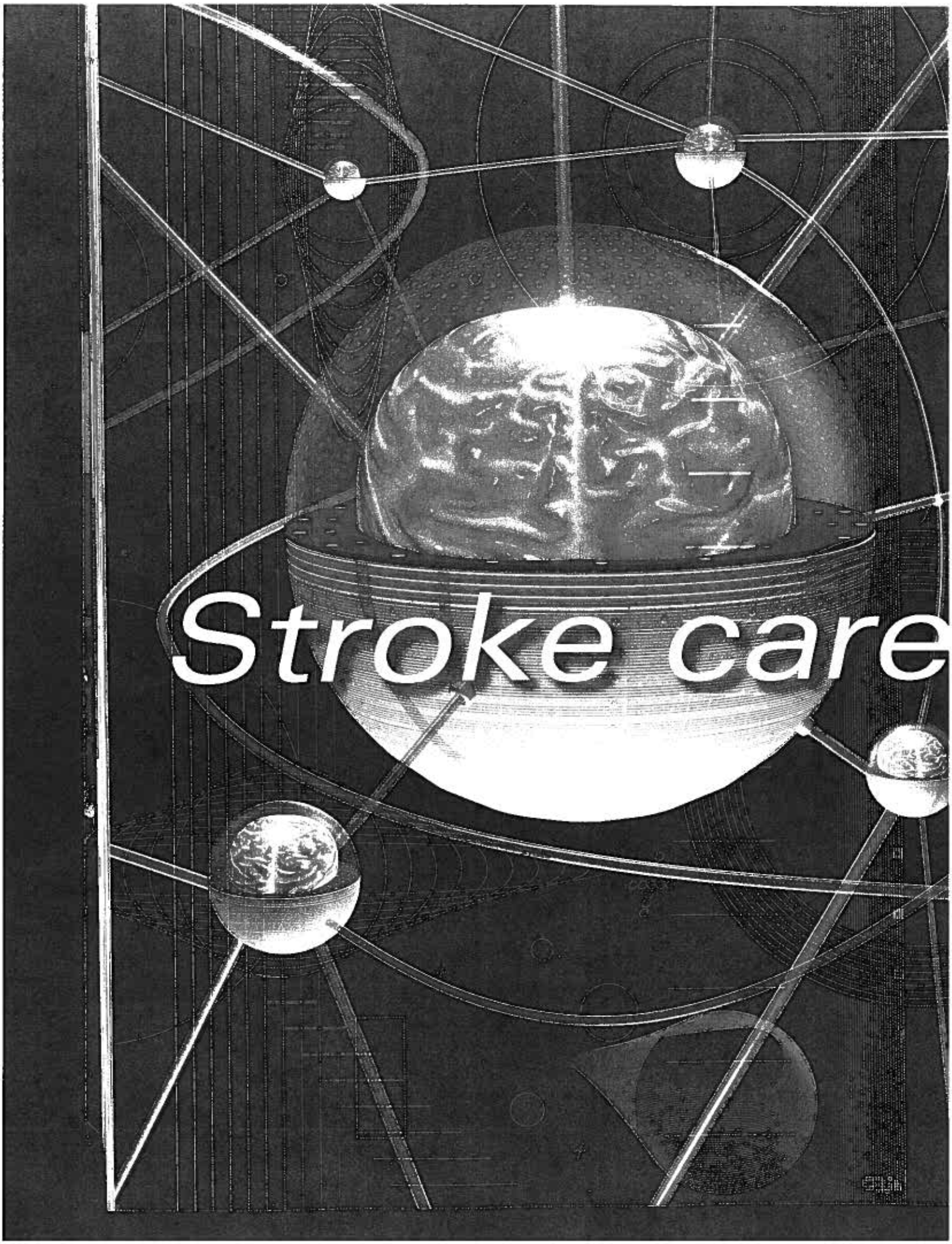
Stroke care

Patricia - Share w Staff; thanks.

