke patient. This determination will include assessments of local resources and transport times.

1. LEMSA destination policies

As LEMSAs develop stroke systems of care, they should establish patient destination policies that stipulate that suspected stroke patients be transported directly to the hospital that is most appropriate for their condition.

- a. All suspected stroke patients who may be eligible for time-sensitive treatments should be transported directly, with the urgency equivalent to trauma or AMI, to a designated stroke-receiving hospital, according to LEMSA policy. (See “Hospital Stroke Care” for definition of a stroke-receiving hospital). The LEMSA destination policy should take into consideration therapeutic time-windows recommended by current national treatment guidelines. In LEMSAs where there are designated stroke-receiving hospitals that can provide therapies within an extended therapeutic window (i.e., hospitals comparable to the Comprehensive Stroke Centers described by the BAC), the LEMSA should develop destination policies that recognize this option.

Suspected stroke patients who may be eligible to receive time-sensitive therapies must meet the following criteria for direct and rapid transport to a designated stroke-receiving hospital:

- Adult (age 18 years or older),
- Symptoms consistent with stroke causing a measurable neurological deficit,
- Stroke screening algorithm positive for stroke,

Pre-Hospital Stroke Care

- Time “last seen without stroke symptoms” well-established to be within the therapeutic window for time-sensitive therapies.

These patients should be transported to a designated stroke-receiving hospital that is, by definition, capable of reliably offering approved time-sensitive therapies with high rates of adherence to protocols and a well-organized acute supportive stroke care structure. (See “Hospital Stroke Care” for definition of a stroke-receiving hospital).

- b. All suspected stroke patients whose time “last seen without stroke symptoms” exceeds the therapeutic window for time-sensitive treatment should optimally be transported to a designated stroke-receiving hospital for supportive acute stroke care. Although these patients may not be eligible for time-sensitive treatments, they will likely benefit from other therapies offered at designated stroke centers. Consideration should be given to local policies, available resources, and hospital agreements.

2. Mode of transportation

In stroke systems of care, stroke patients should undergo rapid transport to the closest facility that provides the appropriate level of stroke care. In most circumstances, this will involve ground transport; however, if indicated, air transport may be considered to shorten time to treatment in accordance with local EMS policy.

3. Rapid Response

Given the emergent nature of stroke, LEMSAs should promote the most rapid pre-hospital response possible. Dispatch and EMS response should be within the time limits and goals established for other acute events, such as trauma and AMI. LEMSAs should monitor response times through the continuous quality improvement process.

PRE-HOSPITAL EVALUATIONS AND OUTCOMES

Improvements in stroke outcomes require an ongoing commitment from every member of the health care team. These efforts are intended to inform the process and to improve disease outcomes. Evaluation of pre-hospital stroke care can occur at many levels and with varying degrees of complexity; however, ensuring that appropriate measurement tools are implemented will facilitate this process. LEMSAs should establish benchmarks for each of these measures.

Procedures

1. Engage in Continuous Quality Improvement (CQI).

The success of the pre-hospital component of the stroke system of care will depend on objective data to assess and improve the process. The overall goal of a stroke system of care is to improve quality of care, thereby improving health outcomes.

a. Structure:

Evaluation of the pre-hospital component of the stroke system of care should include assessment of the following structural components.

- Dispatch protocols requiring the highest priority level (consistent with trauma and AMI) of response for suspected stroke.
- Adequate staff and equipment to transport and care for patients in the pre-hospital setting.
- Ongoing written and in-person education of EMS responders on stroke.
- Validated pre-hospital stroke screening tools.
- Prearranged destination protocols.
- Local medical oversight committee, including neurologists and/or neurosurgeons with stroke expertise, emergency department (ED) physicians, hospital representatives, and EMS for the stroke system of care.
- CQI assessment of educational needs.

b. Process:

In a stroke system of care established by a LEMSA,

Pre-Hospital Stroke Care

data elements for stroke should be collected and analyzed. National guidelines recommend the collection of specific pre-hospital data elements⁸ (see Appendix B). These data elements will be used to evaluate the following EMS process measures or benchmarks:

- Time from “last seen without stroke symptoms” to 911 call.
- Time from receipt of 911 call to dispatch of EMS.
- Time of dispatch of EMS to EMS arrival.
- Time from EMS arrival to patient contact.
- Time “last seen without stroke symptoms” to patient contact time.
- On-scene time.
- For transfer patient, on-scene time at sending hospital.
- For transport patient, interfacility transport time.
- Time from scene to ED or stroke center/ designation hospital door.
- Total EMS contact time (i.e., time from receipt of the 911 call to arrival at the stroke center).
- Use of a documented validated screening tool to identify stroke patients.
- EMS responder documentation of time “last seen without stroke symptoms.”
- Percent of patients routed to designated stroke-receiving hospitals.
- Documentation of pre-arrival notification of receiving facility.
- Documentation of blood glucose by ALS providers.
- CQI assessment of EMS training needs.
- CQI assessment of resource failures (e.g., the frequency with which stroke-receiving hospitals must divert patients due to nonoperating equipment).

To assess the accuracy of field triage, the following measures should be collected by LEMSAs in

cooperation with the receiving hospital:

- Over/Under Triage. Patients entered into the stroke system by EMS assessment who did/did not receive a hospital diagnosis of stroke based on destination hospital determination.
- Documentation that receiving facility received pre-arrival notification of an inbound suspected stroke patient.

c. Outcomes

- Dispatch determination and EMS responder presumptive diagnosis or primary impression should be compared with the hospital diagnoses.

2. Report Quality Improvement Progress

On a regular basis, LEMSAs with stroke systems of care should analyze the data collected in the pre-hospital system and report on the results to their Oversight Committee (see page 40) and providers. Quarterly evaluation and reporting should be considered.

Hospital Stroke Care



Because stroke is the third leading cause of death in California and a leading cause of long-term disability.

