

CONSIDERATIONS FOR STROKE CENTER DEVELOPMENT



What are key considerations for organizations evaluating whether to expand stroke services?

Overview

Stroke care has evolved significantly over the past several years, with advances including the adoption of mechanical thrombectomy as standard of care for acute ischemic stroke and, more recently, guideline updates expanding eligibility criteria for this procedure. New care models are emerging amid demand for advanced interventions. In some cases, this involves a shift from the traditional hub-and-spoke model centered on the comprehensive stroke center (CSC) toward a network-based approach of strategically placed services throughout a market or region to help address logistical challenges related to stroke care. Continued development in stroke networks that helps to balance fast access with effective deployment of limited specialty expertise will support strong growth in advanced services (eg, tissue plasminogen activator [tPA], endovascular procedures). As efforts in the acute care setting help to reduce deficits while driving demand for functional rehabilitation, organizations will need to collaborate across continuing care settings to meet the evolving needs of stroke survivors.

Given these opportunities and continued challenges, managing the stroke portfolio is a major area of focus as organizations look to capture growth and increase access. For those evaluating service expansion or moving toward a higher-level stroke designation, numerous market-specific factors will impact the likelihood of successful adoption. Key areas to consider include geography, market competition, stroke network strength and emergency medical service (EMS) triage protocols.

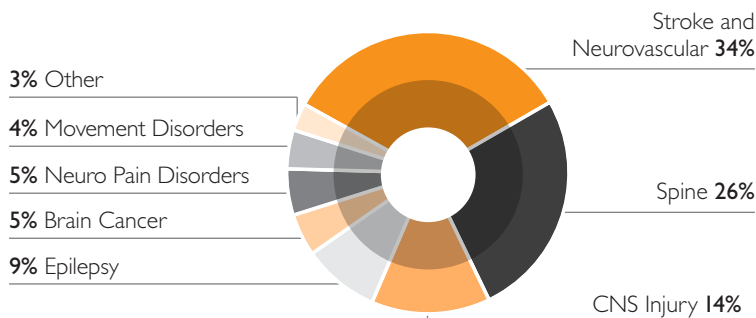
Drivers of Growth in Stroke and Neurovascular Services

Within the neurosciences service line, stroke and neurovascular disease represent a significant portion of inpatient volumes and source of growth (Figure I). Over the next decade, access to thrombolysis and mechanical thrombectomy for ischemic stroke will increase, driven by thrombectomy adoption and expanding eligibility criteria, as well as novel access models (eg, mobile stroke units and other prehospital interventions) that will hasten onset-to-treatment times.



FIGURE I. IP NEUROSCIENCES AND SPINE DISCHARGES
US MARKET, 2018

Total Volume: 2.7 Million



Note: Analysis excludes 0–17 age group and includes the neurosciences and spine service lines and the Brain/Central Nervous System (CNS) Cancer CARE Family from the cancer service line. CNS injury includes concussion, late effects of neuro trauma, paralysis, skull fracture and major brain injury, and spinal cord injury. Movement disorders include Parkinson disease, multiple sclerosis and demyelinating diseases. Neuro pain disorders include headache/migraine, neuro pain and neuropathy. Other includes hydrocephalus and spina bifida, neurologic disease—other, and sleep disorders. Stroke and neurovascular includes ischemic and hemorrhagic stroke, transient ischemic attack (TIA), and neurovascular diseases.

Sources: Impact of Change®, 2018; HCUP National Inpatient Sample (NIS). Healthcare Cost and Utilization Project (HCUP) 2015. Agency for Healthcare Research and Quality, Rockville, MD; Claritas Pop-Facts®, 2018; Sg2 Analysis, 2018.