CE
2.1
CONTACT HOURS

Stroke in the 21st century

By Alison Trembly, MSN, RN, CNRN, FNP

Sarah C., a 41-year-old high school teacher and mother of three in a rural Midwestern town, is alone in her classroom at lunchtime when she suddenly becomes disoriented and slumps to the floor. A fellow teacher finds her and activates 911. The local first-aid squad arrives and quickly transports Sarah to the nearest emergency facility: an urgent care center 9 miles away, which is part of a regional integrated health system.

The emergency physician who examines Sarah suspects that she may have suffered a major stroke. While the urgent care RN obtains information about Sarah's medical history from her husband by phone, the emergency physician conducts a detailed neurologic exam, using a two-way camera and TV system at the bedside that allows him to review assessment findings with a stroke neurologist at the health system's academic hospital 120 miles away.

Sarah's exam shows no movement and diminished sensation of both right arm and leg; a right facial droop; a parallel, fixed gaze toward the left; and an inability to speak or to follow commands. Her score on the National Institutes of Health Stroke Scale (NIHSS) is 24, indicating a severe stroke. The physician orders STAT lab tests and a STAT computed tomography (CT) scan of the head, which is also reviewed by the stroke neurologist at the academic stroke center. The CT scan is negative for bleeding or other abnormal findings, and all lab tests are within normal limits. There are no contraindications to treating Sarah with the clot-busting medication, I.V. tissue plasminogen activator (I.V. t-PA).

Relay race to save brain

About 1½ hours after the onset of Sarah's stroke symptoms, the urgent care RN administers the bolus dose of I.V. t-PA and begins the 1-hour infusion. The emergency physician activates the protocol for a "Stroke Drip-and-Ship" transfer to the academic stroke center for ongoing hospital care.

Weather conditions aren't favorable for air transport, so Sarah is transported via ambulance. A critical care registered nurse (CCRN) monitors her airway, administers I.V. 0.9% sodium chloride solution to maximize brain perfusion, and documents her vital signs and neurologic status during and after the I.V. t-PA infusion. Sarah arrives at the receiving hospital just 4 hours after her stroke began, where she's immediately assessed by the stroke team's advanced practice nurse (APN).

Unfortunately, Sarah's neurologic exam hasn't improved despite the rapid administration of I.V. t-PA. The stroke APN orders a STAT CT angiogram (CTA) of the brain to obtain more information about blood flow within Sarah's brain.

The CTA doesn't show bleeding, but there's a new and ominous finding. A bright thrombus is now seen near the origin of the left middle cerebral artery, and there's minimal blood flow to a large wedge-shaped area of brain tissue beyond the blockage.

The stroke neurologist reviews the scan with Sarah's husband and recommends a direct cerebral angiogram and mechanical clot extraction. Although there's the potential of causing bleeding in the brain, the procedure may open the blocked vessel and lessen the damage from the stroke. Sarah's husband gives consent, while a perioperative RN and nurse anesthetist quickly complete all required assessments and bring her to the endovascular suite.

Five and a half hours after the onset of symptoms, an endovascular neurosurgeon maneuvers a tiny corkscrew-shaped device into the blocked vessel and extracts most of the thrombus. A second device is introduced via microcatheter to suction out the remaining fragments of clot, and Sarah is brought to the neuro-ICU, still intubated and sedated.

From rescue to recovery

The following day, Sarah is weaned from the ventilator and transferred to the neurosciences unit. She's able to form a few words and follow verbal commands, although she still has limited use of her right arm. By hospital day 5, she's walking with assistance, eating a soft diet with thickened liquids, speaking in sentences, and is ready for discharge to an acute rehabilitation hospital closer to her home. Her NIHSS has decreased from 24 to 6, indicating excellent early improvement.

The cause of Sarah's stroke has been identified as a combination of a hypercoagulable blood disorder and a patent foramen ovale: an abnormal opening between the right and left sides of her heart, which allowed an embolism to travel to the brain. Sarah is receiving anticoagulation "bridging" therapy with subcutaneous enoxaparin and oral warfarin, as well as a statin medication for stroke prevention. She has been advised to avoid all estrogen-related hormonal medications, which could cause increased clotting, and to follow up with the neurologist and cardiologist in 1 month.