● **Goal:**

Development of a regional hospital system that provides optimum stroke treatment for every stroke patient.

Hospital Stroke Care

California's health care system includes hospitals that vary considerably in their capacity to care for stroke. Hospitals with the capacity needed to be part of a stroke system of care include:

1. **Primary Stroke Center** (as defined by The Joint Commission) or their equivalents—These facilities have been recognized as hospitals that meet the minimum desirable level of care for stroke patients in the emergency department (ED) and in inpatient care.
2. **Satellite Stroke Centers** (as defined by the multi-organizational Brain Attack Coalition)—These facilities are able to provide the minimum desirable level of care for stroke patients in the ED, particularly when paired with another hospital, but are not documented to provide the minimum desirable level of care for admitted inpatients. These facilities should be regarded as stroke partners or “spokes” and should be aligned by formal agreement with a hospital that can provide the missing service (hub). The most common “missing service” is neurological expertise in the ED and inpatient Stroke Unit care for patients treated with recanalization therapies. In these hospitals, the necessary ED neurological expertise may be provided through telemedicine.
3. **Comprehensive Stroke Centers** (as defined by the multi-organizational Brain Attack Coalition) or their equivalents (sometimes referred to as “primary stroke centers with interventional capability”)—These facilities are equipped with diagnostic and treatment facilities for stroke that are not found in other hospitals and are able to deliver time-sensitive treatment within an extended therapeutic time window. They also have advanced neurological and interventional neuroradiology capabilities. Neurosurgeons and interventional neuroradiologists play important roles for treating intracerebral hemorrhage and subarachnoid hemorrhage. In addition, brain tumors and subdural hematomas are common stroke mimics. Patients who fall within an extended

therapeutic time window should be triaged and transported by emergency medical services (EMS) providers directly to designated Comprehensive Stroke Centers when available, as directed by local policy. Other patients who will likely benefit from advanced clinical neuroscience care should also be transferred to facilities with this service.

In California, EMS transports patients to facilities that have been identified by LEMSAs as appropriate for treatment of a specific condition. Facilities that may be designated as appropriate receiving centers for stroke patients include Comprehensive Stroke Centers, Primary Stroke Centers, and Satellite Stroke Center hospitals or their equivalents. Ideally, every stroke patient will be transported by EMS to a designated stroke-receiving hospital; however, to prepare for patients arriving by private vehicle and for strokes occurring in the hospital, every hospital in California should have a medical protocol for stroke patients. Hospitals that are not designated as stroke-receiving centers should have a pre-arranged plan for transfer and transport of these patients to a stroke-receiving hospital. Hospitals that are not designated as stroke-receiving hospitals should not communicate to the public that they are a stroke center or use other terminology that implies they are capable of delivering the standard of stroke care.

Procedures

In a stroke system of care established by a local EMS agency (LEMSA), the hospital system of care for stroke should include the following:

1. Evaluation of hospital capacity within a Stroke System of Care established by a LEMSA

LEMSAs should survey or otherwise ascertain the capabilities of hospitals in their regions to identify: (1) hospitals that have been certified as Primary Stroke Centers by The Joint Commission or another body with equivalent or higher certification standards; (2) hospitals that are currently seeking

Hospital Stroke Care

or could reasonably seek Primary Stroke Center certification from The Joint Commission or another body with equivalent of higher certification standards; and

(3) hospitals that are Satellite Stroke Centers, possibly through partnerships with Primary Stroke Centers. LEMSAs should use this baseline information to create or augment the stroke system of care within each region.

2. Designation of hospitals as Stroke-Receiving Hospitals

LEMSAs that are developing a stroke system of care should, after evaluating hospitals in their regions, designate those hospitals that are appropriate destinations for stroke patients. Whenever possible, stroke-receiving hospitals should be Primary Stroke Centers. The existence in the future of certified Comprehensive Stroke Centers should also be considered in designating stroke-receiving hospitals. LEMSAs should also consider how they might include hospitals that are not independently stroke-capable, but may become stroke-capable through a telemedicine partnership (Satellite Stroke Centers). LEMSAs are encouraged to make their stroke systems of care as inclusive as possible, without sacrificing the quality of stroke care, so that the largest number of Californians may be served.

The LEMSA should establish a process for designating additional stroke-receiving hospitals as hospitals in their jurisdiction gain capacity. LEMSAs may choose to designate stroke centers through The Joint Commission or another body with equivalent or higher certification standards. Criteria for achieving stroke-receiving hospital status should be at least as rigorous as those used by The Joint Commission for stroke center certification (see Appendix C). No health care facility should advertise in any manner or hold itself out to be a stroke-receiving hospital unless it has been designated by the process authorized by the LEMSA.

3. Policies for Interfacility Transfer

Hospitals that are not designated as stroke-receiving hospitals should have plans developed to ensure that stroke patients who arrive by private vehicles or patients who have an in-hospital stroke receive optimal stroke care. These plans should include: (1) pre-arranged agreements with stroke-receiving hospitals for transfer of patients, and (2) pre-arranged agreements with EMS providers for rapid transport of patients who are eligible for time-sensitive treatments. This might be patients who would benefit from being transferred emergently from a non-stroke-receiving hospital to a stroke-receiving hospital, or patients who might benefit from being transferred from a stroke-receiving hospital with Primary Stroke Center capabilities to a Comprehensive Stroke Center or equivalent (Primary Stroke Center with interventional capability). In either case, emergency transfer protocols should be pre-arranged, and transport should be provided with the urgency of a 911 response.

Improvements in stroke outcomes require an ongoing commitment from every member of the health care team. These efforts are intended to inform the process and to improve disease outcomes. Stroke care within hospitals can be evaluated at many levels and with varying degrees of complexity; however, ensuring that appropriate measurement tools are implemented will facilitate this process. The structure of the stroke system of care should facilitate the exchange of relevant clinical data between appropriate providers (e.g., EMS, hospitals) and system coordinators (i.e., LEMSAs).

