2021 Report to the Virginia General Assembly

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

Table of Contents

Tables

Figures

Appendices

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. In 2021, VDH collaborated with clinical and community-based stakeholders to apply for the Centers for Disease Control and Prevention (CDC) Paul Coverdell National Acute Stroke Program (PCNASP) competitive funding opportunity. The strategies and activities contained in the work plan of the Virginia proposal for the CDC PCNASP align with the previously established legislative mandate. Virginia's CDC PCNASP work plan has been adopted as the updated work plan for this continued work. The strategies and activities contained in the work plan of the Virginia proposal 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).

In September 2021, VDH was granted the Paul Coverdell National Acute Stroke Program (PCNASP) funding award from the Centers for Disease Control and Prevention (CDC). The approved "CDC PCNASP Virginia Proposal" aligns with the core requirements of the 2018 legislation, and the work plan has been adopted as the updated work plan for this continued work. Work plan details are outlined in the legislative requirements section of this report.

Background on Stroke Burden, Preliminary Action Steps and Stakeholder Collaborations

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 37.4 per 100,000 population age-adjusted rate nationally (Stroke Mortality by State, 2021). 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 (Emporia City and Covington City) with the highest burden of stroke hospitalization were 996.48 per 100,000 population and 959.04 per 100,000 population. Conversely, the age-adjusted hospitalization rates for the two counties (Grayson County and Lee County) with the lowest burden of stroke hospitalization were 54.19 per 100,000 population and 34.98 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 131.71 per 100,000 population (Galax City) and the lowest rate was 7.75 per 100,000 population (Rappahannock County).

The two maps below display the geographic distribution of age-adjusted mortality and hospitalization rates, with geocoded hospitals color coded by stroke certification type to include Thrombectomy-Capable Stroke Center (TSC or PSC+), Comprehensive Stroke Center (CSC), Primary Stroke Center (PSC) and Acute Stroke Ready Hospital (ASRH) (Figure 1 and Figure 2).

