<u>2020 Report to the Virginia General Assembly</u>

Data-Driven Action Steps and Statewide Capacity Building Pursuant to Stroke Care Quality Improvement in Virginia

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Executive Summary

The 2018 Virginia General Assembly passed legislation, HB1197 and SB867, to amend the Code of Virginia § 32.1-111.15:1 to require the Virginia Department of Health (VDH) to implement systems for data collection and information sharing, apply evidence-based guidelines for community-based follow-up care, and implement quality improvement initiatives to improve the quality of stroke care. VDH convened a Virginia Stroke Care Quality Improvement (VSCQI) Advisory Group to provide recommendations for quality improvement across the Commonwealth.

The purpose of this report to the Virginia General Assembly is to provide updates on the progress to date on the implementation of data-driven action steps and building statewide capacity pursuant to § 32.1-111.15:1. Legislation implementation processes, recommendations and promising practices are outlined under the following requirements of this legislation:

- Implement systems to collect data and information about stroke care;

- Facilitate data sharing and collaboration;

- Apply guidelines for transitioning patients to community-based follow-up care; and

- Establish a process for continuous quality improvement.

History and Overview of Organized Approaches to Improving Stroke Care in Virginia

Organized approaches to improving stroke care and systems across Virginia have strengthened over the past decade. In 2006, VDH and the American Heart Association/American Stroke Association (AHA/ASA) followed the Recommendations for the Establishment of Stroke Systems of Care to spearhead the development of a work plan designed to be a strategic roadmap for improving stroke systems (Task Force, 2005). In 2007, the legislative Joint Commission on

Health Care (JCHC) conducted a study to develop strategies to address stroke prevention and care across the Commonwealth. The JCHC staff convened a cross-sectional subject matter expert workgroup that met several times to review stroke systems of care in Virginia. Notably among the recommendations approved by the JCHC was the requirement that VDH convene a standing Virginia Stroke Systems Task Force (VSSTF) (Virginia Stroke Systems, 2007).

Since its creation in 2007, the VSSTF has addressed improvement in Virginia's stroke systems by convening strategy meetings focused on the stroke systems work plan, topics referred from the stroke systems workgroup, outcome analysis of interventions, and other stroke issues and concerns as necessary. Membership includes hospitals, EMS, government entities, not-for-profit organizations, professional associations, legislators, telemedicine and pharmaceutical companies, and healthcare professionals including, but not limited to, neurologists, nurses, emergency medicine physicians, pharmacists, physical therapists, and speech-language pathologists. With the large number of hospital-designated stroke coordinators within VSSTF, the Virginia Stroke Coordinator Consortium (VSCC) emerged in 2009 to promote evidence-based care in hospitals, improve statewide and local collaborative partnerships, and serve as mentors, coaches, and resources for Virginia hospitals (Virginia Stroke Coordinators, 2009).

With a commitment to improving the quality of stroke care and building effective stroke systems, VSCC has raised awareness of stroke center certification and acute stroke treatments in hospitals. In recent years, VSCC has focused on improving acute ischemic stroke care by reducing door-to-needle times for eligible patients treated with intravenous tissue plasminogen activator (tPA), also known as alteplase, among hospitals statewide. In 2015, the VSSTF, VSCC, and VDH created the Southwest Stroke Task Force (SWSTF) to support geographic regions with high mortality due to stroke but low access to healthcare services. Primary quality improvement

initiatives of the SWSTF included increasing stroke center certification, implementing EMS triage protocols, decreasing door-to-needle times, and expanding use of tele-stroke consultation.

In addition to ongoing stroke improvement efforts through the VSSTF and VSCC, the VDH Office of Emergency Medical Services (VDH OEMS) maintains the Virginia Stroke Triage Plan pursuant to the Code of Virginia § 32.1-111.3 (§ 32.1-111.3, 2018). The 2017 Virginia Stroke Triage Plan established a strategy through formal regional stroke triage plans that incorporate each region's geographic variations and acute stroke care capabilities and resources. This strategy sets forth a uniform set of criteria for the pre-hospital and inter-hospital triage and transport of acute stroke patients. Among the 11 EMS regional councils, regional stroke triage plans were developed using these statewide criteria and augmented to account for local variation of resources and capacity among EMS and hospitals.

The 2018 General Assembly passed legislation, HB 1197 and SB 867, which enabled VDH to establish the VSCQI Advisory Group. The summary legislation as passed states:

> ***Stroke care quality improvement.*** *Provides that the Department of Health shall be responsible for stroke care quality improvement initiatives in the Commonwealth. Such initiatives shall include (i) establishing systems to collect data and information about stroke care in the Commonwealth, (ii) facilitating information and data sharing and collaboration among hospitals and health care providers to improve the quality of stroke care in the Commonwealth, (iii) requiring the application of evidence-based treatment guidelines for transitioning patients to community-based follow-up care following acute treatment for stroke, and (iv) establishing a process for continuous quality improvement for the delivery of stroke care by the statewide system for stroke response and treatment. The bill also directs the Department of Health to convene a group of stakeholders, which shall include representatives of (a) hospital systems, including at least one hospital system with at least six or more stroke centers in the Commonwealth, recommended by the Virginia Hospital and Healthcare Association; (b) the Virginia Stroke Systems Task Force; and (c) the American Heart Association/American Stroke Association, to advise on the implementation of stroke care quality improvement initiatives. The provisions of the bill making the Department of Health responsible for stroke care quality improvement initiatives in the Commonwealth have a delayed effective date of January 1, 2019.*

The Code of Virginia was amended by adding in Article 2.1 of Chapter 4 of Title 32.1 a section numbered 32.1-111.15:1 (Appendix A).

Background on Stroke Burden and Preliminary Action Steps

Stroke Burden

Stroke is the fifth leading cause of death in the United States, and the fourth leading cause of death in Virginia. Stroke of various types, specifically ischemic and hemorrhagic, lead to 140,000 deaths in the United States each year, or one of every 20 deaths (Yang, 2015). Approximately 795,000 people experience a new or recurrent stroke each year in the United States (Ovbiagele, 2011). Stroke costs the United States $34 billion annually, of which over $1.1 billion dollars is spent in Virginia on total inpatient hospital charges (Benjamin, 2017 and VDH Division of Population Health Data, 2020). This total includes the cost of healthcare services, treatment, and missed days of work related to stroke. The costs also include the initial patient hospital admission and, in many cases, readmissions due to stroke-related comorbidities, as well as long-term effects (Stuntz, 2017).

According to the Centers for Medicare and Medicaid Services, 20% of all patients who are discharged from a hospital after having a stroke will be readmitted within 30 days of discharge (McIlvennan, 2015). Readmissions after ischemic stroke and intracerebral hemorrhages are more common compared to other diseases, especially in the early period after discharge. As many as 21% of stroke patients are readmitted within 30 days, and more than 55% are readmitted by one year (Nouh, 2017). In Virginia, there were a combined 3,774 total deaths in 2018 due to stroke at an age-adjusted rate of 38.8 per 100,000 population, as compared to the 37.1 per 100,000 population age-adjusted rate nationally (Stroke Mortality by State, 2020). Three

percent of Virginians have had a stroke and are living with disability or are at risk for a secondary stroke (VDH Division of Population Health Data, 2015). According to the Virginia inpatient hospital database for 2018, there were 21,987 hospitalizations due to stroke with an age-adjusted hospitalization rate of 238.2 per 100,000 population (VHI Inpatient Discharge Database, 2020).

Hospitalizations due to stroke varied widely by county and city in 2018. The age-adjusted hospitalization rates for the two counties with the highest burden of stroke hospitalization were 1,162.6 per 100,000 population and 1,007.3 per 100,000 population. Conversely, the age-adjusted hospitalization rates for the two counties with the lowest burden of stroke hospitalization were 6.7 per 100,000 population and 5.8 per 100,000 population (VHI Inpatient Discharge Database, 2019). The mortality rate of patients with stroke showed a similar pattern in 2018. The highest age-adjusted mortality rate on the county level ranged from 131.7 per 100,000 population and the lowest rate was 7.8 per 100,000 population.

The two maps below display the geographic distribution of age-adjusted mortality and hospitalization rates, with geocoded hospitals color coded by stroke certification type (Figures 1 and 2).
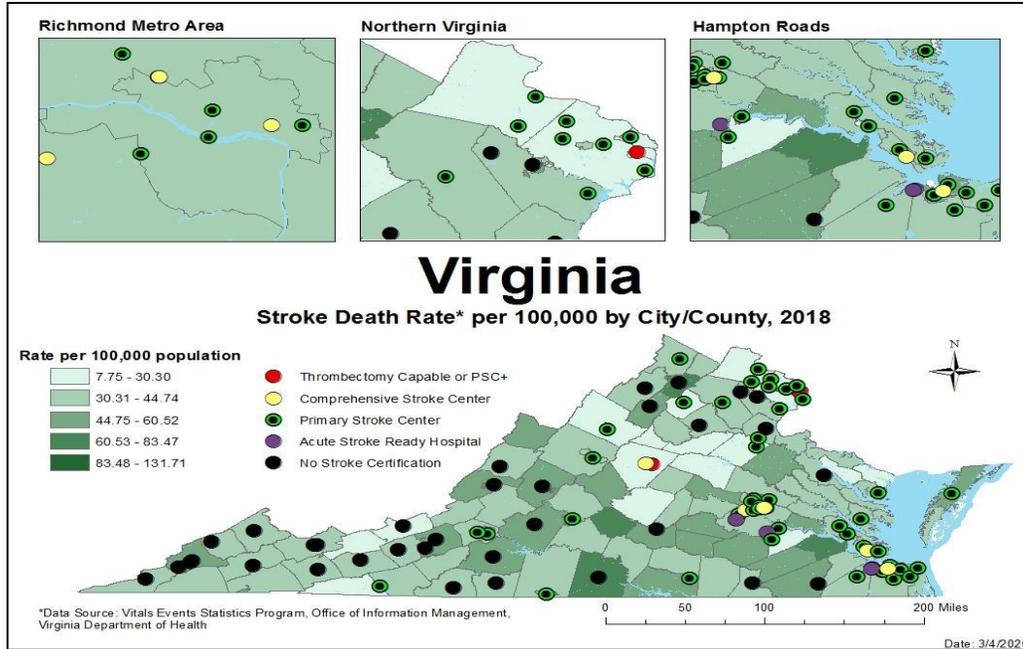
Figure 1. Age-adjusted Rate of Deaths Due to Stroke in Virginia by County/City in 2018. County and City rates stratified by quintiles represented by a light green (low rate) to dark green (high rate) gradient. Hospitals represented by dots and assigned colors by stroke certification type based on 2019 VSCC Stroke Certification Survey. Richmond Metro Area, Northern Virginia, and Hampton Roads are enlarged (Stroke Mortality by State, 2020).