Procedures

1. Engage in Continuous Quality Improvement

The success of the hospital component of the stroke system of care will depend on objective data to assess and improve the process. The overall goal of a stroke system of care is to

Hospital Stroke Care

improve quality of care, thereby improving health outcomes.

a. Structure: Evaluation of the hospital component of the stroke system of care will include assessment of the following structural components:

- Adequate staff, equipment, and training to perform ED rapid evaluation, triage, and treatment.
- Standardized stroke care pathway.
- 24/7 stroke diagnosis and treatment capacity in designated hospitals.
- Quality assurance system in certified hospitals.

b. Process: Data will be collected and reported to the LEMSA on the following hospital process characteristics. Initially, LEMSAs will expect designated stroke-receiving hospitals to collect and evaluate the most critical data elements necessary to permit an assessment of the quality of care. These minimum data elements are consistent with those required by The Joint Commission for Primary Stroke Center Certification. (See Appendix C.) Designated stroke-receiving hospitals will also be expected to collect and report on data elements that measure the quality of pre-hospital patient care, such as hospital pre-notification and the accuracy of field triage. In more mature stroke systems of care, additional data collection should be encouraged. (See Appendix B.) With the advice of the Oversight Committee (see “Policy Recommendations”), LEMSAs should update the data element requirements as needed to align with revisions in national guidelines.

Benchmark: For all of the measures listed below, the goal is for 100 percent of eligible patients to receive the therapy or intervention described.

Minimum requirements:

- Thrombolytic therapy—Ischemic stroke patients who receive thrombolytic therapy within the established therapeutic time window.
- Early antithrombotics—Patients with ischemic

stroke or transient ischemic attack (TIA) who receive antithrombotic therapy by the end of hospital day two.

- Deep venous thrombosis (DVT) prophylaxis—Nonambulatory patients with ischemic stroke or TIA who receive DVT prophylaxis by the end of hospital day two.
- Dysphagia screening—Patients with ischemic stroke or TIA who undergo screening for dysphagia with a simple valid bedside testing protocol before being given any food, fluids, or medication by mouth.
- Antithrombotics—Patients with ischemic stroke or TIA prescribed antithrombotic therapy at discharge.
- Anticoagulation for atrial fibrillation—Patients with ischemic stroke or TIA and atrial fibrillation who are discharged on anticoagulation therapy.
- Cholesterol-reducing drugs—Patients with ischemic stroke or TIA who are discharged on cholesterol-reducing drugs because:
(1) Low-density lipoprotein (LDL) greater than 100 mg/dL or (2) LDL not measured because patient on cholesterol-reducing drugs prior to admission.
- Smoking cessation—Patients with ischemic stroke or TIA and current tobacco use who are, or whose caregivers are, given smoking cessation advice or counseling during hospital stay.
- Stroke education—Patients with ischemic stroke or TIA or their caregivers who are given education or educational materials assessing: personal risk factors for stroke, warning signs of stroke, activation of emergency medical system, need for follow-up after discharge, and medications prescribed.
- Rehabilitation considered—Patients with

Hospital Stroke Care

ischemic stroke or TIA who were assessed for rehabilitation services.

Additional measures:

- o Door to imaging [computed tomography (CT) scan or magnetic resonance imaging (MRI)] time for stroke patients arriving within the therapeutic time window—Time from ED arrival to initial imaging work-up for acute stroke and subacute strokes or TIA patients.
- o Door to thrombolytic therapy—Time from ED arrival to administration of intravenous thrombolytic therapy for ischemic stroke patients.
- o Time “last seen without stroke symptoms” to administration of thrombolytic therapy— Time from symptom onset to administration of intravenous thrombolytic therapy for ischemic stroke patients.
- o Intravenous thrombolytic therapy contraindicated—Reason that ischemic stroke patients were not treated with intravenous thrombolytic therapy.
- o Protocol deviations—Ischemic stroke patients who received intravenous thrombolytic therapy outside of the treatment window.
- o Thrombolytic complications—Ischemic stroke patients with complications secondary to thrombolytic therapy.
- o Complication types—Types of complications seen with thrombolytic therapies received by ischemic stroke patients.
- o Antihypertensive—Antihypertensive medications (class) prescribed at discharge for ischemic stroke or TIA patients.
- o Diabetic medications—Patients with diabetes mellitus, or taking diabetic medications prior to admission, who are discharged on diabetic

medication.

- o Weight recommendation—Ischemic stroke or TIA patients with body mass index (BMI) greater than or equal to 25 kg/m² who receive recommendations at discharge for reducing weight and/or increasing activity.

c. Outcomes

Hospitals will collect and report the following data to the LEMSA. It will be the goal of hospitals to collect these data points on 100 percent of stroke patients:

- Modified Rankin Scale (MRS) or National Institute of Health Stroke Scale (NIHSS)—used to assess changes in clinical status during the course of the hospitalization.
- In-hospital mortality (adjusted for risk and stroke severity).

2. Report Quality Improvement Progress

LEMAs with established stroke systems of care will analyze and report on the data collected to their Oversight Committee (see “Policy Recommendations”) and providers.

Telemedicine can bridge resource gaps at rural hospitals and other hospitals that are unable to secure on-call specialty physicians. Telemedicine may also play a role in urban areas where traffic delays may force EMS to deliver a stroke patient to a hospital where neurological or radiologic expertise is not available.

Systems for remote interpretation of radiologic images are well-established throughout the US and California. For stroke patients, it is critical that interpretation of the initial brain CT scan or MRI be performed within 45 minutes of hospital arrival (for those patients who arrive in less than 3 hours after the onset of symptoms). Systems for remote neurologic audio/video interview and visual examination

Hospital Stroke Care

of the patient by a neurologist are now widely employed in several states and at several sites in California.