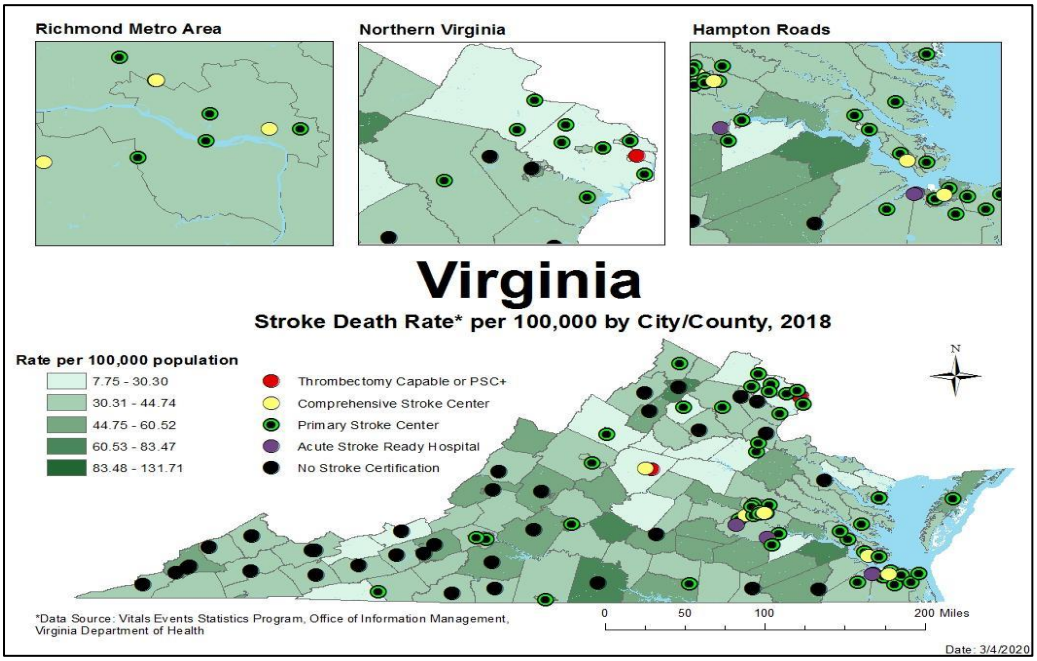

Figure 1. Age-adjusted Rate of Deaths Due to Stroke in Virginia by County/City in 2018. County and City rates stratified by quintiles represented by a light green (low rate) to dark green (high rate) gradient. Hospitals represented by dots and assigned colors by stroke certification type based on 2019 VSCC Stroke Certification Survey. Richmond Metro Area, Northern Virginia, and Hampton Roads are enlarged (Stroke Mortality by State, 2020).

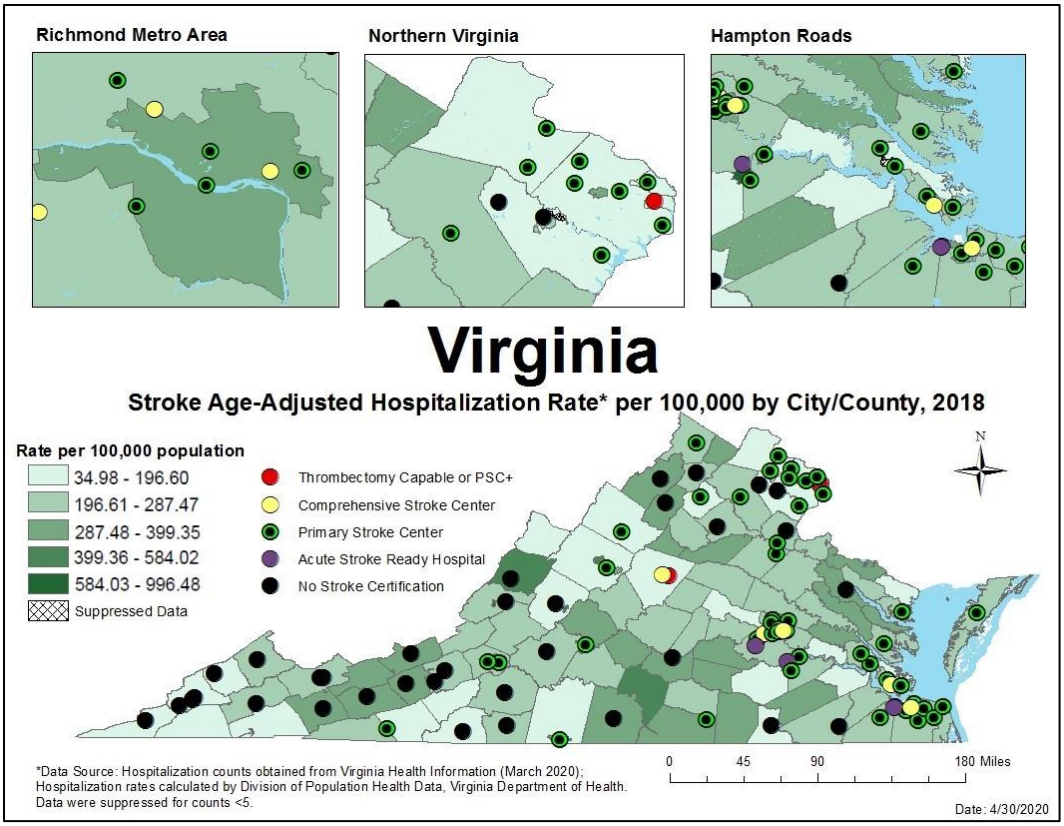

Figure 2. Rate of Hospitalizations Due to Stroke in Virginia by County/City in 2018. Age-adjusted rates stratified by quintiles represented by a light green (low rate) to dark green (high rate) gradient. Hospitals represented by dots and assigned colors by stroke certification type based on 2019 VSCC 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).

