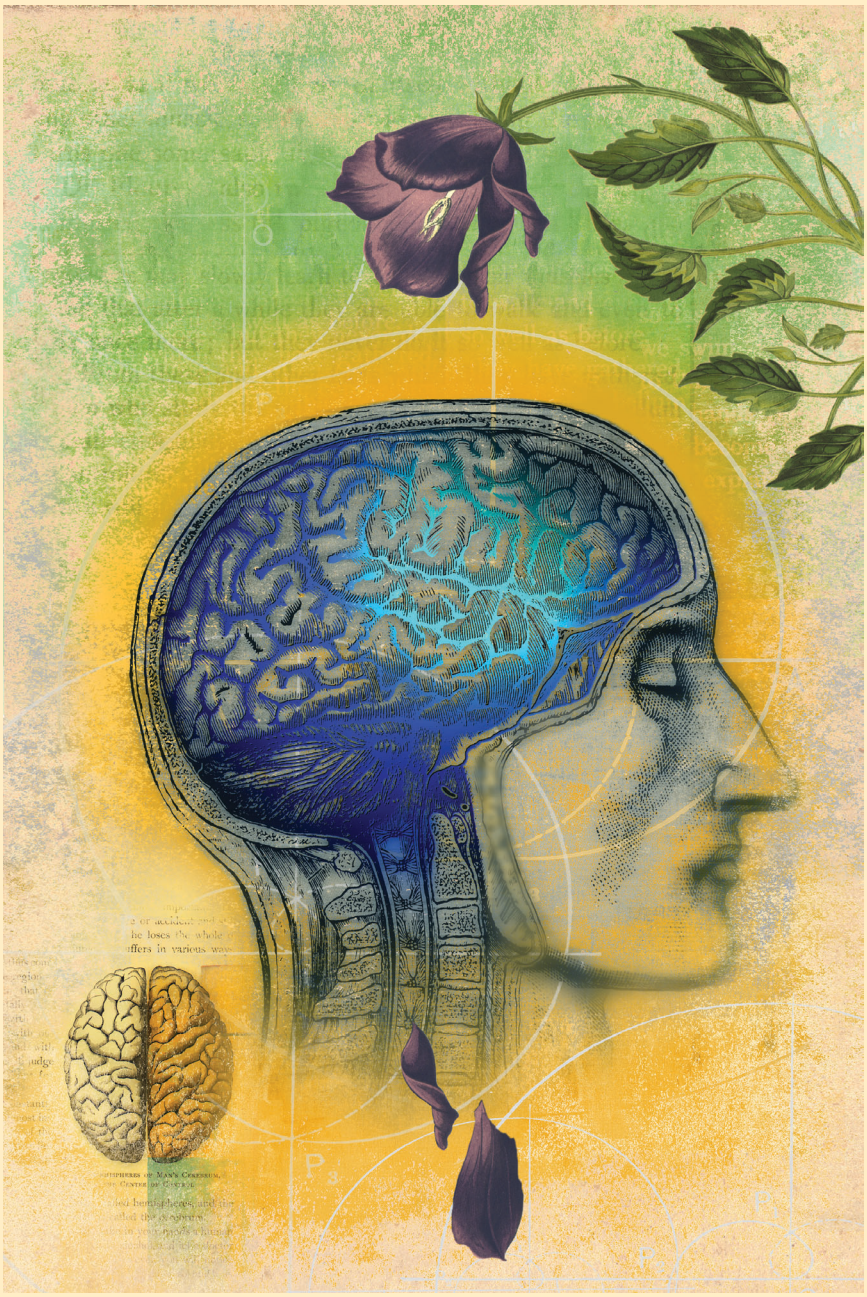
A NATIONAL INSTITUTE OF NEUROLOGICAL DISORDERS AND STROKE SYMPOSIUM



IMPROVING THE CHAIN OF RECOVERY FOR ACUTE STROKE IN YOUR COMMUNITY

Task Force Reports

December 12–13, 2002

National Institutes of Health
DEPARTMENT OF HEALTH AND HUMAN SERVICES

Acknowledgements

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For additional copies of the book please contact the NINDS Brain Resources and Information Network (BRAIN) at P.O. Box 5801, Bethesda, Maryland 20892; the Task Force Reports are also available online at *www.ninds.nih.gov/strokeworkshop.htm*.

National Institute of Neurological Disorders and Stroke

National Institutes of Health

Department of Health and Human Services • USA

American Stroke Association
A Division of American Heart Association

NSA National Stroke Association

FERNE Foundation for Education and Research in Neurological Emergencies

UIC The University of Illinois at Chicago

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September 2003

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Improving the Chain of Recovery for Acute Stroke in Your Community

Contents

Preamble

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On December 12 and 13, 1996, the National Institute of Neurological Disorders and Stroke (NINDS) sponsored a National Symposium on Rapid Identification and Treatment of Acute Stroke.[1] This initial NINDS symposium followed on the heels of the publication of the NINDS t-PA stroke trial demonstrating the effectiveness of intravenous t-PA for victims of acute stroke.[2] The goal of this conference was to provide a platform for coordinating nationwide efforts aimed at implementing acute stroke therapy for all types of stroke patients. The theme was that rapid evaluation and treatment would improve the outcome for all stroke patients.

In December 2002, the NINDS sponsored a second symposium titled Improving the Chain of Recovery for Acute Stroke in Your Community. Six years after our initial call to action, we find that while there have been improvements in the care of patients with acute stroke, we still have much to accomplish. Implementing acute stroke treatment has not been easy, and nationwide only about 2 percent of patients with acute stroke are actually receiving acute thrombolytic or interventional treatment. We also find that the majority of patients with acute stroke are still not presenting to the hospital within 3 hours of stroke onset. And while there are effective models for acute stroke treatment teams, most institutions in the United States are not utilizing these models.

The goal of this second symposium is to improve the overall functional outcome for patients with acute stroke. We hope to accomplish this by identifying barriers to delivering acute stroke treatment and by defining solutions for overcoming these barriers. Six areas have been chosen for more detailed analysis. These include: public recognition of acute stroke, choosing your level of care, professional education, effective templates for stroke triage, incentives for acute stroke care, and support systems for those providing acute stroke care.

We are fortunate that many outstanding and knowledgeable individuals from a variety of professions and medical specialties contributed to this symposium. Our hope is that these Task Force reports will provide a roadmap for hospitals, health systems, payors, and medical professionals to follow in the ensuing years. Each year, more than 600,000 Americans suffer from acute stroke and there are more than 3 million Americans living with some disability resulting from stroke. We also hope that the information from these reports will help to alleviate this heavy burden on our society and lead to improved outcomes for all victims of acute stroke.

1 *Proceedings of a National Symposium on Rapid Identification and Treatment of Acute Stroke.* National Institute of Neurological Disorders and Stroke, Bethesda, MD, August 1997, NIH Publication No. 97-4239.
2 The NINDS rt-PA Stroke Study Group. Tissue plasminogen activator for acute ischemic stroke. *N Engl J Med* 1995;26: pp. 843-849.

Executive Summary

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For months prior to the December 12–13, 2002 symposium, "Improving the Chain of Recovery for Acute Stroke in Your Community," the National Institute of Neurological Disorders and Stroke (NINDS) convened several diverse steering committee and task force subgroup meetings to begin thoughtful formulation of proposed task force reports and recommendations. Not only were these proposals debated, edited, and re-debated long before the culminating symposium, they were also cumulatively reviewed and ardently discussed during the symposium itself in several rotating panels.

In these multiple rotating panels, the majority of participants had the opportunity to provide feedback, input, and active involvement in the final recommendation process for all of the topics covered. The deliberations and proceedings were formally recorded and summary reports were articulated in plenary sessions. Most impressively, the group was interdisciplinary, diverse, talented, knowledgeable, and highly motivated by the quest for improved public health and strong patient advocacy. Whether the participants were neurologists, stroke rehabilitation nurses, emergency specialists, professional group representatives, paramedics, medical educators, or hospital system administrators (just to name a few of the participant groups), they eventually came together in unison to effect these recommendations.

At the risk of oversimplifying the results of the extensive work and many countless hours of effort provided by the individual task forces, their leaders, and the general participants, the principal recommendations detailed in the ensuing chapters can be summarized as follows:

Regarding the issue of **Increasing Public Recognition and Rapid Response to Stroke**:

- *For a variety of reasons, stroke patients, their families, and the public at large generally do not recognize and immediately act following the onset of stroke symptoms.*
- *To date, there is limited experience with interventions to reduce delays, but it is believed that key messages about stroke need to be succinct, intense, and sustained. They should also include motivational components to ensure immediate response to stroke.*
- *Therefore, multi-level interventions, targeted at high-risk individuals and their families as well as special populations and the public at large, must be researched, sponsored, implemented, and measured for cost-effectiveness and sustainability through a collaborative effort of multiple community stakeholders.*

Regarding the issue of **Choosing Your Level of Care**:

- *For a variety of reasons, the level of stroke care and access to acute stroke care interventions is diverse across the United States and other countries.*
- *Recognizing that, today, excellence in stroke care involves more than thrombolytics and invasive interventions, all health care institutions should evaluate their capabilities for stroke care using evidence-based practice guidelines and performance improvement measures.*
- *In turn, hospitals should explicitly state their round-the-clock stroke care capabilities and, through appropriate channels, provide confirmatory data of these capabilities so that patients and providers of prehospital stroke care can make appropriate decisions regarding the destination site for hospital care.*
- *All stakeholders in the community or health care region should join forces to set up mechanisms to assess available stroke care resources and create stroke care networks to better match and optimize patient needs and available resources, including designations of primary and comprehensive stroke care services.*

Regarding the issue of **Professional Education**:

- *For a variety of reasons, there have been shortcomings in the efforts to educate medical professionals regarding acute stroke care, including methodologies and targeted audiences, and there has even been some confusion in the information delivered.*
- *Therefore, comprehensive, consistent, and consensus-based curricula regarding acute stroke care should be targeted at disciplines involved in providing stroke care such as emergency medicine and neurological residencies and relevant nursing personnel.*
- *Also, on-going education of medical professionals, consistent with principles of multi-modal, interactive adult education, needs to be funded for appropriate development, implementation, and evaluation of any respective educational interventions.*

Regarding the issue of **Templates for Organizing Stroke Triage**:

- *For a variety of reasons, including competitive proprietary interests, individual stroke care provider sustainability, or omission of widespread community-based support, mechanisms for designating and verifying appropriate stroke care sites for patient transport decisions are often lacking.*
- *Therefore, in addition to aggressive training of emergency medical services (EMS) personnel with appropriate tools to recognize an acute stroke and provide appropriate advice to patients and families, stroke system organizers must also achieve buy-in from all stakeholders — participating hospitals, neurologists, emergency medicine specialists, medical societies, local government, professional organizations, and community groups.*
- *Also, if feasible, a neutral, non-proprietary community organization (i.e., local stroke council) should be established to develop and monitor EMS triage protocol*

compliance, and to monitor receiving facility capabilities and compliance through appropriate and confidential quality-assurance audits.

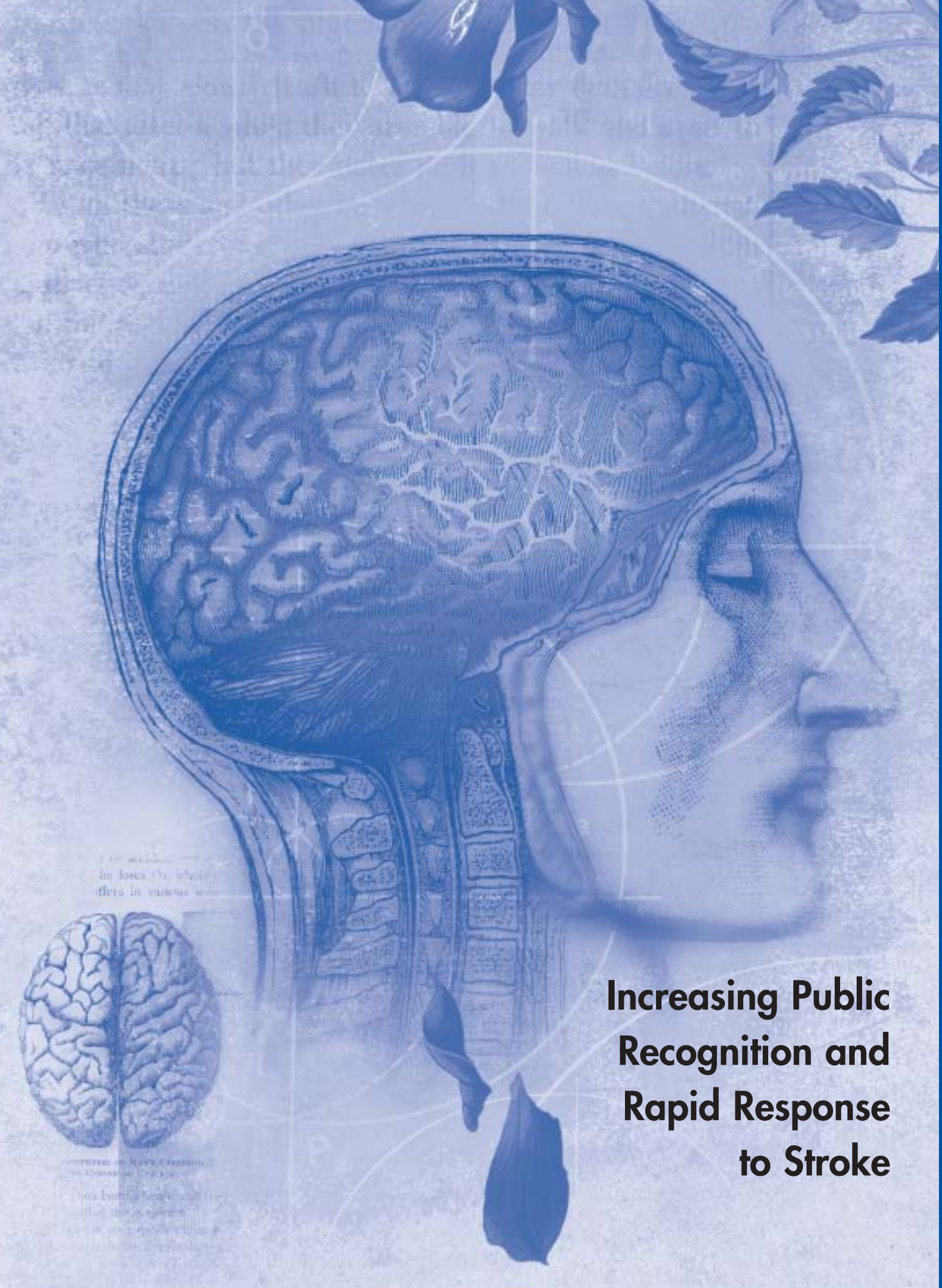
Regarding the issue of **Incentives for Enhancing Stroke Care**:

- *For a variety of reasons, there have been many disincentives for practitioners and facilities alike to provide optimal stroke care, including perceived and actual considerations such as fear of liability, lack of appropriate reimbursement, and even issues such as "off-hours" absence of support.*
- *Therefore, it is essential that the importance of aggressive stroke care be widely accepted and rewarded in a community by developing strategies such as those involving education, practitioner support mechanisms, and a coordinated stroke reimbursement plan involving stroke advocates and professional organizations.*
- *An appropriate forum for discussion should be provided to facilitate: 1) community consensus regarding new therapies and best practices; 2) constructive dialogue between emergency and neurological specialists, nursing personnel, EMS personnel, and hospital administrators; and feedback on outcomes, research, and individual patient care successes.*

Regarding the issue of **Provider Support Systems for Acute Stroke**:

- *For a variety of reasons, many practitioners have avoided active participation in acute stroke care, and a central theme for these practitioners has been the sense of isolation and a lack of back-up support systems.*
- *Therefore, it is first recommended that many of the previous topic suggestions be rapidly implemented, particularly those involving incentives, education, community-wide support, and consensus for stroke care and public education.*
- *Mechanisms for real-time back-up support should be considered. These range from standard telephone advice and teleradiology to sophisticated automated image interpretation.*
- *Stroke care credentialing and hospital "stroke drills" are other options to consider for improving practitioner implementation of acute stroke care.*

In closing, it should be emphasized that these bulleted recommendations serve only to summarize and highlight some of the very detailed and comprehensive text provided in the following chapters by the six task forces and the hundreds of dedicated 2002 symposium participants. It must be recognized that these recommendations generally focus on the limited subject of acute stroke care and specific strategies for getting more acute stroke patients into the health care system for the earliest possible treatment. While the recommendations still may not be as comprehensive or as complete as some might like, they are a wonderful step in the right direction toward achieving further improvements in our nation's management of this major cause of death and disability. Therefore, the NINDS and the other supporting organizations must be strongly commended and appreciated for sponsoring and facilitating this symposium and for publishing these reports. We strongly believe that they can lead to clear improvements in the chain of recovery for stroke in your community.



Increasing Public Recognition and Rapid Response to Stroke

TASK FORCE REPORT

Increasing Public Recognition and Rapid Response to Stroke

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Improved in-hospital care and the advent of time-dependent treatments for stroke have increased the value of reducing delays from the onset of symptoms to acute stroke therapy. Delay to treatment can be generically divided into several components: (a) prehospital patient delay (the time from symptom onset to contact with the health care system); (b) transport time (time from initial contact with the health care system to hospital arrival); and (c) in-hospital delays in diagnosis and treatment. The longest of these is usually prehospital patient delay, which ranges from a median of 3 to 6 hours.[1]

Prehospital patient delay for stroke has been well studied with generally consistent findings. The patient or a witness must recognize the seriousness of the condition, decide to seek help, and arrange transport to a hospital, preferably by ambulance. Age, education, access to medical care, and co-existing medical conditions are not associated with prehospital delay. Gender, ethnic group, and severity of symptoms do predict delay. Patients with prior stroke or TIA do not get to the hospital faster than patients who have not experienced a prior event.

Reasons for delay are found in denial, attempts at self-treatment, mild and/or variable symptoms, living alone, and the incapacitation that accompanies stroke. In addition, even when knowledge about stroke is present, the skills and motivation to take action are frequently missing in the stroke victim and those around him or her. It is apparent that action by a witness — whether a relative, co-worker, or bystander — significantly reduces delay. It is also well recognized that the use of emergency 911 reduces delay to treatment. Much is known about prehospital patient delay in responding to symptoms of stroke. This knowledge could be used to guide a public information program aimed at improving awareness and inspiring appropriate action resulting in more timely access to medical care.

Lessons from Acute Myocardial Infarction

Much of the experience in reducing delay to hospital presentation with an acute episode of a chronic illness comes from experience with acute myocardial infarction (AMI). The problems faced with reducing prehospital patient delay in AMI were similar in many ways to those faced with stroke. Various public and private agencies have worked for nearly 40 years to reduce delay to AMI treatment. A single symptom and action message has been promoted (chest pain, act fast, call 911) with varying intensity and frequency. The result is that most adults, more than 90 percent, recognize persistent chest pain as the critical symptom. More than 80 percent recognize that calling 911 for ambulance transport is the appropriate behavior. Patient delay times have fallen from about 210 minutes in the 1980s to 140 minutes in the early 1990s. Some recent studies suggest that in the mid to late 1990s, improvements in patient delay stalled.

Public campaigns to reduce prehospital delay and increase use of 911 emergency medical services in AMI allowed researchers to gain considerable experience in what works. A 1-year education campaign in Sweden was associated with a significant reduction in median delay time from 3.0 hours to 2.3 hours among patients with confirmed AMI. Another public campaign in Switzerland was associated with a similar reduction of median delay time from 3.3 hours to 2.6 hours for those with confirmed AMI. More modest reductions in delay time were found in a study in King County, Washington, where median delays of 2.6 hours at baseline were reduced slightly to 2.3 hours following a media campaign. The REACT study — Rapid Early Action for Coronary Treatment, sponsored by the National Heart, Lung, and Blood Institute — was the largest effort, involving 20 cities and more than 2 million residents. Residents of ten cities participated in an 18-month educational program and were compared to residents of ten control cities not involved in the educational program. The baseline patient delay identified by the investigators was lower than expected and the trend of declining delay in the control cities was larger than expected. Subsequently, the study failed to show significant reductions in this baseline in response to the intervention strategies tested. Each of these programs used a wide selection of techniques, ranging from face-to-face education to mass media campaigns. All of the programs tested various messages to build knowledge and skills in both high-risk individuals and the general public.

Experience with AMI suggests that a program to reduce prehospital delay should (1) deliver a clear and simple educational message that teaches stroke knowledge and skills for action, including the use of 911; (2) emphasize the role of witnesses in getting help for the victim; (3) target both the general public and high-risk individuals; (4) be intense and sustained; and (5) involve multiple media methods to reach all segments of society.

Lessons from Acute Stroke

There is limited experience with interventions to reduce delay time from onset of stroke to delivery of acute stroke therapies. In the mid 1980s in Durham, North Carolina, a public and professional education campaign to reduce time from onset of stroke symptoms to arrival at a hospital emergency department was implemented.[2] During the pre-education phase 37 percent of stroke patients presented to the emergency department within 24 hours of symptom onset. This percentage was increased to 86 percent during the post-intervention phase. The Temple Foundation Stroke Project demonstrated an increase in the use of intravenous t-PA from 2 percent to more than 11 percent of ischemic stroke patients in rural East Texas.[3]

The Key Message

The message for the public should be clear, crisp, tailored, and sustainable. The essential elements of the message should be symptom recognition, immediacy (every second counts), and a call to action (using 911). It must also include a positive message that there are available treatments in order to motivate individuals to activate emergency medical services.

Examples of messages that have been promoted include a message developed by the National Institute of Neurological Disorders and Stroke: *Know Stroke. Know the Signs. Act in Time*. The University of Cincinnati's education program, FAST (face, arms, speech, time), attempts to simplify stroke recognition and action. This program needs to be validated for community use. To maximize its effectiveness, any public education program to disseminate a message should be developed in cooperation with professionals involved in public communication and public health education.

Knowledge and Motivation

The stroke chain of recovery begins with the rapid identification of stroke symptoms by the patient or a bystander during the prehospital phase. The majority of prehospital delay occurs while the patient or those around the patient are deciding whether or not to seek care. Accurate knowledge and directed motivation are essential components of this decision-making process. Both should be targets for improvement if progress is to be made in reducing prehospital delay.

A key factor responsible for the low proportion of stroke patients obtaining timely medical care is a poor understanding of stroke symptoms. A poor knowledge of the warning signs of stroke has been reported in studies of stroke patients and in surveys of the general population.[4] Current programs by the NINDS, the American Stroke Association and others are important and necessary first steps toward making advances in improving the overall awareness of stroke symptoms.

Knowledge of stroke symptoms alone, however, is not sufficient to reduce prehospital delay time. We know that calling 911 is a major factor in reducing prehospital delay, as well as in-hospital delay, among stroke patients.[5] Special attention should be given to overcoming barriers to calling 911 (e.g., concern for cost, embarrassment) and to reinforcing this behavior in the community. Furthermore, knowledge of symptoms among stroke patients has been shown not to be associated with increased use of emergency medical services. In fact, patients with better than average knowledge of stroke symptoms and who reported having previously received information about stroke symptoms are less likely to use emergency medical services than those with a lower level of awareness.[5] It is clear that there are factors in addition to knowledge that underlie the public's response, or lack of response, to stroke symptoms. A heightened sense of urgency together with knowledge of stroke symptoms may interact to stimulate rapid response. Knowledge alone is not sufficient to effect real change in prehospital care-seeking behavior among stroke patients or those who may witness the onset of stroke symptoms.

A public education effort about stroke symptoms that does not address the motivation or call-to-action component of care-seeking behavior may fall short in reducing prehospital delay. Programs that fail to consider the social/environmental context of the person who suffers a stroke may also be ineffective, as many stroke patients are aphasic and it is frequently others who initiate a call to a medical professional for acute stroke care.

New approaches to instilling a higher sense of urgency around stroke symptoms are needed. The best approach will be one that communicates messages designed to translate

knowledge into action. The most effective tactics to achieve this goal, however, are often debated. No single promotion and advertising campaign is effective in all environments. Whether the approach is soft or hard edged, the nature of the problem calls for more emphasis on the call-to-action behavior and the emergency nature of stroke symptoms.

One important strategy may be to specify possible determinants of these behaviors. From a social cognitive perspective, these determinants include knowledge of exactly what to do and how to do it (behavioral capability); confidence in one's ability to do the behaviors (self-efficacy); and belief that response to stroke symptoms will result in a better outcome (positive outcome expectation). Further, the bystander probably has to surmount the social discomfort of intervening in response to someone else's symptoms. Finally, the public should have some access to vicarious reinforcement (seeing others rewarded for taking action) by an affirmative response from transport and emergency department professionals.

Who is Responsible?

All stakeholders in acute stroke treatment bear the responsibility of leadership. Responsibility for getting stroke patients to the hospital in time for acute stroke therapy is therefore shared by patients, their families, doctors, nurses, hospitals, and insurance companies, as well as by governmental agencies. A dual approach — one from national organizations and one from the grass roots level — is required to accomplish these goals. Grass roots efforts should focus on advocating for increased funding and developing local education programs and systems. Health care providers and their facilities can use their position of responsibility to serve the public and to work toward improving the health of all community members. They should offer the best available therapies to all their citizens and reach out to them in an active manner. It is not enough simply to have a protocol in place for treating patients who are eligible for acute stroke therapy.

National organizations such as the NINDS and its partners can take a leadership role in developing initiatives, influencing policy, and providing funding. Directors of specialty care and governmental departments of public health/national policy should work to infuse a sense of importance into stroke care and a sense of urgency about its execution.