Procedures

1. Standard Protocols

Hub and spoke systems that provide expertise via telemedicine must be designed to optimize system compatibility in terms of patient evaluation and treatment protocols. Protocols must be standardized across all participating facilities so that medical staff will be assured that remote patients will receive evaluation and treatment as expected.

2. Compatible Telemedicine Systems

Partnering facilities must use compatible technology and assure appropriate training of staff in its use.

3. Private Telemedicine Companies

Private telestroke/telemedicine companies that are not connected with a hospital or medical facility are emerging, but the quality of the care they provide has not been adequately researched. What is currently known about the effectiveness of telestroke has been drawn from the hub and spoke hospital model. Agreements between private telemedicine companies and Satellite Stroke Centers are discouraged because of concerns regarding issues of liability, the quality of care provided, and the lack of continuity of care.¹³

4. Credentialing for Specialists

Credentialing is the process hospitals undertake to verify that the physicians to whom they grant privileges are professionally qualified. In a telemedicine network, the consulting physicians at the hub hospital must be credentialed by each of the spoke hospitals. This is a time-consuming, labor-consuming and largely duplicative process that each hospital undertakes individually. This credentialing model impedes the establishment of telemedicine networks.¹³ The development of a uniform credentialing form and potentially a

uniform credentialing process for physicians providing telemedicine services for emergency conditions is desirable for California.

5. Standing Telestroke Advisory Committee

A standing Telestroke Advisory Committee will be established at CDPH to provide ongoing assistance to LEMSAs as they incorporate telemedicine into their acute stroke systems of care. The Telestroke Advisory Committee will interact and collaborate with other telemedicine committees established by the Governor, the Legislature, and nonprofit organizations.

Community Stroke Education



Because stroke is the third leading cause of death in California and a leading cause of long-term disability.

● **Goal:**

Increase the percentage of people who recognize the signs and symptoms of stroke and enter the stroke system of care by calling 911.

Community Stroke Education

The ability to recognize the signs and symptoms of stroke is vital to receiving timely treatment, which increases the chance of achieving a functionally independent outcome. Information on the recognition of acute stroke and appropriate response are the key messages for a public education campaign. Community education should focus on the following critical messages for stroke:

- Signs and symptoms of stroke (e.g., “Give Me 5,” FAST, “Suddens”).
- Time-sensitive window for emergency medical services (EMS) response (i.e., in the event of a stroke, call 911 immediately, since “time is brain”). Unfortunately, the public calls 911 only about half of the time when there is a suspected stroke. People who self-transport miss the opportunity to be triaged quickly and directly to the hospital that can deliver the most appropriate care, including time-sensitive treatment for eligible patients.

The medical staff needs the family’s involvement in choosing among the available treatment options. This is especially important if the patient is unable to communicate.

The public should be educated about the importance of family members accompanying the stroke patient to the hospital.

Educational materials and campaigns should be culturally sensitive, language-appropriate, and presented at the literacy level of the intended audience. Materials should particularly target high-risk racial/ethnic groups (i.e., Hispanics, African Americans, and Native Americans) and women. In addition, public education should be presented in a variety of venues and should be communicated using multiple forms of media.

Procedures

1. Community Benefit Requirements

Nonprofit hospitals should be encouraged to satisfy their community benefit requirements by educating people about the signs and symptoms of acute stroke and the need to call 911 immediately.

2. Public Education Campaigns

Local EMS agencies (LEMSAs) may require designated stroke-receiving hospitals to conduct public education about the signs and symptoms of stroke and the need to call 911.

LEMSAs should also encourage EMS providers and hospitals to educate the public about the signs and symptoms of stroke and the need to call 911. When possible, EMS providers and hospitals should consider creating educational partnerships.

In conducting public education campaigns, LEMSAs may seek partnerships with other private and public organizations that are also committed to the prevention and optimum treatment of stroke.

Policy Recommendations



Because stroke is the third leading cause of death in California and a leading cause of long-term disability.

● **Goal:**

Remove barriers to the establishment and operation of an optimal system of acute stroke care for adults in California.

Policy Recommendations

POLICY

RECOMMENDATIONS

1. The EMS Authority should establish guidelines to encourage all LEMSAs to develop a system of care for stroke so that optimal care will be accessible to all Californians, regardless of place of residence. This will assure a uniformly high standard of stroke care across the State. The Recommendations developed by the Stroke Work Group, California's recognized expert panel on stroke care, is an important resource document for LEMSAs when developing their stroke systems of care. Although the Recommendations establish the minimum standards for excellence in acute stroke care, LEMSAs' approaches to implementing these Recommendations may vary. The Recommendations also allow flexibility at the local level, based on local needs and resources.

2. LEMSAs with established stroke systems of care should convene an Oversight Committee to provide medical oversight and guidance to the local emergency medical services (EMS) and designated hospitals. The oversight committee may be incorporated in a standing committee (e.g., Quality Improvement Committee). The oversight committee should:

- a. Include appropriate representation from key stakeholders, including hospitals, ED physicians, neurologists, and EMS.
- b. Assure that as many hospitals as possible in a region are capable of providing the optimum standard of care for stroke patients, either independently or through a partnership with another hospital. In developing hospital partnerships, the committee will consider the applicability of telemedicine in providing neurological expertise where lacking on-site. CDPH's Telestroke Work Group will serve as a resource for the Oversight Committee.
- c. Facilitate written agreements between hospitals to formalize partnerships.
- d. Review and analyze quality improvement reports on the pre-hospital and hospital components of stroke system

of care submitted by the LEMSA. Results will be used to revise and improve the system.

- 3.** Annually, CHPSD should issue a report describing the stroke systems of care in each California county.

As LEMSAs develop stroke systems of care, additional challenges, including those identified in the introduction to this document, will present opportunities for policy solutions.