Figure 3 and Figure 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).

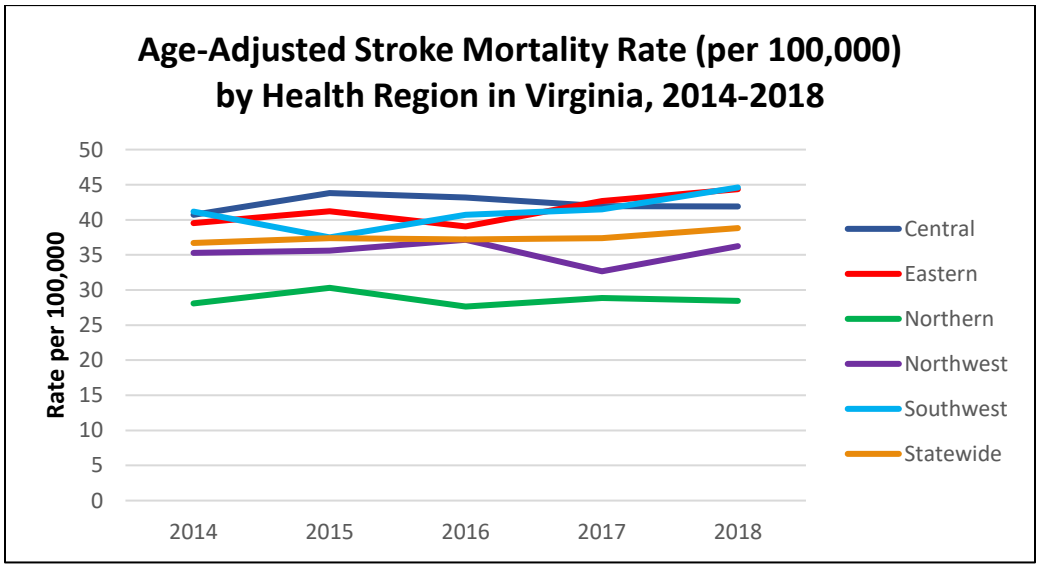

Figure 3: Annual Age-Adjusted Stroke Mortality Rate (per 100,000) by Health Planning Region: Virginia, 2014-2018. (Stroke Mortality by State, 2020).

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).