A sense of partnership and shared responsibility is most likely to provide a platform for progress and advancement in the short term. To be successful, strong central leadership has to have widespread support from all stakeholders. An informed public can do much by demanding better care as well as actively participating in a system of organized stroke care. Once a hopeful outlook is engendered, it is expected that earlier recognition of symptoms will bring more patients to the hospital for treatment. The creation of hope in each community is necessary for any system to provide care. Each member of the health care community bears responsibility for transmitting the message that successful treatments for stroke exist.

Generating a sense of importance, developing a language, and continually transmitting a hopeful outlook are the fundamental forces to be created, tailored to each community, and guided to successful conclusion. The public, health care providers, facilities, and agencies of education, government, and organized medicine all share responsibility for providing the benefits of stroke care to each citizen.

The cost of a sustained public and professional educational program will be substantial. Funding for such programs will require support from public, private, and non-profit organizations.

Integration of the Community and Health Care Providers

The interaction and integration of the public with health care professionals is a key step towards improving the recognition of and the response to stroke. This requires an intricate communication chain between health care providers, health care office personnel, pharmacists, emergency medical personnel, all other allied health providers, and the public. In addition, worksites and public education facilities such as schools should be included as important forums for educating the public about rapid response to stroke.

Ideally, health care providers screen individuals for risk factors that could lead to cerebrovascular disease and use this opportunity to teach their patients about prevention. It is also incumbent upon health care providers to make maximum use of patient interactions as a venue for education about acute stroke, its symptoms, and the need for emergent action. The office setting, including the waiting area, provides one potential environment in which the public may be educated in this regard. While waiting to see a provider, patients who are already interested in their own health may learn from posters, videos, and other available teaching materials. Although this may not be an efficient strategy for primary prevention in a relatively healthy population, it might be quite effective in patients with risk factors for vascular disease, those with pertinent family histories, and those with prior TIA or stroke. All of the vital stroke messages can be delivered in this setting, with encouragement to discuss these issues in greater detail with the health care provider at the actual visit. In effect, this approach also allows for patients to motivate office-based health care providers to educate them.

Medical office personnel are often the first to receive a patient call about an acute problem such as a stroke. As such, the staff can significantly facilitate or obstruct emergent care. In the acute setting of a phone call from a patient (or family member) who may be suffering a stroke, these staff serve in the same capacity as emergency medical services dispatchers. Health care providers must educate their staffs about the key stroke messages, most importantly the need to call 911. Simple tools such as an answering machine in a primary care physician office that directs patients who call regarding stroke-like symptoms to call 911 may give the right message to the right person at the right time.

Pharmacists play a potential role in augmenting patient awareness and modifying patient behavior, as they often provide supplemental information that reinforces prior learning from the health care provider. This supplemental information could be expanded to include stroke messages when appropriate. This could occur by direct conversation, but could also be communicated by including printed information in, or actually printed on, the pharmacy bags.

Since the advent of acute stroke therapy, significant resources have been focused on educating the emergency medical services community and emergency department personnel about the time-critical nature of stroke treatment. Emergency medical services and emergency department personnel can also play a critical role by altering the behavior of patients and hospital-based health care providers. For example, upon arrival at the scene, emergency medical services could inform the patient (and/or family) that the diagnosis may be stroke and that rapid evaluation and treatment could dramatically help. Information (both verbal and written) could be provided immediately to the patient and/or family to initiate the urgent educational process. Further, upon arrival at the hospital,

emergency medical services could accelerate the reaction of the health care providers by asking specifically if the patient is eligible to receive acute stroke treatment.

Communication can also flow from the public to health care providers. Patients expect that they will receive the most appropriate care at every hospital. However, they could catalyze the action of triage personnel and health care providers by asking explicitly for "immediate treatment with the best appropriate therapy for me," or even asking emergency medical services to take them to the "best hospital for stroke."

The Cost-Effectiveness Issue

There is a paucity of data on the cost effectiveness of public and professional educational programs. Although we do not have adequate data to say that expenditures to advance the public's awareness of stroke are cost effective in reducing morbidity or morality from stroke, this should not prohibit public health action. The costs associated with the disability and rehabilitation from stroke are staggering, both in individual suffering and in financial terms. Designing and implementing initiatives that increase the likelihood that persons experiencing stroke-like symptoms will obtain medical care in a timely manner is a public health strategy that has sound backing from a chronic disease secondary prevention perspective.

Measuring Success

More than 600,000 Americans suffer stroke each year, but few directly benefit from the acute treatments available. One goal should be for patients to immediately recognize and respond to stroke. We recommend a target of increasing the percentage of stroke patients arriving at the hospital within 3 hours to 50 percent by 2008 and to 70 percent in 2013. The success of efforts to improve public response should be measured in the numbers of stroke patients arriving early at emergency departments, not only in the number of patients treated with thrombolytics. Other intermediate measures of success are needed to guide the refinement and implementation of effective education programs.

Special Populations

Public recognition of stroke must include each and every segment of the population. Certain segments may be most vulnerable to suffering a stroke, while others may require specialized educational interventions. In addition to high-risk patients with traditional cardiovascular risk factors, other groups such as minority groups, women, elderly adults, children, and rural populations require special focus. Furthermore, different populations have different educational needs and capabilities. The messages to each target group must be culturally sensitive and delivered through means tailored to each group. If a public education message reflects that group's perspectives and customs, it is more likely to be well received and to translate into behavioral changes, which will subsequently lead to a reduction in death and disability from stroke.

Children

A long-term strategy for improving rapid recognition of stroke includes enhancing health education for children and including the time-urgent nature of stroke along with strong primary prevention. This may serve as a basis for lifelong knowledge about stroke prevention and treatment. It may also enable children to activate the emergency health care system if a family member suffers a stroke.

Women

More women than men die each year of stroke. Women are more likely to present with so-called non-traditional stroke symptoms, such as an altered level of consciousness or confusion, pain, or disorientation. Since these signs and symptoms are not usually associated with stroke, women must be particularly vigilant so that whenever they experience any stroke symptoms, they immediately seek medical attention.

Minority Groups

Certain minority groups are at particularly high risk for suffering acute stroke. The frequency of stroke and stroke-associated mortality is higher in blacks and Hispanics than in non-Hispanic whites. Concerted educational efforts must be targeted toward these groups in a way that is supportive, culturally appropriate, and empowering. While the goals and overall message of public education for stroke recognition are homogeneous, in order for the messages to be effective they must be delivered to many diverse groups in our society in a language that is understood by the intended audience.

Conclusions

The Public Recognition Task Force members make the following recommendations:

- To improve rapid recognition of stroke, a multilevel intervention (sponsored in a collaborative fashion by health care organizations, communities, and government) is needed.
- Key stroke messages should be intense and sustained.
- Knowledge of symptoms alone is not sufficient to improve patients' rapid access to care. Education must combine knowledge and motivation for an immediate response to stroke symptoms.
- The target audience for improved knowledge and elevated motivation for action should be defined as all members of the public, not just individuals at high risk of stroke.
- Special attention for such interventions should be given to high-risk groups.
- Areas for additional research that should focus on demonstrating efficacy of health-behavior interventions include:
  - Cost effectiveness
  - Sustainability
  - Outcomes
  - Reaching special populations

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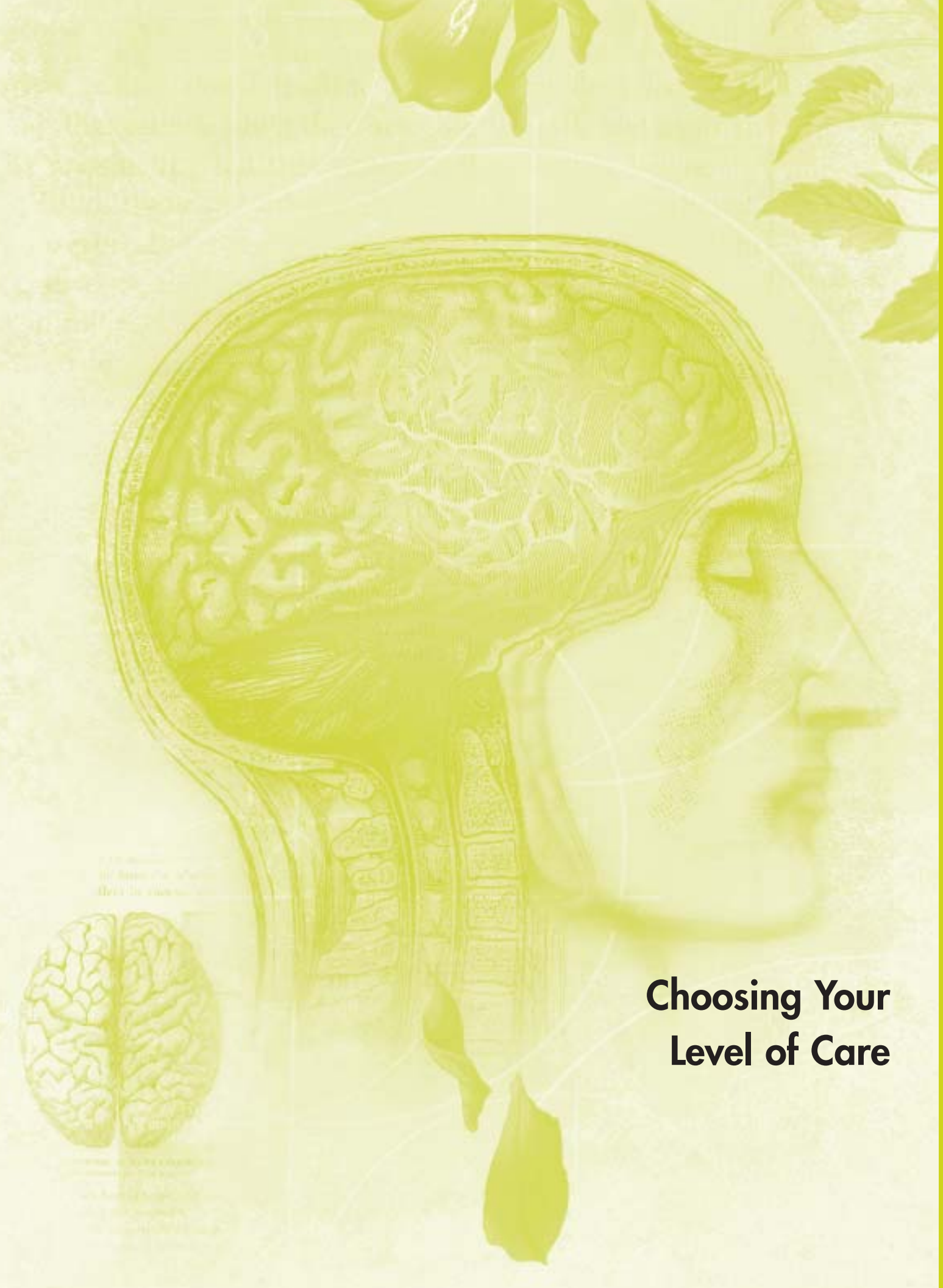

Choosing Your Level of Care

TASK FORCE REPORT

Choosing Your Level of Care

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It has now been 6 years since the guidelines from the NINDS National Symposium on the Rapid Identification and Treatment of Acute Stroke were published.[1] Still, stroke continues to be a devastating disease that affects more than 600,000 Americans each year and killed approximately 278,000 in 1999 alone. In the United States, one in every 14.3 deaths is attributable to stroke.[2] The magnitude of this "stroke burden" is projected to increase as the population ages.

The level of available resources to care for acute stroke victims varies widely among communities and geographic regions. According

to a survey conducted by the American Academy of Neurology, 20 percent of the U.S. population is without access to acute neurological services.[3] This marked variability means that the creation of a universal standard of care is not possible. Instead, this Task Force recommends that hospitals and medical centers assess their current capabilities to provide acute stroke care and determine the optimal level of stroke care that they can provide. In addition, hospitals should perform a community assessment to determine the level of stroke care capabilities offered by other local and regional facilities. This information should encourage local and regional triage or transfers of acute stroke patients when appropriate. The Task Force on Choosing Your Level of Care recommends that every emergency department be able to evaluate and stabilize the acute stroke patient. Ideally, for optimal treatment, most patients should have access to primary stroke centers that provide the level of care defined by the Brain Attack Coalition (BAC) guidelines.[4] Finally, comprehensive stroke centers, in conjunction with primary stroke centers, provide care for more complicated cases or resource-intensive patients and serve as an educational resource to their referral community.

To improve access to facilities capable of providing optimal stroke care, there should be a coordinated effort that involves the community, emergency medical services (EMS) systems, and hospitals. The management of trauma and burns in the United States has shown that facilitated access through care center designation can result in decreased morbidity and mortality. Because treatment of the acute stroke patient is time-sensitive and requires a multidisciplinary approach 24 hours a day, 7 days a week, the Task Force supports the concept of identified stroke centers to improve access to stroke care.

Definitions

Basic Emergency Service: A hospital or emergency department that provides an organized approach to the initial evaluation, stabilization, and treatment of stroke patients, including consideration of transfer for appropriate patients.

Primary Stroke Center: A hospital or emergency department that meets the criteria determined by the BAC for a primary stroke center.[4]

Comprehensive/Specialized Center: A hospital or emergency department that meets the criteria for a primary stroke center but also has availability of neurosurgery, angiography, and neurointerventionalists to meet the specialized needs of some identified stroke patients.

Multidisciplinary Stroke Care

Considerable data support the concept that a streamlined, multidisciplinary approach to stroke care, including stroke protocols, stroke teams, and stroke units, results in improved outcomes.[5-8] Over the past decade, written care protocols have flourished throughout the continuum of medical care, with studies demonstrating the efficacy of such protocols for generalized stroke patient care.[9] These written guidelines, or pathways, help set operating procedures in a medical institution. They are especially helpful in fostering the systematic and expeditious care required to manage acute stroke, such as the administration of thrombolytics.[10] The application of evidence-based protocols may improve outcomes, streamline hospital care from emergency department to hospital discharge, and likely decrease cost. Adherence to treatment protocols minimizes complications associated with intravenous t-PA therapy for acute ischemic stroke.[11-13]

Based on the available resources, stroke programs can be developed and implemented to streamline cost-effective care and optimize patient outcomes. Formation of a specialized "stroke team" may reduce inpatient treatment delays and minimize hospital length-of-stay and cost.[6,14-17] The composition of such teams varies across institutions, but typically stroke teams include nurses and physicians with emergency medical, neurological, neurosurgical, and neuroradiological expertise. Additionally, patient care in a "stroke unit" reduces short-term and long-term mortality rates, the need for institutional long-term care after stroke, and functional dependency.[18-23] Based on one meta-analysis, compared with stroke patients who received care in general medical wards, patients receiving care in dedicated stroke units had a 17 percent reduction in death, an 8 percent reduction in length of stay, and a 7 percent increase in living at home.[24]

An obvious ultimate extension of the stroke team and unit concept is the development of designated stroke centers. The most compelling evidence supporting stroke center development is the combination of the trauma center experience and the recognized association between volume and outcome in many areas of health care delivery.[25-29] Since both stroke and trauma occur acutely and require time-sensitive, organized, and multidisciplinary evaluation to achieve the best outcome, the establishment of stroke centers, mirroring trauma centers, has been proposed.[4,30] Such assemblies of stroke care resources and personnel would ensure their immediate availability upon patient presentation, likely resulting in a reduction in stroke-related death and disability. A referral system that pre-selects potential candidates for thrombolytic therapy and transports them to a stroke referral center can achieve outcome and complication rates comparable to those of multicenter trials.[31] Such protocols could be implemented across EMS regions based on individual hospitals' diagnostic and therapeutic capabilities and a given patient's treatment preferences.[32] Additionally, such systems could consolidate patient volumes, fostering both an economy of scale and the beneficial volume-outcome relationship that has been repeatedly demonstrated in other areas of health care.[33-43] The following sections outline the elements necessary to assess the stroke resources within a community.

The Emergency Medical Services System

Stroke management begins in the prehospital setting.[4] Transport by EMS as opposed to private vehicle has been associated with a more rapid assessment in the receiving emergency department and less delay to head CT and evaluation by a neurologist.[44-50] Unfortunately, approximately half of stroke patients reach the hospital by private vehicle. Clearly, EMS plays one of the major roles in the overall goal of decreasing the time to presentation for the acute stroke patient. As is the case for suspected myocardial infarctions, any patient with neurological symptoms suspicious for a stroke must be given the highest priority.

Recognition of stroke signs and symptoms by EMS personnel is an important step. Prehospital systems should assess their providers' knowledge of stroke symptoms on a regular basis and provide continuing educational courses to reemphasize stroke care and train EMS personnel on stroke symptoms. This training should be simple and incorporate prehospital screening instruments such as the Cincinnati Prehospital Stroke Scale or the Los Angeles Prehospital Stroke Screen, both of which have been shown to identify anterior circulation strokes with high sensitivity and specificity.[51,52] In addition, a checklist of critical information needed by the treating

team, such as time of onset of symptoms, co-existing illnesses that can mimic stroke (i.e., hypoglycemia), and complicating medications (i.e., warfarin), should be incorporated.

Once a potential acute stroke patient is identified, a sense of urgency should dominate. Rapid on-scene assessment and emergent transportation to the most appropriate facility will ensure the best possible outcome for the patient. Immediate notification of the receiving facility will help marshal the appropriate resources and personnel.

The Task Force advocates identifying hospitals that can provide acute stroke care as primary stroke centers, and creating a system of transport to these centers as necessary depending on the location of the EMS call. This system should be planned in advance by prehospital system administrators and appropriate community leaders in order to optimize community-wide stroke services. Regular measures of compliance with the protocols (prehospital recognition of stroke, identification and documentation of time of onset and other critical information while on-scene, notification of the receiving facility, and rapid transport to the most appropriate facility) will ensure an efficient and efficacious system. The EMS community must be formally incorporated into the continuum of stroke care along with the emergency department.[15,16] This can best be facilitated via the participation of the medical center and emergency department staff in the educational activities of the EMS personnel and via formal written agreements for prehospital notification and triage to stroke centers.

Emergency Department Basics

There are fundamental principles in emergency management that will contribute to improving patient outcomes. In essence, these measures are intended to preserve oxygenation and cerebral perfusion and prevent complications.

All patients suspected of having an acute stroke should be triaged immediately to a high-priority area of the emergency department. An acute stroke protocol/pathway should be in place and activated, thus facilitating rapid diagnosis and resource utilization. These patients require initiation of stabilization measures, vital signs, history and physical examination, a neurological exam, diagnostic testing, and implementation of preventive strategies to minimize complications. These actions should be performed simultaneously rather than sequentially. The goal is to complete the initial evaluation of the acute stroke patient, including initiation of laboratory testing and neuroimaging, within 25 minutes of arrival.[53-55]

Initial stabilization — addressing the "ABCs" — ensures that the patient's vital functions are assessed and secured. Patients require a monitored bed that includes continuous cardiac and pulse oximetry monitoring. Vital signs must be obtained initially and repeated serially with dedicated nursing surveillance. An immediate glucose determination must be obtained since hypoglycemia and hyperglycemia can mimic acute stroke and may contribute to additional neuronal injury.[56] Intravenous access must be secured early and, at the same time, blood should be drawn and sent for appropriate laboratory testing.[10]

Endotracheal intubation should be considered in those patients who cannot be adequately oxygenated or ventilated, who show signs of increasing intracranial pressure, or for whom there is concern of potential airway compromise. When intubation is determined to be necessary, a rapid sequence intubation protocol is recommended in order to minimize hypoxic insult, to minimize increases in intracranial pressure, and to prevent aspiration.

Hypotension and abnormalities in cardiac rate and rhythm must be addressed early in order to ensure central nervous system perfusion. On the other hand, elevated blood pressure is common and should be managed based on established guidelines. Excessive lowering of blood pressure in the acute ischemic stroke patient has been associated with neurologic worsening. When the blood pressure must be lowered, an intravenous medication that can be closely titrated is preferred to minimize the risk of cerebral hypoperfusion.[10,57,58]

The history will determine if the acute stroke patient is a candidate for pharmacological interventions or for transfer to a center where those interventions are available. The history must focus on determining the time of onset of neurologic symptoms and those conditions that might exclude the patient from thrombolytic therapy. The history will also identify other medical conditions that could mimic an acute stroke, including hypoglycemia, seizures, metabolic disorders, or pre-existing neurologic deficits from past events. Past medical history, medications, social and family history, allergies, and a review of systems are all necessary to provide the data needed for clinical decision-making concerning these patients.

A physical and neurological examination establishes the baseline with which all future evaluations are compared. The NIH Stroke Scale (NIHSS) is the most commonly used and validated tool that documents and scores the neurologic deficits.[59] The scale, in essence, is a formalized, quantitative assessment of key portions of the neurological exam. It allows for a reproducible, systematic evaluation and thus aids the clinician in communicating with others, performing serial assessments, and evaluating the individual patient in the context of the published literature. In order to facilitate the use of the NIHSS by clinicians who do not perform a complete neurologic exam on a regular basis, pocket cards, flow sheets, and, most recently, hand-held computer programs are available.[60]

A fundamental element of acute stroke care is the prevention of secondary complications. Attention to detail in the management and prevention of aspiration, airway compromise, seizures, cardiac dysrhythmias, and labile hypertension will result in decreased mortality and morbidity.[4,30,57] Consequently, the basic care of these patients must employ meticulous supportive care including continuous monitoring, detection of any deterioration, and ensuring measures to preserve oxygenation and cerebral perfusion. The presence of fever has been noted to correlate with poorer outcome.[61] Antipyretics or other fever-lowering mechanisms are recommended early in the management of acute stroke.[57] Patients with intracranial hemorrhage require early diagnosis, normalization of coagulation status, close management of blood pressure, and occasionally emergent hematoma evacuation.[62]

In conclusion, hospitals that care for acute stroke patients should assess their ability to routinely perform the basic care requirements of the acute stroke patient. At a minimum, patients with an acute stroke require immediate triage to an area where continuous monitoring can be provided. An established stroke protocol/pathway that includes rapid neuroimaging should be implemented. Vital signs and serum glucose must be assessed and stabilization measures initiated. A history and physical exam must be performed with a focus on identifying mimics of stroke and establishing the baseline neurologic status of the patient. The clinician should be cognizant of the potential complications that may ensue and should proactively initiate supportive care measures necessary to prevent, identify, and/or manage them as they occur. The Task Force also recognizes that many hospitals lack resources to consistently offer thrombolytic therapy according to recognized protocols. Patients who require a higher level of care should be triaged as soon as possible to a facility with greater capabilities.

Primary Stroke Center

Primary stroke centers are hospitals that provide the level of stroke care outlined in the BAC guidelines.[4] Their emergency departments should be able to offer approved therapies to appropriately selected patients whether the stroke is ischemic or hemorrhagic. Requirements for a primary stroke center with the capability to provide acute stroke care have been well described by the BAC in their publication on establishing primary stroke centers.[4] Requirements include the following:

- Agreements with EMS systems for pre-notification.
- 24/7 physician-staffed emergency department.
- Written care protocols.
- A defined acute stroke team (should include emergency department staff).
- A named director of acute stroke treatment for the institution.
- Necessary support:
  - Commitment and support of the medical organization.
  - Neuroimaging services (24/7).
  - Laboratory services (24/7).
  - Inpatient services appropriate to the patient's level of illness with close neurologic and cardiorespiratory monitoring (inpatient services are required only for those primary stroke centers that will provide ongoing inpatient care for patients with stroke).
- On-site neurosurgical services or pre-specified transfer agreements.
- Outcome and quality improvement activities.
- Continuing medical education.

Necessary support includes a commitment from the medical center to provide appropriate facilities and staff to care for acute stroke patients. Ideally, primary stroke centers would have the capability to perform either CT scan or MRI within 25 minutes of a physician order.[63] Physicians capable of interpreting the neuroimaging should be available to interpret the scans within 20 minutes of completion. Neuroimaging should be available 24 hours a day. This may be facilitated by cross-training of radiology technicians to perform CT scans as well as teleradiology for the interpretation by remote physicians.[63] Appropriate laboratory facilities capable of performing blood chemistries, complete blood count, platelet count, and a coagulation panel should be available 24 hours a day with results available on a "stat" basis.[64] Primary stroke centers should have either neurosurgical consultation available within 2 hours, when clinically necessary, or pre-existing transfer agreements with a medical center that can provide neurosurgical care when a neurosurgical emergency arises. In geographic regions where a choice between medical centers for prospective stroke patients exists, medical centers should make known the level of stroke care they are able to provide.

The Task Force recognizes the controversy over the safety and efficacy of the use of intravenous t-PA. However, the Task Force members agree that in a well-organized and supported system, intravenous t-PA is an effective therapy for appropriately selected, acute ischemic stroke patients. The risks and benefits of thrombolytic therapy for *eligible* patients with ischemic stroke should be carefully discussed with the patient and/or family.

A system of continuous quality improvement should be in place for the primary stroke centers. Ideally, the system would track the volume of stroke patients as well as any treatment provided and relevant outcomes measures. Specific benchmarks based on published

guidelines for thrombolytic therapy should be measured and tracked. These data should be used to enhance patient care. In addition, educational opportunities and continuing medical education are critical for any multidisciplinary team success. Such education should be available to providers at all levels, from community and emergency medical services personnel to subspecialty physicians with neurological/neurosurgical expertise.

An infrastructure for acute care followed by multidisciplinary inpatient coordination is imperative and has been shown to improve outcomes.[65] Hospitals that do not have the capability to coordinate such inpatient care may still designate their emergency departments as capable of caring for acute stroke patients. After the acute care phase, which may include fibrinolytic therapy, such centers should have EMTALA (Emergency Medical Treatment and Active Labor Act) compliant transfer agreements with a facility offering a higher level of care.