**WORK GROUP
MEMBERS
AND DISCLOSURES**

Jeff Saver, MD, Work Group Chair

Professor of Neurology

Director, UCLA Stroke Center

Geffen School of Medicine at UCLA

Disclosures: Consultant/Advisory Board – AGA Medical, Co-Axia, Ferrar, Pfizer, ImaRx, Fibrogen, Ev3, Talacris; Other Research Support – Concentric Medical; Employment – University of California Regents

Paul Akins, MD, PhD

Director, Neuro Intensive Care

Kaiser Permanente Sacramento

Disclosures: None

James Baranski

Chief Executive Officer, National Stroke Association

Disclosures: None

Bryan Cleaver

Administrator, Coastal Valley EMS Agency

Disclosures: None

Steven Cramer, MD

Associate Professor, Neurology

Co-director Clinical Stroke Services

UCI Medical Center

Disclosures: Research Grants – Northstar neuroscience, Inc, GlaxoSmithKline, Stem Cell Therapeutics; Consultant/Advisory Board – GlaxoSmithKline, Merck & Co., Inc., Stem Cell Therapeutics, Sygnis Pharma AG, Pfizer Inc. CytRx Corporation, Allergan Inc., Grupo Ferrera SA.

Susan Croopnick, RN, MSN

Mercy Health Care Sacramento

Disclosures: None

James Dunford, MD

Emergency Medicine

UC San Diego Medical Center

Disclosures: None

David Ghilarducci, MD

EMS Medical Director

Santa Clara County

Disclosures: Speaker/Honoraria – Genentech; Consultant/Advisory Board – Genentech

Jerome Hoffman, MD

Emergency Medicine
UCLA Medical Center
Disclosures: None

Sherry Houston

Stroke Awareness Foundation
Disclosures: None

Jeff Howard

American Medical Response
Disclosures: None

S. Claiborne Johnston, MD, PhD

Director, UCSF Stroke Services
UCSF Medical Center
Disclosures: Research Grant – Sanofi Aventis

Johnathan Jones, RN, BSN

Trauma & Specialty Care Coordinator
Emergency Medical Services Authority
State of California
Disclosures: None

Paul Katz, MD

Medical Director
Comprehensive Stroke Center
Institute for Neurosciences
Renown Health, Nevada
Disclosures: None

Patrick Lyden, MD

Professor of Neuroscience
Stroke Center Director
UCSD Medical Center
Disclosures: None

William Mallon, MD

Emergency Medicine
LA County USC Medical Center
President, CAL/ACEP
Disclosures: None

Richard McCarthy, MD

Chief, Department of Neurology
San Rafael Medical Center
Permanente Medical Group
Disclosures: Employment/Ownership Interest – Permanente
Medical Group

Michael O'Brien, MD, PhD

Director, Enloe Medical Center Stroke Program

Disclosures: None

Janice Ogar, RN

EMS Clinical Services Manager

San Mateo County EMS

Disclosures: None

Debby Rogers, RN, MS

VP Quality and EMS

California Hospital Association

Disclosures: None

Eric Rudnick, MD

Medical Director

Northern California EMS

Disclosures: None

John Schafer, MD

Catholic Healthcare West

Mercy Medical Group

Disclosures: None

Bonnie Sinz, RN

Division Chief, Emergency Medical Services' Systems

Emergency Medical Services Authority

State of California

Disclosures: None

Terri Sturgill, RN

Desert Regional Medical Center

California Emergency Nurses Association

Disclosures: None

Gene Sung, MD, MPH

Assistant Professor of Clinical Neurology

Keck School of Medicine of USC

Disclosures: Research Grant – EKR Therapeutics;

Speaker/Honoraria – Boehringer-Ingelheim;

Consultant/Advisory Board – The Medicines Company

David Tong, MD

Medical Director, Stroke Care Center

California Pacific Medical Center

Disclosures: Speaker/Honoraria – Genentech

Glennah Trochet, MD

Sacramento County Public Health Officer
President, California Conference of Local Public Health
Officers

Disclosures: None

Piero Verro, MD

Associate Professor
Director, UC Davis Stroke Program
UC Davis Medical Center

Disclosures: None

Tanya Warwick, MD

Assistant Clinical Professor of Neurology
UCSF/Fresno

Disclosures: None

Judith Yates, BSN, MPH

Hospital Association of San Diego and Imperial Counties

Disclosures: None

Work Group Conveners

American Heart Association/American Stroke Association
California Department of Public Health

Representatives:

Selinda Shontz, RD

Vice President, State Health Alliances
American Heart Association/American Stroke Association

Sang-Mi Oh

Senior Director, State Health Alliances
American Heart Association/American Stroke Association

Lily A. Chaput, MD, MPH

Program Director, California Heart Disease and Stroke
Prevention Program
California Department of Public Health

Nan Pheatt, MPH

Secondary Prevention Manager, California Heart Disease
and Stroke Prevention Program
California Department of Public Health

Appendices

- A** *Sample Validated Stroke Screening Tools for EMS Responders*
 - *Los Angeles Pre-hospital Stroke Screen (LAPSS)*
 - *Cincinnati Pre-Hospital Stroke Scale*
- B** *Pre-Hospital and Hospital Data Elements*
- C** *The Joint Commission’s Stroke Framework and Standardized Stroke Measure Set*
- D** *EMS Stroke Plan Template*
- E** *References*

A

SAMPLE VALIDATED STROKE SCREENING TOOLS FOR EMS RESPONDERS

LOS ANGELES PRE-HOSPITAL STROKE SCREEN (LAPSS)

Screening Criteria

	Yes	No
1. Age over 45 years	---	---
2. No prior history of seizure disorder	---	---
3. New onset of neurologic symptoms in last 24 hours	---	---
4. Patient was ambulatory at baseline (prior to event)	---	---
5. Blood glucose between 60 and 400	---	---

Exam: Look for obvious asymmetry

	Normal	Right	Left
Facial smile/grimace	__	__ Droop	__ Droop
Grip:	__	__ Weak grip	__ Weak grip
		__ No grip	__ No grip
Arm weakness	__	__ Drifts down	__ Drifts down
		__ Falls rapidly	__ Falls rapidly
		Yes	No
6. Based on exam, patient has only unilateral weakness		---	---

If Yes (or unknown) to all items above LAPSS screening criteria met:

If LAPSS criteria for stroke are met, call receiving hospital with “code stroke.” If not, then return to the appropriate treatment protocol. (Note: the patient may still be experiencing a stroke even if LAPSS criteria are not met.)