Figure 2. Rate of Hospitalizations Due to Stroke in Virginia by County/City in 2018. Age-adjusted rates stratified by quintiles represented by a light green (low rate) to dark green (high rate) gradient. Hospitals represented by dots and assigned colors by stroke certification type based on 2019 VSCC Stroke Certification Survey. Richmond Metro Area, Northern Virginia, and Hampton Roads are enlarged. (VHI Inpatient Discharge Database, 2020).
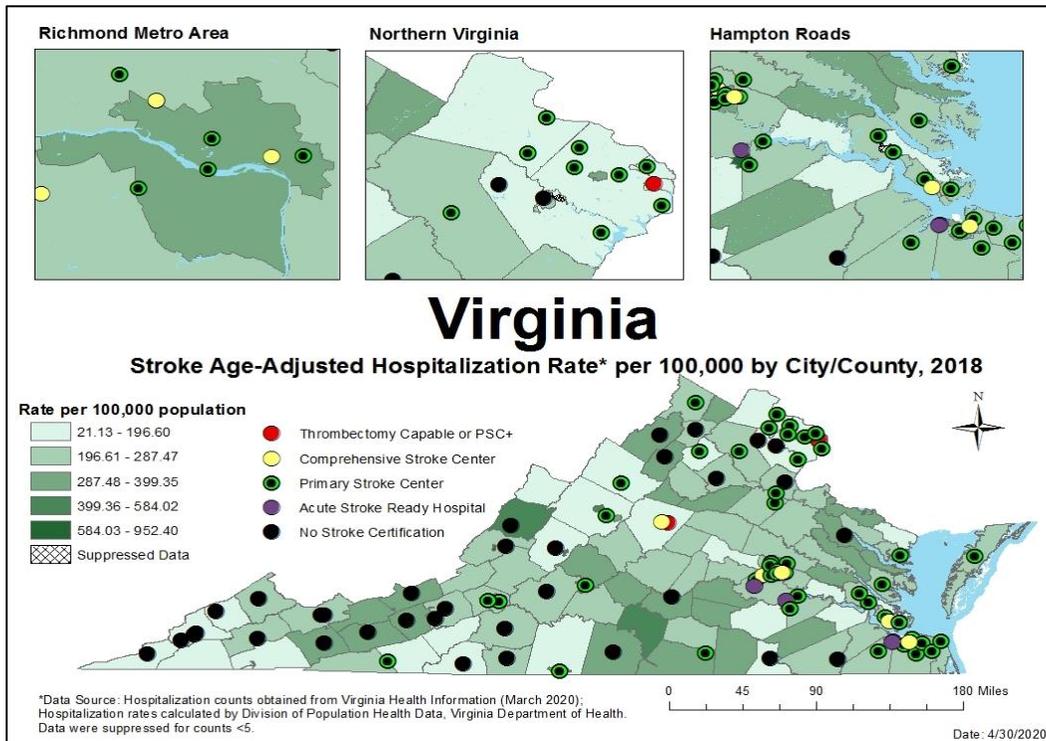
The figures show a comparison of the geospatial distribution of age-adjusted hospitalization and mortality rates by counties and cities from high burden to low burden. Particularly in the Southwest region, Figure 1 shows a low rate of hospitalization due to stroke; however, Figure 2 shows high rates of mortality due to stroke. Contributing factors to these disparities may include a lack of access to quality healthcare services, transportation barriers, poverty, low access to healthy fruits and vegetables, limited physical activity, or lack of education about the signs and symptoms of stroke and the necessity to call 9-1-1 if suspecting stroke (Gonzales, 2017). In the southern part of the Central region, both age-adjusted hospitalization and mortality rates due to stroke are significantly high. Both maps show a scarcity of hospitals to assess, treat, and prevent strokes in these counties. Densely populated cities, including the Richmond Metropolitan Area, Northern Virginia, and Hampton Roads, show differing rates of hospitalizations and deaths due to stroke, with an abundance of hospitals with varying levels of stroke certification by The Joint Commission (TJC), Det Norske Veritas (DNV), and Healthcare Facilities Accreditation Program (HFAP).

Figures 3 and 4 below highlight the variance in age-adjusted mortality rates and hospitalizations rates over time from 2014 to 2018 by health region - Northern, Northwest, Southwest, Central and Eastern. From 2014 to 2018, the statewide age-adjusted stroke mortality rate was relatively stable, ranging from 37 deaths per 100,000 population in 2014 to 39 deaths per 100,000 population in 2018. Among regions, the age-adjusted stroke mortality showed variation. The Northern region had the lowest annual mortality rate during all five years. In 2018, the Eastern and Southwest regions had the highest mortality rates of over 44 deaths per 100,000 population (Stroke Mortality by State, 2020).
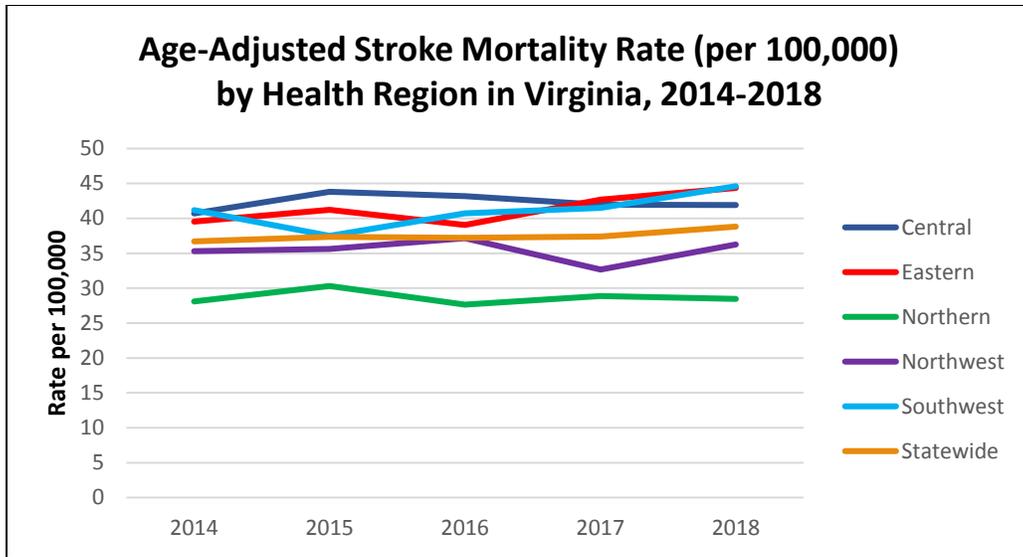
Figure 3: Annual Age-Adjusted Stroke Mortality Rate (per 100,000) by Health Planning Region: Virginia, 2014-2018. (Stroke Mortality by State, 2020).

The age-adjusted hospitalization rate for people with stroke was reduced slightly from 2014 to 2018, ranging from 245.8 to 236.8 per 100,000 population. However, there were variations among regions, with the Northern region having the lowest rates annually during the five-year period and the Central region having the highest rates (VHI Inpatient Discharge Database, 2020).
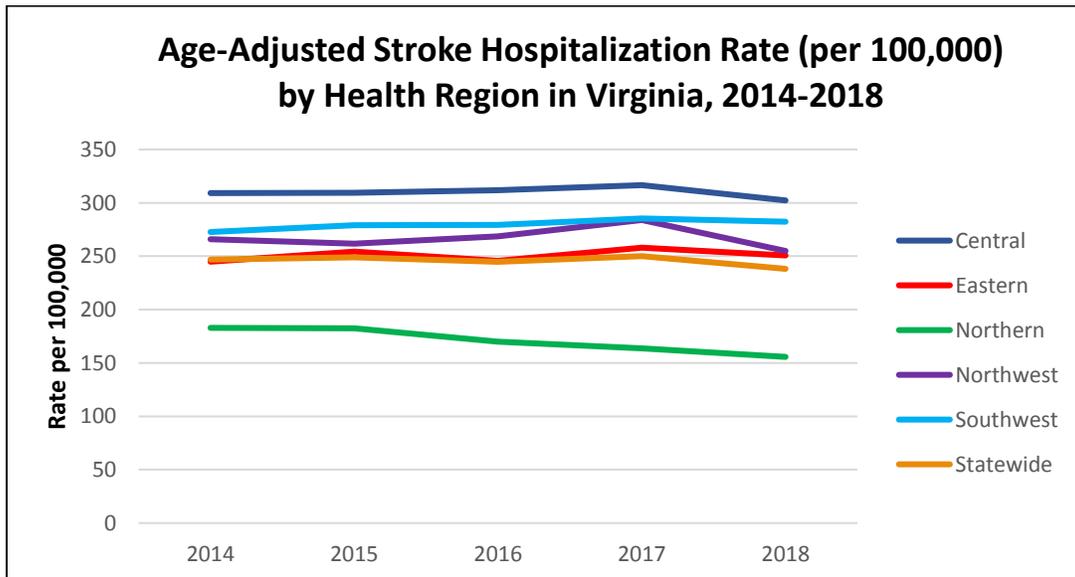
Figure 4. Annual Age-Adjusted Stroke Hospitalization Rate (per 100,000) by Health Planning Region: Virginia, 2014-2018. Data Source: The stroke indicator data were drawn from the inpatient discharge dataset provided to Virginia Department of Health (VDH) by Virginia Health Information (VHI) Discharge Database, 2020. Hospital discharge rate is age-adjusted for any diagnosis based on the 2000 U.S population standard and calculated per 100,000 individuals.