Inpatient Stroke Care

After rapid emergency department determination of stroke type (ischemic vs. hemorrhagic, hyperacute vs. subacute), admission of the acute stroke patient to the stroke unit as defined by the BAC guidelines should be considered.[4,57] Improved outcomes have been demonstrated by admission to an organized stroke unit with a neurologic stroke team.[24,66] A clinical protocol or pathway for inpatient care that encompasses all disciplines (nursing, social work, radiology, cardiology, neurology, neurosurgery, psychiatry, pharmacy, administration, pastoral care, physical therapy, occupational therapy, and speech therapy) should be a part of each specialized stroke center.[67]

Inpatient care at stroke centers should emphasize general supportive care and determination of the etiology of the patient's stroke. Special attention must be given to the patient's neurologic status, cardiac rhythm, risk of aspiration, nutritional support, skin care, blood pressure management, urologic care, blood sugar management, fever control, oxygenation, and ventilation. A dysphagia screen should also be completed within 24 hours and an active, restorative rehabilitation program initiated. Early mobilization within 24-48 hours should be accomplished with careful monitoring for the development of hypotension or worsening neurologic deficit. Prevention of deep venous thrombosis in all stroke patients is paramount. Subcutaneous unfractionated heparin, low-molecular weight heparin, or thigh-high pneumatic compression devices should be considered from the time of admission unless contraindicated.[57,67]

Stroke centers providing inpatient care should have the ability to evaluate the stroke patient to determine stroke etiology. Imaging of the cervical and cranial vessels by carotid duplex Doppler and/or transcranial Doppler, magnetic resonance angiography, computed tomography angiography, or digital subtraction angiography should be undertaken. Cardiac imaging for sources of emboli with either transthoracic or transesophageal echocardiography should also be obtained. Laboratory evaluation for hypercoagulable disorders may be needed if other more common causes of stroke are not found. Specific secondary stroke prevention therapy can be tailored to the results of the etiologic evaluation. Each ischemic stroke patient should be considered for antithrombotic therapy to prevent secondary stroke. Evaluation for other treatable stroke risk factors (hypertension, smoking, diabetes, cholesterol, triglycerides, homocysteine), initiation of appropriate secondary stroke prevention therapy, as well as patient education should be a routine part of the inpatient stroke center evaluation.

In summary, in addition to providing emergency department evaluation and treatment of the acute stroke patient, specialized stroke centers offer an organized approach to inpatient care aimed at preserving and restoring neurologic function and preventing future neurologic damage.

Comprehensive Stroke Centers

In addition to the recommendations for primary stroke centers, stroke specialists, including the BAC, are working to develop guidelines to care for the subset of stroke patients who may require a more advanced level of services to prevent death or severe disability. These guidelines will define comprehensive stroke systems in which patients with special cerebrovascular needs are admitted or transferred to institutions with the needed special expertise. This special expertise may be, but is not necessarily, housed in a single institution, termed a comprehensive stroke center. The services required for comprehensive stroke care, including advanced stroke expertise, neuroimaging technology, neurovascular surgery, intensive care services, neuroendovascular interventions, and cerebral angiography, are especially important in patients with hemorrhagic stroke.

A comprehensive stroke center offers the full spectrum of state-of-the-art stroke care for patients with ischemic as well as hemorrhagic stroke (Table 1). The comprehensive stroke system is made up of primary stroke centers and their referral hospitals with more advanced services to which individual stroke patients are appropriately transferred. Other essential components of a comprehensive stroke system are pathways for patient care, patient transfer, and stroke prevention; interhospital communication; ongoing assessment and improvement of the quality of stroke care; and public and professional stroke education.

Implications and Resources

The aging of the population ensures that stroke care will be an increasingly important consideration for health care systems.[6] In addition, stroke care is advancing, and keeping pace requires resource commitment as well as specific commitments on the part of health care workers and hospitals. Improved patient care is the most important driver of this commitment. However, reimbursement must be adequate to allow for these specialized services.

Hospitals and their professional staffs need to be aware of the potential for local EMS systems to establish a policy that requires diverting stroke patients to institutions that have made the commitment to a higher level of care. The proven success of such a policy for trauma patients enhances this prospect. Communication with the surrounding prehospital providers is usually fostered through emergency department personnel (i.e., physician medical directors) who participate in these activities. Hospital-based ambulances may also fall under scrutiny regarding their protocols for acute stroke patients.

The potential loss of stroke patients has to be considered in light of the economic consequences and the status of the hospital in the community. For teaching hospitals, the impact on medical students and graduate education must be considered, particularly for those with neurology, emergency medicine, radiology, and physical medicine and rehabilitation programs. The decision to commit to advanced stroke care presents a number of issues for prehospital providers, emergency departments, professional staff, and hospitals.

Twenty-four-hour capability of rapid CT scanning and immediate physician interpretation is standard in many major centers but will require additional resources in other centers. Available dedicated CT technicians or cross-training for after-hours coverage is necessary.

If a radiologist is not continuously available in-house, placement of teleradiology systems will be necessary unless another member of the stroke team (emergency physician, neurologist) will assume the responsibility for early CT interpretation.

State-of-the-art stroke care will require a thorough assessment of the patient by a physician skilled in stroke diagnosis. Emergency physicians evaluating stroke patients commonly face competing patient demands in busy centers. Neurologists possess advanced skills but many are not accustomed to the rapid response requirements for state-of-the-art stroke care. On-call members of a stroke team will require compensation for this activity. Specific identification or recruitment of a physician "champion" for stroke care is considered by many to be vital for success.

If the hospital plans to transfer qualifying patients to sites with stroke units, the commitment beyond the emergency department will be minimal. State-of-the-art patient care will require the development of a stroke unit that includes dedicated beds with specialized stroke nursing care. Occupational, physical, and speech therapists, social workers, and discharge coordinators are generally included in the multidisciplinary stroke unit team.[6]

Shortages of nursing, medical, and ancillary staff could present an obstacle to the development of a committed stroke center, although offering staff the opportunity to focus specifically on stroke care could be a powerful retentive tool. Development costs to get a stroke unit team up and running should be offset by improvements in the length of stay for many staff members.[6,24] Dedicated stroke units also create cost efficiencies since patients generally return directly to their homes, rather than needing placement elsewhere in the hospital for recovery.

Vision for the Future

At the 1996 NINDS National Symposium on the Rapid Identification and Treatment of Acute Stroke, the future of stroke care called for "…[C]oordinated systems of stroke care [that] will … enhance the development of new and better strategies…." and "the rapid institution of stroke teams…[that] will lead more quickly to better stroke care for the nation".[1] How well have we achieved these goals? Where do we go from here?

Our country faces significant health care challenges as our population ages. Since elderly individuals have an increased prevalence of risk factors, such as diabetes and hypertension, we will likely see a marked increase in the incidence of stroke. Organized systems for stroke care on regional and national levels are needed to make an impact. All patients should have access to the continuum of care, from basic support to the most advanced innovative strategies.

With the advent of the primary stroke center concept, groups have discussed formal programs to "certify" stroke centers. The implementation of a certification process will raise the level of stroke care by requiring evidence of compliance with evidence-based and consensus-based national standards. In addition, completion of a formal process of "certification" or "accreditation" would provide a mechanism for the public and EMS providers to recognize hospitals that are fully prepared to treat acute stroke patients.

There are several programs in the nation that have been successful in dealing with the challenging issue of access to stroke care, including academic programs, community initiatives, and rural networks. These programs all report good outcomes in their experience in delivering t-PA to patients with acute ischemic stroke. Their success is directly related to the infrastructures created for timely delivery of evidence-based acute stroke care. The rest

of the country would benefit from the establishment of similar models. The Task Force recommends that each health care institution initiate a quality improvement process. The recommendations for acute stroke care suggested in this document should serve as a blueprint for the stroke care quality improvement process.

The Task Force fully acknowledges that each region in this country must assess its local requirements and resources. These regions need to evaluate their role in the continuum of care and coordinate the transport of patients to sites with a higher level of care, if necessary. Despite such regional and community resource variability, a stroke care quality improvement process should be established at every health care institution. Protocols and care plans tailored to each institution must be outlined and supported. While the American Heart Association has set its goal of reducing heart disease, stroke, and associated risk factors by 25 percent by the year 2010, this Task Force recommends the goal of having 80 percent of the health care institutions in the nation establish a stroke care quality improvement initiative by 2005.

The Task Force recommends the institution of a network for stroke care and a national stroke registry to provide reliable data for research and quality improvement. Based on the population distribution, comprehensive stroke centers and primary stroke centers will need to be located appropriately to optimize access. To further alleviate the critical shortage of stroke care expertise, the Task Force recommends the application of telemedicine technology. With advanced digital information techniques, many localities can receive real-time online consultation.

In the future, the complete recovery of stroke patients may be possible as the result of ongoing basic and clinical research. We must require continuing improvements and quality self-assessments of all aspects of the system. While we have made many advances in stroke care, we have a long way to go. In the next few years, as each link of the chain is forged, our vision is to build strong connections that reach every potential stroke patient and improve his or her health.

Conclusions

Stroke places enormous and ever-increasing demands upon the health care system. Limited resources and increasing patient volume require careful personnel and monetary allocation decisions. Marked community variability in available resources requires medical centers to look both internally and externally to optimize the care of the acute stroke patient.

This Task Force recommends that medical centers conduct careful and thorough assessments of their level of stroke care. Institutions caring for stroke victims should use evidence-based practice guidelines and performance-improvement measures to maximize their effectiveness, given their level of resources. The hospitals' level of care should be explicitly stated so that patients and prehospital providers can make appropriate decisions regarding the site of care. Communities and regions should assess available stroke care resources and create cooperating stroke networks to match patient needs with available resources. All facilities providing emergency care must provide a basic level of resuscitative and supportive care. Transfer protocols should be written to ensure that patients receive appropriate care in a timely fashion. Finally, this Task Force endorses the concept of the designation of primary and comprehensive stroke centers that optimize the use of multidisciplinary teams to improve the outcome for acute stroke patients.

Table 1 Specialized Medical Services for Patients with Specific Stroke Subtypes

Stroke subtype	Stroke expertise	Surgery: vascular/ neurosurgery	Cerebral angiography	Neuroendovascular intervention	Intensive care ICU or NICU	Neurorehabilitation	MRI/MRA/CTA/TCD/CNI
Subarachnoid hemorrhage (SAH)	a) Guide use of neurointensive care strategies b) Treatment of neurologic complications	a) Aneurysm clipping b) Ventricular drainage for hydrocephalus, often ventriculo-peritoneal shunt for communicating hydrocephalus	To identify: a) aneurysm(s) b) vasospasm c) occlusive or stenotic complications of endovascular or surgical aneurysm treatment	a) Coiling of aneurysm b) Angioplasty and/or direct intra-arterial instillation of vasodilators for vasospasm	a) Intensive monitoring for neurologic change b) Ventilatory management of intubated patients c) Blood pressure control prior to aneurysm treatment d) "Triple H" therapy for treatment of symptomatic vasospasm e) Management of elevated intra-cranial pressure	a) Motor, cognitive, speech/swallowing therapy may be required depending upon degree and distribution of neurologic deficits b) Respiratory therapy may be required if tracheostomy	a) CTA to define anatomy for neurosurgeon and to detect aneurysms b) Serial CT required for detection of hydrocephalus, infarction c) TCD screening for evidence of vasospasm
Arteriovenous malformation (AVM) with intracerebral hemorrhage (ICH)	a) Neurologic assessments to guide use of neurointensive care	a) AVM removal b) Hematoma evacuation c) Ventriculostomy for secondary hydrocephalus	a) To identify AVM and its vascular anatomy	a) Endovascular embolization or coil occlusion of feeding vessels	a) Ventilatory management of intubated patients b) Intensive monitoring for neurologic change c) Blood pressure control d) Management of elevated intra-cranial pressure	a) Motor, cognitive, speech/swallowing therapy b) Respiratory therapy if tracheostomy	a) MRI often detects flow voids which leads to diagnosis of AVM in a patient presenting with ICH b) Serial CT required for follow-up of mass effect, cerebral edema, hydrocephalus, infarction related to treatment

(continued)

Table 1 Specialized Medical Services for Patients with Specific Stroke Subtypes *(continued)*

Stroke subtype	Stroke expertise	Surgery: vascular/ neurosurgery	Cerebral angiography	Neuroendovascular intervention	Intensive care ICU or NICU	Neurorehabilitation	MRI/MRA/CTA/TCD/CNI
Basal ganglia or lobar hemorrhage	a) Patient management b) Guidance of intensive care c) Management of complications including seizure, brain edema d) Secondary prevention	a) Hematoma evacuation for progressive neurologic deterioration b) Ventriculostomy for secondary hydrocephalus	a) To rule out vascular malformation or vasculitis as cause of hemorrhage in select cases	N/A	a) Ventilatory management of intubated patients b) ICU level monitoring of vital signs c) Intensive monitoring for neurologic deterioration d) Management of elevated intracranial pressure	a) Motor, cognitive, speech/swallowing therapy b) Respiratory therapy if tracheostomy	a) MRI often used as screening tool to detect abnormal flow voids of an AVM b) MRA or CTA in some cases to rule out aneurysmal hemorrhage dissecting into brain
Cerebellar hemorrhage	a) Neurologic assessment to guide neurointensive care b) Secondary prevention	a) Hematoma evacuation for most bleeds greater than 3 cm. in diameter or if brainstem compression and/or b) Ventriculostomy for obstructive hydrocephalus	a) To rule out vascular malformation as cause in some cases	N/A	a) Intensive monitoring for signs of deterioration due to brainstem compression and/ or hydrocephalus b) Management of cerebral edema c) Respiratory support in event of inability to protect airway or central respiratory failure	a) Motor therapy, speech/swallowing therapy b) Respiratory therapy if tracheostomy	a) MRI to screen for vascular malformation as the cause of hemorrhage b) DWI useful in distinguishing primary hemorrhage from bleed into infarct c) In posterior fossa MRI is superior to CT in defining brainstem compression d) Serial CT to follow for hydrocephalus
Brainstem and/or cerebellar infarction	Guide complicated decision-making regarding: a) cause of infarction b) advisability for intravenous or intra-arterial thrombolysis c) anti-coagulation for prevention of progressive basilar thrombosis or artery to artery embolus	a) Emergent decompressive cerebellectomy for brainstem compression due to cerebellar swelling and/or b) Ventriculostomy for obstructive hydrocephalus	a) To assess patency of vertebral and basilar arteries which are parent vessels of the cerebellar arteries (MRA and CTA often adequate)	a) Intra-arterial thrombolysis for patients with otherwise fatal basilar occlusion b) Angioplasty of vertebral or basilar stenosis in patients with concomitant severe vertebro-basilar flow impairment threatening basilar occlusion	a) Intensive monitoring for neurologic deterioration requiring neurosurgical, endovascular or medical intervention b) Ventilatory support often necessary due to pt's inability to protect airway or ischemia of primary respiratory centers	a) Motor, cognitive, speech/swallowing therapy b) Respiratory therapy if tracheostomy	a) MRI/DWI necessary to chart degree and distribution of infarction (CT performs poorly in the posterior fossa) b) CTA/MRA/TCD necessary to identify vascular stenoses/ occlusion in vertebrobasilar arteries

Stroke subtype	Stroke expertise	Surgery: vascular/ neurosurgery	Cerebral angiography	Neuroendovascular intervention	Intensive care ICU or NICU	Neurorehabilitation	MRI/MRA/CTA/TCD/CNI
Carotid territory infarction (internal carotid, middle cerebral, anterior cerebral artery occlusion or severe stenosis)	Patient management including: a) Decision-making regarding intravenous and intra-arterial thrombolysis b) Planning secondary stroke prevention c) Preventing neuro or medical complications	a) Emergent carotid revascularization by experienced surgeon for progressive stroke due to carotid stenosis b) Brain biopsy for diagnosis of cerebral vasculitis c) Hemicraniectomy to prevent death due to malignant brain edema	a) To assess patency of carotid territory vessels (MRA/CTA and ultrasound are often adequate except for vasculitis)	a) Intra-arterial thrombolysis for major artery occlusion within 6 hours of symptom onset b) Stent/angioplasty for carotid stenosis c) Angioplasty for severe symptomatic intracerebral artery stenosis	a) Intensive monitoring for neurologic deterioration in patients with major artery stenosis or occlusion who are candidates for endovascular, surgical or medical intervention b) Blood pressure support for patients with fluctuating symptoms c) Post thrombolysis care d) Management of elevated intracranial pressure in patients with malignant brain edema	a) Motor, speech/ swallowing therapy b) Respiratory therapy if tracheostomy	a) DWI and CT perfusion demonstrate regions of ischemic injury in the acute period b) CT, MR (SPECT) perfusion imaging may be useful in delineating degree and distribution of abnormal cerebral perfusion c) MRA and CTA identify intracanial vascular lesion d) MRA/CTA/CNI detect extracranial stenosis e) Serial CT needed to detect malignant brain edema, degree of infarction
Small vessel infarction	a) Patient management b) Secondary prevention	N/A	N/A	N/A	a) Post-thrombolysis care if decision made to treat with intravenous t-PA	a) Motor, speech/ swallowing therapy	a) DWI often needed to demonstrate the small deep penetrator infarcts b) MRA /TCD/CTA needed to rule out underlying stenosis in Circle of Willis parent vessel
Venous sinus thrombosis	a) Patient management b) Seizure management c) Management of brain edema d) Secondary prevention	a) Rarely decompressive hemicraniectomy needed to prevent death due to brain edema	a) Identify sites of venous occlusion though MRV and CTV often substitute	a) Cerebral arteriogram to make diagnosis b) Intra-sinus thrombolysis or direct thrombus removal	a) Intensive monitoring for neurologic deterioration b) Management of anticoagulation c) Management of raised intracranial pressure	a) Motor, speech/ swallowing therapy	a) MR venogram or CT venogram to make diagnosis and follow state of the venous sinus b) DWI often needed to distinguish venous from arterial "infarct"

DWI: diffusion weighted MR imaging.
CNI: carotid duplex ultrasound.
TCD: transcranial Doppler.
CTA: X-ray computed tomographic angiogram using bolus of intravenous CT contrast.
MRA: magnetic resonance angiography, improved sensitivity and specificity by using bolus of intravenous contrast.
CTP: X-ray computed tomographic cerebral perfusion scan using bolus of intravenous CT contrast.
Perfusion MR: magnetic resonance cerebral perfusion scan using bolus of intravenous gadolinium.
SPECT: single photon emission computed tomography cerebral perfusion scan using radionuclide.

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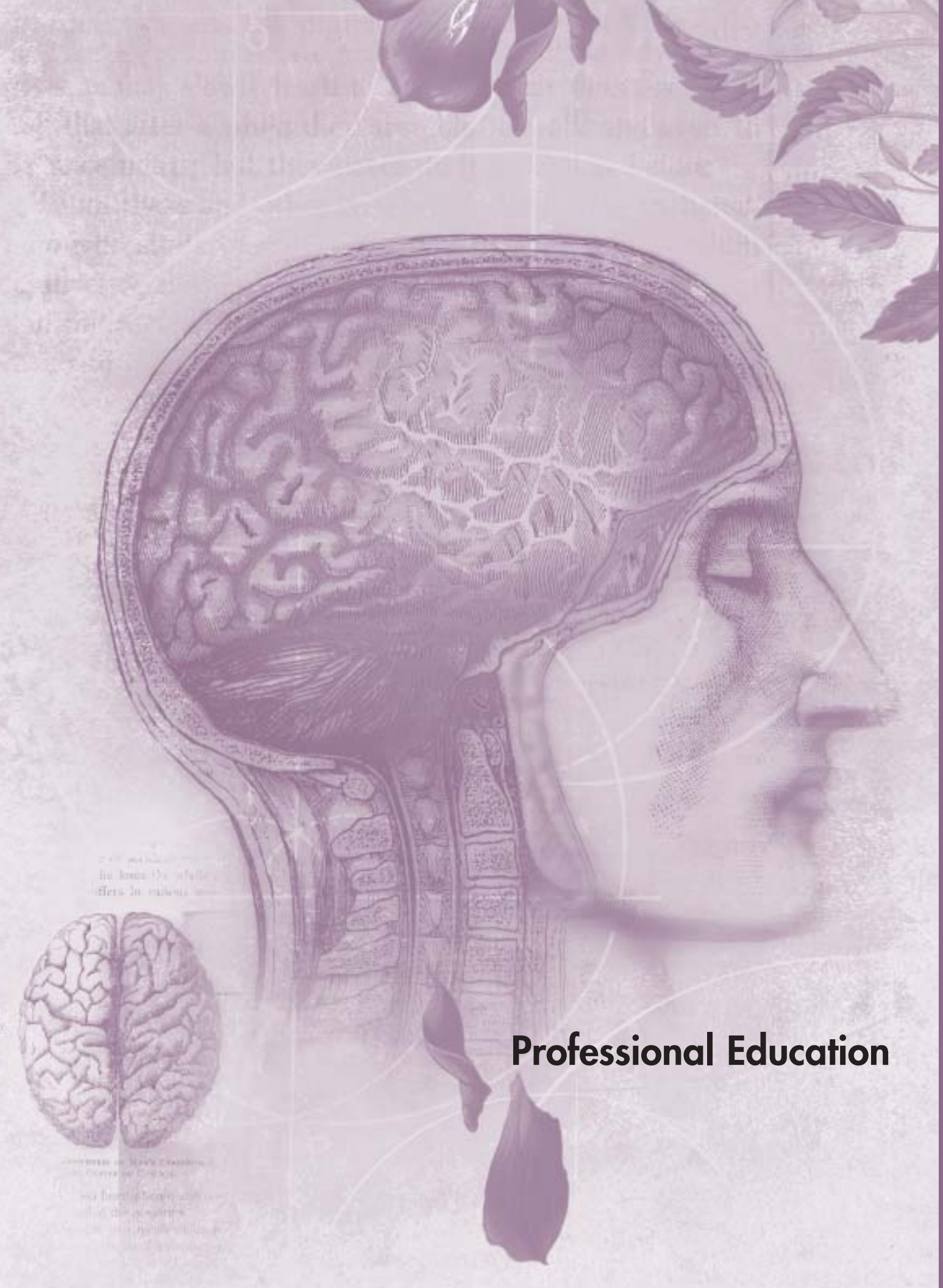

Professional Education

TASK FORCE REPORT

Professional Education

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The objective of the Professional Education Task Force Report is to outline strategies to motivate physicians, other health care providers, and health care organizations to learn and apply the principles of acute stroke care. The report discusses current barriers to implementing recommendations for improved acute stroke care and suggests how to overcome them by using methods that engage the support of local and national organizations in the education process. It also discusses how to improve professional education for acute stroke care by effectively incorporating educational materials into continuing medical education (CME) programs, medical school and nursing school curricula, and residency programs.

Principles of Adult Education

Learning is defined as the acquisition of knowledge that leads to a change in behavior.[1] To modify the practices of health care providers responsible for delivering improved stroke care, the principles of adult education must be incorporated into stroke evaluation and management educational interventions. These principles are summarized in Table 1. Most important, adults must be motivated to learn. Motivation can result from varied forces, both internal and external. The vast majority of health care providers possess strong internal motivation to assimilate new information in order to improve the quality of care they provide to patients. This internal

Table 1 Principles of Adult Education

Adult students —

- must be motivated to learn
- need a relevant use for the knowledge or skill being sought
- prefer learning concepts and principles rather than facts
- prefer an active curriculum that is learner-based
- like to receive feedback on their performance

motivation to improve may be influenced by major life events or may arise from a perceived moral imperative to do what is best for the patient. From a more practical standpoint, this internal desire to learn must be strong enough to successfully compete with other time demands placed on people with already saturated schedules. On the other hand, external factors, including direct supervisors, health system administrators, insurance organizations, and regulatory agencies, can also be very powerful motivators. Pressures from these entities can often promote learning even when internal motivation is lacking.

In general, adults may not learn purely for the sake of learning; they do so because they have a relevant use for the knowledge or skill being sought.[2] Adults also tend to prefer learning concepts and principles rather than facts, and they are better motivated to learn if they can quickly apply what they have learned.[1,3] When new concepts are linked to existing knowledge and experiences, such as through a problem-oriented teaching approach, learning is enhanced. For example, case studies focus learning on a common point and provide opportunities for discussions.[1] Adults prefer learning settings that involve straightforward information, a "how to" focus, and single-concept/single-theory courses.[2] Conversely, information that is complex or conflicts with what is already held to be true is integrated more slowly into practice.

Moreover, adults prefer active, not passive, curricula that are focused on the learner. Thus they often prefer self-directed or self-designed learning projects over group learning experiences, although interaction with other learners is still deemed important. In group learning sessions, adults want instructors to facilitate learning, not to dominate the process.[2] Finally, adults like feedback to evaluate their own performance.[3] Negative feedback is accepted more readily if some positive feedback is also used. Adults tend to take "errors" or bad outcomes personally and thus are less likely to try new approaches.[2] For health care providers, this may be particularly compounded by the current medicolegal atmosphere.

Inadequacies of Previous Professional Education Efforts for Acute Stroke

Continuing education, in the form of meetings and journals, has been the time-honored method of transmitting new medical information to practicing medical professionals. To date, most of the professional education efforts aimed at improving acute stroke care have relied on this traditional approach. Unfortunately, studies have shown that most continuing medical education (CME) aimed at physicians, usually in the form of didactic lectures, results in little if any change in physician behavior and practice.[4,5] CME can be made more effective, especially if it is combined with other techniques to promote behavioral change. New information about acute stroke management must be conveyed to all those in the medical community, but traditional CME needs to be altered to recognize the limitations of didactic lectures. Table 2 outlines techniques that have been tested and their relative effectiveness.