Reference

Kidwell CS, Starkman S, Eckstein M, Weems K, Saver JL. “Identifying stroke in the field. Prospective validation of the Los Angeles pre-hospital stroke screen (LAPSS).” *Stroke* 2000 Jan;31(1):71–6

A

SAMPLE VALIDATED STROKE SCREENING TOOLS FOR EMS RESPONDERS

(Continued)

CINCINNATI PRE-HOSPITAL STROKE SCALE

Facial Droop:

Normal:	Both sides of face move equally
Abnormal:	One side of the face does not move at all

Arm Drift:

Normal:	Both arms move equally or not at all
Abnormal:	One arm drifts compared to the other

Speech:

Normal:	Patient uses correct words with no slurring
Abnormal:	Slurred or inappropriate words or mute

References

Kothari RU, Pancioli A, Liu T, Brott T, Broderick J. "Cincinnati Prehospital Stroke Scale: reproducibility and validity." *Ann Emerg Med* 1999 Apr;33(4):373–8.

PRE-HOSPITAL AND HOSPITAL DATA ELEMENTS

Pre-Hospital Data Elements

Item number	Data Element	Variable Name
1	Incident or onset Date/Time	NEMSIS E05_01
2	PSAP call Date/Time	CEMSIS E05_02
3	Unit notified by dispatch Date/Time	CEMSIS E05_04
4	Unit arrived at patient Date/Time	CEMSIS E05_07
5	Unit left scene Date/Time	CEMSIS E05_09
6	Patient arrived at destination Date/Time	CEMSIS E05_10
7	Stroke scale	NEMSIS E14_24
8	Thrombolytic screen	NEMSIS E14_25
9	Destination/transferred to, name	CEMSIS E20_01
10	Reason for choosing destination	CEMSIS E20_16
11	Provider's primary impression	CEMSIS E09_15
12	Provider's secondary impression	CEMSIS E09_16

Hospital Data Elements—Required

Item Number	Required Data Element
Demographics	
1	Age
2	Gender
3	Birth date
Arrival and Admission Information	
4	Date and time of arrival at hospital
5	Hospital admission date
6	Admitted for sole purpose of elective carotid endarterectomy
7	Point of origin for admission or visit
Medical History	
8	Documented past medical history of smoking
Medications Prior to Admission	
9	Was patient on cholesterol-reducing or cholesterol-controlling medication prior to this hospitalization?
Symptom Time Line	
10	Date/Time patient last known to be well

Continued...

B

PRE-HOSPITAL AND HOSPITAL DATA ELEMENTS (Continued)

IV Thrombolytic Therapy	
11	IV tPA initiated at this hospital
12	Date/Time IV tPA initiated
In-Hospital Treatment and Complications	
13	Is there any evidence that the patient's care was restricted to CMO anytime prior to the end of hospital day 2?
14	Was antithrombotic therapy administered by the end of hospital day 2?
Dysphagia Screening	
15	Was patient NPO (taking nothing by mouth) throughout entire hospital stay?
16	Dysphagia screening prior to any oral intake including food, fluids, or medications
DVT Prophylaxis	
17	Was patient ambulatory at the end of hospital day 2?
18	Was DVT prophylaxis initiated by the end of hospital day 2?
Measurements	
19	LDL
Discharge Information	
20	Date of discharge from hospital
21	In-hospital death
22	Discharge destination
Discharge Diagnosis	
23	ICD-9-CM Principal discharge diagnosis code
Discharge Treatments	
24	Was antithrombotic medication prescribed at discharge?
25	Was atrial fibrillation/flutter or paroxysmal atrial fibrillation (PAF) documented during this episode of care?
26	If medical history of atrial fibrillation/flutter or PAF, or if patient experienced atrial fibrillation/flutter or PAF during this episode of care, was patient prescribed anticoagulation medication upon discharge?
27	Documentation that cholesterol-reducing or cholesterol-controlling medication was prescribed at discharge.
28	If history of smoking, was adult patient or caregiver given smoking cessation advice or counseling during hospital stay?
Stroke Education	
	Was there documentation that the patient and/or caregiver received education and/or resource materials regarding the following:
29	Personal modifiable risk factors for stroke
30	Stroke warning signs and symptoms
31	How to activate EMS for stroke
32	Need to follow up after discharge
33	Their prescribed medications
Stroke Rehabilitation	
34	Patient was assessed for or received rehabilitation services

PRE-HOSPITAL AND HOSPITAL DATA ELEMENTS

Hospital Data Elements—Encouraged

Item Number	Encouraged Data Element
Brain Imaging	
1	Date/Time initial brain imaging completed
IV Thrombolytic Therapy	
	Documented reasons in medical record for not administering IV tPA at this hospital
2	Contraindications
3	Warnings
4	Hospital-related or other factors
In-Hospital Treatment and Complications	
5	Complications of thrombolytic therapy
Discharge Treatments	
6	Documentation that antihypertensive medication was prescribed at discharge
7	Diabetic treatment
Other Lifestyle Interventions	
8	Reducing weight and/or increasing activity recommendations