In summary, the data reveal geographic areas of high burden and disparities between age-adjusted hospitalizations and mortality rates due to stroke. Virginia hospitals provide varying levels of stroke care with advanced levels of stroke care defined by stroke certification type. Further investigation using a broad range of data sources is necessary to identify the local factors contributing to the burden and disparities. Geospatial mapping, overlaying burden distribution and resources, and identifying hospitals locations by stroke certification, serve as critical strategic planning tools for data-driven decision-making and partnership development in the VSCQI Advisory Group.

Preliminary Action Steps

Prior to the legislation's January 1, 2019 effective date, VDH took preliminary action steps to build capacity among stakeholders. The first preliminary action step was to identify stakeholder members for the VSCQI Advisory Group. VDH formed the initial consortium of advisory group members in June 2018 based on suggested lists of hospital and EMS regional council contacts recommended by Virginia Hospital and Healthcare Association (VHHA) and VDH OEMS, respectively. Stakeholder entities were identified based on their role in the continuum of stroke care and expertise to move the advisory group forward (see Table 1).

Table 1. List of Advisory Group Stakeholders and Roles

Stakeholder	Role(s)
VDH	Convene the stroke care advisory group and collaborates with stakeholders to implement Code of Virginia § 32.1-111.15:1
VDH OEMS	Provide statewide leadership for the planning and coordination of an effective and efficient EMS system
VHHA	Provide access to hospital data and guidance to their hospital members
AHA / ASA	Provide technical support to hospitals and EMS participating in Get With The Guidelines®-Stroke (GWTG-Stroke) through their quality improvement programs such as GWTG-Stroke and Target Stroke[SM]

Hospitals	Receive, treat, and refer patients for assessment, clinical care, and rehabilitation, with varying levels of hospitals certified to provide advanced levels of stroke care
EMS Regional Councils and Agencies	Coordinate with local EMS agencies/staff, facilitate local stroke task force meetings, and provide community education
U.S. Department of Veterans Affairs	Provide comprehensive healthcare services to eligible military veterans at VA medical centers in Virginia
Physical Rehabilitation Centers	Provide comprehensive physical rehabilitation services and education; Inclusive of skilled-nursing facilities
VSSTF and VSCC Co-Chairs	Provide leadership and coordinate VSSTF and VSCC initiatives

Representatives of these stakeholder entities include public health practitioners, data analysts, quality improvement coordinators, EMS medical directors and field coordinators, and healthcare professionals including, but not limited to, neurologists, neurosurgeons, radiologists, emergency medicine physicians, nurses, stroke coordinators, physical therapists, and telemedicine specialists.

On August 10, 2018, VDH facilitated the initial VSCQI Advisory Group meeting with stakeholder representation from VHHA, AHA/ASA, VDH OEMS, eight EMS regional councils, and ten hospitals (Appendix B). VDH presented geospatial maps of stroke burden across Virginia, and facilitated a discussion on data collection, information sharing, and quality improvement initiatives. Stakeholders highlighted the need to select priority stroke measures across the continuum of stroke care in order for the advisory group to identify areas of high need or gaps in care, monitor outcomes, and inform recommendations for quality improvement initiatives.

At the VSSTF quarterly meeting held on October 19, 2018, VDH invited all VSSTF members to propose and submit stroke-related metrics of interest to VDH between October and December 2018. These proposed, preliminary metrics provided VSSTF members an opportunity to explore population health indicators and analyses that describe Virginia's progress in improving stroke outcomes both regionally and statewide. Various stakeholders, including neurologists, stroke coordinators, EMS field coordinators, and Get Ahead of Stroke (GAOS) representatives, proposed metrics grouped into four categories – prevention/risk factors, pre-hospital, in-hospital, and post-hospital. On January 18, 2019, the VSCQI Advisory Group convened and reviewed the metrics proposed by VSSTF members and compiled by VDH. Based on the feedback provided during the meeting, VDH then created four draft metric surveys for advisory group members to prioritize sub-categories and corresponding metrics for each of the four categories.

In addition to preliminary efforts to compile and prioritize stroke metrics, VDH has built internal capacity by leveraging existing staff to facilitate the successful implementation of the requirements pursuant to the Code. VDH designated existing staff that work in heart disease and stroke prevention to lead facilitation of the VSCQI Advisory Group and collaborate with VHHA, VDH OEMS, and AHA/ASA. VDH maintains and recently improved its stroke webpage to allow for information sharing, monitoring of state and regional stroke metrics, quality improvement best practices and resources, including information on local stroke support groups and tools or protocols shared by VSSTF and the VSCQI Advisory Group (Virginia Stroke, 2019). Additionally, AHA/ASA granted VDH state epidemiologists super-user access to the GWTG-Stroke platform. The GWTG-Stroke super-user access is limited to aggregated, de-identified stroke measures with hospitals enrolled in GWTG-Stroke in accordance with a signed

data use agreement with VDH. However, only 40 out of 93 hospitals participate and pay an annual subscription for GWTG, leaving a number of hospitals without the ability to participate in a statewide stroke registry through VDH. This report details the specific needs within VDH to develop and maintain a statewide stroke registry, while highlighting the guidelines and quality improvement recommendations that hospitals and stakeholders should undertake locally, regionally or system-wide.

Legislative Requirements – Implementation Process, Recommendations and Promising Practices

Prior to the legislation's effective date of January 1, 2019, VDH developed a work plan with implementation steps assigned to each of the listed requirements of HB 1197 and SB 867. Since 2019, VDH assembled the following work groups to move particular legislative priorities forward through the VSCQI Advisory Group – Hospital and EMS Stroke Inventory Survey Work Group, Data Council, Acute Stroke Treatment Strategies Work Group, Stroke Survivor and Caregiver Supports Work Group, and Primary Prevention Work Group. This section of the report describes data-driven action steps taken throughout the implementation process, recommendations, and promising practices, where applicable, identified by VDH, the VSCQI Advisory Group, and the aforementioned work groups. The information is organized according to the legislative requirements: implement systems to collect data and information about stroke care; facilitate data sharing and collaboration; apply guidelines for transitioning patients to community-based follow-up care; and establish a process for continuous quality improvement.

Implement Systems to Collect Data and Information about Stroke Care

Legislation Implementation Process

The VSCQI Advisory Group aims to implement systems to collect data about stroke care by first identifying priority stroke metrics along the continuum of care, as requested by advisory group members. In 2018, the advisory group responded to a Stroke Priority Metrics Survey that facilitated ranking metrics by category and subcategory along the continuum of stroke care: prevention/risk factors, pre-hospital, in-hospital, and post-hospital. These priority metrics have informed data sources and the respective systems to collect the data from hospitals and EMS, as well as directed quality improvement initiatives. Hospital and EMS capacity surveys developed in 2019 will provide complementary data to inform where resources and supports should be focused. From October to December 2018, VSSTF members proposed a preliminary list of stroke-related metrics that were reviewed by the VSCQI Advisory Group in January 2019. VDH grouped the metrics into four categories and subcategories (Table 2).

Table 2. Stroke Metrics Categories and SubCategories List

Category	SubCategory
Prevention / Risk Factors	Medical Risk Factors, Lifestyle Risk Factors, Education, Healthcare Access, Social Determinants of Health, Financial Impact
Pre-Hospital	Transport Time: EMS Home/Scene to Hospital, Transport Time: Interfacility Transport, Type of Stroke Transport and Triage, Stroke Screening, Patient Encounter Documentation and Last Known Well, Stroke Alert Pre-Notification, Patient Monitoring
In-Hospital	Outcomes, Assessment and Screening, Interfacility Transfer, Treatment, Tele-Stroke, Education and Counseling
Post-Hospital	Rehabilitation Outcomes, Transitions of Care, Stroke Patient Supports, Disability, Cost

Following development of the list of metrics, VDH formed the Data Council within the advisory group to focus on the development of a statewide registry among other data-driven activities, including reviewing data sources for prioritizing geographic areas within Virginia. Within this Data Council, 10 hospitals expressed interest in pilot testing or developing a statewide stroke registry. VDH and the VSCQI Advisory Group collectively decided that GWTG

would not serve as the statewide stroke registry in 2019 based on the limitations stated

previously. In addition, VDH determined that the costs necessary to develop and maintain a

statewide stroke registry would require more funding than what was included in the fiscal impact

statement presented with the 2018 legislation. Although VDH OEMS has indicated ability to

cover costs related to the expansion of existing registries to include the initiation and

maintenance costs for a statewide stroke registry platform, funding is needed to support three full

time employees (FTE).

Recommendations

Based on recommendations received from VDH OEMS, staff support would consist of

three positions totaling $327,624 for registry development, quality assurance, and data analysis.