For neurovascular disease, the identification of neurovascular abnormalities, including unruptured cerebral aneurysms and arteriovenous malformation (AVM), will increase through the continued use of head and neck imaging. Declines in stroke incidence have plateaued, and rates have begun to rebound in younger patients, with persistent risk factors such as obesity and hypertension among the contributors. Inpatient treatment and procedure volumes will continue to grow for patients who are at risk of hemorrhagic bleeds. Aneurysms at bifurcations, larger aneurysms and aneurysms in hard-to-reach locations are increasingly targeted for treatment. However, technological advances will reduce the need for repeat procedures (such as those seen with coiling embolization), attenuating growth later in the decade. Patients with TIA who do not require an emergent procedure will increasingly be managed in observation units, reducing inpatient admissions for this patient population.

In the outpatient setting, improved care coordination and Systems of CARE will drive increases in the use of disease management services. Increased awareness of stroke (driven by the presence of strong stroke care in the market) enables early recognition and drives more patients to the ED for stroke-related symptoms. Clinical care advances, increased stroke survivorship and other factors will drive continued growth for follow-up care with imaging, evaluation and management visits, and OP rehabilitation. Patients who have received a prophylactic procedure (eg, inpatient aneurysm coiling) will be more likely to have follow-up MRI and MR angiography exams when there is a clinically integrated System of CARE. In addition, the adoption of telestroke services will increase the use of virtual visits, and organizations will increasingly explore telerehabilitation to support recovery.



Evolving Care Delivery Models

Since the release of [the Joint Commission’s comprehensive stroke center certification](#) in September 2012, many organizations have evaluated the feasibility of attaining this level of designation. As stroke intervention advanced with the release of the 2015 guidelines supporting endovascular interventions for acute ischemic stroke (and 2018 updates expanding eligibility criteria), a level between primary and comprehensive certification emerged in which thrombectomy began to be performed at primary stroke centers (PSCs). In fact, by early 2018, an estimated [one-third of the Joint Commission’s certified primary stroke centers were performing mechanical thrombectomies](#). Supporting this trend, the Joint Commission collaborated with the American Heart Association/American Stroke Association to launch the thrombectomy-capable stroke center designation in January 2018 as an effort to assign criteria for stroke center development at this level. However, debate is ongoing surrounding the specifics (eg, training and volume requirements), and additional dialogue is needed among stakeholders.

Some markets have seen a shift from the traditional hub-and-spoke model centered on the comprehensive stroke center and movement toward a network-based approach where services and resources are strategically placed throughout a market or region. Sg2 expects this shift to continue as advances in treatment elevate the need to balance fast access with effective deployment of limited resources.

Stroke Center Accreditation

Today, there are 3 organizations that accredit stroke center programs: the Joint Commission, DNV GL and the Healthcare Facilities Accreditation Program. Although the majority of programs are certified through the Joint Commission, specific requirements and processes vary among accrediting bodies. Organizations pursuing accreditation must consider several factors, including current strengths, capabilities and state requirements for stroke center designation (eg, some states designate centers through their department of health while other states recognize only Joint Commission certification).

Table I includes some of the requirements for stroke center certifications, including for acute stroke-ready, primary stroke, thrombectomy-capable and comprehensive programs. For a complete list, reference [the Joint Commission’s stroke certification requirements](#).

TABLE I. STROKE CENTER DESIGNATION CRITERIA

ACUTE STROKE-READY PROGRAM	PRIMARY STROKE CENTER	THROMBECTOMY-CAPABLE STROKE CENTER	COMPREHENSIVE STROKE CENTER
<ul style="list-style-type: none"> • Dedicated stroke-focused program • Acute stroke expertise on-site or via telemedicine/telestroke • 24/7 imaging (CT); IV tPA • Transfer protocols with PSC/CSC • Streamlined flow of patient information • Use of data to improve quality of care 	<ul style="list-style-type: none"> • 24/7 neurology coverage • CT/MR in the ED • tPA • Community education • Transition to rehabilitation • Complication management 	<ul style="list-style-type: none"> • 24/7 thrombectomy • Minimum case volume • Training and workforce • Dedicated ICU beds 	<ul style="list-style-type: none"> • 24/7 interventional and neurosurgical coverage • Interventional treatments for stroke • Aneurysm and hemorrhagic stroke care • Neuro ICU

Sources: The Joint Commission website. Accessed November 2018; Sg2 Analysis, 2011–2018.