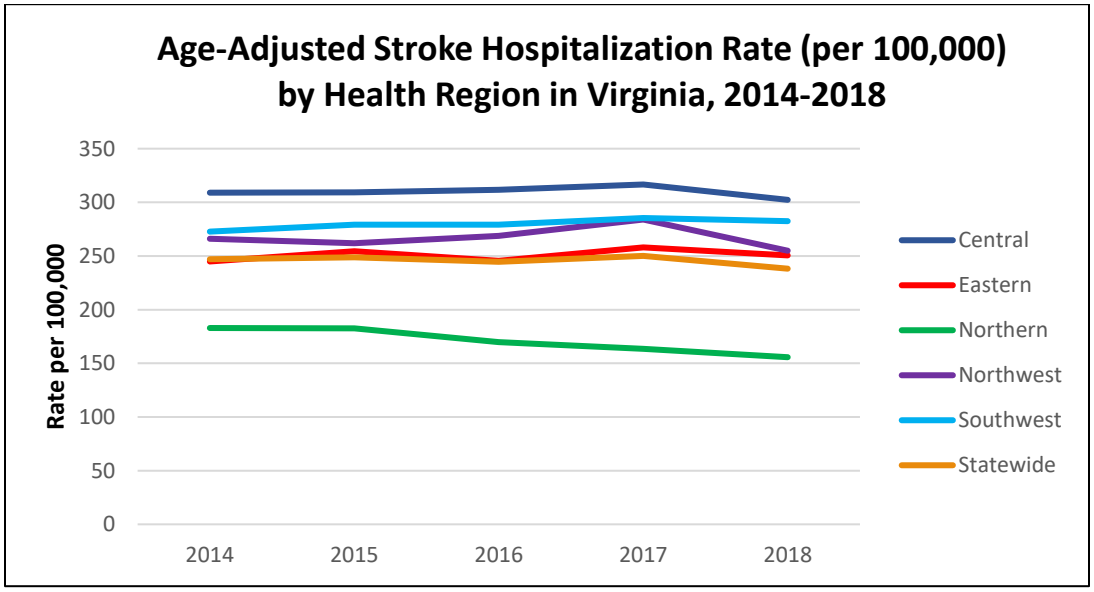

Figure 4. Annual Age-Adjusted Stroke Hospitalization Rate (per 100,000) by Health Planning Region: Virginia, 2014-2018. Data Source: The stroke indicator data were drawn from the inpatient discharge dataset provided to Virginia Department of Health (VDH) by Virginia Health Information (VHI) Discharge 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 to include:

- Identified stakeholder members for the VSCQI Advisory Group (Table 1).
- 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) to facilitate a discussion on data collection, information sharing and quality improvement initiatives.
- Invited all VSSTF members to propose and submit stroke-related metrics of interest to VDH, providing an opportunity to explore population health indicators and analyses that describe Virginia's progress in improving stroke outcomes. VDH compiled the proposed metrics were into four categories – prevention/risk factors, pre-hospital, in-hospital, and post-hospital.
- Created four draft metric surveys.
- Updated and maintained VDH's stroke webpage to allow for information sharing, monitoring of state and regional stroke metrics, and quality improvement best practices and resources.

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℠
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

In addition to the actions outlined above, 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 participated and paid an annual subscription for GWTG, which left a number of hospitals without the ability to participate in a statewide stroke registry through VDH. Details regarding the summary of preliminary actions described above were provided in prior VDH annual reports, which can be accessed on the General Assembly's Legislative Information System (LIS) website. This report describes 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. Key strategies and activities are outlined in the updated work plan, sections of which are presented with the applicable legislative requirement.

Stakeholder Collaborations

VDH continues to foster cross-sector collaboration and leading change across the continuum of stroke care. VDH will continue to lead the VSCQI Advisory Group, co-lead the

VSSTF, and support the VSCC. VDH meets bi-weekly with the VSSTF and VSCC Co-Chairs and planning teams to identify speakers, professional development and peer learning opportunities, and logistics for quarterly statewide meetings. VDH convenes the VSCQI Advisory Group quarterly, and its work groups meet monthly. Clinical experts with experience in stroke care co-lead the following work groups with VDH: Data Council, Acute Stroke Treatment Strategies (ASTS), and Hospital and EMS Transitions of Care. VDH has expanded the scope of established coalitions and broadened stakeholder collaborations in response to the CDC PCNASP funding opportunity.

Continued work through the VSCQI Advisory Group, VSSTF, and VSCC partnerships will help achieve the strategies and activities outlined in the work plan, and the roles of expanded stakeholder collaborations are defined. All CSC and PSC+ hospitals will lead activities outlined in the first year of the work plan and serve as mentors to all other hospitals in the following years. VHHA will be a critical partner in hospital engagement, data analysis, and quality improvement facilitation to all hospitals. EMS regional councils will lead engagement and quality improvement among EMS agencies. Sheltering Arms Institute (SAI) will work with CSC and PSC+ hospitals to create in-patient rehabilitation clinical guidelines and scale the VDH toolkit to all in-patient rehabilitation facilities. Unite Us will create a specific focus on stroke transitions of care and engagement of patient navigators through their state referral system. Kwikpoint, VHHA, (MSV), and (VPhA) will sread the Stroke Smart Virginia campaign to all hospitals, primary care practices, federally qualified health centers (FQHCs), free clinics, and pharmacies, in addition to establishing a Stroke Smart Virginia: Cities and Towns Campaign.