These recommendations have been compared to staff support related the VDH Cancer Registry

and current salaries of VDH staff with roles and responsibilities related to supporting chronic

disease prevention, management, and epidemiology/evaluation efforts. A breakdown of staff

descriptions and costs are detailed below:

Stroke Data Analyst (1.0 FTE): The primary responsibility is to manage the database/system
support. This position will manage and maintain the validation rules, schematron changes, site
implementations, end user education, system audit reports, and submission compliance. A key
component of this role is to ensure that the facility submissions meet internal data quality
standards. The secondary responsibility is to answer support calls (account set ups, password
lockouts, etc.) Cost: $115,010 (based on an annual salary of $72,000)

Staff Cost Estimator		
	Salary:	
	$ 72,000	
Sub-object	Item	Amount
1111	VRS	9,734
1112	FICA	5,508
1114	Life Insurance	943
1115	Health Insurance	21,624

Sub-object	Item	Amount
1116	Retiree Health Ins Credit	842
1117	Long-term Disability	446
1123	Salary	72,000
1138	Deferred Comp	480
1216	Phone	492
1278	Vita	2,940
	Travel	
	Training	
	Total:	**115,010**

Stroke Registry Administrator (1.0 FTE):   The primary responsibility is to handle all support calls, end user calls, assist with submission compliance monitoring and data quality. The secondary responsibility is to be cross-trained in IT systems and database management. Cost: $106,312 (based on an annual salary of $65,000)

Staff Cost Estimator		
Salary:		
	$ 65,000	
Sub-object	Item	Amount
1111	VRS	8,788
1112	FICA	4,973
1114	Life Insurance	852
1115	Health Insurance	21,624
1116	Retiree Health Ins Credit	761
1117	Long-term Disability	403
1123	Salary	65,000
1138	Deferred Comp	480
1216	Phone	492
1278	Vita	2,940
	Travel	
	Training	
	Total:	**106,312**

Quality Assurance Coordinator (1.0 FTE): The primary responsibility is to perform data analysis, quality assurance, and reporting. Ideally, this would be a clinician experienced in stroke care in a certified and non-certified setting. Cost: $106,312 (based on an annual salary of $65,000)

Staff Cost Estimator		
Salary		
	$ 65,000	

Sub-object	Item	Amount
1111	VRS	8,788
1112	FICA	4,973
1114	Life Insurance	852
1115	Health Insurance	21,624
1116	Retiree Health Ins Credit	761
1117	Long-term Disability	403
1123	Salary	65,000
1138	Deferred Comp	480
1216	Phone	492
1278	Vita	2,940
	Travel	
	Training	
	Total:	**106,312**

Until funding is appropriated to hire the three recommended staff, VDH will work closely with the Data Council to standardize stroke-related data metrics across TJC, DNV, and HFAP standards/certification requirements manuals. Existing VDH staff will continue to explore additional action steps in preparation for the development of a statewide stroke registry for Virginia.

Facilitate Data Sharing and Collaboration

Legislation Implementation Process

Continuous processes for quality improvement requires thorough data collection on priority stroke metrics, capacity building where resources are scarce, and platforms that both continually educate practitioners and enable them to develop, test, and evaluate quality improvement initiatives. In 2019, VDH simultaneously developed two surveys that will be used to inform where resources are needed to improve a hospital's or EMS agency's capacity to provide quality stroke response, assessment, treatment, and follow-up.

In partnership with VSSTF and VSCC, VDH developed an inventory capacity survey modeled after the national Centers for Disease Control and Prevention (CDC) Paul Coverdell Program's survey (Paul Coverdell Program, 2019). The hospital inventory survey will assess a hospital's structure, process, and utilization regarding stroke care. Other capacity assessment questions will include hospital stroke certification, stroke care protocols and workflows, stroke care supports available, local stroke support group information, data collection and reporting capabilities, and ongoing quality improvement efforts. In partnership with VDH OEMS and the EMS regional councils, VDH also developed an EMS inventory survey that asks about structure, process, and utilization. Additional questions relate to protocols, triage plans, community paramedic programs, community education, stroke scale use, 911 dispatcher information, funding, and ongoing quality improvement efforts. Both the hospital and EMS stroke inventory surveys will be disseminated and analyzed in 2020.

Qualitative data from the surveys will inform hospital and EMS decision-making processes, workflows, coverage areas, and gaps or needs for all hospitals and EMS agencies located within Virginia. While VDH will have an environmental scan of the entire Commonwealth, the survey results can prove critical for closing the gap on needs in counties and cities with the highest stroke mortality. The advisory group's prioritized geographic areas based on age-adjusted stroke mortality rates from 2014 to 2018 are detailed in Table 3. Additionally, Figure 5 below maps these priority geographic areas.

Table 3. Virginia Stroke Priority Geographic Areas by Mortality Age-Adjusted Rates, 2014-2018.

Region	Locality	Local Health Department	Mortality Combined (ICH & AIS)	Intra cerebral Hemorrhage (ICH)	Acute Ischemic Stroke (AIS)

Region	Locality	Area			
Central					
	Greensville County	Crater	64.76	14.78	49.98
	Brunswick County	Southside	59.44	6.11	53.33
	Nottoway County	Piedmont	59.13	12.02	47.11
	Petersburg City	Crater	58.65	18.75	39.90
	Surry County	Crater	57.96	23.70	34.26
	Mecklenburg County	Southside	56.97	13.55	43.41
	Hopewell City	Crater	49.93	14.03	35.90
Eastern					
	Franklin City	Western Tidewater	93.20	15.17	78.03
	Portsmouth City	Portsmouth	52.67	13.65	39.02
	Lancaster County	Three Rivers	52.66	12.58	40.09
	Norfolk City	Norfolk	50.01	13.43	36.58
	Hampton City	Hampton	47.33	11.58	35.75
	Accomack County	Eastern Shore	45.56	11.98	33.57
	Mathews County	Three Rivers	44.48	13.89	30.59
Northern					
	Manassas City	Prince William	49.75	12.40	37.35
	Fairfax City	Fairfax	41.11	10.19	30.92
Northwest					
	Highland County	Central Shenandoah	60.66	11.94	48.72
	Lexington City	Central Shenandoah	60.00	9.65	50.35
	Buena Vista City	Central Shenandoah	53.67	12.07	41.61
	Harrisonburg City	Central Shenandoah	48.99	13.01	35.97
	Staunton City	Central Shenandoah	48.17	15.06	33.12
	Warren County	Lord Fairfax	44.16	7.47	36.69
	King William County	Rappahannock	44.14	11.68	32.45
	Caroline County	Rappahannock	42.46	10.43	32.03
Southwest					
	Martinsville City	West Piedmont	84.64	26.86	57.79
	Covington City	Alleghany	74.77	27.28	47.48
	Galax City	Mount Rogers	70.09	20.14	49.95
	Radford City	New River	67.57	24.22	43.35
	Lynchburg City	Central Virginia	61.13	14.51	46.61

Appomattox County	Central Virginia	59.56	23.44	36.12
Danville City	Pittsylvania-Danville	54.72	14.07	40.65
Salem City	Alleghany	51.26	12.40	38.87
Amherst County	Central Virginia	50.55	10.34	40.21
Wythe County	Mount Rogers	47.76	13.19	34.57

Notes: Localities were categorized by Virginia Health Planning Region and sorted by Age-Adjusted Mortality Rate. The top quartile of each region was then selected to indicate priority localities. (Virginia Department of Health, Office of Vital Records).
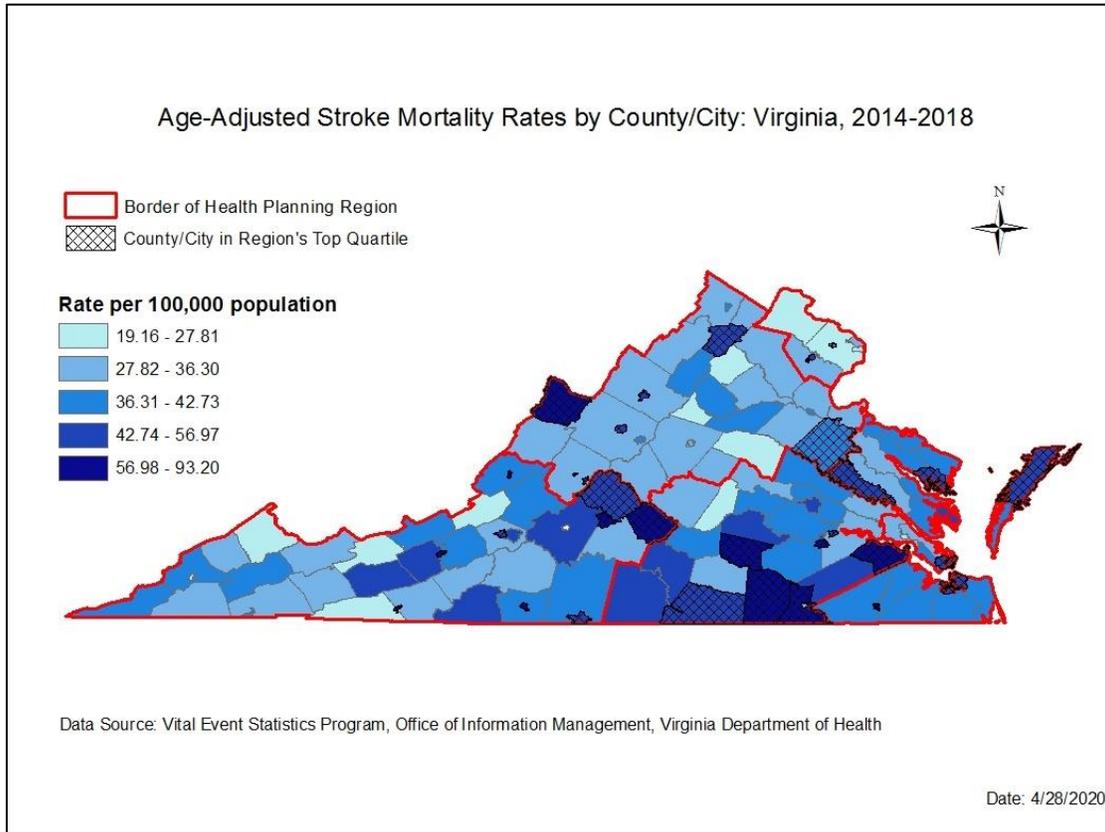
Figure 5. Age-adjusted Stroke Mortality Rates by County/City between 2014 and 2018 (Stroke Mortality by State, 2020).

The geographic priority areas represent the top quartile of counties/cities with the highest age-adjusted mortality rates within each of the five health regions – Central, Northern, Northwest, Southwest, and Eastern. As the VSCQI Advisory Group identifies the hospitals and EMS agencies that provide services to residents of these counties/cities, VDH can target strategic partnerships among hospitals and between hospitals and EMS agencies to facilitate data sharing and collaboration.