The range of available stroke designations will continue to evolve. In the future, certifications are expected to emerge whereby organizations are certified at the system level rather than by individual institution. This evolution toward system-level certification highlights the increasing emphasis on stroke networks and the ability to function across a geography as opposed to individual sites.



Care Delivery Models

As organizations look to navigate the logistical challenges associated with advanced stroke treatment, care delivery models are evolving. Common strategies include partnerships, rationalization and network-based approaches to stroke services. However, the ideal model will be highly dependent upon local market dynamics (eg, EMS triage, competition, geography, telestroke network strength) and resource availability.

- **Partnerships** can include collaborative programs between health systems and physician groups, with components such as joint programs or “leasing arrangements” among multiple health systems or shared community-based specialists. For leasing arrangements, Sg2 has spoken with health systems that have implemented this model using neurointerventionalists from one institution who were deployed to agreed-upon acute care sites of a partnering organization to provide emergent neurointerventional coverage. While early experiences with this model have highlighted its potential to increase access and interventional volumes for all parties, one downside is the risk associated with reliance on another institution for critical workforce, which may lead to instability if unmitigated.
- **Rationalization** involves the relocation, consolidation and, in some instances, elimination of particular services to improve efficiency. One health system on the West Coast took this approach to shift and decentralize its program in order to increase its regional presence. The organization chose to decertify one of its primary stroke centers to ensure that patients would be routed to a centrally located acute care site it had designated to provide the bulk of care for emergent cases.
- **Network** models use an enterprise-level strategy to coordinate and deliver care, integrate services across multiple sites, and deploy workforce at the regional level. The following case study outlines a regional network approach to stroke services by a multihospital health system.

CASE STUDY

Integrated Stroke System Approach Balances Market Demand With Resource Availability

A multihospital health system has several of its acute care sites involved in the stroke program. Recognizing that the existing distribution of stroke services—with comprehensive centers primarily centralized downtown—coupled with traffic conditions were posing a barrier to timely access to advanced treatment, the organization identified a need for an internal network-based approach to placement of resources across the geography.

INITIATIVES

- Rather than requiring that all patients go downtown for advanced stroke care, the program looked to identify which services should be pulled out into the community to maximize access without unnecessary duplication.
- Four acute care sites were identified as most appropriate to support higher-level stroke care. Each provides urgent/emergent stroke services (eg, thrombectomy) and postprocedure care and has capabilities, coverage and expertise similar to a comprehensive stroke center. While emergent cases will be routed to any of the 4 sites, niche populations (eg, subarachnoid hemorrhage, cases requiring open surgeries) are generally routed to a specific center where patients expected to need significant longer-term ICU care may be transferred to 1 of 2 specific centers.
- The workforce includes a growing group of neurointerventionalists responsible for covering the 4 sites. Their backgrounds include neurosurgery as well as neurology and interventional radiology.
- Challenges and ongoing efforts include standardization and optimization (eg, in imaging, triage and transfer processes) across facilities.

EXPECTED IMPACT AND KEYS TO SUCCESS

- The program's structure provides flexibility to customize where a patient is taken based upon the patient's needs, but it avoids unnecessary duplication across the system.
- It provides EMS with reliable, consistent options for patients to receive standard of care closer to home.
- The keys to success include a foundation of integration and strong governing structure within the neurosciences.
- The role of stroke coordinators at each site is instrumental to pulling off the transition from individual stroke centers toward an integrated stroke system.

Source: Sg2 Interview, August 2018.