Approaches to Reducing Disparities and Risks in Virginia

Virginia belongs to the Stroke Belt, a region of southeastern US recognized for its unusually high incidence of stroke and cardiometabolic conditions. Virginia has an estimated population of 8.47 million, and 5.8 million Virginians have prediabetes, high blood pressure, high blood cholesterol, diabetes, or coronary heart disease. While Virginia is home to a unique blend of beautiful mountains, rural countryside, urban population centers, scenic beaches and the Washington, DC suburbs, this geographic diversity presents obstacles to accessing care, especially concerning accessing primary care, EMS, and hospitals that provide thrombectomy for large vessel occlusions. Patients are not receiving life-saving tPA quickly enough, as evidenced by the disparities between stroke mortality and stroke hospitalizations by county in Figure 1 and Figure 2 in the preceding *Stroke Burden* section.

Due to geographic, socioeconomic, and burden of risk factors previously described, VDH has employed three approaches to identify specific target populations to achieve the goals of reducing disparities and risk among the most vulnerable and high-risk populations.

> *Approach 1: Identify counties and cities with the highest stroke mortality rate and identify the hospitals with the highest stroke admission percentage within the identified counties and cities.*

VDH completed the analysis for all Virginia counties, cities and hospitals. A data excerpt of three hospitals with the highest admissions of stroke is shown in Table 2.

Table 2. Stroke mortality per 100k population and % admission by hospital by locality, 2014-2018

Region	Locality	All-Stroke Mortality per 100k Population	Hospital 1		Hospital 2		Hospital 3	
			Hospital Name	% Stroke Admissions in Locality	Hospital Name	% Stroke Admissions in Locality	Hospital Name	% Stroke Admissions in Locality
Central	Greensville County	64.76	VCU Health System	45.1%	Southside Regional Medical Center	18.5%	Southern VA Regional Medical Center	16.9%
Eastern	Franklin City	93.20	Southampton Memorial Hospital	37.1%	Sentara Norfolk General Hospital	20.0%	Sentara Obici Hospital	16.8%
Northern	Manassas City	49.75	Novant Health Prince William Medical Center	41.6%	Inova Fairfax Hospital	35.2%	Prince William Hospital	5.4%
Northwest	Highland County	60.66	Augusta Health	46.3%	University of VA Medical Center	34.2%	Sentara RMH Medical Center	7.3%
Southwest	Martinsville City	84.64	Memorial Hosp. Martinsville & Henry Co.	66.8%	Carilion Medical Center	19.1%	Memorial Hosp. Martinsville & Henry Co.	8.3%

Approach 2: Utilize identified hospitals' electronic health records (EHR) and health information technology (HIT), VHHA's Data Analytics Dashboard and predictive modeling[1] to create patient registries for hospitals to proactively engage high-risk patients for stroke and connect them to services through the Unite Us statewide referral system.

Hospitals are critical access points to reach target populations and improve health in Virginia. Among the 40 health systems covering 109 hospital and healthcare centers, there were 767,485 patient admissions in 2016. Within the six largest hospitals of each region, 177,546 patient admissions accounted for 1,065,034 patient days. EHR querying can group patients by diagnoses, demographics, socioeconomic factors, insurance, and health history. Between November 2019 and January 2021, VDH and VHHA trained 12 hospitals on predictive modeling and identified their target populations, specific to the patients and communities they serve.

[1] VHHA predictive modeling tool is an algorithm that utilizes an odds ratio analysis to determine patient-level risk for developing stroke, cardiovascular disease, diabetes and uncontrolled hypertension and high blood cholesterol. The algorithm overlays health indicators, SDOH, and health behaviors to determine low, medium, and high risk.

Approach 3: Identify target populations in counties and cities based on social determinants of health (SDOH) using the Health Opportunity Index (HOI)[2] and the Unite Us health equity dashboard.