Ever-changing treatment

Stroke care has changed dramatically in the last decade. Sarah's story emphasizes several key points about stroke in the 21st century:

- The new approach to the patient with a "stroke" is almost identical to the care of the patient with an acute myocardial infarction (AMI). Successful stroke rescue begins long before hospital arrival; it's community-based, team-focused, protocol-driven, time-sensitive, and often interventional.
- Stroke treatment options continue to multiply, including an extended time window for treatment with I.V. t-PA for many patients, new "endovascular rescue" devices, and the ability to combine pharmacologic and microsurgical approaches in acute stroke treatment.
- Regional stroke care systems that emphasize resource sharing and cooperation—not competition—can save brains and lives, by ensuring that all patients have access to maximal expertise and treatment options.

Only a small number of hospitals in the United States currently offer the full spectrum of advanced stroke treatments. However, every hospital and healthcare facility can—and *must*—be prepared to identify the signs and symptoms of stroke and to activate a preestablished protocol for rapid diagnosis, treatment, and/or transfer of stroke patients. How can your institution adopt a proactive model of stroke care, even with limited resources?

Building a dedicated nursing workforce

Emerging roles for RNs in stroke care include:

- Transfer center RN coordinators and critical care transport RNs (including flight RNs)
- Acute stroke team RNs
- Stroke clinical research RNs
- Interventional radiology and endovascular team RNs
- APNs specializing in neurology, neurosurgery, critical care, and anesthesia.

Other important nursing roles in stroke systems of care include the stroke program RN coordinator (often the program's most visible champion and ambassador); nurse educator; quality/informatics RN to collect, analyze, and report stroke data; community health RN for outreach and education; and stroke rehabilitation RN.

Because the nationwide demand for experienced neuroscience RNs far exceeds the present supply, creativity and innovation are essential to developing stroke nursing teams. According to the American Board of Neuroscience Nursing, there are 3,300 certified neuroscience registered nurses (CNRNs) in the United States, and about 350 new CNRNs are certified annually. By comparison, there were over 44,000 CCRNs in the United States in 2009.[1]

Because stroke is both a vascular disease and a brain injury, think outside the box to identify RNs whose skills are well matched to the 21st century paradigm of stroke care. RNs with experience in interventional cardiology, emergency nursing, radiology, trauma, critical care, and vascular surgery, as well

Table 1: A 21st century toolkit for stroke treatment

Stroke subtype	Contributing factors	Treatment options
Acute ischemic stroke	**Most common:** Atherosclerosis, hypertension, hyperlipidemia, diabetes, smoking, atrial fibrillation, carotid artery disease	I.V. t-PA is FDA-approved for use for selected patients in the first 3 hours of acute ischemic stroke. A 2009 scientific advisory statement from the ASA supports use of I.V. t-PA for certain patients up to 4.5 hours after symptom onset; however, this is an investigational (nonFDA-approved) therapy at this time
	Less common: Structural heart defects (such as, patent foramen ovale, atrial septal defect), hypercoagulable state (including use of oral contraceptive and hormone therapy), dissection of carotid or vertebral artery, vasospasm (such as cocaine-related), severe hypotension	Intra-arterial (IA) thrombolytic medications may be administered through microcatheters during cerebral angiography. IA thrombolytics aren't yet FDA-approved, but are widely used in advanced stroke centers in combination with I.V. t-PA and devices, usually during the first 6 hours after symptom onset.
		Various devices—the MERCI etriever, the PENUMBRA clot aspiration system, ultrasound-frequency vibration, and intracranial balloons and stents—may be used in combination with thrombolytic medications for acute stroke rescue.
		Hemicraniectomy may be considered for massive stroke with uncontrollable increased intracranial pressure, to improve survival.
		Induced hypothermia through external systems (such as, cooling vests or wraps) or internal cooling may be used to reduce cerebral metabolic demands during the first days after a severe stroke.
Intracerebral hemorrhage (ICH)	Hypertension, diabetes, smoking, excessive alcohol use, coagulopathy, amyloid angiopathy (age-related fragility of blood vessels), cocaine use	Most ICH patients aren't treated surgically. Critical care management of BP, intracranial pressure, and other body systems is the foundation of care. Surgery is reserved for patients with life-threatening increases in intracranial pressure.
SAH	Ruptured cerebral aneurysm or arteriovenous malformation (AVM), hypertension, smoking	If due to a ruptured blood vessel, SAH may be treated by open craniotomy with clipping of aneurysm or AVM, or by the endovascular approach: cerebral angiography with placement of metal coils, stents, and/or glue embolization to stop bleeding.
		Critical care management after SAH is highly complex, including monitoring for vasospasm, rebleeding, cardiac injury, and other delayed complications.