Table 2 Strategies for Changing Physician Behavior*

Most effective strategies:
- Reminders (at point of need/services)
- Patient-mediated strategies
- Outreach visits
- Encouragement from opinion leaders
- Multiple, sequenced interventions sustained over time

Moderately effective strategies:
- Audit and feedback
- Educational material

Least effective strategies:
- Formal CME conferences or activities

*Adapted from Davis et al, 1995.[5]

Furthermore, previous educational efforts for acute stroke care may not have been well targeted. Many national and local stroke education programs have focused primarily on postgraduate physician education, but have not distinguished between those already familiar with the latest strategies for diagnosis and management of acute stroke (e.g., neurologists or emergency medicine physicians) and those who may have less exposure to these aspects of stroke care (e.g., primary care providers). In addition, non-physician learners may have different needs. For example, much of the current nursing school curriculum is based on a "foundational concept" approach. Because such curricula are driven by a health-patterns model, nursing students are provided a foundation for providing care to patients with impairments in mobility, sensation, or communication. While this information clearly applies to a stroke patient, it is not often presented in the disease-focused model that drives continuing education. The portion of nursing school curricula that focuses on neurological diseases in general is limited, varying from 16 hours total for an associate's degree in nursing to 24-30 hours total for a bachelor's degree or advanced practice nursing specialties. As a result, nursing school graduates receive information about care needs of stroke patients indirectly at best. Continuing education efforts aimed at nurses should include information on disease-specific pathophysiology as an introduction to acute stroke care, as well as focusing on factors that have been found to effect change in clinical nursing

Table 3 Factors Found to Effect Change in Clinical Nursing Practice*

Most effective strategies:
- Well-timed education sessions with clinical application of care-specific interventions
- Demonstrations of obvious advantage to patients and positive patient outcomes
- Availability of clearly written agency policy and procedures manuals
- Access to opinions and support of other professionals
- Efforts to bring about changes that are compatible with nursing values
- Availability of simple-to-understand and easy-to-implement guidelines
- Promotion of changes that can be tested and evaluated, that quickly demonstrate results, and that are accompanied by effective plans for implementation

Barriers to change:
- Perceived lack of authority to institute changes
- Lack of physician and other administrative support
- Efforts to mandate change without proper training
- Absence of credible justification for change

*Adapted from Clarke, 1995.[6]

practice[6] (Table 3). Finally, some type of introductory instruction might be needed in undergraduate medical education or with others not as familiar with acute stroke care. Thus, a range of educational efforts is needed, and trying to create "one-size-fits-all" stroke courses may leave all attendees feeling dissatisfied, as educational expectations and needs are not met.

Finally, the content of previous acute stroke educational programs may have been too focused on thrombolysis to be of value to many learners. Because of variability in clinical resources, emphasis on this treatment only may distract learners from retaining stroke educational messages on the whole. Some physicians or other health care providers may have very infrequent opportunity to use thrombolysis, yet could still benefit from education about other aspects of acute stroke care.

Environmental Barriers to Implementing Professional Education

Over the past decade, there has been an explosion in the number of individuals seeking emergency care nationwide. In 2000 there were 108 million emergency department visits, an increase of 17 percent over the number of visits in 1997. At the same time, many emergency departments are being closed. Furthermore, many locations are experiencing a significant decrease in the number of on-call specialists maintaining a full complement of privileges. Hospital crowding, declining financial resources for the provision of health care, and medicolegal issues further complicate delivery of medical care.

The current national nursing shortage has increased the workload of emergency department and hospital nurses, and places limits on nurses' opportunities to leave the bedside to attend in-service continuing education events. The nursing shortage has also created a deficit of administrative support by limiting the number of hospital-based educators or clinical nurse specialists and others who have traditionally been responsible for presenting innovative practice information to the bedside nurse. In times of acute staff shortages, most hospital nursing leadership is focused on keeping beds open rather than on effecting behavioral change.

The impact of these difficulties on the ability of a health care system to undertake any specialized education initiatives related to stroke is evident. This environment would not be conducive to special initiatives that require focused activity or new approaches to learning.

Improving Professional Education for Stroke

Improving the quality and increasing the impact of educational interventions for health care professionals is a worthy goal, as it should improve acute stroke care and outcomes for stroke patients in the long run. While the problem is complex, several steps can be taken to work toward this valuable goal.

Incorporating Educational Theory into Practice

Whatever the method, target audience, or content of future educational programs for improving stroke care, the interventions will need to incorporate lessons learned from educational theory. In order to maximize the potential for success, new interventions will need to (a) elucidate and focus on health care provider motivation to learn, (b) be relevant to those taking care of stroke patients in clinical practice, (c) emphasize concepts and principles of stroke care, rather than reiterating facts, (d) involve participants in active learning, and (e) provide feedback to learners. External motivation to improve acute

stroke care could be generated by garnering involvement of quality improvement divisions, marketing departments, or regional peer review organizations of local institutions. In addition, physicians and other health care professionals would be highly motivated to learn about acute stroke care if it were an emphasized part of the skill set needed in order to practice. Encouragement could come from employers (hospitals or medical groups), professional societies (American College of Emergency Physicians, American Academy of Neurology, etc.), or certifying bodies through their various exams (U.S. Medical Licensing Exam; American Board of Emergency Medicine; American Board of Psychiatry and Neurology; American Board of Internal Medicine; American Board of Family Practitioners; neuroscience, critical care, or emergency nursing organizations; etc.).

Changing the Approach to Continuing Education

Traditional continuing education activities will need to be modified to include the above concepts. Several factors have been identified as most effective in preparing physicians and other health care providers for change and learning.

- Providers must recognize the need to change.
- Educational tools must provide interaction among learners with opportunities to practice the skills learned.
- Education should use sequenced and multifaceted activities.[7]

Thus, options for improved CME programs on stroke include the following:

1 **Provide material or data that raises awareness of gaps in knowledge or performance.** Motivation to improve knowledge or performance can come from audit and feedback, benchmarking, registries, or any technique that demonstrates gaps between performance and guidelines. Behavior must first be measured before it can be successfully changed. Assessment of process and outcomes can be promoted locally. This may include the development of forms to collect specific information and allow feedback on compliance with the recommendations. Means to this end could include:

   – Developing web-based, interactive individual and system assessment tools for stroke. These tools could offer case studies with multiple choice answers and feedback, and downloadable model guidelines, orders, and pathways (both in PDF format and compatible with PDAs).

   – Developing tests of knowledge and assessment of clinical practice about stroke before didactic lectures.

   – Developing benchmarks of care so providers and systems can compare their practice to "best care."

2 **Provide interactive learning opportunities.** "Interactive" continuing education, requiring some response from the receiver, has shown the best outcomes in studies of physician knowledge and practice patterns.[8] Examples include workshops, small discussion groups, and individualized training sessions. More extensive use of personal computers, PDAs, and the Internet may revolutionize the field and make this a feasible and cost-effective evolution.[9] Some interactive options include:

   – Live or video lectures with local/regional/national leaders who use an interactive approach, such as a case study review.

   – PDA-appropriate content about acute stroke management. This could include information such as decision trees for

thrombolysis, blood pressure management, glucose issues, discharge medications for secondary stroke prevention, and atrial fibrillation anticoagulation issues.

– A forum on the Internet for stroke-related management discussion through a moderated site (e.g., via the American Academy of Neurology, the American College of Emergency Physicians, or the American Stroke Association).

– Use of simulated stroke patients and mock "stroke codes."

Self-assessment tools and interactive learning materials are under development or are available through many organizations, including the American Academy of Neurology, the American Stroke Association, and the Foundation for Education and Research in Neurological Emergencies.

3 **Provide sequenced and multimodal activities.** Because health care providers learn in different ways and several factors are involved in changing behavior,[10] the most successful teaching techniques include using a combination of the methods shown in Table 2.[5]

Targeting Multiple Audiences with Interventions Appropriate to Knowledge Level

As noted above, it is important to design multifaceted educational programs that include information targeted to learners from different disciplines and at different levels of training. Since medical students, nursing students, and medical residents are essentially a captive audience primed for learning, a major goal should be improving stroke-related curricula in medical and nursing schools and residency programs.

Stroke-related components of nursing school, medical school, and residency curricula should be evaluated for their currency and comprehensiveness. Because stroke is the third most common cause of death in the United States, physicians in all specialties are frequently confronted with patients at risk for stroke, or who are experiencing stroke symptoms. To address this medical need the American Academy of Neurology is preparing a neurology residency curriculum with input from all the specialty sections of the Academy. Implementation of this curriculum, with current stroke information, should be a priority. In addition, national organizations charged with overseeing undergraduate and graduate education for medicine, emergency medical services providers, physician assistants, etc., should incorporate stroke into their curricula.

Nursing education in stroke should be reviewed and updated as follows:

- Undergraduate nursing education should be evaluated for content specifically relevant to stroke care across the health care continuum.
- Continuing education for nurses needs to be developed to effectively integrate baseline nursing knowledge of stroke care management into the multidisciplinary stroke system approach. For example, continuing education strategies should include nursing participation in case-conference discussions with physicians and other stroke care providers.

Education for other personnel who care for stroke patients, including emergency medical services providers and physician assistants, should also be reviewed and updated. Home health providers and those who deliver services to residents in assisted living, nursing care, and other long-term facilities need specialized education in caring for a population where pre-stroke functional disability, cognitive impairment, and co-morbidities are common. This specialized education will help ensure that this high-risk population is properly evaluated for stroke symptoms and referred promptly to hospitals when appropriate.

Expanding the Content of Acute Stroke Education

As noted above, new interventions for professional stroke education cannot focus only on the delivery of thrombolytic therapy. Additional aspects of stroke care that need to be addressed in educational interventions might include epidemiology, pathophysiology, stroke syndromes, emergency care and stabilization, evidence for or against other acute therapies (heparin, temperature or glucose control, etc.), emerging therapies, diagnostic workup including CT interpretation, inpatient care, rehabilitation and recovery, quality of life issues, secondary prevention, systems of care, and quality improvement.

Moreover, there is a need for the development of consistent, easily accessible "model" guidelines on stroke management and prevention for local adaptation and use in quality improvement projects. A recent study pointed out the variability of advice given in national guidelines regarding stroke prevention.[11] Validated guidelines for medical and nursing management of stroke patients should be developed using simple language and "how to" advice. These guidelines should be made available at all point-of-care sites. Local health care providers could adapt these guidelines to fit their needs and environment, and quality improvement measurements could be created from them. Hospitals and payers could then pursue quality improvement in stroke care for their communities, tying current knowledge about stroke management to easily measured hospital quality improvement projects. Potential measures might include antithrombotic therapy use at discharge, proportion of ischemic strokes treated with thrombolytics, use of early swallowing assessments, and use of deep vein thrombosis prophylaxis in non-ambulatory stroke patients.

Overcoming Other Barriers

Other chapters in this book will deal more fully with issues of implementing a systems approach for acute stroke care, navigating the current medicolegal climate as it pertains to acute stroke care, and developing financial incentives for acute stroke care. However, it should be noted that these environmental barriers play a role in frustrating effective education. Behavioral change needs to occur within an organization, and organizational barriers to change must be removed for education to succeed. A fundamental way to begin to overcome organizational barriers at the local level is to form teams of health care professionals to encourage local implementation of guidelines.[12] The use of local opinion leaders to deliver seminars has also been effective to encourage local change.[13]

As noted above, national specialty organizations, advocacy groups, regulatory agencies, and others should be approached to aid in the development and implementation of these proposals, to gain institutional "buy-in" for acute stroke education and care, and also to provide external motivation for behavioral change among health care providers. Institutional motivation to bring about these changes will be key in a successful educational intervention. In addition to the desire to provide quality care, institutions can be motivated to provide or require professional education by ranking, certification, or regulation. These approaches have been used effectively in stimulating overall institutional performance as well as specifically for cardiac and trauma care.[14-17] Ranking institutional performance is usually a function of a media outlet or advocacy group. This function is not usually a function of regulatory agencies, as these agencies view their role as delineating minimum performance or adherence to standards. Promotion of an institutional ranking system through stroke

advocacy groups and/or a major magazine that would take an interest in this area could be pursued. Certification systems could also serve to motivate institutions. Development of stroke center identification, mostly through the efforts of the American Stroke Association, could provide further impetus to apply current stroke management knowledge at hospitals throughout the country. Guidelines for the establishment of a "primary stroke center" were published in the *Journal of the American Medical Association* in 2000.[18] A survey done in Southern California found that large numbers of hospitals believed they met these criteria, but when actually evaluated, a small percentage truly qualified (Kidwell CS, personal communication, 2002). In a competitive health care market, such efforts can be expected to attract sufficient attention to improve professional education and stroke care, and educational materials with practical advice on how to develop and maintain a stroke center will be useful in this process. Finally, regulation is an efficient, if onerous, method of promoting professional education, but there are currently no examples of nationwide professional education required by regulation. Efforts to increase recognition of stroke and to compel immediate transport of the patient to an emergency department might be successful, and a national stroke registry is in prototype testing. These approaches could be areas worthy of further exploration.

Finally, financial support will be needed to develop, implement, and evaluate professional education for stroke. Programs for needs assessment, validation of guidelines, measuring adherence to guidelines, and assessing the effectiveness of educational interventions will all need to be supported through national funding initiatives.

Conclusions

The Professional Education Task Force members summarized their recommendations to the educational community as follows:

- Develop comprehensive stroke curricula targeted at disciplines involved in providing stroke care.
- Deliver professional education in a multimodal, interactive manner, consistent with the principles of adult education.
- Increase funding for the development, implementation, and evaluation of professional education interventions.

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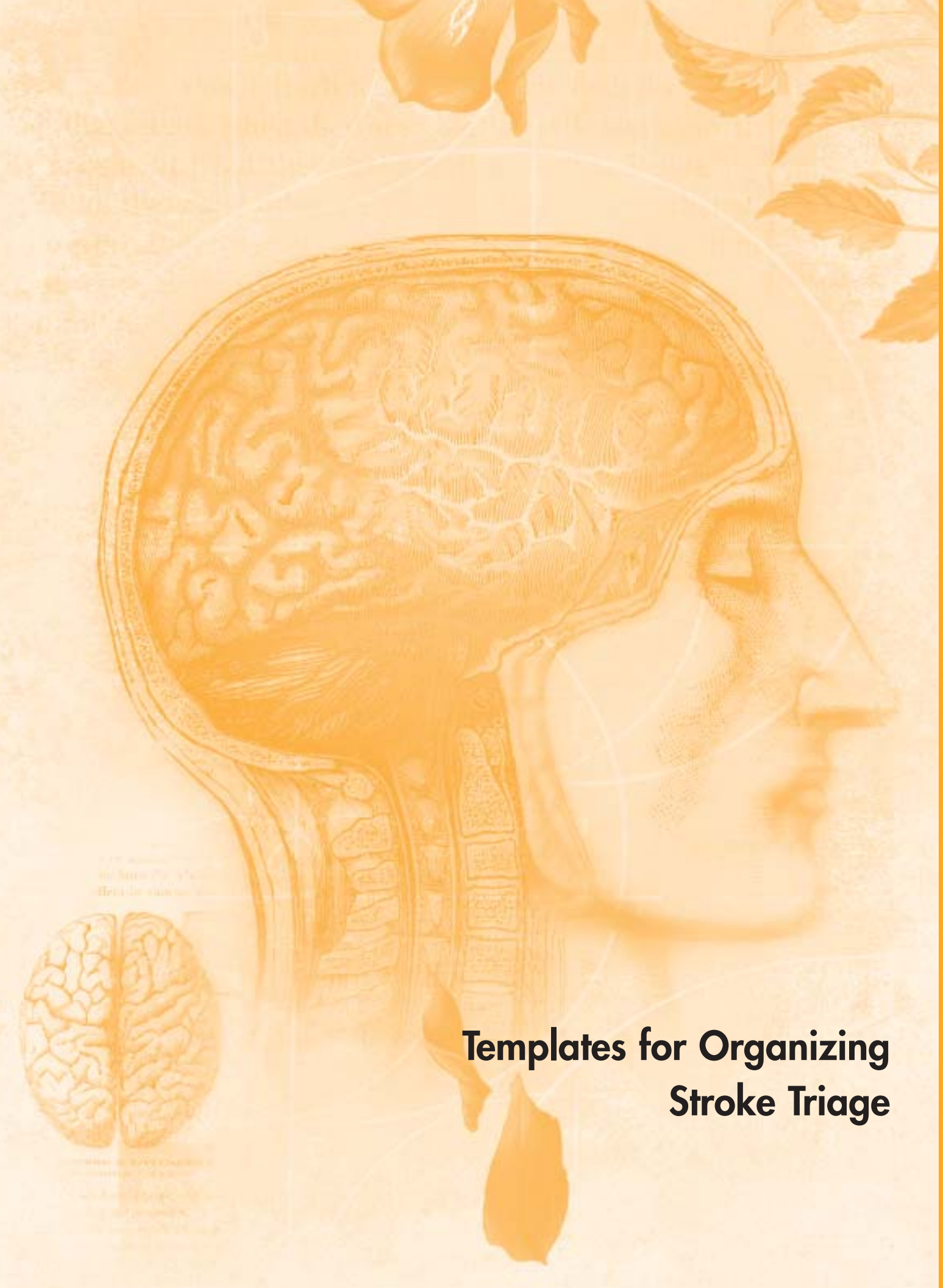

Templates for Organizing Stroke Triage

TASK FORCE REPORT

Templates for Organizing Stroke Triage

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Our health care systems need specialized physician expertise and in some cases above-average diagnostic capabilities with the current recommendations for management of acute stroke. Specialized care is particularly important in the use of thrombolytic drugs, which ideally should be used by physicians with special expertise in acute stroke management and at facilities with organized stroke programs. This sentiment is supported by two successive articles focusing on the use of intravenous t-PA in stroke, which appeared in the March 1, 2000, issue of the *Journal of the American Medical Association*. In the first article,[1] which reported the results of the STARS1 study, the participating medical centers had well-established stroke programs and were in fact chosen from among centers already enrolled in the ATLANTIS2 study.[2] The favorable outcomes in acute stroke patients achieved by the STARS investigators were comparable to the outcomes from the original NINDS study, but with a reduction in the incidence of intracerebral hemorrhage.[1] The second *JAMA* article presented data gathered from evolving community programs at 29 mostly non-stroke center hospitals in the Cleveland, Ohio, metropolitan area.[3] In contrast to the STARS study, the Cleveland survey revealed a significant increase in the mortality rate in acute stroke patients receiving t-PA, with an almost threefold increase in the intracerebral hemorrhage rate.

It is important to note that subsequently, when quality improvement programs were applied to the same Cleveland hospitals, outcomes improved significantly. This reinforces our conviction that acute stroke patients need to be treated by specialized physicians at designated stroke centers to assure optimal care, as well as to provide a safety net for potential complications. Furthermore, proper emergency management of all stroke patients, even those not receiving t-PA, prevents complications and improves outcomes. Even after delivery of specialized care in the acute care setting, hospitals supporting a specialized inpatient stroke unit have documented an improvement in patient outcomes, as well as the added benefit of overall cost reductions.[4] These considerations led the Brain Attack Coalition to propose the establishment of stroke centers that could effectively deliver this specialized care and possibly duplicate the success of the trauma centers.[5]

This chapter is offered as a guide for setting up systems to facilitate delivery of specialized stroke care, including emergency medical services (EMS), and networks of stroke center hospitals. The information in this "how to" chapter has been supplied by individuals who have experienced first-hand the challenges and rewards of establishing these centers of excellence. The Appendices at the end of this report include additional resources that may be of use to those establishing a new acute stroke program.

Hospitals should set a timetable of 1 year following the publication of this document to assess their capacity to meet evolving standards in order to qualify as a stroke center and justify the triage of patients for specialized care. Definitions for primary and comprehensive centers can be found in the Choosing Your Level of Care section of this book, along with suggested requirements. It is important to acknowledge that not all hospitals have the capability or desire to establish stroke programs, just as many hospitals do not offer a trauma program. The decision to organize as a stroke center should be strictly voluntary. It is hoped that the information from these Task Force reports will induce more hospitals to join in this national effort and establish stroke programs. Hospitals not equipped to safely deliver t-PA should not be forced to offer this type of treatment to patients at their facility. It is expected that these non-participating hospitals would decide not to actively attract stroke patients, and would cooperate with community efforts to triage appropriate patients to stroke centers. Most larger community hospitals have the proper training and facilities to correctly use t-PA, and hospitals that evaluate substantial numbers of stroke patients should consider becoming stroke centers.

Getting Started

Usually one or more physicians step forward to champion and guide the effort to establish a stroke center hospital or network of hospitals. While not obligatory, such leaders are often neurologists. In some cities, emergency physicians have assumed the leadership role in this regard. A physician leader must be convinced of the importance of stroke centers as an enhancement to patient care. In addition, there must be a commitment to see the process through to completion, as there are many challenges and success will not come immediately. However, leaders should be fortified with the knowledge that the concept of stroke centers is a sound one, and that with perseverance success will usually follow. At a local level, the leader or stroke director will have the responsibility of transforming his or her hospital into a facility capable of quickly evaluating and treating stroke patients. At a network level,

participating hospitals must be organized into an efficient system that provides access to specialized stroke care for all or most of the population in a community.

The project cannot succeed without enlisting the assistance and support of many other interested parties, and it is important for the leadership to identify those likely to be helpful and those likely to benefit from the formation of stroke centers. These might be called stakeholders. At a hospital level, planning and execution must be a joint effort between physicians and hospital administrators. However, on a community-wide basis, other stakeholders might include medical societies, hospital councils, stroke survivors, people at risk for stroke in the community at large, state and national organizations, and political bodies. At any level, the EMS system is an integral part of the process. The EMS system includes dispatch agencies, first responder agencies, transport agencies, and medical control physicians and hospitals. Training programs for EMS providers and dispatchers are essential. Also, much thought and effort must be applied to designing a seamless communication link between EMS provider groups in the field, hospital emergency departments, and acute stroke teams. In some cases a dispatch service provides this link and directs the transport according to pre-established algorithms.

Local Hospital Stroke Center Development

Physician Buy-In

It is usually important for the stroke director to recruit other physicians to join in and shoulder the responsibility of care. Considerations here include arranging a stroke call schedule, as well as forming a stroke team. Depending on the size of the hospital, the stroke team might consist of neurologists, emergency medicine physicians, radiologists, neurointerventionalists, neuroradiologists, internists, and neurosurgeons. A non-physician stroke coordinator, usually a nurse or physician assistant, is also an extremely important addition to the stroke team. These individuals may help with clinical responsibilities as well as data collection and outcome monitoring. It is always advantageous to have a neurologist perform a neurological assessment early in the process and to be closely involved in making the complex decisions regarding treatment. However, this is not always possible, and other willing physicians must be trained to assess the patient neurologically, with phone consultation from a neurologist if possible. Emergency physicians are usually the first physicians to examine the patient and are sometimes the only physician initially involved. Their complicity and partnership in the stroke program is of course essential, and these physicians must be thoroughly familiar with the established emergency procedures and treatment guidelines, including transfer procedures, for stroke. Radiologists must be available to interpret imaging studies on an emergency basis. More advanced treatment is available at comprehensive centers, including interventional neuroradiology and up-to-date neuroimaging capabilities such as digital angiography. Patients with stroke frequently have significant underlying medical conditions, and emergency availability of internal medicine consultation is invaluable. Finally, neurosurgical expertise is called for in cases of subarachnoid hemorrhage, intracerebral hemorrhage, and thrombolytic-related hemorrhages. At other times, other specialty consults, such as cardiology, will be necessary.

Tips for Obtaining Physician Buy-In

Physicians may be reluctant to participate in the stroke team and to extend themselves on an emergency basis. This is particularly true of neurologists, whose practices are often office-based. Points to consider

when recruiting neurologists include the following:

- Of all the specialties, neurologists are most capable of accurately assessing the stroke patient and making the tough treatment decisions that are sometimes required. Their input is very important for the delivery of quality care. It may be important to remind reluctant neurologists of this, and this realization might persuade them to make their expertise more available in the interests of patient care.
- If the availability of neurologists on a hospital staff is limited, bedside emergency consultations on a continuous basis may not be feasible. In this case, the emergency physicians must develop expertise in stroke evaluation.
- Radiology expertise may not be available on a continuous basis at some hospitals, and of course this is essential. However, the essentials of CT reading sufficient for t-PA patient selection can be learned by non-radiologists, especially neurologists, neurosurgeons, and emergency physicians. Teleradiology arrangements have in many cases circumvented this obstacle, and remote interpretation of radiological tests is now very common.
- If the barrier to physician participation is not a manpower issue, but is strictly the inconvenience of receiving an emergency call, hospital medical boards may apply pressure by requiring emergency call participation as a requirement for hospital staff privileges.
- If a hospital is truly committed to attaining distinction as a stroke center, a hospital stipend for physicians agreeing to take emergency stroke calls can be an attractive incentive. For instance, it is not uncommon for hospitals to provide some financial incentive to surgeons involved in trauma calls.
- Convincing physicians that timely and quality acute stroke care, even apart from t-PA, results in improved outcomes will encourage their participation.
- "Commando" systems are difficult to maintain. Ensuring appropriate financial and logistical support, adequate staffing, and renewal by training of younger stroke clinicians should help encourage and support the health care professionals involved in such efforts.

Hospital Administration Buy-In

An initial reticence from hospital administration is not unexpected, and it is important for stroke leaders to see the endeavor through the eyes of the administrators. Implementation of a stroke program at a hospital requires considerable effort on the part of the hospital, as well as some expenditures. Upgrades to diagnostic imaging equipment may, in some cases, be necessary. Staffing of stroke services in many hospitals is not 24/7, thus hospital administration may be faced with additional staffing costs. In addition, t-PA itself is an expensive drug. Ideally, a stroke unit or neuro-ICU would be available, and this requires considerable allocation of resources. Outcome monitoring is an important part of any stroke program, and continuing medical education must be provided for all involved. Creating a stroke program is no small task for a hospital. Nevertheless, with patience and tenacity, the hospital will often see the value to the institution and its patients and make the decision to become a partner in this.