In addition to hospital target populations identified by stroke risk in patient EHR queries, VDH has identified target populations within the counties and cities of highest stroke burden (approach 1) by sex, race, and age. Of the stroke deaths in 2019, 56% were female, 22% were Black, and 86% were 65 years and older. These target populations will be the areas of focus within communities of very low, low or moderate HOI. In Virginia, SDOH are geographically analyzed by census tract to expose the range of opportunities for health. The resulting SDOH index correlates with life expectancy and other health measures but reveals significant inequities in opportunities to be healthy. The regional differences across Virginia are clearly illustrated in Figure 5. While individual experience will vary based on social, economic, environmental, and geographical factors, roughly 58% of Virginia residents live in very low, low or moderate HOI communities that do not provide sufficient opportunities to achieve optimal health.

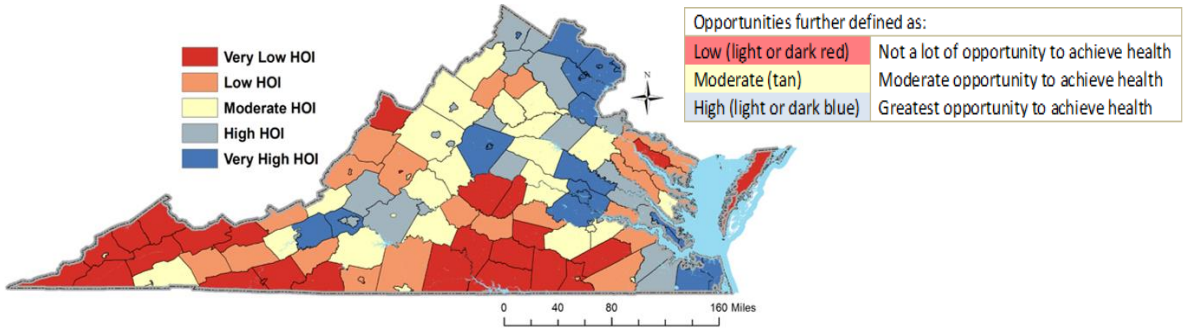

Figure 5. Health Opportunity Index (HOI) in Virginia.

With the target populations identified, the Unite Us health equity dashboard will be used to assess health inequities by county and city. Unite Us will assess availability and proximity of

[2] HOI was developed by VDH to assist the public, businesses, policy makers, communities, healthcare organizations and public health professionals in identifying key social and economic factors (also known as SDOH) that affect the health outcomes of the residents of Virginia communities. HOI uses 13 indices that are broadly defined into four profiles: community environmental, consumer opportunity, economic opportunity, and wellness disparity.

clinical, social, and mental health services, and community resources, to define geographic areas of need. While engaging target populations in hospital and community settings, VDH will align and allocate resources to reduce health disparities and improve SDOH. This approach will allow VDH to achieve maximum patient reach through partnerships with hospitals, EMS, Unite Us, and state associations with large provider membership in VSSTF, VSCC, VHHA, Medical Society of Virginia (MSV), and Virginia Pharmacists Association (VPhA).

Legislative Requirements – Implementation Process, Recommendations and CDC PCNASP Work Plan

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, ASTS 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 an updated work plan with strategies and activities that align with the legislative requirements. 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 continue to 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 3).

Table 3. 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, all CSC and PSC+ 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 for registry development, quality assurance, and data analysis. Staff descriptions are detailed below:

> Stroke Data Analyst / Evaluator (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.)
>
> 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.
>
> Quality Assurance Specialist (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.

Funding awarded through the CDC PCNASP funding opportunity will support the three recommended staff. VDH will continue to work closely with the Data Council to standardize stroke-related data metrics across TJC, DNV, and HFAP standards/certification requirements

manuals. Once hired, the new staff will explore additional action steps in preparation for the development of a statewide stroke registry for Virginia.