as RNs who belong to code teams and rapid response teams, can bring a wealth of transferable expertise to acute stroke care.

Recruit—or grow—from within: A case study

Is it possible to staff a rapidly growing stroke center without an extensive nurse recruitment effort? Our 610-bed regional academic medical center faced that question in 2008 when it became one of 11 state-designated comprehensive stroke centers and began to attract critically ill stroke patients for complex new treatment options.

The Neuroscience Nurse Clinician program was launched in 2009 to provide the hospital's RN staff with an avenue for clinical and professional advancement in the specialty. Twenty nurses enrolled in the 12-month program, whose benefits included monthly seminars taught by neuro-specialty physicians and APNs; paid membership in the American Association of Neuroscience Nurses (AANN); a 2-day, off-site CNRN review course; and observational experiences in private neurology practices, the OR and endovascular suite, acute stroke team responses, and the Trauma ICU.

The support of nurse managers was critical to the success of the program, which required flexible staff scheduling and 24 hours of paid educational time for each participant. In its first year, the Neuroscience Nurse Clinician program graduated 14 CCRNs and 6 telemetry RNs to staff the hospital's emerging Neurointensive Care Unit and Neuroscience Stepdown Unit. Twenty-five RNs are enrolled in the program in 2010.

APNs close treatment gaps

Although the number of U.S. stroke centers soared in the last decade, national rates of acute stroke treatment with I.V. t-PA still remain extremely low.[2] There's a major shortage of vascular neurologists, and many community hospitals—particularly in rural

areas—have limited or no access to in-person neurology services.

The innovative NET SMART APN program was launched in 2007 "to develop a critical mass of APNs capable of providing neurovascular clinical practice leadership."[2] The Neurovascular Education and Training in Stroke Management and Acute Reperfusion Therapy (NET SMART) APN program is a self-paced, distance-learning, academic stroke fellowship for APNs. In addition to completing online learning modules and tests, APNs also gain direct clinical practice experience with a local physician-supervisor, in accordance with their state's APN scope of practice standards.

The capstone of the NET SMART APN program is an 80-hour residency with the Acute Stroke Team at the University of Alabama, Birmingham Stroke Center, which has one of the highest acute stroke treatment rates in the nation. To date, 12 APNs have graduated and taken on new stroke leadership roles in their institutions.

Don't compete—Collaborate!

All hospitals that receive stroke patients need to regularly ask (and honestly answer) the related questions: Where are our institutional gaps in stroke care? Which patients should be triaged to a higher level of stroke care?

Consider Stephen, a healthy 21-year-old college student who has a generalized seizure in the pool during a swimming competition. He's taken to a nearby 250-bed community hospital for evaluation, where a STAT CT scan of the brain demonstrates a subarachnoid hemorrhage (SAH), possibly caused by bleeding from a cerebral aneurysm. The hospital has an ICU and a staff neurosurgeon. Based on this information, should Stephen be treated there or transferred out to a higher-level facility?

Aneurysmal SAH is widely acknowledged as the most lethal, disabling type of stroke. Up to one-third of SAH patients die before arriving at the hospital; many experience secondary brain injury from rebleeding and/or vasospasm in the first 30 days; and most patients who survive experience some degree of lasting disability.[3] In this subgroup of stroke patients, the decision to keep a patient or to transfer can have life-or-death consequences.