THE JOINT COMMISSION'S STROKE FRAMEWORK

DOMAINS	KEY MEASUREMENT AREAS		
Urgent Care Assessment	<ul style="list-style-type: none"> • Stroke team • Written care protocols 	<ul style="list-style-type: none"> • Initial Physical Assessment & Neurological evaluation <ul style="list-style-type: none"> o Ischemic vs. hemorrhagic stroke o Vital signs 	<ul style="list-style-type: none"> • Diagnostics <ul style="list-style-type: none"> o Blood counts, coagulation, chemistry o EKG o Chest X-ray o Vascular imaging o Brain imaging
Acute Care Hospitalization/ Treatment	<ul style="list-style-type: none"> • Airway/ventilatory support • Anticoagulation • Rehab referral 	<ul style="list-style-type: none"> • Anti-platelet therapy • Anti-thrombotic therapy 	<ul style="list-style-type: none"> • Avoidance of nifedipine • DVT prophylaxis
Risk Factor Modification	<ul style="list-style-type: none"> • Smoking • Obesity • Alcohol intake 	<ul style="list-style-type: none"> • Heart disease • Sedentary lifestyle/physical activity 	<ul style="list-style-type: none"> • Diet
Secondary Prevention	<ul style="list-style-type: none"> • Hypertension • Medications • Carotid artery disease 	<ul style="list-style-type: none"> • Smoking cessation • Diabetes 	<ul style="list-style-type: none"> • High cholesterol • History of TIA
Education	<ul style="list-style-type: none"> • Causes of stroke • Adherence to medication use • Resources for social support or services 	<ul style="list-style-type: none"> • Risk factor modification/ healthy lifestyle 	<ul style="list-style-type: none"> • Treatment of stroke • Discharge preparation
Rehabilitation	<ul style="list-style-type: none"> • Instrumental activities of daily living • Multidisciplinary evaluations • Speech therapy <ul style="list-style-type: none"> o Dysphagia o Speech o Aphasia 	<ul style="list-style-type: none"> • Activities of daily living • Physical Therapy (PT) • Vocational Therapy • Sensory disturbances 	<ul style="list-style-type: none"> • Bowel/bladder control • Occupational Therapy (OT) • Psychological evaluation



THE JOINT COMMISSION'S STANDARDIZED STROKE MEASURE SET

Primary Stroke Centers

Stroke-1

Deep Vein Thrombosis (DVT) Prophylaxis

Stroke-2

Discharged on Antithrombotic Therapy

Stroke-3

Patients with Atrial Fibrillation Receiving Anticoagulation Therapy

Stroke-4

Thrombolytic Therapy Administered

Stroke-5

Antithrombotic Therapy By End of Hospital Day Two

Stroke-6

Discharged on Cholesterol-Reducing Medication

Stroke-7

Dysphagia Screening

Stroke-8

Stroke Education

Stroke-9

Smoking Cessation / Advice / Counseling

Stroke-10

Assessed for Rehabilitation

Note: Effective January 1, 2008, all ten measures are required for certification.

EMS STROKE PLAN TEMPLATE (North Carolina Model)

Summary:

Every EMS patient requesting EMS services with a medical presentation of an Acute Stroke will be screened to rapidly identify an acute stroke and will be rapidly triaged and transported to the appropriate destination for an optimal patient outcome.

Purpose:

The purpose of this policy is to:

- Rapidly identify patients presenting with symptoms of an acute stroke.
- Minimize the time from onset of stroke symptoms to the arrival of the patient at a care site where specialized care can be provided.
- Quickly determine the best destination for each stroke patient (based on the onset of the patient's symptoms and the distance from a stroke center).
- Provide quality EMS service and patient care to the county's citizens.
- Provide a means for continuous evaluation to assure this plan's compliance.

Definition of Stroke-Receiving Centers:

Stroke-receiving centers are facilities that have been designated by the local emergency medical services agency (LEMSA) as appropriate care centers for patients with suspected stroke. Stroke-receiving centers may have different capacities:

- **Comprehensive Stroke Centers** (as defined by the multi-organizational BAC)—These facilities are equipped with diagnostic and treatment facilities for stroke that are not found in other hospitals. They are able to deliver time-sensitive treatment within an extended therapeutic time window. They also have advanced neurological and interventional neuroradiology capabilities. Referrals are made for those patients who require the expertise of specialists and the procedures they perform.
- **Primary Stroke Center** (as defined by The Joint Commission)—These facilities have been recognized as hospitals that meet the minimum desirable level of care for stroke patients in the ED and in inpatient care.
- **Satellite Stroke Centers** (as defined by the multi-organizational BAC)—These facilities are able to provide the minimum desirable level of care for stroke patients in the ED, particularly

D

EMS STROKE PLAN TEMPLATE (Continued)

when paired with another hospital. They may not be able to provide the minimum desirable level of care for admitted patients. These facilities should be regarded as stroke partners or “spokes” and should be aligned by formal agreement with a hospital that can provide the missing service. The most common “missing service” is neurological expertise in the ED and inpatient Stroke Unit care for patients treated with recanalization therapies. In these hospitals, the necessary ED neurological expertise may be provided through telemedicine.

Procedure:

The success of an EMS Stroke Plan is based on the completion of the following:

- Early recognition of stroke symptoms and activation of the EMS System.
- Rapid identification of an acute stroke patient through the use of a validated stroke screen.
- Documentation of the onset of stroke symptoms.
- Completion of a reperfusion checklist to determine potential eligibility for thrombolytic therapy.
- Providing quality EMS care to each acute stroke patient.
- Based on the elapsed time from the onset of symptoms and thrombolytic eligibility, determine the most appropriate destination for the acute stroke patient.
- Early activation/notification of the receiving stroke center.
- Early activation of alternative prearranged transport (e.g. air transport) if the EMS System is unable to transport the stroke patient to the appropriate destination within the treatment time window.
- Ongoing evaluation to assure the Stroke Plan is implemented and maintained within the EMS System.

The following time parameters should be applied to determine the appropriate destination for each Acute Stroke Patient:

(Items that are bulleted and in italic font are the EMS System-specific information that should be included when developing the EMS Stroke Plan. Under these items, list the names of the Comprehensive Stroke Centers, Primary Stroke Centers, or Satellite Stroke Centers that will be used.)