Not all hospitals in Virginia are certified to provide the same level of stroke care. However, as of January 1, 2020, 59 out of 93 (63.4%) Virginia hospitals are certified by TJC, DNV, and HFAP. Of those with stroke certification, two hospitals are certified Thrombectomy Capable or Primary Stroke Center (PSC) +; six hospitals are certified Comprehensive Stroke Centers (CSC); 46 hospitals are PSC; and five hospitals are Acute Stroke Ready Hospitals (ASRH) (Virginia Stroke Coordinators, 2019). The VSCC Stroke Certification Survey provides a breakdown of hospital certifications (Figure 6).
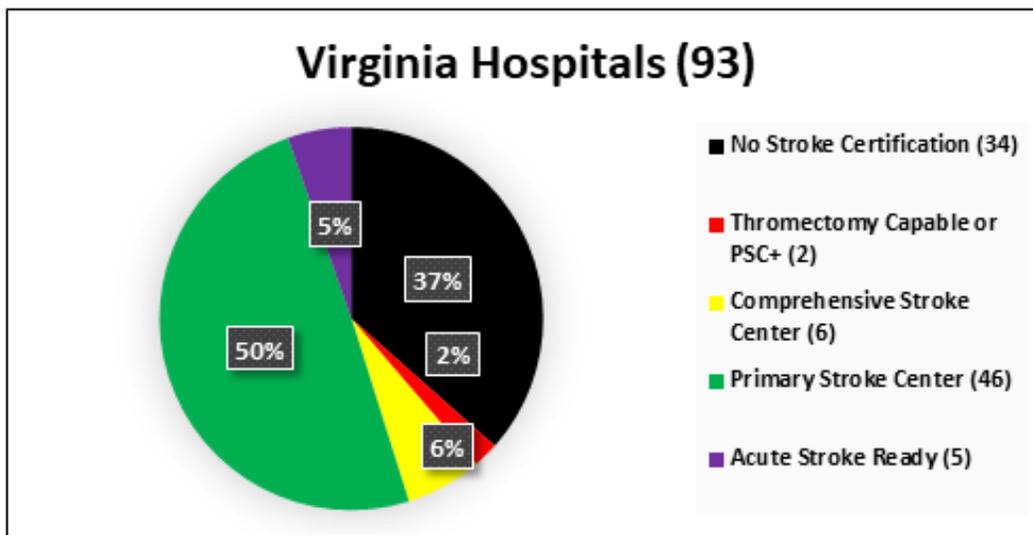

Figure 6. Stroke certification breakdown among Virginia Hospitals. Hospitals are assigned colors by stroke certification type - HFAP Thrombectomy Capable or PSC+ (red), Certified Comprehensive Stroke Center (yellow), Certified Primary Stroke Center (green and black), Certified Acute Stroke Read Hospital (purple), No Stroke Certification (black). (Virginia Stroke Coordinators, 2019).

Recommendations

Future recommendations for the VSCQI Advisory Group will include engaging hospitals and EMS within the identified geographic priority areas. Each geographic area presents unique challenges that provide opportunities for strategic collaboration. For example, the Virginia Stroke Triage Plan encourages EMS providers to transport stroke patients to the most appropriate stroke care facility. If a patient is screened for a large vessel occlusion, the EMS regional stroke

triage plan would encourage bypassing a non-stroke certified center or acute stroke ready center to a more advanced comprehensive stroke center capable of mechanical thrombectomy to remove the large vessel occlusion. Data sharing between hospitals and EMS can equip providers involved in the treatment, management, and follow-up care of stroke patients with the necessary data for making the informed decisions about patient care. The process of strategically identifying the areas impacted by the highest stroke mortality rates, identifying key hospitals, EMS agencies and other local stakeholders, and fostering collaboration is a necessary precursor to improving the health outcomes of stroke patients in communities.

Apply Guidelines for Transitioning Patients to Community-Based Follow-up Care

Legislation Implementation Process

Following selection of the priority stroke metrics by the VSCQI Advisory Group, members who were focused on the post-hospital category engaged in a strategic planning meeting to identify local, regional, and state partners and models to implement guidelines for transitioning patients who had experienced stroke or transient ischemic attack (TIA) to community-based follow-up care. The group identified best practice models from state health departments, evidence-based guidelines, and partners for transitioning patients to community-based follow-up care following acute stroke treatment. Upon thorough review of state health departments' transitions of care plans, Minnesota Health Department provided a comprehensive transitions of care plan with tools and resources pulled from high-performing states with stroke plans such as California, Massachusetts, and Georgia (Minnesota, 2019). Recommendations for applying guidelines for transitioning patients to community-based follow-up care and for follow-up care after acute stroke treatment have been summarized below:

Recommendations for Transitions to Community-based Follow-up Care:

- Systems should be in place to assist in the transfer of patient records and patient care from hospital to clinics and community.

- For patients going home after discharge for stroke, processes and mechanisms should be in place in the emergency department, acute care, primary care, rehabilitation, and community settings to address efficient communication between settings and healthcare providers.

- Transition of care programs implemented should be evidence- or practice-based (e.g., COMprehensive Post-Acute Stroke Services (COMPASS), Project Red, Reducing Avoidable Readmissions Effectively (RARE), Care Transitions Program®) (StratisHealth, 2020).

Recommendations for Follow-up Care after Acute Stroke Treatment:

- Ensure that transition plans are in place and followed so that the patient's care is coordinated between multiple caregivers. Interventions may include use of a care coach, transition coordinator, stroke navigator, or community health worker.

- The geographic locations of where the patient lives and where the patient was treated for stroke must be taken into consideration when making decisions about transitional care and services, particularly for patients receiving care across state lines or at hospitals at long distance due to state/regional stroke triage plans.

- The care model should support seamless care by ensuring access to appropriate and timely services, whether in-person, telephonically, or through telehealth technology.

- Patients and their caregivers should receive follow-up calls at several touch points post-discharge, i.e., within 72 hours, at two weeks, and at 30-days.

- At the post-discharge follow-up appointment, the primary care provider should discuss warning signs, patient's personal risk factors for stroke, when to call, diet, daily activities, a list of things to monitor and things to avoid. The appointment is also an opportunity to discuss end of life planning, assess social and economic barriers, reinforce and adjust the plan of care as necessary, and perform medication reconciliation and medication management.

VDH will hold a workshop in state fiscal year2021 for stroke coordinators to further explore best practice strategies for effectively implementing transitions of care guidelines. Subsequently, individualized follow-up meetings will be held with the stroke coordinators to ensure that hospitals, particularly those identified in the priority geographic areas, are applying such principles for transitions of care and community-based follow-up care.

Promising Practices

VCU Cerebrovascular Center of Excellence

The VCU Comprehensive Stroke Center, Virginia's first comprehensive stroke center certified by TJC and the AHA/ASA, serves as a major tertiary referral center for patients in the Commonwealth and as a model system for implementing community-based treatment following stroke care. Patients discharged from the VCU Comprehensive Stroke Center are provided the option to receive follow-up care with the Stroke Outpatient Clinic. Operational since 2015, the Clinic's approach to stroke outpatient care following patient discharge includes continuous quality monitoring and has resulted in improved patient outcomes, as evidenced by improved stroke readmission rates from 2018 to 2019.

The initial concept for community-based follow-up care has grown into a more comprehensive post-stroke care model through the creation of an outpatient Cerebrovascular

Center of Excellence (Center). The specific goals of the Center include the application of evidence-based stroke guidelines and telehealth strategies to create an outpatient practice model that will facilitate the transition of care from hospital to clinic follow up within 7 to 14 days of patient discharge and improve access to care for patients with suspected neurovascular disorders. This practice model will directly connect the VCU inpatient Stroke Nurse Navigator to VCU's ambulatory care system. With a comprehensive community-based care approach and the assistance of telehealth technology, the Center aims to serve as an option for post-hospital discharge stroke follow up anywhere in the Commonwealth.

The Center will use the "Guidelines for the Prevention of Stroke in Patients with Stroke and Transient Ischemic Attack: A Guideline for Healthcare Professionals From The American Heart Association/American Stroke Association," (2014) to delineate outpatient management of the following conditions for prevention: cerebrovascular conditions, hypertension, dyslipidemia, smoking cessation, glucose disorders, obesity, physical activity, nutrition, sleep apnea, and coagulation-related conditions. With a targeted launch date of July of 2020, the Center will initially place emphasis on specific metrics, using data transparency and establishing basic clinical benchmarking. The key metrics of focus will be on the following areas:

- Improvement of patient access: The practice will be staffed by board certified vascular neurologists and stroke nurse practitioners. A metric driven approach will be used to increase available appointment capacity and management of referrals made to the clinic.
- Enhance coordination from inpatient to outpatient settings: The inpatient navigator will focus on stroke measures related to the acute diagnosis of stroke and the return to functional status. The outpatient navigator will focus on the transition of care into the clinic, facilitating follow up appointments with other specialties and health care providers

and focusing on secondary stroke prevention as highlighted in the AHA/ASA prevention guidelines and measures.

- Establish new practices to improve the rate of follow-up: The outpatient nurse navigator will work with patients on an individual basis to facilitate a deeper understanding of factors contributing to failure to follow up for ambulatory transition visits and other aspects of post-acute stroke care. These issues likely include challenges related to memory, transportation, support systems, income, and other social determinants of health.

- Telehealth technology: The Center will use clinical criteria to establish patients who are eligible to use telemedicine visits. This initiative will aim to reduce no-show follow up visit rates and patient transport burden.

The Center's use of quality metrics and evidence-based medicine to sustain a high-value stroke care delivery system can more efficiently achieve the overarching goal of functioning as an integrated practice unit for cerebrovascular diseases. The Cerebrovascular Center of Excellence in 2020 serves as critical resource for patients post-discharge and a model to all health systems for the application of evidence-based guidelines for referring patients to community-based follow-up care after acute treatment of stroke.