The patient always comes first

Outcome studies have consistently shown that hospitals and surgeons that treat higher numbers of SAH patients have lower mortality and improved neurologic outcomes. Available treatment modalities also contribute to positive outcomes after SAH. Patients treated at hospitals that offered only traditional surgical care for SAH (open craniotomy and aneurysm clipping) were more likely to die or suffer secondary brain injury, compared with patients treated at institutions that offered both surgical and endovascular (catheter-based) treatments, such as aneurysm coiling and balloon angioplasty for vasospasm.[3]

Returning to our patient Stephen, the decision to admit or transfer should include the following questions:

- How many SAH cases does the smaller hospital treat annually?
- Is there a neurosurgeon with endovascular capabilities who regularly treats SAH and its delayed complications, and is available 24/7?
- Do the critical care physicians and RNs have experience in the complex postoperative care of the SAH patient?
- Is there an available bed at an advanced stroke center and a readily available critical care transport team?

These questions need to be addressed long *before* the critically ill stroke patient arrives—ideally, in a regional "blueprint" for stroke care delivery that's freely shared with prehospital providers. Some of the most outstanding stroke success stories in the United States have come from the adoption of a "hub-and-spoke" model of care that links smaller hospitals with large regional stroke centers through telemedicine, emergency medical services (EMS) routing protocols, air transport teams, and shared expertise.[4]

Hospitals should also plan in advance for other stroke patient subgroups for which expedited transfer may be critical: postsurgical patients who can't receive I.V. t-PA, pregnant women, children, and patients with severe brainstem stroke.

Hard-wiring best practices

Regardless of how far along your institution is in its stroke care development, don't reinvent the wheel. In the 21st century, evidence-based stroke care protocols and order sets, policies and procedures, educational plans, and data collection tools are often just a phone call or a mouse-click away and are easily modifiable for use at your institution. Here are possible sources:

- Does your state or region have a consortium of stroke nurse coordinators, emergency physicians, or EMS providers who meet regularly to share stroke resources and tools?
- Is there a major stroke center in your region or state? Leading academic stroke centers are often happy to share "best-practice" resources with smaller hospitals, including web links to stroke order sets and protocols.
- Do you belong to an organization that helps stroke professionals to network and share resources? The American Heart Association, the

tional Stroke Association, and
AANN are organizations that
er excellent forums for network-
; and sharing practice tools.
Also examine your own institu-
n's existing protocols for AMI or
uma as a possible model. How
you communicate with prehospi-
providers? What types of assess-
nt information are shared before
patient arrives? Which depart-
nts are put on "standby" or
rt? Who's on the treatment team,
d how are they alerted? What are
time goals for physician call-
k, in-person team response, lab
d radiology turnarounds, and
dication delivery? What's the
ality improvement and reporting
cess? Remember that it's always
ier to build on a "hard-wired"
cess that's working well, than to
ate a new one.

ing public with quality

oke has moved to center stage
the public's attention. Since The
nt Commission implemented its
mary Stroke Center Certifica-
n program in 2003, over 600 U.S.
spitals have achieved and main-
ned certification. A growing
mber of state legislatures and
partments of Health have also
roduced initiatives to improve
oke care, including Florida,
orgia, Illinois, Maryland, Mas-
husetts, Missouri, New Jersey,
w York, North Carolina, Okla-
na, Virginia, and Washington
te.[5]

Stroke quality measurement
s standardized in 2007, when
major stroke quality overseers
eed to a common set of defini-
ns and measures.

Key players in stroke quality over-
ht in 2010 include the National
ality Forum, the American Stroke
sociation (ASA), and The Joint
mmission. In 2009, the Centers
Medicare and Medicaid Services (CMS) announced the introduction of new core measures in stroke care. Hospitals may voluntarily use stroke core measures to satisfy their ORYX reporting requirements in 2010. However, CMS may require mandatory reporting of stroke core measures as soon as 2012; "pay-for-performance" bonuses for hospitals that provide highest-quality stroke care may soon become common among all payers.