Tips for Obtaining Hospital Buy-In

- Hospitals with large medical staffs and advanced diagnostic capabilities are usually able to offer specialized care in many fields. It is in keeping with their position in the community for them to include excellence in stroke care in the services they offer, particularly if they wish to consider their institution a center of excellence. This argument may carry some weight in discussions with hospital administrators.
- For all hospitals, the formation of a first-rate stroke program may enhance their image in a community, increase patient volume, and improve patient outcomes.
- The procedures developed for a hospital stroke program often result in cost savings by reducing length of stay and minimizing medical complications.[4]
- Increased staffing costs and functions may, in some cases, be shared with other programs, for example, x-ray technicians can be trained to operate CT scanners.
- The members of the board of trustees may have an ambitious long-range vision for the hospital and may, by virtue of having a keen sense of responsibility to the community, be very helpful to the stroke program effort.

Stroke Center Systems Serving a Community

Providing more complete access to expert stroke care for patients in a geographical area requires close cooperation between physicians and administrators of the participating hospitals. The following suggestions may be helpful to those leaders planning to establish a community-wide coalition of stroke centers.

- A steering committee or stroke council should be formed by the founding physicians and hospitals to oversee and monitor the activities of the network. Representatives from all participating EMS provider agencies must be included on the committee as well. It is also prudent to include other stakeholders such as the local medical society, hospital council, etc.
- In designing the triage transport system, the steering committee should make every attempt to offer services to all neighborhoods in a community.
- A quality assurance program should be in place to measure performance by participating hospitals and EMS provider agencies.
- Outcome data should be shared among the participating hospitals and EMS providers; this will require resolution of any confidentiality issues.
- An important function of the steering committee would be the development of basic qualifications for hospitals wishing to participate. The guidelines established by the Brain Attack Coalition might serve as a starting point.[5] An invitation should go out to all hospitals in the community, and any hospital should have the opportunity to join in the effort at any time, provided it is sincere in attempting to comply with the standards established by the steering committee. The decision to become a part of the network should be a joint decision between the committee and the hospital candidate. The committee does, of course, have a responsibility to insist that the participating hospitals meet certain basic requirements in the interests of patient care.

- Non-participating hospitals should understand that transport of patients to a stroke center within the first few hours of symptom onset is unlikely to have a financial impact on them. This is because the percentage of stroke patients presenting within a short time of onset of symptoms is relatively small.
- EMS providers are usually willing participants. They do need reassurance that patients transported to stroke centers will receive prompt and specialized care. It is important to involve them as much as possible in the planning stages, as they can offer helpful suggestions in the design of the triage system.
- All EMS provider agencies should have an opportunity to participate at any time if they are willing and able to comply with the policies established by the steering committee.
- EMS providers, through community education programs, can help dispel reluctance and embarrassment about calling 911.
- Opposition to the plan may come from hospitals, physicians, or sometimes other groups. It is important to have open discussion with these dissenting voices, since the objections are often based on misunderstandings.
- It is critical to obtain the endorsement of the local medical society or other physician representative organizations. These bodies usually recognize the value of stroke centers and are likely to offer enthusiastic support. They are particularly useful in neutralizing political obstacles among physicians and hospitals. If the medical society is firmly behind the effort and considers the idea an enhancement to patient care, it is more difficult for hospitals or individual physicians to erect barriers.
- The American Heart Association has long been behind this national initiative and the local chapter can be a helpful catalyst in launching stroke center networks. The Association will soon introduce a new product, the Acute Stroke Treatment Program, designed to guide hospitals through a step-wise process for establishing primary stroke center operations. The Program is based on and complements the recommendations for the establishment of stroke centers published in 2000.[5] The organization also hosts educational activities and promotes community awareness of stroke symptoms. The National Stroke Association is also a useful resource.
- At a national level, organizations such as the American Academy of Neurology and the American Medical Association can urge Congress to allocate funds for the founding of stroke centers.
- Media coverage is helpful, but only after the network is working smoothly and efficiently.
- Finally, organized stroke survivor groups may be helpful in lobbying efforts with various groups including hospitals and physicians.

EMS Stroke Triage Policies

Stroke Center System Coordination/Oversight

The key to effective stroke center/system development and implementation is to identify or create a single entity responsible for organizing the stroke system. The entity

should have the ability to cross geopolitical lines and coordinate all participants: 911 centers, EMS response agencies, medical control physicians, and hospitals. The entity may be an organization already in existence or may be created for this sole purpose. The entity must be viewed as neutral to all parties and receive its policy direction from the steering committee.

911 Call Center

Emergency medical dispatch and call-taking has improved greatly over the past decade. Standards exist for emergency dispatching, there is a National Standard Curriculum in place, and there are several dispatch accrediting agencies. Integral to effective stroke care is early identification of potential stroke patients and subsequent prioritization of the dispatch. Most EMS call-taking protocols allow for the caller to report what they believe the patient's problem may be. While some callers may be astute enough to correctly report that the patient is having a stroke, many stroke patients will initially be reported as being the victim of a fall or having altered mental status, diabetic problems, or cardiac problems. It is unrealistic to expect call-takers to accurately identify all potential stroke patients. However, sophisticated call-processing protocols generally include key questions designed to identify potentially critically ill patients. These questions usually pertain to whether or not the patient is awake and breathing or speaking normally. The uniform use of these key questions for all reported emergencies allows the dispatch center to identify potentially seriously ill patients, including stroke patients, even if the caller misidentifies the patient's actual medical problem.

When a caller reports that the patient's problem may be a stroke, the prioritization scheme of the dispatch center must reflect the time-dependent nature of stroke care. Just like dispatches to patients with serious trauma or acute myocardial infarction, dispatches to potential acute stroke patients must be given high priority, above less critical and less time-dependent emergencies.

EMS Assessment of the Patient

Several studies have demonstrated that emergency medical technicians and paramedics are able to identify acute stroke patients with relatively good reliability. Prior to any specific stroke-identification training, San Francisco Fire Department paramedics correctly identified 61 percent of acute victims. Following a 4-hour training program on stroke and instruction on how to administer a modified NIH Stroke Scale, they correctly identified 91 percent of acute stroke victims.[6] Other large EMS systems, including those in Los Angeles, Cincinnati, West Central Florida, Birmingham, Houston, and Dallas, have designed prehospital acute stroke evaluation tools for use by their emergency responders (Appendix A).

Each of these stroke-screening processes includes a brief and simple physical exam. The Cincinnati Prehospital Stroke Scale (CPSS) consists of observation for a unilateral facial droop when the patient is asked to smile; arm drift from a position of the arms being held out in front; and slurring of words, use of incorrect words, or inability to speak when asked to repeat the phrase "you can't teach an old dog new tricks".[7] The Los Angeles Prehospital Stroke Screen (LAPSS) consists of a physical examination that evaluates smile, arm drift, and grip as well as five inclusion criteria (exclusion questions concern age, duration of symptoms, glucose level, and history of seizures).[8] The LAPSS proved to be very accurate, with a sensitivity of 91 percent, a specificity of 97 percent, a positive predictive value of 86 percent, and a negative predictive value of 98 percent.[9]

In addition to the physical exam, each of these prehospital stroke scales inquires about specific details of the patient's medical history. One of the most important parts of the history for the EMS caregiver to ascertain is the exact time of symptom onset. Paramedics and emergency technicians should be trained to use all available information sources to determine as exactly as possible when the patient's symptoms started. Patients are often unable to provide the time of onset as they have become confused or are frightened about what is happening to them. Family members or bystanders may remember what events were occurring when the patient began to develop symptoms. This type of information can be used to help them recall the time of symptom onset. A useful tool is to ask the bystanders what was on the television or what meeting had just started when the symptoms began. Whenever possible, it can be helpful to bring family members and/or witnesses of the acute event with the patient. This allows physician and nursing staff to obtain further historical details and to address issues of consent and advanced directives.

If there is a history of seizure disorder, and in particular if the patient has had a seizure in the past 24 hours, the diagnosis may be Todd's paralysis rather than stroke. Another co-morbidity to be considered is hypo- or hyperglycemia in diabetic patients.

In addition to the rapid recognition of a possible stroke, EMS workers can benefit their patient by providing supplemental oxygen, intravenous access, and cardiac monitoring while expediting rapid transport to the nearest stroke center. The intravenous fluid of choice should not include dextrose as it is well recognized that elevated levels of glucose are potentially harmful to at-risk cerebral tissue. Hypertension should not be treated in the field because it heightens the risk of hypoperfusion to the penumbra. The patient should be transported in a laterally recumbent position on the affected side to protect the affected limb, provided this does not cause any respiratory compromise. Finally, giving early notification to the destination hospital can be extremely beneficial by allowing health care personnel more time to mobilize the necessary resources for patient care.

Decision-Making for Destination Selection

Once a patient is recognized as being a probable acute stroke patient, the decision must be made to transport the patient expeditiously to the most appropriate pre-identified hospital. Essential to the success of such a program is that the prehospital personnel know, with little or no delay, which facilities are able to appropriately care for the patient. In Houston, a criterion for hospital participation in the stroke care system is resource availability 24 hours a day, 7 days a week. In Dallas, on the other hand, four stroke center hospitals are available but participate in a rotational system on a weekly basis. Regardless of the system used, two important features must exist: (1) the system should be easy to understand, and (2) EMS providers should routinely and reliably know which hospital is the appropriate facility to receive the patient.

In the setting of rural prehospital care, it may be especially difficult to maintain a rotational system due to the time and distance variables that this would involve. Additionally, web-based hospital status systems may be difficult to maintain due to funding issues and the diversity of institutions that could potentially be involved. Consequently, innovative approaches may need to be adopted. For example, expanding the role of EMS dispatchers may allow confirmation of the destination hospital. After determining that an acute stroke has probably occurred, EMS personnel in rural areas could recruit dispatch personnel to confirm a hospital's availability and suitability to receive the presumed stroke patient. Communication over long distances can be difficult

from the field. For this reason, rural EMS systems should consider having their dispatch centers communicate patient care issues to the destination hospital. This has the added benefits of (1) providing the receiving hospital with more time to mobilize necessary resources, (2) allowing time for alternative arrangements to be made during times of hospital crisis or unavailability, and (3) determining bypass of unavailable hospitals rather than relying on time-consuming transfer processes. This might include air-medical transport.

As hospital and ED overcrowding continues to be an active issue for emergency care systems, contingency plans must be developed by EMS and hospital providers. For example, if a participating stroke care hospital has determined the need to request diversion of incoming emergency patients due to ICU overcrowding, does this affect the hospital's ability to care for a new stroke patient? Many stroke patients, even those receiving t-PA, do not require ICU care and can be managed in specialized intermediate care settings. Diversionary status for stroke patients should be determined locally and independently of other diversionary conditions. EMS providers must have a way of knowing if a stroke care facility can continue to accept potential acute stroke patients if the intended receiving facility has requested ICU diversion. The same pre-planning must occur for ED diversion requests, trauma diversion requests, etc. Also, how are EMS providers to react if all stroke care hospitals are at full capacity? Are they to take the patient to a non-stroke care hospital or are all the stroke care hospitals to be considered open and acute stroke patients divided among each of them in a rotation? The steering committee should also consider provisions relating to patients' personal preferences about hospital destination. In today's health care financial landscape, patients often find themselves unsure of the impact on health care coverage if they are not taken to an "in-service" hospital. EMS care providers need to be adequately educated on this issue in order to correctly advise patients.

One city that has implemented such a system and measured the impact is Houston. Prior to the implementation of an EMS stroke triage program, a local group of university-based neurologists coordinated an aggressive stroke treatment program in four EDs. Supported by an American Heart Association grant, each hospital in the city was asked to participate in the program. Six of 29 invited hospitals agreed to share quality improvement data and offer acute stroke care 24 hours a day, 7 days a week. Paramedics were then trained how to identify possible acute stroke patients using a stroke screening tool. Prior to the start of the program, 46 percent of all acute stroke patients were being transported to one of four original centers covered by the University of Texas stroke team, with 50 percent arriving less than 2 hours after symptom onset. After the paramedics were trained in the stroke screening assessment, 70 percent of all apparent acute stroke patients were transported to one of the six stroke center hospitals. The University of Texas team continued to cover the original four hospitals, and two new hospitals were added with their own in-house stroke teams. The most common reason for a possible acute stroke patient to be transported to a non-stroke center hospital was patient insistence on transport to the non-stroke center hospital. As a result of this effort, door-to-needle times decreased from a mean of 68 ± 28 minutes to 54 ± 11 minutes across all six centers, and the proportion of stroke patients receiving t-PA increased from 7.4 to 10.8 percent.

Model Systems for Stroke Response

One of the goals of this document is to provide models for communities wishing to improve the care available to patients with acute stroke. A number of different locations across the

United States have developed systems that address many of the issues identified as inhibiting effective emergency response to these patients.

Urban Settings

Change is occurring too slowly for many patients. Some communities may find it helpful to identify elements from the following descriptions of stroke response systems that may be good models for them.

Houston

Area Leadership Team

In 1999, James Grotta, a neurologist at the University of Texas Medical School in the Texas Medical Center, received a grant from the American Heart Association to develop a regional stroke system. The grant was titled "Can Paramedic Education Improve Stroke Outcome?" The specific aim was to determine if a program of paramedic education, including the identification of designated stroke center EDs, would result in improved urgent stroke management. The program was a collaborative effort between the stroke teams at the two Houston medical schools — University of Texas and Baylor — and the Houston Fire Department EMS. The grant paid for a study nurse to recruit hospitals to participate and help develop the paramedic and ED educational programs, and it provided funds to develop a paramedic educational program focused on acute stroke recognition and triage. Limited funds for hospital staff education were also provided.

There were only two conditions for hospitals to join the system. The hospital had to offer advanced stroke care 24 hours a day every day, and it had to collect patient outcome information and allow the study nurse to verify quality improvement processes. All 29 hospitals in the area were invited to join the system. Six agreed to participate. The organizers of the system tried, with limited success, to recruit hospitals to achieve a geographic balance.

The local chapter of the American Stroke Association's Operation Stroke program endorsed the system. All area hospitals had representatives on the Operation Stroke task force, which included a variety of different professionals such as neurologists, emergency nurses, and emergency physicians. Participating EDs received recognition from this group as designated stroke centers, and recognition was given to paramedics who brought to stroke centers two or more patients who got treated. An evening program with stroke survivors was orchestrated by the American Stroke Association chapter and was attended by stroke center ED nurses, paramedics, EMS directors, and the University of Texas and Baylor stroke teams.

Receiving Hospital Designation System

Many hospitals that wanted to participate found they were unable to do so since they did not have the internal resources to collect data on numbers of patients treated, process control variables (door to CT time, etc.), and patient outcome information. In some hospitals, emergency physicians wanted to participate but neurologists were not available for 24/7 coverage.

Of the six hospitals that participated, two were the home hospitals of the two medical school stroke teams (Hermann and Methodist). At three large community hospitals (St. Luke's, Memorial Southwest, and Memorial Northwest), a hybrid system had been developed during the NINDS study in which University of Texas stroke team neurologists responded to treat patients. In one remaining hospital, an internal stroke team, coordinated from the ED, responded to treat patients.

During the term of the American Heart Association grant (1999-2002), the study nurse verified the capabilities of the participating hospitals. After the grant ended, the Operation Stroke task force assumed that responsibility. There is a well-organized system for collecting process and outcome information from the

six participating hospitals, including times to treatment, the proportion of stroke patients treated, and the accuracy of stroke assessment by EMS personnel.

EMS Triage Policy

The Houston Fire Department transports acute stroke patients to whichever hospital the patient or family designates, but paramedics routinely encourage acute stroke patients to go to one of the six stroke treatment centers. The Houston Stroke Scale, a variation of the LAPSS, is used to identify potential fibrinolytic treatment candidates. Paramedics call the medical control system when they recognize a possible candidate, and the paramedic at medical control pages the stroke team at the destination hospital.

Early stroke recognition and the stroke scale was taught to paramedics during the first year of the grant, and the training is routinely reinforced at least twice yearly by the University of Texas stroke team at regularly scheduled meetings of all paramedics.

Receiving Hospital Response System

The response system in each of the six hospitals varies. In two hospitals, there is an internal stroke team and a neurologist responds to the ED to assess the patient. In those hospitals, the emergency physicians are taking on increasing responsibility for assessing patients and initiating fibrinolytic therapy without a bedside assessment by the neurologist. In three large community hospitals, the neurologist from the University of Texas at Houston travels to the ED to assess the patient. Within each hospital, there are specific systems to mobilize the CT scanner and other support services.

Cincinnati

Area Leadership Team

In the mid-1980s an emergency physician, William Barsan, and a neurologist, Thomas Brott, who worked at the University of Cincinnati College of Medicine began to collaborate under the mentorship of a senior research neurologist, Charles Olinger, to develop an emergency treatment for stroke. They decided to develop a regional stroke response team. The key idea was that the clinical researcher who was going to be enrolling a patient into the t-PA stroke trial would travel to the patient instead of having the patient travel to the medical center. Choosing that approach defused potential political opposition. Although the strategy added complexity for the researcher, it simplified emergency treatment of acute stroke patients.

This single regional team, called the Greater Cincinnati Northern Kentucky Stroke Team, was founded in 1987. Team members met with area neurologists to allay any concerns they might have about the program. The community neurologists were pleased that the patients would largely be cared for at community hospitals by the stroke team physicians for the first 24 hours and then have their care handed over to the community-based neurologists. The team was available 24 hours a day to assess and potentially treat patients with acute stroke in EDs of any hospital in the metropolitan area.

The Cincinnati stroke team researchers also obtained approval from institutional review boards at each of the receiving hospitals for clinical trials including the NINDS dose escalation and randomized trials. Once the original NINDS t-PA stroke trial ended and the results were known, the stroke team continued its commitment to patient care and began using t-PA to treat eligible patients outside the research process while still responding to more than 17 community hospitals in the region. The core group of treating clinicians includes stroke-trained neurologists and emergency physicians who share call duties equally. A major advantage of this system is that a small group of clinicians gains extensive clinical experience treating patients with acute stroke.

The stroke team also holds weekly case review and quality improvement meetings in which patient cases from the previous week are discussed and new team members are trained in acute stroke treatment. Another benefit is that the emergency physician at the community hospital never has to decide which neurologist the patient's primary care physician wishes to use since there is only one group of clinicians treating patients in the entire region. A single telephone number is used to access the system from any hospital at any time, simplifying the process for activating the team.

The team provides EMS agencies with a mechanism to activate the response system in which EMS contacts the regional on-line medical control at the university hospital and asks to have the stroke team paged for a patient. The treating paramedic provides as much detail as possible about the stroke, including the time of onset, when known, and the estimated time of arrival at the receiving hospital. Then the medical control physician pages the stroke team and also notifies the receiving ED.

Receiving Hospital Designation System

Hospital participation is voluntary, and all acute care hospitals within the greater Cincinnati area, with the exception of the Veterans Affairs Medical Center, participate. A de facto two-tiered treatment system has developed. In the base tier, patients are treated with intravenous fibrinolytic therapy and then remain at the community hospital for subsequent care. If the patient is thought to need specialized care such as intra-arterial treatment or the community hospital staff is not comfortable maintaining the patient after administration of intravenous fibrinolysis, then he or she is transferred to one of the two hospitals with stroke units.

Patients who are brought to the EDs by their families rather than EMS comprise about 40 percent of the acute stroke patients in the area. They are cared for using the same system as patients who arrive by EMS. However, the system response for patients brought by family members is not as efficient as it is for patients brought by EMS, primarily because without EMS participation no real advance notification of the system takes place. On the other hand, the distributed delivery model developed by the Cincinnati stroke team means that all patients, regardless of their choice of hospital, will have access to intravenous fibrinolytic therapy.

There is an ongoing epidemiologic study of stroke patients in the Greater Cincinnati area that measures a number of patient outcomes. Recently, stroke team researchers shared data collected through the Ohio Paul Coverdell National Acute Stroke Registry with all participating institutions and the community at large.

EMS Triage Policy

Local EMS agencies generally take patients to the hospital chosen by the patient or family members, unless that hospital is on ED diversion. Acute stroke patients are not routed preferentially to any particular hospital. The paramedics use mobile telephones to contact the local medical control physician at the university hospital or to make direct contact with the receiving hospital. Depending on the clinical status of the patient, the stroke team may be notified about the case before the patient arrives at the ED so that the stroke team physician can begin to respond to that hospital.

Receiving Hospital Response System

A neurologist or emergency physician who is a member of the stroke team responds to the ED upon the request of the treating emergency physician. While responding to the hospital, the stroke team physician uses his or her mobile phone to mobilize hospital resources. The mobile telephone is programmed with the telephone numbers for various hospital departments such as CT and pharmacy. The ED staff is also integral to the process and

is responsible for making a room available in the ED and notifying the CT technician that an acute stroke patient is arriving.

After the patient is assessed in the ED and the decision whether to treat with fibrinolysis is made, the stroke team physician communicates with the emergency physician and admitting neurologist. The stroke team physician will usually stay involved in the care of patients who receive fibrinolytic therapy for the first 24 hours of hospitalization. After that initial period, patient care is the responsibility of the patient's primary care physician and consulting neurologist.

Dallas

Area Leadership Team

In 1999, Richard Hinton and Hal Unwin, neurologists and members of a stroke committee of the local chapter of the American Heart Association, began an initiative to establish a regional stroke response system in Dallas. James Atkins, then medical director of the Dallas EMS system, assisted them in this effort. Presentations were made to various groups including the Dallas County Medical Society (DCMS) and the Dallas-Fort Worth Hospital Council. Eventually, all potential physician and hospital participants were invited to a meeting hosted by the DCMS.

After receiving approval from the DCMS and enthusiastic support from EMS, all hospitals in the region were then invited to actively participate in a stroke center network. The purpose was to provide access to expert stroke care for all patients in the Dallas County region. Four hospitals agreed to participate in this Dallas Area Stroke Network, and a rotational arrangement for the participating hospitals was established with the help of Paul Pepe, current medical director of the Dallas Metropolitan BioTel (EMS), and Ray Fowler, deputy medical director for operations of BioTel and its EMS base station. A Dallas Area Stroke Council was formed to oversee this network. The council is composed of physicians and administrators from the participating hospitals, with representation from BioTel, the DCMS, and the American Heart Association. The network became operational on August 1, 2002. An open invitation remains to any other hospital in the Dallas area wishing to participate.

Receiving Hospital Designation System

There are four hospitals that are prepared to receive acute stroke patients from the EMS system. Each of these hospitals is a self-designated, comprehensive stroke service hospital. Two are in the northern part of Dallas and two are in the south. Hospitals alternate weeks being on-call, with one hospital in the north and one in the south on-call each week. Then the other two hospitals take call for a week, although all four hospitals can care for acute stroke patients at any time.

Membership in the system is voluntary and other hospitals are still encouraged to join the network. According to their own stated capabilities, each of the four hospitals has a comprehensive stroke service.

EMS Triage Policy

Paramedics quickly assess the patient with a short stroke scale, developed by Paul Pepe, to identify patients with possible stroke. If the last time the patient was known to be normal was within 3 1/2 hours of the arrival of the medics, then the patient is considered for transport to a stroke service hospital. The 3 1/2-hour window was chosen in order to allow the opportunity for intra-arterial thrombolysis (available at all the participating hospitals under experimental protocols) for patients presenting after the 3-hour window for intravenous t-PA. As soon as the medics identify a patient fulfilling these criteria, the patient is given the choice of being transported to a stroke service hospital or another hospital. If the patient wishes to go to a stroke service hospital, the paramedics contact the

regional base station (BioTel). BioTel confirms with the EMS crews which hospital is on-call and prepared to receive the patient. In turn, the BioTel staff notifies the receiving hospital, which then notifies its own stroke team. Even if the stroke service hospital is on EMS diversion because of overcrowding, stroke patients are not diverted.

Receiving Hospital Response System
Each of the four treating hospitals maintains its own acute stroke treatment team, available on a continuous basis regardless of their rotational status at any particular time. In most of the facilities, the stroke team membership includes an emergency physician, a neurologist, a neuroradiologist, and an internal medicine hospitalist. Neurosurgery consultation is also available on a continuous basis, if necessary.

Smaller Cities

Ann Arbor

A different treatment model is functioning in Ann Arbor, Michigan. Stroke research physicians at the University of Michigan developed a unique system for supporting emergency physician administration of fibrinolytic therapy at a number of hospitals in southern Michigan without requiring the stroke expert physicians to travel to those hospitals. A system like this could cover a large geographic area.

Area Leadership Team
Phillip Scott and William Barsan, both emergency physicians at the University of Michigan, pioneered this approach in March 1996. Initially, the participating hospitals were four teaching hospitals affiliated with the University of Michigan.

A treatment guideline was developed with features specific to each of the participating hospitals. The guideline had a number of components such as inclusion and exclusion criteria for t-PA administration in acute stroke, blood pressure control parameters, informed consent documents, dosing charts, and standard ICU order sets. Emergency physicians, nurses, and other staff at the hospitals were trained to use the guidelines. All of the treating emergency physicians were board certified in emergency medicine and the majority were members of the teaching faculty at the University of Michigan/St. Joseph Mercy Hospital emergency medicine residency. Regional stroke team members were available for emergency telephone consultation, but contact with the team was initiated at the discretion of the treating emergency physician. CT scans were interpreted in real time by radiologists at each of the treating hospitals.

Receiving Hospital Response System
Membership in the program is voluntary. Since this is a distributed system, all patients are able to be cared for whether they come to the hospital by EMS or private vehicle; about 30 percent of the treated patients come by private car. During the initial 18 months of the program, about 60 percent of the treated patients received either an in-person or telephone neurology consultation before treatment was initiated.