Key Considerations

To determine whether advanced stroke services or certification is right for your organization, assess whether volumes will be sufficient to support the significant workforce and infrastructure requirements and whether local market dynamics (eg, EMS protocols, proximity to other stroke centers) create an environment where designation will be beneficial. Consider the following key questions in your assessment.

What Population-Based Estimates for Eligibility Are Available?

Population-based estimates for eligibility for stroke intervention vary, though the estimate that Sg2 most commonly encountered following the initial 2015 guideline changes was in the 7% to 13% range for ischemic strokes. However, the proportion of eligible ischemic strokes will broaden as stronger Systems of CARE reduce prehospital delay and onset-to-treatment times and as eligibility criteria evolve. Following the DAWN trial (which illustrated the efficacy of thrombectomy treatment within the 6-to-24-hour window), it's been suggested that the [extended time window might boost the eligible stroke population by an additional 2% to 5%](#).

While significant gains have been made since 2015, there is still much work to be done to close the gap between the eligible patient population and those who currently receive treatment. Illustrating this point, a 2017 study using data from the Get With The Guidelines registry found [an increase in adoption of mechanical thrombectomy](#) since the publication of the 2015 trials, citing that the number of patients obtaining the procedure increased from ~2% to over 3% for all ischemic strokes in the US.

Regarding national demand for advanced stroke services, it is estimated that up to 250 comprehensive stroke centers are needed, roughly translating to 1 comprehensive center per 1.2 million people. However, these estimates refer to fully comprehensive centers (with sufficient subarachnoid hemorrhage and aneurysm clipping/coiling volumes).

What Volumes Are Needed to Ensure Quality?

It is critical to consider the minimum volumes required to make a program viable—from both quality and financial perspectives. Below are several recommendations and consensus statements that speak to volume and other requirements for neurointerventional procedures. However, it is important to note that the volume and training criteria required for thrombectomy-capable centers remain a topic of debate.

- The [2018 international consensus statement for acute ischemic stroke intervention](#) recommends a minimum of 50 intracranial thrombectomy procedures for emergent large vessel occlusion per center per year and a minimum of 15 acute intracranial thrombectomy procedures per neurointerventionalist per year.
- The [2016 recommendations for mechanical thrombectomy from the Society of Vascular and Interventional Neurology](#) (SVIN) suggest a minimum of 25 mechanical thrombectomy–treated patients per center annually and a minimum of 10 mechanical thrombectomy procedures per affiliated neurointerventionalist.
- As of late 2018, [to be eligible for the Joint Commission's thrombectomy-capable stroke center designation](#), it is expected that an organization have experience in performing 15 mechanical thrombectomies over the course of 12 months or 30 over 24 months.
- Based on the Brain Attack Coalition's 2005 consensus statement *Recommendations for Comprehensive Stroke Centers*, annual volume requirements for the Joint Commission CSC designation include 15 clippings or coilings for aneurysm.



Are Facility Requirements Currently in Place? If Not, Will It Be Possible to Build Them?

Organizations considering advanced stroke services and/or obtaining advanced certification will need to either have the required infrastructure in place or be willing to invest in it. For many organizations, the need for dedicated neurocritical care beds and the ability to provide 24/7 neurocritical care coverage are major barriers to pursuing comprehensive status. Building this infrastructure entails significant investment and will require enough volume to justify (and retain) a neurointensivist. The basic elements of a modern neuro ICU include:

- Dedicated beds with equipment for monitoring neurophysiology (eg, intracranial pressure)
- Video electroencephalogram monitoring
- Transcranial Doppler imaging
- Mobile CT
- Neurosciences-trained nurses
- 24/7 access to a neurosciences-trained physician
- Private beds

Additionally, for key components of interventional labs performing stroke intervention, SVIN's 2016 consensus paper outlines [Stroke Interventional Laboratory Consensus criteria](#) developed by the society. The paper provides guidance on standardized protocols for stroke workflow optimization as well as insight into infrastructure requirements (eg, staffing, facility needs, medical inventory).