The power of shared knowledge

The American Heart Association's *Get with the Guidelines–Stroke* (*GWTG-Stroke*) program is an example of a quality improvement program that can drive the quality of stroke care in real time, at the level of bedside care. More than 1,100 U.S. hospitals have adopted *GWTG-Stroke* as their framework for stroke performance improvement, and over 1 million patient records have now been entered in the nation's largest stroke registry.

The *GWTG-Stroke* program is used by a majority of The Joint Commission-certified Primary Stroke Centers to meet performance improvement standards. It also allows hospitals to compare their performance on dozens of stroke quality measures with other participating *GWTG-Stroke* hospitals.

Nurses at all levels of stroke care delivery can use *GWTG-Stroke* to access a wealth of information that can improve clinical care and the health of their communities. Here are a few examples of research questions for which data can quickly be retrieved and analyzed:

Table 2: Stroke quality measures

The eight stroke quality measures approved by CMS in 2010 include:

1. Deep vein thrombosis prophylaxis by end of hospital day 2
2. Discharged on antithrombotic therapy
3. Patients with atrial fibrillation/atrial flutter receive anticoagulant therapy at discharge
4. Thrombolytic (I.V. t-PA) therapy administered
5. Antithrombotic therapy begun by end of hospital day 2
6. Discharged on statin medication
7. Stroke education provided
8. Assessed for rehabilitation

CMS didn't approve two prior measures—dysphagia screening before any oral intake and smoking cessation were removed from the list in 2010, although they continue to be important clinical interventions for all stroke patients.[6]

Resources

American Association of Neuroscience Nurses: http://www.aann.org

American Heart Association/American Stroke Association, Professional Resources (scientific statements, guidelines and practice advisories): http://www.americanheart.org/presenter.jhtml?identifier=3004586

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

Get with the Guidelines-Stroke: http://www.americanheart.org/presenter.jhtml?identifier=1165

National Stroke Association: http://www.stroke.org

NET SMART Fellowship Program: http://www.netsmart-stroke.com

The Joint Commission, Disease-Specific Care Certification, Primary Stroke Centers: http://www.jointcommission.org/CertificationPrograms/PrimaryStrokeCenters

How long do patients in our community wait before coming to the ED with acute stroke symptoms? What are the differences in stroke type, patient age, and risk factors between the white and African American patients that we treat? Are I.V. t-PA "door-to-needle" times consistent at my hospital, or are there particular hours or days of the week when the acute stroke protocol doesn't meet time targets such as, change of shift, nights, or weekends)?

Nurses can also use *GWTG-Stroke* to create individualized patient education materials and discharge summaries for stroke patients to bring to their primary care providers after discharge.

The "century of the brain" is here

Stroke care is one of the most rapidly evolving specialties in 21st century medicine. In the last 12 months alone, the ASA has released 10 scientific statements and clinical practice guidelines, while the fields of endovascular neurosurgery and critical care medicine continue to develop new tools for brain rescue. Nurses who lend their talents—whether clinical, administrative, or managerial—to this specialty area will be challenged, as well as gratified by the extraordinary degree to which their knowledge and skills can literally change a patient's future. NM

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The author has disclosed that she has no financial relationships to this article.

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oke care in the 21st century

pose: To provide the professional registered nurse with an update on evidence-based clinical and management practices that improve stroke outcomes.
rning Objectives: After reading the preceding article and taking this test you should be able to: 1. Describe the types and contributing factors for strokes. Identify management approaches for advanced stroke care. 3. Discuss ways of preparing organizations to provide optimal stroke care.

Which statement *doesn't* reflect current roaches to successful stroke rescue?
's always time-sensitive.
: begins long before hospital arrival.
's community-based.
's always noninvasive.

he latest stroke treatment options include all he following *except*
n extended time-window for treatment with V. t-PA for many patients.
ne ability to begin interventional treatment prior o hospital arrival.
ew "endovascular rescue" devices.
ne ability to combine pharmacologic and nicrosurgical approaches.