This system has the advantage of developing under the auspices of a regional stroke research team, and therefore outcomes were measured. One-year mortality among the first 124 patients treated in this distributed system between March 1996 and April 2001 was 27 percent, which is equivalent to the 24 percent 1-year mortality in the NINDS trial cohort.

Birmingham

Area Leadership Team
The process of organizing stroke care began in 1997 when Camilio Gomez, a neurologist, and Joe Acker, executive director of the Birmingham Regional Emergency Medical Services System (BREMSS), agreed to serve as co-chairs of a stroke task force sponsored by the local chapter of the American Heart Association. Neurology,

emergency medicine, EMS, hospital administration, nursing, public health, politicians, and stroke survivors were all at the table. After the task force developed the plan, which covered the six-county Birmingham, Alabama metropolitan area, it was approved by the local American Heart Association chapter, the Birmingham Regional Hospital Council, and other groups. The plan then became a part of the BREMSS Regional Medical Control Plan which was adopted by the Alabama Committee of Public Health. One key to achieving success was the inclusion of stroke survivors on the committee. Their presence served to inhibit economic self-interest behavior by some participants.

Receiving Hospital Designation System
The system includes all hospitals that are willing to participate. Participating hospitals sign a contract with BREMSS. To be stroke-ready a hospital must have current availability of ED, x-ray, operating room, stroke ICU bed, neurologist, CT scan, and neurosurgeon (or transfer agreement). Each hospital notes its current availability within a computer network, which is updated every 3 minutes or less. This provides the hospital the availability to determine "stroke readiness" based upon available resources. Twelve of 19 hospitals have been verified by a multidisciplinary site review team to receive stroke patients from EMS.

EMS Triage Policy
EMS routes patients only to stroke-ready hospitals unless the patient requests another hospital. EMTs use the Stroke Observation Scale (SOS) triage system to identify stroke patients. The EMT then communicates with the Trauma Communication Center (TCC) and relays information on the patient. The TCC informs the EMT of the currently available stroke hospitals. The EMT, in conjunction with the patient, chooses a destination hospital. The chosen hospital is notified by TCC and a copy of the stroke patient report is electronically sent to the receiving hospital. An education program and a train-the-trainer process educated more than 2,500 EMTs and personnel from all EDs in the region.

The BREMSS performs quality improvement and reviews system, hospital, and prehospital performance. Through their contract with BREMSS, participating hospitals provide the required outcome and process data. A feedback loop to the EMT who placed the patient in the stroke system and the TCC communicator who handled the call is also performed. Each EMT and communicator learns the outcome for each patient entered in the stroke system.

Stroke patients who arrive at a hospital ED by non-EMS means are not entered into the stroke system. However, if a non-participating hospital initiates an interhospital transfer, the stroke system assists with this process.

Receiving Hospital Response System
Each of the 12 hospitals that receive patients from the stroke system has its own internal stroke team that is responsible for the care of acute stroke patients within that institution.

Rural Settings

Morgantown

Area Leadership Team
The rural area surrounding Morgantown, West Virginia, has developed an effective stroke treatment system. The champion of the system was David Libell, who serves as director of the Comprehensive Stroke Unit at West Virginia University (WVU). WVU's primary teaching hospital is Ruby Memorial, which is a large tertiary care center and the only university hospital in the state.

Receiving Hospital Designation System
Within the city of Morgantown, there is only one other hospital. Patients who arrive at that hospital with symptoms suggestive of acute stroke are routinely transferred by ground

ambulance approximately 1 mile to the WVU Medical Center. Participation in the system is voluntary. Ruby Memorial Hospital spent about $250,000 on a marketing campaign during the year 2000 to inform the public and rural hospital personnel that acute stroke treatment was available. When a patient with acute stroke arrives at a rural hospital, the referring emergency physician contacts medical control for the air medical service to facilitate patient transfer. The referring emergency physician speaks with the emergency physician on duty at Ruby Memorial to verify that the patient is possibly a candidate for either intravenous or intra-arterial stroke therapy. About two-thirds of the stroke patients cared for at Ruby Memorial arrive by ground EMS, while 17 percent are delivered by air medical transport, 15 percent are brought by friends or family, and 2 percent have some other mode of arrival.

There is no organized system for verification of stroke treatment capability at hospitals in West Virginia. There is a stroke unit at Ruby Memorial Hospital, and there is a hospital-based stroke care committee that includes representatives from hospital administration as well as all disciplines caring for stroke patients during the entire hospitalization. The committee meets quarterly and reviews quality improvement activities. Reports from the hospital are made available to EMS.

EMS Triage Policy

Paramedics generally use either the Cincinnati Prehospital Stroke Scale or the LAPSS to identify patients with acute stroke. These patients are then transported to Ruby Memorial Hospital. If the patient or family insists on transport elsewhere, they will be accommodated if the facility is within reasonable distance. The paramedics contact medical control at Ruby Memorial about a potentially treatable stroke patient. The medical control paramedic activates the stroke response system if there is an obvious stroke. The medic can consult the emergency physician on duty to get advice as needed.

Receiving Hospital Response System

Calling a single pager number sets off a group of pagers and activates the stroke team. Pagers are carried by the emergency medicine attending physician, an ED charge nurse, a stroke neurology attending physician, a pharmacist, laboratory personnel, the CT technician, and a "stat" nurse.

In the mid-1990s, a telemedicine demonstration project was in place for about a dozen hospitals throughout West Virginia. John F. Brick, who is chairman of the department of neurology at WVU, championed this effort. Medical professionals at WVU can use the system to evaluate patients remotely using cameras and audio equipment. Histories and physicals can be performed using the system. While CT scans can be read remotely using the system, acute stroke patients have not been treated using this system alone. Since this technology infrastructure remains in place, its increased role in the remote management of acute stroke patients is targeted for further study.

Summary

The task force envisions the development of local, and eventually state and national, guidelines for stroke care delivery, including prehospital stroke care. In anticipation of these developments, this document has been created to help communities begin to pursue these goals.

The task force urges that, within 1 year of publication of this document, each community should:

- Evaluate its stroke care system capabilities regarding:
  - Public awareness of the signs and symptoms of stroke

  - Prioritization of potential stroke patients within EMS dispatch protocols
  - Training of EMS professionals in recognition and treatment of stroke
  - Uniformity of prehospital stroke care protocols among all EMS provider agencies
  - Uniformity of transportation algorithms and destination protocols for stroke patients
  - Identification of hospital resources regarding stroke care
- Identify or create a community organization to implement and oversee the stroke care system.
- Ensure competency for all components of the EMS system and participating hospitals in assessing and treating patients with acute stroke.
- Prioritize dispatch of acute stroke patients similar to that assigned to patients with major injury and acute myocardial infarction.
- Develop triage protocols for preferential stroke patient transport (including inter-hospital transfers) to designated stroke center hospitals.
- Collect, analyze, and share EMS and stroke center hospital data among participating EMS systems and hospitals for purposes of quality improvement and patient outcome.
- Develop local guidelines for stroke care delivery, including prehospital stroke care.

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APPENDIX A

Prehospital Stroke Screening Systems from Different Communities

Cincinnati Prehospital Stroke Scale

Assess for the unilateral presence of at least one of the following:

Item	*Description*
Facial droop	Ask the patient to smile. Watch for weakness on one side of the face.
Arm drift	Ask the patient to hold both arms out with palms up and eyes closed for 10 seconds. Watch for a drift of one side. A positive result is present if there is weakness in one arm. Weakness in both arms or normal strength is a negative test result.
Slurred speech	Ask the patient to repeat a simple sentence such as "The sky is blue in Cincinnati." Inability to repeat the words correctly and intelligibly is a positive result.

Los Angeles Prehospital Stroke Scale

Criteria	*Yes*	*Unknown*	*No*
1 Age > 45	☐	☐	☐
2 No history of seizures	☐	☐	☐
3 Symptoms < 24 hrs	☐	☐	☐
4 Not wheelchair-bound or bedridden at baseline	☐	☐	☐
5 Glucose 60–400	☐	☐	☐

Assess symmetry in facial movement, hand grip, or arm strength

	Normal	*Right*	*Left*
Facial smile/grimace	☐	☐ Droop	☐ Droop
Grip	☐	☐ Weak ☐ None	☐ Weak ☐ None
Arm strength	☐	☐ Drifts down ☐ Falls rapidly	☐ Drifts down ☐ Falls rapidly

	Yes	*No*
6 Based on exam, patient has only unilateral weakness	☐	☐

Items 1-6 all Yes or Unknown, then LAPSS criteria are met. If LAPSS criteria are met, then call the receiving hospital with a "code stroke"; if not, then return to the appropriate treatment protocol. (*Note*: the patient may still be experiencing a stroke even if the LAPSS criteria are not met.) *From* Kidwell CS, Starkman S, Eckstein M, et al. Identifying stroke in the field. Prospective validation of the Los Angeles Prehospital Stroke Screen (LAPSS). *Stroke* 2000; 31: pp. 71-76.

Dallas Area Stroke Council Stroke Evaluation Sheet

	Yes	*No*	*Unknown*
1 Age 18 years old or older?	☐	☐	☐
2 Symptom(s) onset 3.5 hours or less?	☐	☐	☐
3 Are any of the following symptoms present?	☐	☐	☐

a) Facial droop
b) Sudden asymmetry in neurological exam
c) Weak grip or loss of grip
d) Arm drift
e) Sudden abnormal speech
f) Sudden imbalance in walking
g) Acute arm and/or leg weakness
h) Sudden loss of vision

If the answers to questions 1, 2, and 3 are all "yes," the patient is considered to be having an acute stroke event under this protocol. If the answer to any of these 3 questions is "no" or "unknown," then the patient should be transported to the closest appropriate facility or to the hospital of the patient's choice.

BREMSS Stroke Observation Scale

Level of consciousness	Alert – 0 Requires stimulation – 2
Visual function	No deficit – 0 Any deficit – 2
Facial function	Symmetrical movements upon smiling – 0 Any lateralization – 2
Arm/leg movements	Normal symmetry – 0 Arm or leg weaker than contralateral – 2
Verbal function	Normal communication skills – 0 Abnormal articulation or language content – 2

Entering a patient into the Stroke System

1 Call the Trauma Communication Center (TCC) as soon as practical.
2 Identity yourself and your agency by name and number. If on-line medical direction is necessary, the receiving stroke hospital becomes medical direction. TCC will help coordinate on-line medical direction with a physician immediately.
3 Give location and request any additional resources needed.
4 Give age and sex of patient (patient name is not necessary).
5 Give criteria of entry.
6 Give vital signs — BP, P, R, GCSS or AVPU, glucometer reading.
7 TCC will offer available stroke hospitals based on information given above.
8 Give transportation type/provider.
9 Give PCR number and time of transport.

The receiving stroke hospital should be updated by the transporting unit 5–10 minutes out. This update need only consist of any patient changes and patient's current condition. A repeat of information used to enter the patient into the stroke system is not necessary, as this information will be relayed by the TCC to the receiving stroke hospital.

After the patient is delivered to the stroke hospital, the transporting provider should call the TCC with Patient Care Report times.

■ West Central Florida EMS

STROKE ALERT AGENCY_____

Date:_____/Time:_____ Rescue Unit #:_____ Age_____ Male: ☐ Female: ☐

Pt. Name _____ Incident #_____

CINCINNATI STROKE SCALE (FAST)

(check if abnormal)

☐ **F-(face)** FACIAL DROOP: Have patient smile or show teeth. (Look for asymmetry.)
Normal: Both sides of the face move equally or not at all.
Abnormal: One side of the patient's face droops.

☐ **A-(arm)** MOTOR WEAKNESS: Arm drift (close eyes, extend arms, palms up).
Normal: Remain extended equally, or drifts equally or does not move at all.
Abnormal: One arm drifts down when compared with the other.

☐ **S-(speech)** "You can't teach an old dog new tricks" (repeat phrase).
Normal: Phrase is repeated clearly and correctly.
Abnormal: Words are slurred (dysarthria) or abnormal (aphasia) or none.

☐ **T-TIME of SYMPTOM ONSET:_____!**

EVENT WITNESS NAME_____ Cell Phone_____ Home_____ Pager_____

CLOSEST RELATIVE NAME (if different)_____

Cell Phone _____ Home _____ Pager _____

STROKE ALERT criteria met – Transport *IMMEDIATELY*.

Determine if destination facility can handle an acute stroke (see below).

PERTINENT HISTORY/SYMPTOMS

- ☐ Cardiac Arrhythmias
- ☐ Weakness/numbness
- ☐ Dizziness
- ☐ Headache, Nausea/ Vomiting, Neck Pain*
- ☐ Visual Disturbances
- ☐ Other_____
- ☐ Head trauma at onset**
- ☐ Seizure at onset**
- ☐ On Coumadin (Warfarin)**
- ☐ Recent or current bleeding, trauma, surgery, or invasive procedure**
- ☐ Bleeding Disorder**
- ☐ Pregnancy**

EVALUATION:

SpO2_____ % Glucose _____ mg/dl

TREATMENT:

Head Elevation > 30 (unless hypotensive)

IV NaCl (2 sites preferred, draw labs)

O2 @ 2 L/min (unless hypoxic then high flow)

Drug Therapy _____

Other_____

*HEADACHE ONSET: If present, was onset that of a classic "explosive" headache that is the *"worst of the patient's life"*?: ☐ YES ☐ NO (if yes, consider aneurysm)

Vital Signs: P: _____ R: _____ BP: Lt: _____ Rt: _____

Destination: Onset < 2hours, Transport to facility capable of IV thrombolytics within 3 hour window
Onset 2-4 hours, Consider transport to facility capable of Intra-cerebral thrombolytics
* For suspected aneurysms ***or***
** When lytics are potentially contraindicated: consider transport (including aeromedical) to Neuroendovascular/ Neurosurgical facility

Hospital Destination:_____Time Stroke Alert called:_____

Name of hospital contact person:_____ Time arrived at hospital_____

APPENDIX B

Primary Stroke Center Assessment*

Hospital Name_____

Address _____

Patient Care

1 Does EMS pre-notify your emergency department of potential stroke patients?

☐ Yes ☐ No

If yes, is there a protocol in place to notify the stroke team?

☐ Yes ☐ No

Comments_____

_____

2 Do you have an agreement with local EMS for consistent transport of stroke patients to appropriate hospitals using high priority coding?

☐ Yes ☐ No

3 Do you have written care protocols (standing orders) for emergency care of stroke patients?

☐ Yes ☐ No

If yes, are the orders:

Specific for t-PA? ☐ Yes ☐ No

General stroke orders? ☐ Yes ☐ No

Comments_____

_____

4 Are the emergency department personnel trained in diagnosing and treating acute stroke?

☐ Yes ☐ No

Comments_____

_____

5 Are dedicated, trained, stroke health-care providers (stroke team) available to evaluate a suspected stroke patient within 15 minutes of the patient's arrival 24 hours a day, 7 days a week?

☐ Yes ☐ No

If yes, define the members of your stroke team by specialty:

_____

_____

Comments_____

_____

* From the **Acute Stroke Treatment Program**. Used with permission from the American Stroke Association, a division of the American Heart Association.

6 What is your typical "door to needle" time for ALL suspected stroke patients from time of arrival at emergency department?

☐ Less than 60 minutes
☐ 60 to 120 minutes
☐ More than 120 minutes

Comments_____

_____

7 Is t-PA for stroke patients available in the emergency department 24 hours a day, 7 days a week?

☐ Yes ☐ No

Intravenous t-PA? ☐ Yes ☐ No

Intra-arterial t-PA? ☐ Yes ☐ No

Comments_____

_____

8 Does your hospital have physicians experienced in the administration of thrombolytic therapy for stroke on-site or on-call 24 hours a day, 7 days a week?

☐ Yes ☐ No

Comments_____

_____

9 Is a CT scan or MRI performed and interpreted by an attending or staff radiologist or neurologist within 45 minutes of the arrival of a potential candidate for t-PA therapy 24 hours a day, 7 days a week?

☐ Yes ☐ No

Comments_____

_____

Support Services

10 Do you have the following staff available or on call 24 hours a day, 7 days a week?

Neurologist	☐ Yes	☐ No
Neurosurgeon	☐ Yes	☐ No
Designated stroke/neuro nurse	☐ Yes	☐ No
Diagnostic neuroradiologist	☐ Yes	☐ No
Interventional neuroradiologist	☐ Yes	☐ No
Designated medical director of stroke unit?	☐ Yes	☐ No

Comments_____

_____

11 Do you have neurosurgical services available 24 hours a day, 7 days a week and ready within 2 hours?

☐ Yes ☐ No

If no, are you prepared to transfer the patient to a hospital that does?

☐ Yes ☐ No

Comments_____

_____

12 Are hospital personnel trained in the National Institutes of Health Stroke Scale (NIHSS)?

☐ Yes ☐ No

If yes, please list staff by specialty (ED Physicians, ED Nursing, etc):_____

_____

_____

_____

If no, what scale do you use?_____

12a Are any of those staff (and therefore the ability to use the NIHSS) available 24 hours a day, 7 days a week?

☐ Yes ☐ No

Comments_____

_____

13 Are stroke-relevant blood work (coagulation, CBC, basic metabolic panel, etc.), x-ray, and EKG completed with results back within 45 minutes?

☐ Yes ☐ No

Comments_____

_____

14 Do you operate a stroke unit with written care protocols, continuous telemetry, or ICU staffed by physicians and nurses trained and experienced in caring for acute stroke patients?

☐ Yes ☐ No

If no, are you prepared to transfer the patient to a hospital that does?

☐ Yes ☐ No

Comments_____

_____

15 Does your hospital have a critical pathway, care-map, or collaborative pathway for stroke patients during their inpatient stay?

☐ Yes ☐ No

Comments_____

_____

16 Does your hospital utilize a stroke rehabilitation decision guideline or pathway?

☐ Yes ☐ No

Comments_____

_____

17 Does your hospital track any of the following in a database or stroke registry?

a. Elements of the stroke timeline for treatment with t-PA:

Door to first physician contact? ☐ Yes ☐ No

Door to CT scan read? ☐ Yes ☐ No

Door to needle? ☐ Yes ☐ No

If yes, what treatments (drugs)?_____

b. Number of stroke patients seen ☐ Yes ☐ No

c. Type of stroke ☐ Yes ☐ No

d. Stroke patient outcomes ☐ Yes ☐ No
Graded examination ☐ Yes ☐ No
Disposition ☐ Yes ☐ No
Other — please explain_____
_____

18 Does your hospital provide the following diagnostic procedures?

a. Diffusion imaging MRI ☐ Yes ☐ No
b. MRA ☐ Yes ☐ No
c. CT ☐ Yes ☐ No
d. CTA ☐ Yes ☐ No
e. Cerebral angiography ☐ Yes ☐ No
f. Transcranial Doppler ☐ Yes ☐ No
g. Transthoracic echo ☐ Yes ☐ No
h. Transesophageal echo ☐ Yes ☐ No
i. Ultrasound ☐ Yes ☐ No

Comments_____
_____

19 Does your hospital provide the following surgical endovascular procedures?

a. Carotid endarterectomy ☐ Yes ☐ No
b. Intracranial balloon angioplasty ☐ Yes ☐ No
c. Intracranial stenting ☐ Yes ☐ No
d. Extracranial stenting ☐ Yes ☐ No
e. Intracarotid balloon angioplasty ☐ Yes ☐ No
f. Intracarotid stenting ☐ Yes ☐ No
g. Aneurysm clipping ☐ Yes ☐ No
h. Aneurysm coils ☐ Yes ☐ No
i. Treatment of vasospasm (transcatheter) ☐ Yes ☐ No

Comments_____
_____

20 Does your hospital participate in any of the categories of stroke care programs below?

a. Secondary prevention ☐ Yes ☐ No
b. Rehabilitation ☐ Yes ☐ No
c. Other ☐ Yes ☐ No

If other, please describe_____
_____

21 When patients are discharged, are they given a standard packet of information and materials and counseled about next steps and follow-up?

☐ Yes ☐ No

Comments_____
_____

22 How long does your hospital track stroke patients after discharge?_____
_____

23 Does your hospital provide at least 2 community outreach education programs annually?

☐ Yes ☐ No

If yes, please describe_____

_____

24 Do you provide a minimum of 8 hours of continuing stroke education for hospital staff annually?

☐ Yes ☐ No

Comments_____

_____

25 Has your hospital provided a stroke education and training program for staff in the past year?

☐ Yes ☐ No

Comments_____

_____

26 Does your hospital have continuing education criteria for each member of the stroke team?

☐ Yes ☐ No

If yes, does this include emergency department personnel?

☐ Yes ☐ No

Comments_____

_____

27 Does your hospital sponsor a stroke support group?

☐ Yes ☐ No

Comments_____

_____

28 Do you have telemedicine capabilities (use of remote video technology) to provide stroke treatment in your facility?

☐ Yes ☐ No

Comments_____

_____

Name of person(s) completing the assessment:

Print Name_____

Date_____ Title_____

Indicate all names of persons contributing information; note which responses they provided:

Name/Numbers completed (example: 1,2,3,16,22)

Thank you for taking the time to complete this assessment.

AHA Contact_____ Phone number_____

APPENDIX C

Example of Emergency Response Evaluation Form*

Fire department or private ambulance company _____

Total number of EMS personnel _____

Name of person completing survey _____

Phone _____ E-mail _____

Emergency Medical Calls

Do you receive 911 calls directly? ☐ Yes ☐ No
If not, from where do you receive them? _____

Does the public ever contact you directly with medical emergency calls (pertains to private ambulance companies)?

☐ Yes ☐ No
Is this a private number or via 911? _____

Do you require your dispatchers to be trained in Emergency Medical Dispatching (EMD)?

☐ Yes ☐ No
If no, is your department considering requiring dispatchers to be trained in EMD?

☐ Yes ☐ No

Are you aware of any advocacy efforts to promote EMD funding in your service area?

☐ Yes ☐ No
If yes, please explain. _____
_____

What are the barriers to implementation, e.g., support, funding?_____
_____
_____

If someone calls 911 for a cardiac arrest victim, will the dispatcher provide him CPR and AED instructions over the phone?

CPR ☐ Yes ☐ No
AED ☐ Yes ☐ No

If someone calls 911 and says that he is experiencing numbness and weakness, will the dispatcher suspect that he is having a stroke and code this call as a high priority/expeditious transport?

Suspect stroke ☐ Yes ☐ No
Code as high priority/expeditious transport ☐ Yes ☐ No

* From the **Acute Stroke Treatment Program**. Used with permission from the American Stroke Association, a division of the American Heart Association.

Please provide the name and contact information of the person who is in charge of dispatch.

_____

Are there any other dispatch key-decision makers? ☐ Yes ☐ No
If yes, please provide name(s) and contact information. _____

_____

Addresses

Do some areas of your service area have inappropriate or no address labeling — e.g., route and box numbers instead of street names and numerical addresses? ☐ Yes ☐ No

Approximately what percentage of your service area has inappropriate or no address labeling? _____%

Has the local governing body considered addressing the issue? ☐ Yes ☐ No

What are the barriers to implementation — e.g., support, funding? _____

_____

_____

Please provide the name(s) and contact information for the person(s) who are responsible for appropriate addressing. _____

_____

Defibrillation Capability

1 How many BLS response vehicles do you have? (do not include personal vehicles that a volunteer EMT may use) _____

2 How many ALS response vehicles do you have? _____

3 Are you aware of any non-EMS or non-law enforcement vehicles that respond first to a medical emergency call? (i.e., a security vehicle at a manufacturing plant or in a mall) ☐ Yes ☐ No
If yes, please list and provide contact information.