Sheltering Arms Institute Guidelines

Despite significant improvements in systems to recognize stroke symptoms and deliver care promptly, many survivors are left with residual functional deficits. Fortunately, rehabilitation is often successful in promoting recovery, particularly in an intense environment specifically designed for stroke rehabilitation. Programs at Sheltering Arms Physical Rehabilitation Hospital and VCU Health in the greater metropolitan Richmond area include

integration of clinical evidence and clinician decision-making, using practice guidelines to lead to improved patient outcomes. According to the Institute of Medicine (2011), clinical practice guidelines are "statements that include recommendations intended to optimize patient care that are informed by a systematic review of evidence and an assessment of the benefits and harms of alternative care options." Clinical practice guidelines provide a framework for patient care and are designed to assist clinician decision-making, thereby reducing variability in practice.

Sheltering Arms is a Joint Commission Stroke Center of Excellence recognized for improving outcomes for patients who experience stroke and disability. Sheltering Arms uses a standardized, evidence-based approach for rehabilitation to promote recovery and to create evidence-based clinical practice guidelines. These guidelines are specific to the rehabilitation setting and incorporate advanced technology and tools for optimal rehabilitative outcomes. By standardizing the approach, Sheltering Arms is able to limit unwarranted variability in practice while still creating an individualized rehabilitation plan for each patient. Every patient is evaluated using a standardized, validated set of measures. The results of those measures are used to determine the patient's rehabilitation plan, including how to prioritize interventions and when to progress to more advanced interventions. This approach has resulted in patients experiencing greater recovery at a faster rate. The approach has also established a need for a more specialized facility in Central Virginia to ensure that stroke survivors are able to live healthier with fewer long-term effects that contribute to increased health care costs over their lifetime.

In 2020, Sheltering Arms anticipates opening the Sheltering Arms Institute (SAI), a collaboration with VCU Health, which will contain a unit specifically designed for patients who have experienced a stroke. SAI aims to reinvent rehabilitation for stroke survivors by using a trans-disciplinary approach, emphasizing knowledge translation, implementing clinical practice

guidelines, and integrating community partners into the hospital environment. As leaders in the stroke rehabilitation field, Sheltering Arms is currently adapting its clinical practice guidelines to include the latest research and advances in technology to achieve the vision of reinventing rehabilitation for life beyond limits. A scientific approach to close the gap between research and practice will assess barriers to adoption of guidelines and provide clinicians with additional support for maximizing patient outcomes.

The Virginia Commonwealth University (VCU) Stroke Outpatient Clinic/ Cerebrovascular Center of Excellence and Sheltering Arms Institute's clinical practice guidelines are two models that highlight promising practices from the field that other rehabilitation centers and hospitals might find beneficial.

Establish a Process for Continuous Quality Improvement

Legislation Implementation Process

In 2019, the VSCQI Advisory group established the Acute Stroke Treatment Strategies (ASTS) work group to put forth recommendations for establishing a process for continuous quality improvement for stroke care. Work group members consisted of an emergency medicine physician, stroke coordinator co-leads, vascular neurologists, stroke coordinators, and pharmacists. After meeting regularly throughout 2019, the work group reached the following consensus and understanding surrounding stroke acute care needs – the most important factor in decreasing disability and mortality from acute stroke is early treatment. "Time lost is brain lost," and it is reported that the typical patient loses almost two million brain cells for every minute in which stroke is untreated (Saver, 2006). Selection of appropriate patients for treatment requires neurological evaluation and neuroimaging. Early successful treatment for acute stroke requires a system that coordinates pre-hospital emergency medical services, emergency medicine, stroke

neurology, intensive care services, interventional neuroradiology, and neurosurgery to provide optimal and timely treatments. The immediate goals of treatment are to restore blood flow to regions of the brain that are ischemic but not yet infarcted using treatment with thrombolytics (intravenous alteplase) and/or mechanical thrombectomy. Long-term goals are to improve outcomes by reducing stroke-related disability and mortality. These guidelines are reflected in the AHA/ASA Target Stroke Phases II and III as best practice strategies (Appendix C). The ASTS work group strongly advises recommendations as standard practice across all Virginia hospitals, depending on resources and capacity:

Recommendations for Defined Stroke Alert Process:

- EMS Pre-Hospital Notification

Early stroke recognition is essential to timely care. EMS should provide pre-hospital notification when a stroke is recognized or suspected in the field. Evidence clearly shows a pre-alert notification allows the hospital to mobilize resources, and it also shows faster door-to-imaging, door-to-needle (thrombolytic) times, symptom onset to needle times and increased use of alteplase treatment within three hours (Powers, 2019). EMS pre-notification is recognized in Target: Stroke Phase II Best Practice Strategies (Target: Stroke Phase II #1, 2017).

- Transfer Directly to Computed Tomography or other Designated Stroke Assessment Area

A designated stroke assessment area should be identified as the first point of contact between EMS and the medical team receiving a patient with potential stroke from EMS transport. Potential stroke assessment areas could include computed tomography (CT) or emergency department (ED) triage/resuscitation area. Unless CT is not available or patient is unstable, the patient may be transported with the treating physician and nurse directly to CT on EMS gurney bypassing the ED bed where the neurologic exam and brain imaging are performed

to determine eligibility for intravenous thrombolytic therapy (alteplase). Once the physician has read the CT as non-hemorrhagic and there are no other contra-indications, the initial bolus of alteplase may be delivered while the patient is still on the CT table.

Alternatively, the stroke assessment area may be a dedicated hallway space or area in the ED (preferably labeled for this particular use) where rapid assessment by the ED physician may occur to ensure hemodynamic and respiratory stability and to evaluate for other emergency diagnoses followed by prompt transport to the CT. Appropriate written protocols with explicit inclusion and exclusion criteria should be in place and this should include if the patient arrives to ED triage instead of by EMS. Protocols for the transport of stroke patients by EMS directly to CT and bypassing the conventional ED bed and full assessment process have been associated with door-to-needle times less than 30 minutes and substantial improvements in door-to-needle times reported by select centers. Transfer directly to CT is recognized as Target Stroke Phase II (Target: Stroke Phase II #6, 2017), and it is associated with significant reduction in door-to-needle times. The following outlines the steps needed for transition upon ED patient arrival ED patient arrival (note certain processes occur simultaneously):

1. Registration takes priority and is conducted upon arrival unless completed pre-arrival.

2. Upon arrival patient is assessed for hemodynamic/respiratory stability and, if stable, is transported directly to CT.

3. EMS gives report while patient is being transferred to weight stretcher.

4. Obtain weight and connect patient to monitor and obtain vital signs. Blood pressure may need treatment as per established stroke guidelines.

5. Check finger stick blood glucose (if not previously checked) and draw other laboratories, as indicated. Verify functioning intravenous line and determine whether additional lines are needed.

6. Perform focused clinical assessment, examination, and initial neurological exam. Patient education is initiated including working diagnosis, potential for alteplase and/or neurointervention.

7. Brain imaging is performed to exclude imaging contraindications to alteplase.

8. Review indications and potential contraindications for intravenous alteplase.

9. Monitor and treat patient as indicated.

10. If patient is determined to be a candidate, administer alteplase bolus and start continuous infusion in CT.

11. After alteplase is started, follow hospital-specific protocol for the next phase of acute stroke care, which may include additional vascular imaging, assessment for endovascular treatment, further acute care in the ED, admission to the stroke unit or transfer to another facility for admission.

- Rapid Access and Administration of Thrombolytics

The benefits of thrombolytics in patients with acute ischemic stroke are time-dependent. Each 15-minute reduction in time to initiation of alteplase treatment was associated with an increase in the percent improvement of walking independently at discharge (4%), being discharged to home rather than an institution (3%), decrease in symptomatic hemorrhagic transformation of infraction (4%) and decrease in the odds of death before discharge (4%) (Saver, 2013). Once eligibility has been determined, alteplase should be administered without delay. The thrombolytic should be readily available in the ED and can be retrieved and

administered by the emergency medicine team. A useful strategy is to reconstitute the thrombolytic once the patient is identified as a possible thrombolysis candidate. High performing organizations reconstitute the thrombolytic immediately on identification of tPA-eligible patients to save time. Crucial steps to meet the metric include staff education and drug administration resources such as dosing charts. Rapid administration of alteplase is recognized as Target: Stroke Phase II and Phase III Best Practice Strategies (Target: Stroke Phase III #10, 2019).

- Triage/Algorithm for Large Vessel Occlusion Detection and Screening

Large vessel occlusion (LVO) accounts for up to 38% of acute ischemic stroke and is associated with devastating outcomes for patients, families and society. Five randomized controlled trials concluded that mechanical thrombectomy for acute stroke offers benefit. Two subsequent trials expanded the time window for mechanical thrombectomy, prompting changes to the 2018 stroke guidelines for patients presenting with acute stroke within 24 hours to be evaluated for LVO stroke so that treatment with thrombectomy can be performed as indicated (Sweid, 2019). The expanded time window for mechanical thrombectomy for appropriate patients allows more patients who could benefit from the procedure and lowers their risk of disability from stroke. In addition, earlier thrombectomy treatment is associated with better patient outcomes, including independent ambulation at discharge, discharge to home, functional independence and freedom for disability at discharge and at three months, and lower complications, including symptomatic intracranial hemorrhage and in-hospital mortality (Jahan, 2019). Important strategies include establishing an algorithm for LVO evaluation, which may include use of LVO scales to identify patients that need additional imaging and thrombectomy treatment with transfer process in place if required. It is crucial to understand that rigid selection

criteria may deny evaluation to patients that may benefit from thrombectomy and that algorithms are needed to establish minimum standards for which patients should be evaluated for this potential treatment (Nogueira, 2019). Rapid acquisition and interpretation of additional imaging to evaluate for LVO and thrombectomy is recognized as Target: Stroke Phase III Best Practice Strategies (Target: Stroke Phase III #3, 2019).

Recommendations for Continuous Quality Improvement for the Delivery of Stroke Care:

- Prompt Data Feedback & Review of Key Performance Indicators

Continuous quality improvement implemented and evaluated by each stakeholder of the stroke system of care can be useful in improving patient care and outcomes (Powers, 2019). Accurately measuring and tracking time intervals and the system's performance in key indicators can equip the interdisciplinary collaborative team to identify areas for improvement and take appropriate action. A data monitoring and feedback system is essential in providing prompt feedback and developing recommendations on a case-by-case basis and at the organization and system levels.