EMS STROKE PLAN TEMPLATE (Continued)

1. Acute stroke patients who can be transported directly to a designated stroke-receiving center with the capabilities equivalent to a Primary Stroke Center in less than 2* hours from the onset of stroke symptoms should be transported directly to a such a facility.

- *Describe how this operationally will occur and list the designated stroke-receiving centers that will be used. Note the importance of early notification to the center.*

2. If Item 1 above is not possible, but the acute stroke patient can be transported to a designated stroke-receiving center with capabilities equivalent to a Satellite Stroke Center in less than 2* hours from the onset of stroke symptoms, the stroke patient should be transported to such a facility.

- *List the stroke-receiving centers that will be used and any criteria to determine the destination. Note the importance of early notification to the center.*

3. If the acute stroke patient's onset of symptoms is beyond the time required for Items 1 or 2, but the patient could be delivered to a stroke-receiving center with the capabilities of a Comprehensive Stroke Center within 5* hours of symptom onset, transport the patient to such a center.

- *List centers to be used in this circumstance. Note the importance of early notification to the center.*
- *If the EMS System is unable to leave their service area and the nearest stroke-receiving hospital with Comprehensive Stroke Center capabilities lies outside the service area, EMS should transport the patient to the nearest hospital. With early notification, the nearest hospital will activate pre-arranged appropriate alternative transport (air may be considered) to deliver the patient to the Comprehensive Stroke Center within the 5-hour time window.*
- *If there is no stroke-receiving center with capabilities equivalent to a Comprehensive Stroke Center in the system, EMS will directly transport the patient to the closest stroke-receiving center. List centers to be used in this circumstance. Note the importance of early notification to the center.*

* *These times may change as new recommendations emerge from developing research.*

Continued...

D

EMS STROKE PLAN TEMPLATE (Continued)

4. If the Acute Stroke Patient's onset of symptoms is beyond the time required for Items 1, 2, or 3, or if the time of onset of symptoms is unknown, the patient should be delivered to a stroke-receiving center.

- *List centers to be used in this circumstance.*
- *If EMS responders are unable to leave their service area, the patient will be transported to the nearest hospital. The nearest hospital will activate pre-arranged alternative transport to deliver the patient to a stroke-receiving center as quickly as possible.*



REFERENCES

1. Reynen DJ, Kamigaki AS, Pheatt N, Chaput LA. The Burden of Cardiovascular Disease in California: A Report of the California Heart Disease and Stroke Prevention Program. Sacramento, CA: California Department of Public Health, 2007.
2. http://www.ninds.nih.gov/disorders/stroke/stroke_background.htm. Accessed April 2008.
3. Alberts MJ, Hademenos G, Latchaw RE, Jagoda M, Marler JR, Mayberg MR, et al., for the Brain Attack Coalition. Recommendations for the Establishment of Primary Stroke Centers. *JAMA* 2000;283:3102.
4. Alberts MJ, Latchaw RE, Selman WR, Shepherd T, Hadley MN, Brass LM, et al. for the Brain Attack Coalition. Recommendations for Comprehensive Stroke Centers: A Consensus Statement from the Brain Attack Coalition. *Stroke* 2005;36:1597.
5. National Institute of Neurological Disorders and Stroke. Report of the Stroke Progress Review Group. April 2002. Online at www.ninds.nih.gov
6. American College of Emergency Physicians. Use of Intravenous tPA for the Management of Acute Stroke in the Emergency Department. Policy #400313, approved February 2002.
7. Schwamm LH, Pancioli A, Acker JE, Goldstein LB, Zorowitz RD, Shephard TJ, et al. Recommendations for the Establishment of Stroke Systems of Care: Recommendations From the American Stroke Association's Task Force on the Development of Stroke Systems. *Stroke* 2005;36:690.
8. Acker JE, Pancioli AM, Crocco TJ, Eckstein MK, Jauch EC, Larrabee H, et al. Implementation Strategies for Emergency Medical Services Within Stroke Systems of Care: A Policy Statement from the American Heart Association/American Stroke Association Expert Panel on Emergency Medical Services Systems and the Stroke Council. *Stroke* 2007;38:3097.
9. National Association of EMS Physicians. The Role of EMS in the Management of Acute Stroke: Triage, Treatment, and Stroke Systems. *Prehosp Emer Care* 2007;11:312.
10. Meyer B, Raman R, Hemmen T, Obler R, Zivin JA, Rao R, Thomas RG, Lyden PD. Efficacy of site-independent telemedicine in the STROkE DOC trial: a randomized, blinded, prospective study. *Lancet Neurol* 2008;7:787.
11. American Academy of Neurology, American College of Emergency Physicians, American Heart Association/American Stroke Association. Tissue Plasminogen Activator (tPA): What You Should Know. www.giveme5forstroke.com
12. American College of Surgeons, Committee on Trauma. Resources for Optimal Care of the Injured Patient: 2006. American College of Surgeons, Committee on Trauma. 2006.
13. Schwamm LH, Audebert HJ, Amarenco P, Chumbler NR, Frankel MR, George MG, et al. Recommendations for the Implementation of Telemedicine Within Stroke Systems of Care. A Policy Statement from the American Heart Association. *Stroke*. Published online May 7, 2009.

Reorder Information:

Recommendations for the Establishment of an Optimal System of Stroke Care for Adults — A Statewide Plan for California

California Heart Disease and Stroke Prevention Program
California Department of Public Health
1616 Capitol Avenue
P.O. Box 997377
MS 7212
Sacramento, CA 95899 -7377
(916) 552-9099

ARNOLD SCHWARZENEGGER
Governor
State of California

KIMBERLY BELSHÉ
Secretary
Health and Human Services Agency

MARK B HORTON, MD, MSPH
Director
California Department of Public Health