Is the Necessary Workforce Attainable, and Will Volumes Sustain 24/7 Call Coverage?

Recent developments in acute ischemic stroke treatment have increased demand for endovascular services, shifting the supply-demand balance as organizations seek to expand endovascular expertise. However, not all programs will have the volumes (both emergent and elective) to support investment in workforce and other resources required to provide comprehensive care. Another important consideration is the background of the neurointerventionalist, who may come from neurology, neurosurgery or interventional radiology. Assessing demand for these 3 subspecialties within an organization and the role they might play in rounding out the broader stroke or neurosciences program when they aren't providing stroke coverage may help to build your case.

In some markets, organizations that do not have an adequate internal workforce may create arrangements with shared community-based neurointerventionalists to provide stroke intervention or consider other partnerships, as described previously. These arrangements focus on the ability to provide advanced treatments rather than supporting CSC designation.

Additionally, it will be critical to assess training needs among staff (eg, ICU nurses) who will care for stroke patients, which may be a significant transition for those organizations that are adding interventional services or other advanced offerings at a site for the first time.

Has a Stroke Champion Been Identified?

As with any major initiative, success will hinge on having a program champion with a vision for delivering comprehensive stroke care. Identifying potential candidates requires careful consideration and can be a challenging process. The ideal candidate should be passionate about stroke care and motivated to primarily focus his/her practice in this area. It will be important to ensure that this person is a leader who can bridge gaps among disparate perspectives and is willing to invest the energy required to move the program forward. Finally, as you seek program growth, an effective public speaker who can relate to patient and family needs will be needed to speak to the program's benefits and effectiveness (both to the public and to EMS, spoke sites and others).

In addition to workforce, market-specific factors, including competitive landscape, geography that impacts transportation and EMS triage, will influence a center's ability to capture volume.



What Is the Current Level of Care Offered by Other Stroke Providers in the Primary and Secondary Market?

Stroke center status alone does not necessarily guarantee incremental volume or greater market share. However, it is important to assess your local market competition. Is another organization already a comprehensive center or primed to move to comprehensive status? If so, does its designation pose a risk to your program's continued success? In addition, when considering your leadership position within a telestroke network, does the lack of certification create challenges or risks such that existing or potential referring sites will choose an alternative hub?

What Are EMS Triage Protocols for Stroke Patients?

As triage protocols evolve, organizations not offering thrombectomy may be at risk of losing stroke volumes that will bypass to other centers. If your organization falls within this category, it is especially important to review the criteria emerging in your area for EMS stroke care triage and routing as well as identify the latest protocols for stroke patients. Does your state/county currently direct EMS to thrombectomy-capable or comprehensive stroke centers, and is there any legislative movement that might change EMS protocols in the near future? Also, would your system be covering an area that spans multiple counties? As development of state stroke legislation continues, these factors will be important to consider.

Sg2 Perspective

- As organizations consider strategies to expand access and capture high-growth neurointerventional volumes, numerous market-specific factors must be taken into consideration. **Leverage Sg2 analytics and expertise** to help assess the opportunity in your market.
- Stroke-care specialists are becoming increasingly important. **Utilize dedicated providers** and advanced practitioners to balance inpatient stroke coverage with access to follow-up in the outpatient setting.
- The patient pool for available interventions will broaden. Continue to **assess stroke protocols** to ensure appropriate access and **prepare for increasing competition** for interventional volumes.
- Advancements in acute stroke therapy will continue to drive down demand for intensive inpatient rehabilitation services. **Enhance collaboration with continuing care providers** to plan for the changing post-acute needs of stroke survivors.
- **Build and manage the portfolio of stroke services at the system level**, ensuring that goals align with local needs and considering both quantitative and qualitative factors (eg, geography, EMS triage protocols).
- **Align stroke and neurovascular programs with market demand and resource availability.** Comprehensive stroke care requires significant infrastructure and resources. Table 2 provides a road map of key services, workforce and technologies associated with basic, intermediate and comprehensive programs.