Key performance indicators include, but should not be limited to the following: door-to-needle (thrombolytic/alteplase) times, alteplase treatment rates in eligible patients, door-in-door-out times for patients transferring to tertiary centers for specialty acute stroke care, door-to-intervention (thrombectomy) times, and patient outcome metrics including complication rates. Prompt data feedback is recognized as Target: Stroke Phase II (Target: Stroke Phase II #12, 2017) and Phase III Best Practice Strategies (Target: Stroke Phase III #12, 2019). Hospitals without local stroke expertise 24/7 should explore building relationships with stroke centers to facilitate more timely evaluation, decision-making and treatment. Telehealth solutions may be a critical component to support acute stroke teams.

- Multidisciplinary Collaboration for Process Improvement

Healthcare organizations should organize and implement a multidisciplinary quality improvement committee to evaluate quality benchmarks, indicators, evidence-based practices and outcomes (Powers, 2019). A multidisciplinary team is recommended to be effective in enhancing the number of stroke patients eligible for treatment and reducing time to treatment in stroke. The multidisciplinary team includes but is not limited to emergency medicine, neurology, nursing, pharmacy, quality, hospital administration, stroke coordinator, neurosurgery, case management, neuro intervention, allied health, hospitalist medicine and radiology. The team should meet on a regular basis to review processes, quality data, and clinical outcomes and make recommendations for process improvement.

A multidisciplinary committee was associated with decreased time to alteplase administration. It has also been shown to lower in-hospital mortality related to intracranial hemorrhage and increase the percent of patients discharged home. This process allows the identification of treatment barriers and facilitates team interventions to increase stroke treatment continuous quality improvement starting from the initial patient encounter through the ED. Stroke team activation and post stroke care can help improve patient outcomes (Powers, 2019). This team-based approach is recognized as Target: Stroke Phase II Best Practice Strategies (Target: Stroke Phase II, 2017). A multidisciplinary team can escalate barriers to senior leadership to improve processes. Hospital administration should provide resources to help maintain strategies for process improvement. Interprofessional collaboration of urban and rural centers is important in the coordination of care from a pre-hospital encounter to post stroke care. See Appendix D for example roles and responsibilities of a stroke multidisciplinary team.

Summary of Recommendations

Following is a summary of VSCQI Advisory Group recommendations that are detailed in the preceding sections of this report for each of the legislative requirements. The recommendations include one key recommendation for the General Assembly:

- Appropriate $327,624 in FY22 and FY23 to support three FTEs needed for the development, maintenance, and data analysis of a statewide stroke registry platform in the Commonwealth of Virginia.

Other key recommendations of the VSCQI Advisory Group are targeted to other stakeholder entities and include the following:

- VDH, hospitals and EMS entities should focus collaborative efforts in the recommended, priority geographic areas (counties/cities) with the highest age-adjusted stroke mortality rates per health planning region
- Virginia hospitals, VDH, EMS, stroke rehabilitation centers, community clinics, caretakers and all relevant stakeholders concerned with stroke care quality should follow the specific recommendations and guidelines outlined in *Transitions to Community-based Follow-up Care* and *Follow-up Care after Acute Stroke Treatment*.
- Virginia hospitals and EMS agencies should ensure that the *Defined Stroke Alert Process* and *Continuous Quality Improvement for the Delivery of Stroke Care* processes become standard practice across all Virginia hospitals.

Conclusion

Prior to the enactment of § 32.1-111.15:1, VDH collaborated with VSSTF, VSCC, VDH OEMS, VHHA, AHA/ASA, hospitals and EMS to select and prioritize stroke metrics along the continuum of care. The initial data collected from these stroke metrics informed the quality improvement initiatives and processes undertaken by the VSCQI Advisory Group. VDH simultaneously built capacity within the advisory group through work groups dedicated to move key components of the legislation forward in Virginia.

In 2019 and 2020, VDH recognized the need for funding to hire staff for the development and maintenance of a statewide stroke registry. VDH took considerable steps to analyze age-

adjusted mortality rates and hospitalization rates to study stroke burden in counties and cities across the Commonwealth. Using data from the Department of Vital Records, VDH prioritized counties and cities with the highest age-adjusted stroke mortality rates from 2014 to 2018 within each of the five health regions. These prioritized geographic areas will be key focus areas for facilitating data sharing and collaboration among hospitals and between hospitals and EMS. Progress has been achieved in identifying recommendations for transitions of care and quality improvement for stroke through the Acute Stroke Treatment Strategies work group. In 2020 and 2021, VDH, through the VSCQI Advisory Group and its work groups, will move the key components of the legislation forward through increased engagement with hospitals and EMS agencies and assisting these entities with implementing best practices for the improvement of stroke outcomes in Virginia.

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Appendix A – Code of Virginia, Section 32.1 – 111.15:1

CHAPTER 276

An Act to amend the Code of Virginia by adding in Article 2.1 of Chapter 4 of Title 32.1 a section numbered 32.1-111.15:1, relating to stroke care quality improvement.

[H 1197]

Approved March 9, 2018

Be it enacted by the General Assembly of Virginia:

1. That the Code of Virginia is amended by adding in Article 2.1 of Chapter 4 of Title 32.1 a section numbered 32.1-111.15:1 as follows:

§ *32.1-111.15:1. Department responsible for stroke care quality improvement; sharing of data and information.*

A. The Department shall be responsible for stroke care quality improvement initiatives in the Commonwealth. Such initiatives shall include:

1. Implementing systems to collect data and information about stroke care in the Commonwealth in accordance with subsection B;

2. Facilitating information and data sharing and collaboration among hospitals and health care providers to improve the quality of stroke care in the Commonwealth;

3. Requiring the application of evidence-based treatment guidelines for transitioning patients to community-based follow-up care following acute treatment for stroke; and

4. Establishing a process for continuous quality improvement for the delivery of stroke care by the statewide system for stroke response and treatment in accordance with subsection C.

B. The Department shall implement systems to collect data and information related to stroke care (i) that are nationally recognized data set platforms with confidentiality standards approved by the Centers for Medicare and Medicaid Services or consistent with the Get With The Guidelines-Stroke registry platform from hospitals designated as comprehensive stroke centers, primary stroke centers, or acute stroke-ready hospitals and emergency medical services agencies in the Commonwealth and (ii) from every primary stroke center with supplementary levels of stroke care distinction in the Commonwealth. Every hospital designated as a comprehensive stroke center, primary stroke center, or primary stroke center with supplementary levels of stroke care distinction shall report data and information described in clauses (i) and (ii) to the Department. The Department shall take steps to encourage hospitals designated as acute stroke-ready hospitals and emergency medical services agencies to report data and information described in clause (i) to the Department.

C. The Department shall develop a process for continuous quality improvement for the delivery of stroke care provided by the statewide system for stroke response and treatment, which shall include:

1. Collection and analysis of data related to stroke care in the Commonwealth;

2. Identification of potential interventions to improve stroke care in specific geographic areas of the Commonwealth; and

3. Development of recommendations for improvement of stroke care throughout the Commonwealth.

D. The Department shall make information contained in the systems established pursuant to subsection B and data and information collected pursuant to subsection C available to licensed hospitals and the Virginia Stroke Systems Task Force, and, upon request, to emergency medical services agencies, regional emergency medical services councils, the State Emergency Medical Services Advisory Board, and other entities engaged in the delivery of emergency medical services in the Commonwealth to facilitate the evaluation and improvement of stroke care in the Commonwealth.

E. The Department shall report to the Governor and the General Assembly annually on July 1 on stroke care improvement initiatives undertaken in accordance with this section. Such report shall include a summary report of the data collected pursuant to this section.

F. Nothing in this article shall require or authorize the disclosure of confidential information in violation of state or federal law or regulations, including the Health Insurance Portability and Accountability Act, 42 U.S.C. § 1320d et seq.

2. That the provisions of the first enactment of this act shall become effective on January 1, 2019.

3. That the Department of Health shall convene a group of stakeholders, which shall include representatives of (i) hospital systems, including at least one hospital system with at least six or more stroke centers in the Commonwealth, recommended by the Virginia Hospital and Healthcare Association; (ii) the Virginia Stroke Systems Task Force; and (iii) the American Heart Association/American Stroke Association, to advise on the implementation of the provisions of this act.

Appendix B – Alphabetized List of Advisory Group Stakeholders

American Heart Association / American Stroke Association (AHA / AHA)

Emergency Medical Services Regional Councils

Hospitals

Physical Rehabilitation Centers

United States Department of Veterans Affairs

VDH Office of Emergency Medical Services (VDH OEMS)

Virginia Hospital and Healthcare Association (VHHA)

Virginia Department of Health (VDH)

Virginia Stroke Coordinators Consortium (VSCC) Co-Chairs

Virginia Stroke Systems Task Force (VSSTF) Co-Chairs

Appendix C – AHA/ASA Target: Stroke Phases II and III Action Strategies

Target: Stroke Phase II	Target: Stroke Phase III
1. Hospital pre-notification by Emergency Medical Services 2. Rapid triage protocol and stroke team notification 3. Single call/paging activation system for entire stroke team 4. Use of a stroke toolkit containing clinical decision support, stroke-specific order sets, guidelines, hospital-specific algorithms, critical pathways, NIH Stroke Scale and other stroke tools 5. Timer or clock attached to chart, clipboard, or bed 6. Transfer directly to CT/MRI scanner 7. Rapid acquisition and interpretation of brain imaging 8. Rapid Laboratory Testing (including point-of-care testing) if indicated 9. Pre-mixing tPA medication ahead of time for high likelihood candidates 10. Rapid access to intravenous tPA in the ED/brain imaging area 11. Team-based approach 12. Rapid data feedback to stroke team on each patient's DTN time and other performance data	1. Rapid Administration of Alteplase 2. Rapid Acquisition and Interpretation of CT/MR Angiography 3. Rapid Acquisition and Interpretation of Additional Imaging 4. Pre-Notification and Rapid Activation of the Neurointerventional Team 5. Rapid Availability of the Neurointerventional Team 6. Timer or Clock Attached to Chart, Clip Board, or Bed 7. Transfer Directly to Neuroangiography (NA) Suite 8. Transfer Directly from Brain Imaging Suite to NA Suite 9. Endovascular Therapy Ready NA Suite 10. Team Based Approach 11. Anesthesia Access and Protocols 12. Prompt Data Feedback