CDC PCNASP Virginia Work Plan: Statewide Stroke Registry

Both the CDC PCNASP and the Virginia legislation require the development of a statewide stroke registry. The activities described in the CDC PCNASP work plan below not only meet CDC PCNASP requirements, but also provide the necessary steps to develop a stroke registry and prepare hospitals for collecting data on stroke care as outlined in the legislation. In addition, the funding provided by the CDC PCNASP will mitigate the funding gap related to hiring three full-time employees responsible for developing and managing the stroke registry. A fully operational statewide stroke registry would set the barometer for quality stroke care statewide, regionally, and locally.

In order to successfully implement systems to collect data and information about stroke care across the Commonwealth, VDH will need to help prepare hospitals that will be collecting and providing hospital data to VDH. In activity C.1.1 below, VDH has already begun partnering with VHHA to prepare hospitals on utilizing their EHR data by identifying target patient populations of patients who experienced a stroke or are at high risk of stroke. Since 2018, VDH and VHHA have partnered and established a VHHA Data Analytics Portal and Predictive Analytics Dashboard for hospitals. This dashboard assists hospitals in identifying patients at high risk of stroke or stroke readmission through analysis of hospital discharge data, including 30-day readmissions for stroke, geographic predictive modeling for stroke, and a stroke risk factor analysis. Feedback from hospitals indicates that this tool has made their utilization of EHR data actionable to improve care in cardiovascular disease, stroke, diabetes, and chronic kidney disease. In activity C.1.2, VDH will continue its partnership with Unite Us to create a

health equity dashboard to collect data on stroke care access across the Commonwealth. This information will further inform hospitals, EMS, and policymakers more specifically about the gaps in stroke care along the continuum of care with an analysis on pre-hospital, in-hospital, and post-hospital stroke care by geography. This is a proposed core component of the stroke registry to make the information within the registry actionable on a systems and population health level.

At patient and hospital levels, activities C.2.1 and C.2.2 include the convening of all Virginia CSC and PSC+ hospitals to form a work group to inform all aspects of the stroke registry. This will encompass standardizing metrics across the accrediting bodies for stroke certification, pilot testing data collection and transfer mechanisms within hospitals, and ensuring that the least amount of burden is imposed on data abstractors and subsequent hospitals participating in the registry, especially low-resourced and rural hospitals. These activities will inform the development of data collection and submission processes to the stroke registry add-on to OEMS' Emergency Services Organization (ESO) Trauma Registry. Funding for the ESO stroke registry add-on will be provided by OEMS.

Activities C.2.3 and C.2.4 describe how the data and information collected in the stroke registry will be shared statewide and back to the hospital or EMS of data origin through closed feedback loops. VDH will update its stroke webpage to feature aggregated, de-identified data on stroke care at the state and regional level. The webpage will display maps, data comparisons, and links to resources. In addition to hospitals and EMS agencies receiving the data they submit, they will also receive comparisons to statewide and regional benchmarks as well as access to additional data such as EMS, acute stroke care, rehabilitation, readmissions, and mortality data. If a hospital has data sharing agreements in place with other hospitals and/or EMS, they will be able to access their data through the data sharing agreement with VDH at each party's request.