Which statement is true about U.S. hospitals' paredness for stroke rescue?
Most U.S. hospitals currently offer the full pectrum of advanced stroke treatments.
The Joint Commission requires all hospitals to oin a regional stroke care system by 2015.
A pre-established protocol is unnecessary for roviding basic stroke care.
A proactive model of stroke care should be dopted by all hospitals.

pproximately how many certified neuroscience istered nurses were in the United States in 2009?
50 c. 12,000
,300 d. 44,000

Ine of the most common contributing factors acute ischemic stroke is
tructural heart defect.
hypercoagulable state.
therosclerosis.
evere hypotension.

ntra-arterial thrombolytic medications
ave FDA-approval.
an be given up to 12 hours after symptom onset.
re used in combination with I.V. t-PA and devices.
re contraindicated with I.V. t-PA for stroke reatment.

7. Hemicraniectomy is used
a. to treat a typical stroke in combination with intra-arterial alteplase.
b. to treat a massive stroke with uncontrollable increased intracranial pressure.
c. in combination with induced hyperthermia and I.V. t-PA.
d. typically in combination with induced hyperthermia and clot aspiration.

8. Non–life-threatening intracerebral hemorrhage is usually managed with
a. critical care.
b. surgical care.
c. I.V. t-PA.
d. endovascular placement of a stent.

9. Cerebral angiography with placement of coils, stents, and/or glue embolization is typically used to treat
a. intracerebral hemorrhage.
b. subarachnoid hemorrhage.
c. acute ischemic stroke.
d. atherosclerotic stroke.

10. Which program provides the RN with clinical and professional specialty advancement in neuroscience?
a. NET SMART APN program
b. Stroke "Drip-and-Ship" program
c. Primary Stroke Center Certification program
d. Neuroscience Nurse Clinician program

11. Aspects of the Neuroscience Nurse Clinician program include all *except* that
a. it's a 12-month program.
b. it includes monthly seminars taught by neuro-specialty physicians and APNs.
c. it includes a 12-day, off-site CNRN review course.
d. it includes paid membership in the American Association of Neuroscience Nurses.

12. Which program for nurses includes an 80-hour residency at a university stroke center?
a. NET SMART APN program
b. *GWTG-Stroke* program
c. Neuroscience Nurse Clinician program
d. Primary Stroke Center Certification program

13. The most lethal, disabling type of stroke is the
a. acute ischemic stroke.
b. aneurysmal SAH.
c. atherosclerotic stroke.
d. intracerebral hemorrhage.

14. Which statement about aneurysmal SAH survival is accurate?
a. Up to one-third of these patients die before arriving at the hospital.
b. Most patients experience secondary brain injury from rebleeding in the first 3 days.
c. Most surviving patients don't experience any lasting disability.
d. Most patients don't survive the ED experience.

15. Which isn't associated with lower mortality rates and improved neurologic outcomes for SAH?
a. Hospitals that offer both surgical and endovascular treatments.
b. Hospitals that offer traditional surgical care only for SAH.
c. Surgeons that treat higher numbers of SAH patients.
d. Hospitals that treat higher numbers of SAH patients.

16. The "hub-and-spoke" model refers to
a. linking smaller hospitals with large regional stroke centers.
b. extending a Neuroscience Nurse Clinician program to rural hospitals.
c. dispatching a specialized stroke transport team from a centralized call center.
d. a plan for expediting transfer of high risk stroke subgroups to stroke centers.

17. Which *isn't* one of the eight stroke quality measures approved by CMS in 2010?
a. deep vein thrombosis prophylaxis by end of hospital day 2
b. discharged on antithrombotic therapy
c. I.V. t-PA therapy administered
d. smoking cessation

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.	○	○	○	○	6.	○	○	○	○	10.	○	○	○	○	14.	○	○	○	○					
.	○	○	○	○	7.	○	○	○	○	11.	○	○	○	○	15.	○	○	○	○					
.	○	○	○	○	8.	○	○	○	○	12.	○	○	○	○	16.	○	○	○	○					

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