Appendix D – Stroke Multidisciplinary Team Roles and Responsibilities

ROLE	RESPONSIBILITIES
Stroke Team:	
Medical Director	● The physician provides leadership and clinical governance and is knowledgeable of the specialty practices and techniques to lead and advise the team. ● Responsible for development of new written care protocols as needed. ● Responsible for routine review of all current protocols and orders ensuring the most up to date care standards are being implemented. ● Conduct medical review of charts; address significant or potential medical care issues. ● Correcting deficiencies and coordinating performance improvement peer review through bimonthly multidisciplinary stroke collaborative meetings. ● Involved in the assessment of patients and provides consultative advice to other treatment physicians.
Stroke Program Coordinator	● Guide and foster development of a cohesive interdisciplinary team with a continuum focus. ● Policy and Procedure development. ● Responsible for regulatory and stroke certification/designation requirements. ● Formal reporting on all aspects of the stroke program to committee and boards. ● Implementation of quality methodology to improve performance. ● Initiate quality improvement projects. ● Community Outreach – organize programs, lectures for community groups. ● Educational programs for EMS. ● Provide ongoing education to staff on clinical care issues for stroke; i.e. nurses, providers, patient care assistants, therapists, radiology staff, etc. ● Develop competency demonstration for staff. ● Participate in interdisciplinary rounds. ● Collect, validate, analyze, and disseminate data to drive process improvement initiatives.
ICU Unit Nurse Manager	● Maintains quality patient care through use of clinical expertise, nursing process, and effective supervisory skills. ● In consultation with the stroke program coordinator and staff development, assists with DNV requirements, planning, coordination, implementation and evaluation of clinical education. ● Provides tools/education/resources to ensure all quality indicators are met. ● Assures that staff are provided the necessary orientation/training to ensure safe patient care. ● Monitors the identification of learning needs of the staff, patient/family, and physicians. ● Assures that quality educational programs are developed to meet those needs. ● Participate in interdisciplinary rounds when possible.

Neuro Unit Manager	- Maintains quality patient care through use of clinical expertise, nursing process, and effective supervisory skills. - Provides tools/education/resources to ensure all quality indicators are met. - In consultation with the stroke program coordinator and staff development, assists with DNV requirements, planning, coordination, implementation and evaluation of clinical education. - Assures that staff are provided the necessary orientation/training to ensure safe patient care.
Other Members:	
ED Physician	- Demonstrate knowledge and understanding of stroke protocol. - Collaborate effectively with EMS, nursing staff, acute stroke team and hospitalist team. - Initiate stroke protocols concurrent with ED evaluation and management. - Implement interventions as indicated.
ED Nurse Manager	- Maintains quality patient care through use of clinical expertise, nursing process, and effective supervisory skills. - Provides tools/education/resources to ensure all quality indicators are met. - In consultation with the stroke program coordinator and staff development, assists with DNV requirements, planning, coordination, implementation and evaluation of clinical education. - Assures that staff are provided the necessary orientation/training to ensure safe patient care.
Neurologist	- Serve as consultant for patients with stroke/transient ischemic attack. - Coordinate acute care for stroke. - Implement interventions as indicated. - Determine appropriateness of aggressive intervention in collaboration with primary/attending.
Neurosurgeon	- Serve as consultant for patients with hemorrhagic stroke and patients with ischemic stroke requiring hemicraniectomy. - Implement interventions as indicated. - Determine appropriateness of aggressive intervention in collaboration with primary/attending.
Neuro Interventionist	- Serve as consultant for patients with acute stroke. - Perform imaging and procedures as indicated. - Implement interventions as indicated.
Attending Physician	- Coordinate overall medical management of patient - Implement interventions as indicated.
Advanced Practice Nurse	- Collaborate with the attending and specialist team on evidence-based care for stroke patients. - Demonstrate knowledge and understanding of stroke order-sets, protocols and appropriate management of stroke patients. - Implement interventions as indicated.

Nursing: RN certified in NIHSS	● Conduct NIHSS stroke scale assessment to evaluate progression/improvement of stroke deficit. ● Assure that physician-ordered tests and procedures are planned and implemented in an efficient, patient-centered manner. ● Conduct initial swallow screening before oral nutrition or medication is provided. ● Provide stroke education to patient and family. ● Implement a stroke plan of care. ● Communicate team suggestions with appropriate physician(s). ● Participate in interdisciplinary rounds.
Case Manager	● Coordinate discharge plan as targeted by the interdisciplinary team. ● Facilitate referrals to appropriate resources (rehab, outpatient therapies, wound care, etc.) based on initial assessment. ● Initiate connection to community supports, referrals as appropriate (e.g. community-based long-term care, Meals on Wheels, driving evaluations, support groups, etc.).
Physical Therapy: RPT	● Evaluate, treat patients for ambulation, bed mobility, transfers, and gait. ● Work with large muscle groups to maintain or restore function, mobility. ● Determine patient's in-hospital physical therapy goals; recommend level of continued physical therapy in appropriate setting (Rehab vs. SNF vs. Outpatient vs. Home Health). ● Identify and address safety concerns with respect to mobility and transfers. ● Provide patient/family education. ● Conduct Pre-Morbid Modified Rankin Scales to determine patient's baseline function; assess for physical and occupational therapy needs.
Occupational Therapy	● Evaluate and treat patient's functional abilities for self-care skills with the goal of maximizing independence in skills (bathing, dressing, toileting, feeding). ● Assess visual and cognitive skills; provide compensatory strategies for safe independent functioning. ● Assess occupational needs; provide maximizing skills. ● Determine patient's in-hospital occupational therapy goals; recommend level of continued occupational therapy in appropriate setting (rehabilitation, skilled nursing facility, home health, or outpatient setting). ● Provide patient/family education.
Speech Therapist	● Evaluate and treat dysphagia; assess for signs of aspiration. ● Assess speech/language, cognition, memory recall, and thought coordination. ● Use speech pathology assessment to identify special nutritional needs of patients. ● Provide patient/family education. ● Provide recommendations for appropriate texture/consistency of food.

Appendix E - Glossary of Terms

Acute Stroke Unit	A stroke unit providing acute care in the early stages post-stroke. Treatment and care during the acute phase of stroke are crucial and will include a number of tests to confirm the diagnosis, including a brain scan.
Aneurysm	A balloon-like bulge in the wall of an artery. The walls of an aneurysm are thin and weak and so they are more likely to burst and cause bleeding in the brain (a hemorrhagic stroke).
Angiography	An invasive procedure that uses x-ray imaging to detect blockage or narrowing in blood vessels.
Aphasia	The loss of ability to communicate normally resulting from brain damage, typically to the left side of the brain.
Apraxia	A neurological disorder exemplified by the inability to carry out familiar movements when commanded to do so. Persons with apraxia understand such commands, and are willing to carry them out, but are physically unable to perform the task.
Atherosclerosis	Hardening of the arteries.
Atrial Fibrillation	An irregular heart rhythm in which many impulses begin and spread through the atria. The resulting rhythm is disorganized, rapid and irregular and the atria (upper chambers of the heart) are not able to fully empty their contents into the ventricles (lower chambers of the heart).
Blood Vessels	Blood vessels form part of the circulatory system that transports blood throughout the body. There are three major types of blood vessels. Arteries carry the blood containing oxygen and nutrients away from the heart out to the rest of the body. Capillaries are tiny blood vessels within the tissues of the body, and veins carry blood containing waste products like carbon dioxide back toward the heart and lungs.

CT Scan	CT stands for computerized tomography and is a type of brain scan. It is a type of X-ray that is used to see what is going on inside the brain. It is particularly good at seeing whether a stroke is caused by a blockage or a bleed. It is a quick and painless test. People who have a suspected stroke should have a CT scan as soon as possible.
Hemorrhagic Stroke	This type of stroke takes place when a weakened blood vessel in the brain ruptures. A hemorrhage, or bleeding from the blood vessel, occurs suddenly. The force of blood that escapes from the blood vessel can also damage surrounding brain tissue. Hemorrhagic stroke is the most serious kind of stroke.
Hyperlipidemia	High cholesterol.
Hypertension	High blood pressure.
Ischemic Stroke	Type of stroke that occurs when a blood vessel in the brain develops a clot and cuts off the blood supply to the brain. Blood clots often result from a condition called "atherosclerosis," the build-up of fatty deposits within blood vessel walls.
Mobility	Capability of movement or of being moved. Examples include moving in bed, getting up from a chair or sitting on a toilet.
Paralysis	Inability to move part of the body.
Rehabilitation	Support to recover and adapt to the impact of illnesses and long-term conditions. It usually involves specific therapies such as physiotherapy, speech and language therapy or occupational therapy and often involves exercises to help the person recover any abilities they have lost and learn new techniques to compensate for any lasting effects

Reperfusion	The restoring of blood flow to an organ after blood flow had been cut off.
Skilled Nursing Facility	Facility that offers services including long-term nursing care and rehabilitation.
Thrombus	A blood clot that forms in a blood vessel in the brain.
TPA	Tissue plasminogen activator (TPA) is a thrombolytic agent, or "clot buster" medication, that can dissolve a blockage within an artery to restore blood flow to the brain.
Transient Ischemic Attack (TIA)	A TIA occurs when blood flow to a certain part of the brain is cut off for a short period of time, usually 15 minutes or less. A TIA is a warning sign that something is wrong. It should be treated as seriously as a stroke.