_____

_____

4 What percentage of the time do the following units arrive first to a medical call?

_____ Fire department ambulance
_____ Fire truck
_____ Private ambulance
_____ Other, please list. _____
_____ Police
_____ Sheriff
_____ Individual Volunteer EMTs (personal vehicle)

5 Of the following who would be available for a typical call, how many would have an AED available? (i.e., 2 of 2 ambulances means all ambulances have an AED; 1of 4 fire trucks means only 1 fire truck in the department has an AED)

____of ____ambulances ____of ____police cars
____of ____fire trucks ____of____sheriff cars
____of ____individual volunteer responders (EMTs)

Are there plans to equip all first line ambulances, fire trucks, police and sheriff cars with defibrillators?
☐ Yes ☐ No _____ 100% of first line emergency vehicles are equipped with AEDs
If no, what are the barriers to implementation?_____
_____

Stroke

1 Do patients with signs and symptoms of stroke receive the same priority response and transport as heart attack and other life-threatening emergencies? ☐ Yes ☐ No

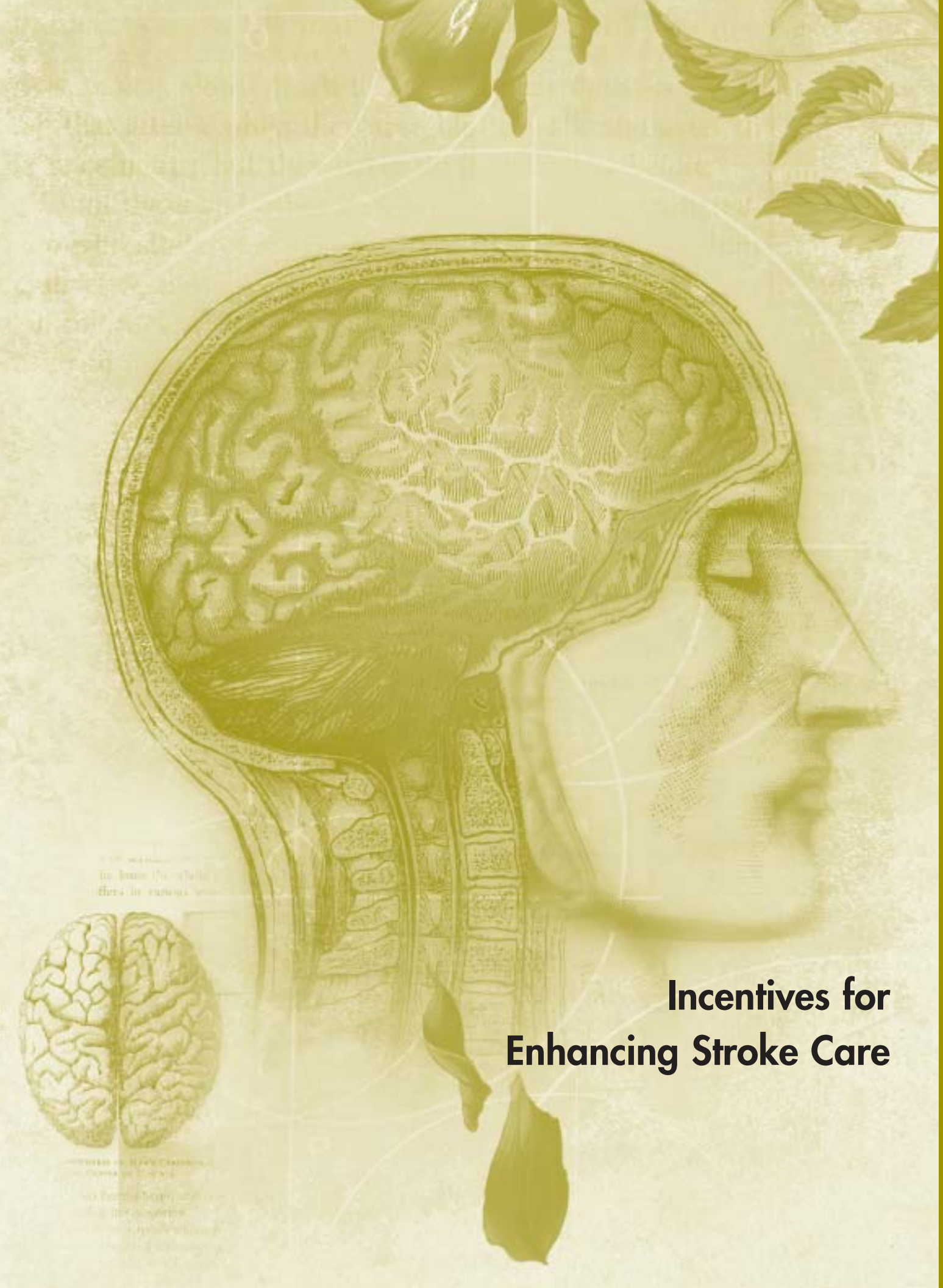
2 Do your EMS personnel pre-notify the emergency department of a potential stroke patient?
☐ Yes ☐ No

3 Are all of your EMS personnel trained to properly assess for stroke according to the American Heart Association's Guidelines 2000 (e.g., use of the Cincinnati Stroke Scale, recognition of stroke signs and symptoms and establishing time of symptom on-set)? ☐ Yes ☐ No
If all are not trained, how many are trained? _____

4 Is your department willing to increase stroke training? ☐ Yes ☐ No

5 What is the name of the person who is responsible for EMT training for your department?
_____
_____

6 Who conducts EMT refresher training for your department?
_____ Your department _____ MATC _____ WCTC
_____ Other, please list: _____



Incentives for Enhancing Stroke Care

TASK FORCE REPORT

Incentives for Enhancing Stroke Care

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Health care providers strive to provide optimal treatment for their patients. However, medicine is becoming more complex and is practiced in a multifaceted environment that includes an array of potential barriers to effective acute stroke care. The identification of appropriate incentives to overcome these impediments is critical to advancing the overall level of stroke care in the country.

Emergency Department

The emergency department (ED) plays an important role in achieving optimal care of the stroke patient. It provides immediate accessibility, integration with the emergency medical services (EMS) system, and access to a hospital's resources. A stroke patient's initial contact with hospital-based personnel is generally in the ED.

Until the advent of treatment with intravenous t-PA, ischemic stroke was considered not reversible even by aggressive emergency care. The goals of acute treatment were to avoid complications and reduce the risk of recurrence. Some of the barriers to optimizing acute stroke care are related to general challenges faced in this care setting. The ability to deliver optimal care can be affected by limited available resources. For example, a sudden increase in patient volume can make it difficult to meet the immediate needs of all patients. Because stroke patients often present with limited readily available background history (e.g., pre-existing conditions, current medications, etc.), hospital personnel must take the time to gather this important information. A single patient requiring aggressive treatment and the attention of multiple staff members can exacerbate this problem.

Compounding these problems, nearly 70 percent of ED care is delivered in "off-hours" (i.e., evenings, nights, weekends, and holidays), times when consultative support is even more limited. Therefore, the emergency physician must often evaluate patients with neurological complaints without the benefit of consultation with a neurological specialist. This can be a particular barrier to the delivery of therapies with a narrow therapeutic index such as intravenous thrombolysis. Similarly, radiology resources in many hospitals can be overloaded during the off-hours when technicians and radiologists are often in short supply. Smaller EDs may not have immediate imaging resources available at any time. These types of challenges have increased over the past few years because of ED overcrowding. More than 90 percent of ED directors perceive that their departments are either at or over capacity,[1,2] and available data indicate that this perception is well founded. According to a recent American Hospital Association poll, 62 percent of hospital EDs are at or over capacity. An ED point prevalence study done on a typical spring evening found there were 1.1 patients per treatment space, 4.2 patients per registered nurse, and 9.7 patients per physician.[3] This overcrowding introduces stress in the system that can interfere with the optimal delivery of care.

Given the nature of emergency care, emergency physicians must frequently rely on consultation with physicians from other specialties. These physicians assist in evaluation and treatment and assume the care of patients requiring hospital admission. The importance of consultative services to a smoothly functioning ED is recognized in the EMTALA (Emergency Medical Treatment and Active Labor Act) statute that requires hospitals to identify specific physicians with on-call responsibilities. This has become more difficult in recent years (see below, Neurology section).

Using intravenous t-PA as an example of the problems associated with the use of an innovative therapy with a potentially narrow therapeutic index, most emergency physicians have been unwilling to accept sole responsibility for a decision to administer the drug without adequate consultative and administrative support. Concerns focus on the need for expert CT scan interpretation and detailed neurological examinations with continuing patient reassessments. These concerns are heightened in the increasingly hectic and crowded ED environment. In addition, relative lack of extensive experience with the use of t-PA leads most emergency physicians to seek the opinion of a neurologist prior to drug administration, or even to require that the neurologist order the treatment. In contrast, ED physicians are quite willing to independently administer t-PA for myocardial infarction. Unlike CT scan interpretation, identifying ST elevation on an EKG is one of an emergency physician's basic skills. The indications for t-PA for myocardial infarction are more straightforward, the frequency of its use in this situation is greater, the risk to the patient with treatment is less, and there is less controversy regarding its use.

In the United States, the problems of lack of space, personnel, technological resources, and support from subspecialty consultants are formidable, and the situation is much the same in Canada. These barriers can be partially addressed through development of efficient prehospital and ED triage systems, increased funding to support the availability of needed technological resources in hospitals caring for patients with acute stroke, and the development and adoption of care pathways including predetermined orders to facilitate the use of potentially hazardous stroke therapies by emergency physicians. However, these approaches do not address the need for consultative support.

Neurology

As reflected above, a perceived or actual lack of consultative support is viewed by emergency physicians as a barrier to the provision of potentially risky therapies, such as thrombolytics for acute ischemic stroke. As compared to acute cardiac emergencies, many emergency medicine physicians are not sufficiently trained in neurology to feel comfortable using new stroke therapies that have the potential to cause harm.

Although stroke is one of the most common inpatient problems confronting neurologists, many neurologists subspecialize and do not provide care for stroke patients on a regular basis. Beginning in 1996, most neurology residency programs in the United States began including some training related to intravenous t-PA for acute stroke. Nonetheless, many neurology residents have little experience or confidence in the use of intravenous t-PA.[4] Surveys in Texas[5] and by the American Academy of Neurology[6] suggest that no more than 50 percent of American neurologists have given intravenous t-PA for acute stroke. Less than one third (30 percent) of the neurologists found the evidence for t-PA efficacy "very convincing," with the majority (67 percent) finding the evidence of efficacy "somewhat convincing." Many neurologists felt the drug was "too risky," and 62 percent were "very concerned" about intracerebral hemorrhage.

In addition to uncertainty about the efficacy of new therapies, most general neurologists see patients in outpatient settings. The economics of clinical practice dictate a tightly scheduled day. Interruptions to evaluate a patient with acute stroke can take several hours. Given the limited financial reimbursement associated with this activity (see below, Financial Reimbursement section), there is a strong disincentive to leaving a crowded office to provide emergency consultative services. The acute stroke time targets developed at the first NINDS National Symposium in 1996 included "access to stroke expertise" within 15 minutes of ED arrival.[7] The phrase "access to stroke expertise" was purposefully used because neurologists are not immediately physically available in many community or rural hospitals. Therefore, the recommendation anticipated telephone consultations, telemedicine, and the fact that in many situations it may be impossible to have a neurologist physically present in the ED before emergency therapies such as t-PA are started. Although consultants are legally liable for advice given over the telephone, there is no financial reimbursement for telephone consultation. Therefore, many neurologists refuse to give advice about intravenous t-PA over the telephone. Finally, when radiologists are not immediately available, neurologists interpret radiographic studies such as CT scans to guide treatment. However, they are rarely financially reimbursed for these activities. Given this reality, it is not surprising that emergency medicine physicians cite a lack of neurological support as a barrier to acute stroke treatment.

Medicolegal Concerns

The introduction of t-PA for acute stroke led to several legal theories that could provide a basis for a claim for medical malpractice, defined as violation of the accepted standard of care causing harm to a patient. Similar theories could apply to other innovative acute stroke therapies. The primary basis for any malpractice claim is a bad outcome. With a bad outcome, the task from the plaintiff's perspective merely becomes relating the outcome to a deviation from the standard of care. Evidence of the standard of care is provided by the opinion of expert witnesses, with arbitration by a judge and jury. One physician with minimal qualifications expressing an opinion that certain conduct violated the

standard of care can be sufficient to have a jury consider the case and award damages to compensate for the bad outcome.

In the case of any innovative stroke treatment, the starting point is often a bad outcome (because the patient had a stroke). The first theory available to a plaintiff's attorney would be to argue that failure to administer t-PA was a violation of the standard of care, and that, had it been used, the outcome would have been the elimination of the patient's neurological deficits. The latter is hard to prove scientifically, but easy to establish in a court of law since it merely requires the opinion of a qualified witness. A second theory available to a plaintiff would be to argue that the administration of t-PA was either not indicated or that the drug was improperly administered, leading to a bad result (either hemorrhage or perhaps simply failure to be cured). Finally, there is the doctrine of informed consent. In this case, a plaintiff's attorney could argue that the patient should have been informed of t-PA as an available treatment including its risks and benefits.

The Food and Drug Administration approved intravenous t-PA as a treatment for acute ischemic stroke in 1996. Shortly thereafter, its use was advocated in a scientific statement from the American Heart Association and an almost identical practice parameter from the Quality Standards Subcommittee of the American Academy of Neurology.[8,9] Editorials were published and educational campaigns were launched, aimed toward educating physicians and patients alike. The popular press, magazines, newspapers, and media of all types heralded the new treatment for stroke.

These efforts in part created a fertile field for malpractice litigation related to the use of intravenous t-PA. The plaintiffs' bar recognized that a new potential cause of action existed. Advertisements and websites for malpractice attorneys highlighted the "alarmingly low" use of t-PA for patients with acute stroke, "especially for African Americans".[10] Solicitations educated patients, "If you suspect that a loved one should have received t-PA but did not, or that t-PA was administered improperly, it may be important to contact an attorney".[11]

Legal solicitation continued as medical scientific debate and physician education was ongoing. Legal scrutiny was noted even before there was national consensus among specialties. With such a threat present, establishing national consensus to undertake a time-sensitive, technically demanding, high-risk therapy was unlikely. The scientific evidence was argued to be insufficiently convincing, the operational challenges enormous, and the complication rate worrisome. The perception was that any effort to further advocate for the use of thrombolytics could increase legal risk. The counterargument was that a higher threat existed from failure to administer thrombolytics.

There are several ways to deal with high-risk medicolegal situations, such as those involving t-PA. From the standpoint of emergency physicians, appropriate consultative support for treatments with a narrow therapeutic index is viewed as important. The development of institutional policies for the use of a specific treatment also reduces medicolegal risk. For example, an institutional policy decision could define the circumstances in which a treatment could or could not be safely administered. Such advance policy decisions, if reasonable and if followed, can provide protection against the opinion of a plaintiff's expert. Support may also be obtained from guidelines or policy statements by professional organizations. When a real difference of opinion exists within the medical community, an expert's adoption of one view does not lead to legal liability.

Emergency physicians indicated to the American College of Emergency Physicians that they were facing litigation for failure to administer t-PA for acute stroke. Given the perceived medicolegal risk, the American College of Emergency Physicians developed a policy on the matter.[12] Similarly, the Canadian Association of Emergency Physicians published a policy indicating that current evidence did not support the use of t-PA in acute stroke as a "standard of care." The American Academy of Emergency Medicine was the first professional association in the United States to note that "evidence…is insufficient to warrant [t-PA's] classification as standard of care." This announcement served as powerful advocacy and welcome support for emergency physicians who felt great medicolegal threat, even while trying to provide the highest levels of service to patients.[13]

The experience with t-PA may be viewed as a model of what can be expected for other emerging acute stroke therapies in the future. Proponents of the use of innovative therapies for acute stroke must frame a convincing scientific stance and ensure the high levels of system supports that will reliably achieve timeliness and safety. Promulgation of new, potentially hazardous acute stroke therapies before health care providers and institutions have been educated about appropriate organizational changes and support mechanisms will likely bring about challenges similar to those facing t-PA use.

Financial Reimbursement

Appropriate financial support for consultative services and stroke systems has been discussed as important to the provision of optimal stroke care. In addition, indigent care must be supported. Because there may be different payers for acute and long-term care, even if an acute treatment is cost-effective from a societal standpoint, it may increase the costs to those providing the treatment. Other health care systems avoid this conflict through global health care budgeting. The financial disincentives to the use of intravenous t-PA would be similar for other innovative approaches. For example, hospital and physician reimbursement is the same whether or not t-PA is administered to an acute stroke patient. Unless payers recognize the added value of implementing an acute stroke response system, many hospitals will be unable to dedicate the resources needed to consistently provide rapid, state-of-the-art care to acute stroke patients.

Surprisingly, only a minority of neurologists listed low reimbursement as a reason for not giving t-PA. This contradicts the common knowledge that neurologists consider reimbursement for intravenous t-PA inadequate, especially when they must go to the hospital in the middle of the night, on weekends, or during a busy daytime practice.

Many neurologists are unfamiliar with optimal current procedural terminology (CPT) billing for thrombolytic therapy. The American Academy of Neurology has published a Stroke Coding Guide, which advocates using CPT Codes 99223 (initial hospital care, high complexity), 99291 (critical care, first hour), and 99292 (critical care, subsequent half hour) for initial treatment of acute stroke patients with thrombolytic therapy. The average national payment in 1997 using these three CPT codes was $394.77; in 2002, the average payment increased to $447.43. Although there is a CPT code for intravenous t-PA for acute stroke (37195), the work relative value unit (RVU) for this code is 0! This reimbursement rate provides little incentive for neurologists to interrupt an otherwise busy workday or to respond during evenings, weekends, or holidays. Recognizing that it is unlikely that the emergency physician and neurologist will both be fully reimbursed when they bill under the same codes for the

same patient, there is little financial incentive to establish a highly functional team approach.

Adequate financial resources to promote optimal stroke care and to support physician leadership for the direction of a multidisciplinary stroke team is critical. A significant opportunity exists to amend the current system to create meaningful incentives in the provision of contemporary stroke care.

From the institutional standpoint, governmental payers such as Medicare compensate facilities based on a diagnosis related grouping (DRG) methodology. This DRG methodology largely reflects overhead costs calculated from "case data" with little recognition of the expense and higher resources involved in contemporary thrombolytic or evolving neurological therapies and technologies. Commercial payers typically compensate acute care and rehabilitation facilities on a per diem basis, with denied payment inconsistency occurring for services involving progressive stroke care. These reimbursement limits create a disincentive to the provision of optimal stroke care. New compensation levels must reflect three essential elements: 1) the increased costs involving present and evolving thrombolytic and novel interventions; 2) the cost in providing uncompensated care; and 3) resources to develop and support medical leadership and system analysis.

The support of a "stroke team" and team leader is particularly important. Traditionally, medical directorships have been developed for care that typically involves specific units within a given hospital. Stroke care, however, occurs in many locations within the hospital. It will be difficult, if not impossible, to nurture an optimal approach to care without financial resources to properly encourage physician leadership and system development with meaningful clinical quality review.

Incentives must also be developed for those providing primary bedside care. One opportunity involves amendments to the current nomenclature involving the CPT-4 codes used by physicians and ancillary providers to describe the care provided to stroke patients. A second opportunity involves the development of new CPT codes to accurately reflect new services in progressive stroke care.

The CPT-4 published by the American Medical Association is the prevailing nomenclature in the United States used to describe provider services to patients and it includes evaluation and management visit services, observation services, and critical care services. However, "concurrency of care" limitations in the provision of services occur when they are simultaneously provided by multiple physicians from multiple specialties. These types of restrictions undermine an integrated multidisciplinary approach and must be discontinued.

CPT codes presently exist that could be helpful in promoting an integrated team approach. They include: 1) 99360, physician standby service, requiring prolonged physician attendance, each 30 minutes; and 2) 99371, telephone call by a physician to a patient, for consultation or medical management, or for coordinating medical management with other health care professionals (e.g., nurses, therapists, social workers, nutritionists, physicians, pharmacists). Other existing codes include: 1) 99371, simple-brief, e.g., to report on tests and/or laboratory results, to clarify or alter previous instructions, to integrate new information from other health professionals into the medical treatment plan, or to adjust therapy; 2) 99372, intermediate, e.g., to provide advice to an established patient on a new problem, to initiate therapy that can be handled by telephone, to discuss test results in detail, to coordinate medical management of a new problem in an established patient, or to initiate a new plan of care; and 3) 99373, complex or lengthy, e.g., lengthy counseling session

with anxious or distraught patient, detailed or prolonged discussion with family members regarding seriously ill patient, or lengthy communication necessary to coordinate complex services of several different health professionals working on different aspects of the total patient care plan.

The majority of third-party payers in the United States, including Medicare, do not typically recognize these physician services for payment. Efforts should be directed to securing specific descriptive language amendments in these codes in order to support the development of multidisciplinary teams and to recognize the challenges in providing consultative services to acute care providers and patients.

The second opportunity for developing incentives exists through the creation of new and innovative language within CPT-4 to specifically describe acute resuscitative and chronic stroke care. This descriptive nomenclature for acute care could be global in scope and analogous to the present Critical Care 99291 or the CPR 92950 codes. As an example, an entirely new CPT code could be developed that more accurately and fairly captures the physician resources in the provision of stroke care.

Some of these financial incentives have already been implemented in Canada over the last 3-5 years. For example, there has been a general move toward payment for on-call services, with several provinces providing stipends for either neurology call (including acute stroke) or acute stroke only. Payments range from $150 a day (neurology including acute stroke care) in Manitoba, to $300 a day (stroke call) in Alberta, to $500 a day (stroke only) in Ontario, to as high as $740-$850 a day (neurology including acute stroke care) in British Columbia. In addition to billing for their usual consultation fee, most bill for an additional 30-90 minutes for the time required for t-PA administration.

A coordinated stroke reimbursement strategy by patient advocates and professional organizations may be the most effective way to change the reimbursement system to facilitate quality stroke care. Nationally, the Centers for Medicare and Medicaid Services (CMS) regularly reviews reimbursement levels for specific conditions and physician payments and invites public comment. Locally, carrier review committees can be similarly approached.

Health Systems

Systems approaches to stroke care are central to many of the identified resource issues. Studies show that having an organized system of stroke care improves outcomes, reduces complications, shortens hospitalizations, and reduces costs. However, current reimbursement systems in the United States do not support this approach. In addition, reimbursement levels have not accounted for the added expense involved in the use of new therapies. For example, DRG14 (stroke) was created before intravenous thrombolysis was introduced.

Stroke quality assessment was recently discontinued by the CMS. As a result, there is currently little incentive for hospital systems to monitor the quality of their stroke care. Programs to identify stroke centers are being discussed, and CMS is planning to reintroduce stroke quality indicators in its next scope of work. This should help in gaining institutional support to enhance stroke process improvement programs and provide a consistent mechanism for giving feedback to all caregivers, including emergency care providers.

Incentives to Improve Acute Stroke Care

- Develop and maintain stroke care systems.
- Provide acute stroke consultative support (especially neurological and radiological expertise) for ED physicians and non-specialist care providers through in-hospital

protocols and systems approaches, including telemedicine consultation and teleradiology as appropriate.

- Develop a coordinated stroke reimbursement strategy involving patient advocates and professional organizations.
- Define medicolegal issues to reduce physician liability risk related to the provision of innovative acute stroke care.
- Support outcomes assessment programs to inform process improvement efforts and dissemination of best practices.
- Assure that appropriate education is conducted and that consensus is achieved as new therapies are introduced. Educational priorities include emergency caregivers, neurologists, and nursing staff.
- Provide forums for constructive dialog among emergency physicians, neurologists, and other key stroke care providers.
- Continue to refine and advance the level of stroke care through clinical research.

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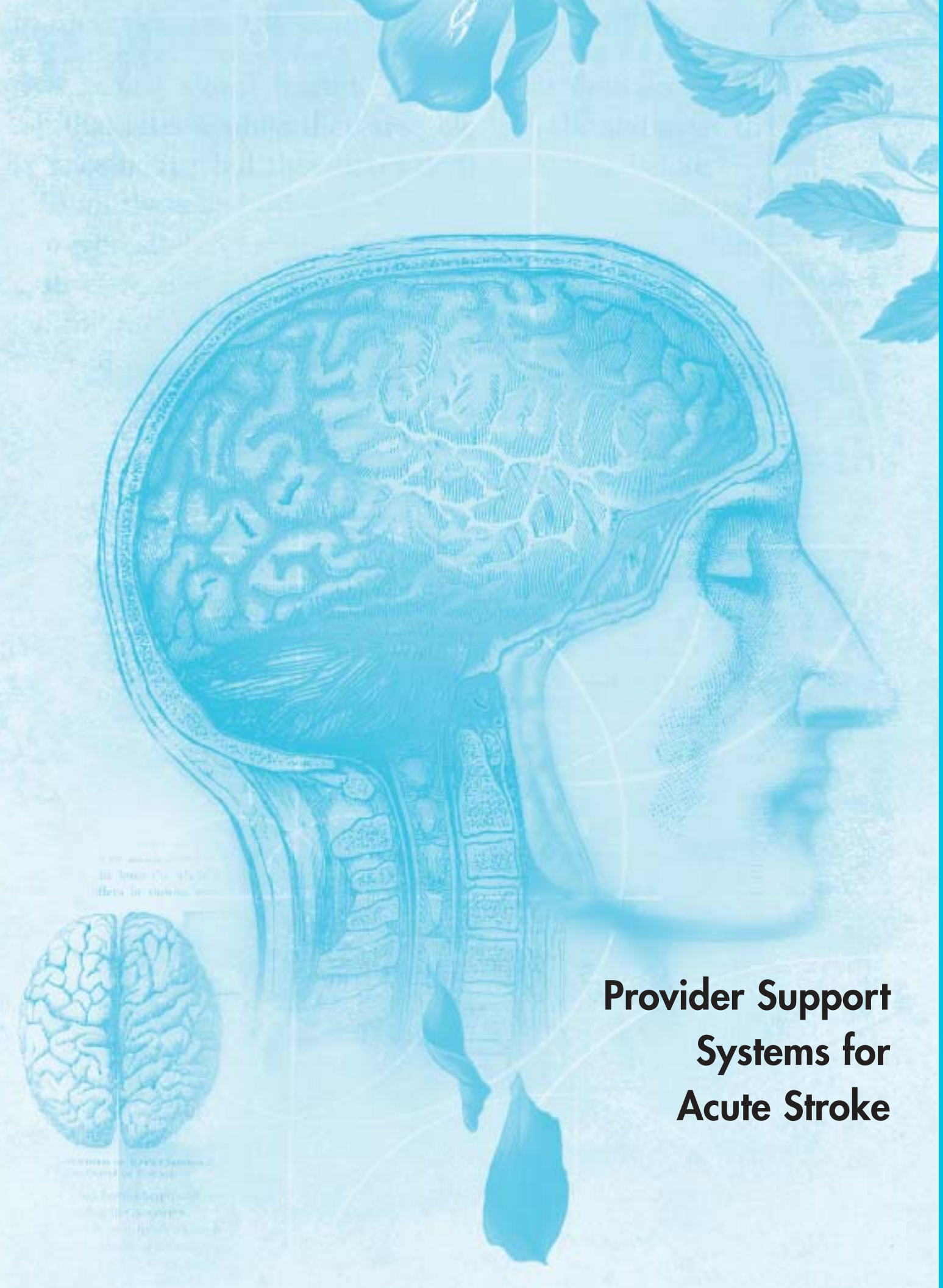

Provider Support Systems for Acute Stroke

TASK FORCE REPORT

Provider Support Systems for Acute Stroke

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The phrase "provider support systems" describes the organization of human and material resources necessary to solve a clinical problem. Developing support systems is an integral step in the second phase of translational research. In the first stage, the principal focus is on bringing new therapeutic approaches from the laboratory to clinical trials. In the second phase, the problem is to move from the clinical trial setting to accepted clinical practice.