TABLE 2. STROKE PROGRAM ROAD MAP: KEY SERVICES, TECHNOLOGIES AND STAFFING

	BASIC	INTERMEDIATE	COMPREHENSIVE
SERVICES	<ul style="list-style-type: none"> Stroke triage Neuroimaging Inpatient and outpatient rehabilitation 	<ul style="list-style-type: none"> Primary stroke center (designated) Thrombectomy-capable center (designated) TIA clinic Nurse navigation PM&R program 	<ul style="list-style-type: none"> Comprehensive stroke center (designated) Neurocritical care unit Aneurysm and AVM repair
TECHNOLOGIES	<ul style="list-style-type: none"> CT tPA Telemedicine/telestroke 	<ul style="list-style-type: none"> Mechanical thrombectomy Neurological biplane CT/MRI angiography CT/MR perfusion Stereotactic radiosurgery Image-guided surgery systems 	<ul style="list-style-type: none"> Mechanical thrombectomy Aneurysm coils, clips and stents Pipeline device
STAFFING	<ul style="list-style-type: none"> ED and EMS staff Internists Neurologists Physical therapists Stroke nurse coordinator 	<ul style="list-style-type: none"> Interventional neuroradiologists Physiatrists Neuropsychologists or neuropsychiatrists Neurosciences nurses (including APNs) 	<ul style="list-style-type: none"> Cranial neurosurgeons Neurointensivists Neuropathology specialists

Note: Columns are additive. A comprehensive program will include all service offerings. APN = advanced practice nurse; PM&R = physical medicine and rehabilitation.

Sg2 RESOURCES

- **Analytics: Impact of Change[®] Forecast**
- **Resource Kit: Growing Your Neurosciences Service Line**
- **You Asked: Addressing Neurology Inpatient Coverage—Neurohospitalist Models and Beyond**

Sources: Powers WJ et al. *Stroke*. 2018;49(3):e46–e110; Higashida R et al. *Stroke*. 2013;44(10):2961–2984; McMeekin P et al. *Eur Stroke J*. 2017;2(4):319–326; Bhole R et al. *J Neurointerv Surg*. 2017;9:225–228; Smith EE et al. Rapid increase in endovascular thrombectomy for acute ischemic stroke in the United States: data from Get With the Guidelines—Stroke. Presented at 2017 International Stroke Conference, February 2017, Houston, TX; Commins J. Joint Commission launches new stroke certificate—identifies hospitals that meet standards for performing mechanical endovascular thrombectomies. *Medpage Today*. February 4, 2018; Hughes S. Sharp increase in US stroke thrombectomy after major trials. *Medscape*. March 3, 2017; Hughes S. DAWN: thrombectomy effective up to 24 hours after stroke. *Medscape*. May 17, 2017; Alberts MJ. *Update on CSCs and Acute Stroke Care*. 2013; Shams T et al. *Interv Neurol*. 2016;5(1–2):1–28; English JD et al. *Interv Neurol*. 2016;4(3–4):138–150; The Joint Commission website. Accessed September 2018; Rai AT et al. *J Neurointerv Surg*. July 15, 2016 [Epub ahead of print]; Alberts MJ et al. *Stroke*. 2005;36(7):1597–1616; Chia NH et al. *Stroke*. 2016;47(5):1377–1380; Pierot L et al. *J Neurointerv Surg*. 2018;10:1121–1126; The Joint Commission. Certification for thrombectomy-capable stroke centers. Accessed December 2018; The Joint Commission. Training and volume requirements for individual physicians in stroke certification suspended. Accessed December 2018; The Joint Commission. The Joint Commission stroke certification programs—program concept comparison. Accessed December 2018; The Joint Commission. Facts about advanced certification for comprehensive stroke centers. September 2012; Sg2 Analysis, 2016–2018.