Why Develop Support Systems?

Provider support systems have proven remarkably effective in improving medical care in numerous areas in the United States. Regional trauma systems emphasizing the "golden-hour" have led to improvement in the outcome of patients suffering injury.[1,2] Systems effective in reducing door-to-needle times in patients with myocardial infarction receiving thrombolytic therapy have also led to improved outcomes.[3] Similarly, the

progressive testing of chemotherapeutic agents in a systematic, sequential fashion has substantially improved quality of life and survival in patients with cancer.[4]

Clinical trials have demonstrated that interventions exist to reduce the morbidity and mortality from stroke. These include primary treatment (thrombolysis in acute ischemic stroke[5]) and prevention of secondary complications of stroke (deep vein thrombosis, aspiration pneumonia, decubitus ulcer formation, etc.). The use of other interventions, such as specialized stroke care units, is supported by evidence of improved long-term survival and independence for stroke patients treated in such settings compared to patients treated in a standard hospital setting.[6] The widespread application of these disease management approaches is limited by various barriers, some of which can be overcome through effective support systems.

While it is not reasonable to expect every physician and health care institution to manage every aspect of stroke care, it is reasonable to expect pre-established plans to deal with stroke patients falling outside the expertise of an individual provider or health system. These systems should serve to enhance the providers' and facilities' own capabilities while providing for patients needing additional resources, thus improving the delivery of care for all stroke patients.

Every health care delivery system providing care for patients with acute stroke has a responsibility to develop and implement plans for meeting the requirements of each phase of stroke care. The burden of stroke, for individuals and society, compels us to develop effective support systems to deliver the optimum care to every patient with stroke. This document identifies multiple support systems to accomplish this task.

Specific Challenges for Support Systems

The use of thrombolytic therapy for acute ischemic stroke poses an especially difficult challenge in the development of support systems. Ischemic stroke is a clinical diagnosis based primarily on patient history and physical findings. Unlike cases of acute myocardial infarction or trauma, there are no immediately available confirmatory studies for stroke. Guidelines derived from successful clinical trials call for treatment when the diagnosis is established by a person with expertise in stroke; however, the vast majority of patients present to hospitals without specialized stroke teams, and are instead seen by frontline medical providers, such as emergency medical services (EMS) personnel, emergency physicians, family practitioners, and internists, who have limited expertise in diagnosing stroke and/or using thrombolytics in patients with stroke.

Even when physicians who are comfortable in diagnosing stroke are available, there may be other substantial barriers to treatment. Patients often fail to seek medical support in the initial hours of ischemic stroke, therefore delaying initial presentation. In-hospital delays may exist, including impediments at triage, during initial physician evaluation, and in obtaining required CT and laboratory studies. Given the potential obstacles encountered, it is not surprising that more than 7 years after the initial NINDS t-PA publication overall utilization rates are estimated in the 1 to 2 percent range for all patients with acute ischemic stroke.[7] Even at centers with specialized stroke capability, only 7 to 9 percent of all acute stroke patients undergo thrombolytic therapy.[8]

The barriers encountered in the development of systems to deliver hyperacute therapies to stroke patients highlight many of the obstacles to effective care for patients with either ischemic or hemorrhagic stroke in complex health-delivery

systems. By developing support systems to overcome these barriers, it is anticipated that care of stroke patients in general will improve. It is encouraging that recent evidence suggests that development of support systems for providers serves to increase the use of thrombolytic therapy in stroke.[9]

Areas for Support System Development

From a chronological perspective, there are multiple points during the care of acute stroke where pre-established systems should exist to enhance patient care. In some locations, all the resources for a given phase may be present. More often, however, institutions and caregivers require additional resources to provide optimum neurologic care. These resources may be as simple as advice over a telephone or as complex as automated image interpretation. Regardless of the precise details, it is usually possible to predict the resources required, and to plan in advance the manner in which the necessary resources will be obtained.

Presently, optimal stroke care requires rapid evaluation and management in the first few hours after the onset of clinical symptoms. The phases of stroke care for which advanced planning is required include:

- Prehospital care
- Hospital-based care
  - Diagnostic assistance
    - Radiologic and imaging expertise
    - Stroke diagnostic expertise
  - Management assistance
- Systems implementation and evaluation

Moreover, each health care delivery system must monitor the success of its plans and be prepared to change, as necessary, to improve. As staff change over time, an institution should develop protocols and plans for training new personnel in the resources and techniques that have proven feasible at that site.

In general, knowledge used by medical personnel in the acute setting falls into at least three categories: training acquired in advance, information and training available upon demand, and information obtained in the acute care setting. Training and continuing education are discussed in more detail elsewhere (see chapter on Professional Education, page 29); the following discussions will emphasize the range of support systems and resources that may be used in the acute care setting. A list of suggested sites for additional information appears in the Appendix on page 95.

Prehospital Care Support

Prehospital recognition of the potential stroke patient is essential for rapid initiation of treatment. Evidence from prehospital studies indicates that stroke patients accessing 911 emergency systems have significantly shorter times to physician evaluation and CT imaging of the brain than patients arriving at the hospital via other means.[10] To exploit these benefits the following support systems are recommended for prehospital care.

EMS Training and Stroke Identification Support

Education on the signs and symptoms of stroke should be included in the initial and continuing education of all prehospital personnel. Since EMS providers function according to written guidelines developed by their medical directors, it is advantageous for such guidelines to contain a prehospital stroke identification instrument, e.g., Cincinnati Prehospital Stroke Scale, Los Angeles Prehospital Stroke Screen, or other similar scale.[11,12]

Prehospital stroke identification instruments can be rapidly administered and they enhance the ability of EMS providers to accurately identify stroke and notify the receiving facility in advance. All EMS providers should be familiar with such an instrument and employ it when assessing suspected stroke patients to allow early hospital notification.

EMS Transfer Support Systems

Stroke patients should be transported without delay to the closest appropriate facility. Guidelines for hospital destination decisions should be made in advance with the cooperation of area hospitals, emergency departments, EMS agency administrators, and EMS medical directors. Such decisions should result in the patient reaching a stroke-capable facility in the most timely manner. In cases where long ground transport time to the receiving hospital is anticipated, consideration should be given to aeromedical evacuation to preserve the potential for thrombolytic, endovascular, neurosurgical, and/or investigational therapy in appropriate cases. Data suggest that aeromedical transfer of stroke patients may increase the opportunity for acute intervention and can be accomplished safely.[13-15]

Prehospital Management Support

While prehospital providers are knowledgeable about the symptoms of stroke, many are unaware of the appropriate use of supplemental oxygen, the potential detrimental effects of unnecessary dextrose administration, the need to avoid rapid lowering of blood pressure, and the presence of a therapeutic window for thrombolytic delivery.[16] The development of EMS system guidelines requiring intravenous access and glucose measurement, avoidance of interventions to lower blood pressure, and methods to assist in identifying the symptom onset time (e.g., transporting a family member or event witness with the patient) and stressing the importance of early treatment is recommended.

EMS personnel routinely provide reports of individual patient assessment to local medical directors. Guidelines should exist to ensure that physicians at the receiving facility are made aware of the prehospital assessment of possible stroke, thus allowing internal hospital systems to prepare for rapid evaluation and treatment. Currently, such reports are given verbally; however, new technologies utilizing real-time video/still image linkages between ambulances and receiving centers may allow receiving physicians to remotely examine the patient during transport. This type of communication may shorten the decision-making process for acute therapies.

Hospital Care Support

Following arrival at the hospital, via EMS or other means, the stroke patient faces barriers within the hospital setting. These include many that are not amenable to hospital support system development: emergency department (ED) and intensive care unit overcrowding, reductions in hospital staff, and nursing shortages. A lack of access to consultants — particularly those with radiology and neurology expertise — is modifiable through specific support system development and is discussed in detail below.

Radiologic Imaging

Rapid radiologic assessment is necessary to determine patient eligibility for thrombolysis, neurosurgical evacuation of intracranial hematomas, and early treatment of aneurysmal subarachnoid hemorrhage. Hospitals that provide acute stroke care but do not have available expert CT interpretation on-site must develop a plan for urgent and accurate

interpretation of brain CT scans. This may be accomplished via use of local resources, remote teleradiology systems, or patient transfer.

Teleradiology Support Systems

Teleradiology is a widely accepted practice for a variety of medical conditions. Traditionally, high-cost teleradiology solutions for CT interpretation have imported uncompressed brain images into a Picture Archiving and Communications System (PACS) workstation to be viewed on a 2K black and white high-resolution monitor. Newer low-cost teleradiology systems are now available for the transmission of wavelet compressed DICOM images.[17] These images are compressed without loss of visual resolution and can be viewed using an internet browser on a conventional PC equipped with a cathode ray tube or liquid crystal display monitor.[18-21] These systems allow local radiologists or neurologists to provide rapid interpretation of high-quality images from their homes or offices, and allow outside physicians to provide interpretation services by contract. Because these systems handle much smaller datasets (a head CT scan is approximately 8 MGB, uncompressed) they can be effectively transmitted at low to medium bandwidth rates that are widely available. The impact of integrating these technologies may be substantial at non-urban hospitals with a high likelihood of first medical contact.

Stroke Expertise

Rapid assessment, including neurologic examination, is necessary for optimum acute stroke care; it is especially urgent in determining eligibility for thrombolysis. Patients in areas without local expertise may have limited access to these treatments. Hospitals providing acute stroke care must have a plan for urgent and accurate patient evaluation. This may be accomplished via use of local resources, remote teleconsultation systems, or patient transfer. The delivery of rapid, efficient, and accurate neurological evaluation has been improved by the creation of "acute stroke teams" in various hospital settings. Centers that utilize such teams may have better outcomes compared with those administering t-PA ad hoc or to relatively few patients.[22,23]

Teleconsultation

Teleconsultation can allow a stroke expert to remotely evaluate a patient's neurological condition, review brain images, and initiate a collaborative management plan with a referring physician. This location-independent infrastructure collapses barriers of time and distance to bring medical expertise to the bedside, potentially enabling delivery of care that would not otherwise be available. Telemedicine for stroke, sometimes referred to as Telestroke, offers the potential for:

- Improving diagnostic accuracy in the setting of stroke-mimics
- Facilitating delivery of thrombolytic therapy to patients with identified acute strokes
- Enhancing referring physician education on acute stroke management
- Improving non-thrombolytic acute stroke care
- Improving post-stroke management
- Allowing remote follow-up and monitoring for secondary stroke prevention
- Increasing standardization of acute stroke care
- Identifying patients for enrollment into acute treatment studies

Telemedicine has been shown to be a feasible and effective method of performing consultative services and delivering remote neurologic assessment and treatment to stroke

patients.[24,25] Specifically, reasonably good inter-rater reliability of NIH Stroke Scale scores is preserved when performed over a telemedicine video link.[26] These preliminary data support the potential role of a remote telemedicine link in the assessment and treatment of a patient's neurologic deficit.

Available Technologies

Depending on the degree of information required, teleconsultation methods can range from telephone consultation to advanced hardware and imaging devices. At the simplest level, a telephone call to share clinical information can suffice, and this currently occurs in numerous settings where face-to-face acute evaluations are not possible. Limitations of this method are the inability to personally visualize the degree of clinical deficit, view the relevant neuro-imaging data, confirm the patient history, or have face-to-face interactions with patients, family members, and the treating bedside physicians. This method has been used to successfully support emergency physician delivery of t-PA in one model.[27] Concerns remain, however, on the widespread acceptance of this strategy as an effective consultative mechanism in stroke.

High bandwidth data transmission allows real-time video consultation to support truly interactive patient evaluation and management. It can be performed with off-the-shelf commercially available systems that utilize integrated services digital network (ISDN) lines or digital subscriber lines (DSL) with internet/intranet protocols for data transfer. These systems can generate 30-frames-per-second video resolution and should support such features as remote pan/tilt/zoom to allow full remote control of the camera functions. These technologies have been tested and are currently feasible for the remote evaluation of patients.[28]

Today's telemedicine systems serve point-to-point, hard-wired connections, but newer wireless and mobile systems are being developed and evaluated. Software systems should be designed to facilitate the collection of critical patient data, assist in decision-support, and create documents to meet medical, legal, and regulatory requirements. Further research regarding these newer technologies should be addressed.

Teleconsultation Implementation

Implementation of teleconsultation requires installation of essential equipment, availability of the relevant telecommunications infrastructure, personnel training, technical support, and periodic maintenance. Teleconsultation must be integrated into the acute stroke evaluation process so that activation of the remote stroke team occurs in much the same manner as that of a local stroke team. When a potential acute stroke patient presents in the emergency or hospital setting, an initial evaluation by the bedside treating physician is performed. If special expertise is indicated, but not locally available, the remote system can be activated and the consultation can take place via telemedicine technologies.

Multiple practical barriers have thus far limited the widespread use of teleconsultation technology. The need for data transfer systems that can support high bandwidth transmissions (LAN/ISDN/TCP-IP) has limited its use in some rural areas; however, this bandwidth is rapidly becoming ubiquitous. Current state medical board regulations define the site of health care delivery as the patient location, preventing physicians in other states from providing teleconsultation into states in which they are not licensed. Some malpractice carriers are wary of the liability risks associated with teleconsultation and may impose restrictions to coverage.

Additionally, most third-party payers have been slow to recognize these activities as eligible for reimbursement, whereas others, such as the Centers for Medicare and Medicaid Services, have provided reimbursement based solely on hospital location without reference to the availability of resources specific to stroke. Because these teleconsultation methods are not yet widely accepted in acute stroke care, many practitioners obtain informed consent from patients or their designated caregivers prior to initiating these consultation services, imposing additional time delays in the care of the patient with acute stroke.

Management Decision Support

Clinical management decision-making is often complex and involves the mechanics of health care delivery as well as institutional policies, regional practices, and referral patterns. The process becomes even more difficult when time limitations are added.

In stroke patients, once the initial neurologic assessment and diagnosis is established and radiologic interpretation obtained, the treating physician still faces fundamental issues regarding what, if any, interventional therapy is appropriate. Who is responsible for administering thrombolytics in eligible patients? Which patients with intracranial hemorrhage would benefit from surgical consultation? Who will assume care of the patient following ED evaluation or treatment? The wide variability in stroke experience among individual physicians and limitations in local emergency/hospital stroke care delivery systems — combined with the potential medicolegal risk of failure to treat or inappropriate treatment — has impeded widespread adoption of thrombolytic stroke therapy.

The availability of patient management support systems can assist the treating physician in achieving the essential care needed for patients with acute stroke. The need for such support can clearly be found in the following statement by the American College of Emergency Physicians regarding the use of t-PA in acute ischemic stroke:

"There is insufficient evidence at this time to endorse the use of intravenous t-PA in clinical practice when systems are not in place to ensure that the inclusion/exclusion criteria established by the NINDS guidelines for t-PA use in acute stroke are followed. Therefore, the decision for an emergency department to use intravenous t-PA for acute stroke should begin at the institutional level with commitments from hospital administration, the emergency department, neurology, neurosurgery, radiology, and laboratory services to ensure that the systems necessary for the safe use of fibrinolytic agents are in place".[29]

Options for management decision support may be conceptually divided into systems or elements available locally to the treating physician; those located in off-site (remote) locations; those facilitating patient transfer to a higher level of stroke care; and those providing patients access to clinical trial participation.

Local Decision Support

Local decision support identifies processes or elements which assist physician decision-making within a hospital or health care system. Pre-planned guidelines developed by all involved groups, such as family physicians, internists, neurologists, neurosurgeons, radiologists, and emergency physicians, are a critical initial step for developing a standardized approach to acute stroke management. All stakeholders, including nursing and ancillary services, should participate in their development.

Potential options for delivering such support include web-based and PDA-based tools[30] in addition to traditional paper-based formats. In the setting of emergent

thrombolytic decision-making, these can assist with information on patient eligibility, risk/benefit information for providers and patients, dosing information, and care guidelines. The web- and PDA-based tools have the added potential of supporting interactive management tools, allowing pre-programmed algorithms to support treatment decisions in the acute setting. Such protocols, in certain settings, can empower emergency physicians to initiate interventional care in the most expedient manner possible.

In circumstances requiring additional expertise in therapeutic decision-making, the most familiar approach is the use of "in-house" specialty consultation. The reasons for specialty consultation in stroke are numerous and include: understanding co-morbid conditions, providing effective communication on the current diagnosis and treatment plan, discussing preferred treatment options, enlisting additional treatment assistance, and/or enhancing completion of a recommended course of action and disposition decisions.[31] The use of standard consultation methods, whether by phone or in person, can be effective in this setting[27] but is dependent on specialist availability, technical capability, and experience.

An extension of this standard consultation support is found in hospitals using the "code-stroke" or "brain-attack" strategy to activate multiple resources, including neurologists — who often assume both ED decision-making and inpatient care roles. These teams have demonstrated effectiveness but are labor-intensive in resource utilization. Development of such teams within a hospital has been outlined by several groups.[8,32,33]

Remote Decision Support

For facilities without the consistent local specialty consultation needed for a particular aspect of stroke care, processes must be in place to obtain off-site assistance. Such support might be as simple as telephone consultation with regional stroke centers[34] or as technically complex as the telemedicine solutions outlined earlier. The identification of regional stroke referral centers with access information should be immediately available in the ED. Just as medical staff must obtain assistance in managing patients with multiple trauma, so too must institutional and medical staff initiate pre-planning if time-limited interventional therapies are to be available to stroke patients.

Transfer Protocol Support

Hospital managers need to identify in advance the closest stroke referral centers, along with the most expedient means to transport patients needing a higher level of care. Protocols should exist to enable rapid contact with staff at the receiving institution, as well as ambulance agencies providing appropriate transfer level of care, so that little time is lost arranging acceptance and transport. Important administrative issues in patient transfer include:

- Obtaining patient transfer consent
- Completing and copying medical records
- Providing duplicates or originals of any radiographic studies
- Completing appropriate transfer forms

All of these items must accompany the patient during transport. Transfer forms must include signatures from the patient or next of kin to ensure compliance with the Emergency Medical Treatment and Labor Act (EMTALA) requirements.

Clinical Trial Access

While developing systems for local and remote support of clinical decisions, consideration should be given to encouraging participation in clinical trials for acute stroke. Facilities

offering participation in clinical trials are more likely to implement new therapies if they are proven to be beneficial. Participation in clinical trial networks promotes a sense of community commitment to improve delivery of acute stroke care. Clinical trials also provide the infrastructure to support acute stroke management and help highlight the importance of aggressive early care. Ideally, consideration of clinical trials should be integrated into clinical management algorithms, whether paper or electronic based. An electronic system offers the advantage of using automatic flags to identify patients eligible for research protocols. Manual systems can replicate this with intensive education and advertising about clinical trial eligibility.

Implementation and System Evaluation Support

To be effective in reducing stroke morbidity and mortality, support systems must not only be created, they must also be implemented. As outlined previously, multiple barriers at all levels of the health care system lead to suboptimal recognition and early management of stroke. A concerted effort on the part of all health care workers and health care administrators will be necessary to overcome these barriers.

Delivery System Analysis and Implementation

To successfully implement an effective support system for frontline providers, each component of the chain of recovery for acute stroke must be reviewed. This process also creates the expectation of high-quality performance from the various stakeholders in the delivery system. Recommendations for system analysis include focus groups (for medical staff and administrators) and the use of checklists, patient simulations, and/or external reviewers. Each of these processes can identify specific areas for improvement. A clearly identified local leader for the process may be instrumental in implementing a successful change in acute stroke management behavior.

Focus groups are effective in identifying barriers to delivery of stroke care and are commonly used in the ED setting to evaluate the level and consistency of care in other medical situations. It is a familiar process and requires few additional resources to conduct beyond a facilitator and staff time. Potential groups include EMS personnel; ED nursing, physician, and ancillary personnel; radiology technicians and physician staff; neurology, neurosurgery, and pharmacy staff; intensive care unit personnel; and cardiac arrest team representatives. Independent of a focus group evaluation, checklists may be used to ensure availability of needed resources — triage assessment tools, emergent care pathways, inpatient care plans — for stroke patients.

Patient simulations using mock "Code Stroke" events offer the advantage of actually testing a system design and can be done for a variety of patient subtypes, including:

- Altered mental status
- Transient ischemic attack
- Acute ischemic stroke
- Acute hemorrhagic stroke

The mode of patient arrival or location at onset may reveal important system status information and should be varied in these simulations to include:

- Arrival by ambulance
- Arrival by private vehicle
- Symptom onset in long-term care facilities
- Symptom onset in hospital inpatients
- Symptom onset in an outpatient clinic

The benefits of such testing include identifying areas of suboptimal access to care and increasing the visibility of the therapeutic options in stroke in multiple health care settings. Such test situations also offer an effective means for regularly evaluating an established acute stroke treatment system. Finally, external review by individuals with acute stroke care expertise may assist in improving system design and care delivery.

Educational Programs

Following development and identification of the support systems available to assist in the care of the stroke patient, their existence must be communicated clearly to all involved personnel. This can occur via regular staff meetings, mock drills, in-service meetings, and new-hire training materials. The opportunity to utilize repetitive forms of communications for educational reminders is encouraged, particularly email.

Additional physician education in the management of acute stroke will also be needed. In a 1999 survey of emergency medicine residents, 89 percent indicated their willingness to use t-PA with either telephone or bedside neurology consultation, while only 8 percent would administer the drug without a consult.[35] A recent survey of graduating neurology residents found only 73 percent comfortable giving t-PA for stroke independently.[36] Thus, it is not surprising to find a wide variation in attending physician practice with respect to the acute treatment of stroke. In addition to strengthening residency training programs in stroke care there is an additional need to provide continuing medical education materials to those already in practice.

Credentialing

The formal process of credentialing new staff and re-credentialing current staff is a potentially powerful tool in the effort to increase staff knowledge about stroke care pathways, algorithms, and resources. For physicians with a significant probability of caring for patients with acute stroke a clear attestation of their diagnostic and treatment capability is recommended.

From an institutional perspective, all health facilities providing stroke care need to establish policies supporting the chain of recovery for acute stroke. Opportunities exist for such organizations as the Joint Commission on Hospital Accreditation to champion this cause as they have done for other health care issues. Requirements for evidence of a hospital's stroke care plan should be established with criteria for outcome assessment and this should be linked to the institution's quality assurance/improvement program.

Establishing Support System Effectiveness

Considering the functional specifications of optimal stroke care, and the variety of system tools that can serve to fulfill those specifications, it may seem self-evident what needs to be done to improve local acute stroke practice. However, initial and ongoing assessment is indispensable for assuring that the implementation approach chosen is effective in achieving this goal.

Stroke care systems need to maintain a mechanism for ongoing assessment of performance. This can follow the structure/process/outcome formulation, focusing on aspects essential to satisfying the functional specifications of optimal stroke care. An example of a structure measure might be whether a person skilled in reading head CT scans is available 24 hours a day, or whether a "care map" or other description of expected stroke management is accessible to relevant care providers. Process measures could include the time from "door to needle" in patients receiving t-PA, rate of t-PA use, referral to physical therapy within 48 hours, or appropriate assessment for carotid testing. Outcome measures could potentially include blood pressure or functional status on discharge.

Some form of database or registry is valuable for assuring that the hospital has captured the population of stroke patients for whom stroke systems may be relevant. What is less clear is whether a stroke registry can serve all the needs for ongoing assessment for the majority of hospitals that do not have comprehensive electronic medical record systems. In the absence of an electronic medical record system, experience suggests that a special-purpose stroke registry should have a minimal number of data elements; the choice of elements should only be sufficient to guide the selection of a sample of patients for either a prospective evaluation or a retrospective chart review of a subset of patients. These may possibly be implemented through existing hospital quality assurance mechanisms.

Improved resources to evaluate the impact of the cumulative effect of the above strategies in improving acute stroke care in the United States are recommended. Research into the optimum methods of creating medical care delivery systems to reduce morbidity and mortality from stroke is also encouraged. Effective development, implementation, and monitoring of stroke support systems can improve the care of patients in the U.S. health system.

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APPENDIX

Provider Support Systems: Suggested Sites for Additional Information

National Institute of Neurological Disorders and Stroke
http://www.ninds.nih.gov/

Brain Attack Coalition
http://www.stroke-site.org/

List of Professional Society Guidelines for Stroke Treatment
http://www.stroke-site.org/guidelines/guidelines.html

American Stroke Association
http://www.strokeassociation.org/

The Internet Stroke Center at Washington University
http://www.strokecenter.org/prof/index.html

National Stroke Association, professional resources
http://www.stroke.org/

Foundation for Education and Research in Neurologic Emergencies
http://www.ferne.org/

eMedicine
http://www.emedicine.com/emerg/NEUROLOGY.htm

Virtual Hospital, University of Iowa
http://www.vh.org/adult/provider/neurology/Stroke/index.html

American Academy of Neurology, stroke clinical assessment instruments
http://www.aan.com/professionals/patient/clinical.cfm

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Partners

The following organizations joined with the NINDS to develop agreement on how systems can be created and improved to benefit acute stroke patients in all communities.

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Air & Surface Transport Nurses Association
Air Medical Physician Association
Alliance for Aging Research
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American Academy of Neurology
American Academy of Nurse Practitioners
American Academy of Physical Medicine and Rehabilitation
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American Society of Neuroimaging
American Society of Neuroradiology
American Stroke Association, a Division of the American Heart Association
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Association of Physician Assistant Programs
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Council of Emergency Medicine Residency Directors
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National Association of EMS Educators
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National Stroke Association
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Society of General Internal Medicine
Society of Interventional Radiology
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Stroke Belt Consortium
Veterans Administration

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