<table>
<tr><td colspan="5">Strategy C1: Leverage electronic health records (EHRs) and health information technology (HIT) to identify patients with stroke risk factors (e.g. undiagnosed hypertension) and monitor health care disparities for those at highest risk for stroke events.</td></tr>
<tr><td colspan="3" rowspan="4">Activity C.1.1: Convene 8 hospitals to utilize their EHR to monitor target populations at high risk for stroke for healthcare disparities and SDOH. Share best practices from Health Begins Upstream Learning Collaborative, a program funded through VA’s CDC DP18-1815 and DP18-1817, to implement upstream approaches to reduce healthcare disparities.</td><td colspan="2">Lead Staff: Clinical Improvement Specialist (CIS), DPS</td></tr>
<tr><td colspan="2">Contributing Partners: Hospitals (Comprehensive Stroke Centers (CSC) and Primary Stroke Centers + (PSC+))</td></tr>
<tr><td colspan="2">Key Contracts/Consultants: VA Hospital and Healthcare Association (VHHA)</td></tr>
<tr><td colspan="2">SFY Start/End Qtr: Q1-Q4</td></tr>
<tr><td colspan="3" rowspan="4">Activity C.1.2: Leverage Unite Us' health equity dashboard to analyze patient healthcare disparities statewide due to lack of hospitals, EMS, rehabilitation facilities, primary care, pharmacies, and social and mental health services in high burden geographic cities and counties. Share data with hospitals to inform their use of EHR/HIT monitoring of healthcare disparities.</td><td colspan="2">Lead Staff: CIS, DPS</td></tr>
<tr><td colspan="2">Contributing Partners: N/A</td></tr>
<tr><td colspan="2">Key Contracts/Consultants: Unite Us</td></tr>
<tr><td colspan="2">SFY Start/End Qtr: Q1-Q4</td></tr>
<tr><td>Period of Performance Short Term and Intermediate Outcome(s)</td><td colspan="4">• Increased measurement, tracking, and assessment of data across stroke systems of care for those at highest risk for stroke events and stroke patients.
• Increased linkage and usage of data across stroke systems of care for those at highest risk for stroke events and stroke patients.</td></tr>
<tr><td>Measure Description</td><td>Baseline</td><td>Year 1 Target</td><td>Year 3 Target</td><td>Data Source</td></tr>
<tr><td>C.1.i. # and % of entities across stroke systems of care monitoring disparities in identification of stroke risk factors, stroke care, and referrals for populations at highest risk for stroke events compared to all stroke patients</td><td>11/ 110 (10%)</td><td>18 / 110 (16.36%)</td><td>95 / 110 (86.36%)</td><td>VHHA and Unite Us</td></tr>
<tr><td colspan="5">Strategy C2: Establish and expand statewide data infrastructure through an integrated data management system that links pre-hospital, hospital, and post-hospital follow up data for measurement, tracking, and assessment of quality of stroke care data.</td></tr>
<tr><td colspan="3" rowspan="4">Activity C.2.1: Develop, trial, and maintain a statewide Stroke Registry by procuring a stroke registry platform, funded by VDH OEMS, and hiring registry team staff. Convene a stroke registry work group with the 8 VA CSC and PSC+ hospitals to standardize stroke quality metrics across accrediting bodies and trial data transfer methods between VDH, Hospitals, and EMS agencies. Enable VDH’s data infrastructure and management system to integrate and link pre-hospital, hospital, and post-hospital follow up</td><td colspan="2">Lead Staff: Epidemiology Supervisor (ES), Data Analyst / Evaluator (DAE), Stroke Registry Administrator (SRA), Quality Assurance Specialist (QAS)</td></tr>
<tr><td colspan="2">Contributing Partners: OEMS, Hospitals</td></tr>
<tr><td colspan="2">Key Contracts/Consultants: N/A</td></tr>
<tr><td colspan="2">SFY Start/End Qtr: Q1-Q4</td></tr>
</table>

data for measurement, tracking, and assessment of quality of stroke care data.	
Activity C.2.2: Convene a stroke registry work group with all CSC and PSC+ hospitals and EMS agencies to submit monthly/quarterly CDC short-term, intermediate and long-term metrics to VDH for CDC reporting. Once C.2.1 is completed, data reporting will be streamlined through the statewide stroke registry.	**Lead Staff:** DPS, ES, DAE, SRA, QAS **Contributing Partners:** OEMS, Hospitals (CSC, PSC+), EMS agencies **Key Contracts/Consultants:** N/A **SFY Start/End Qtr:** Q1-Q2
Activity C.2.3: Enhance the VDH Stroke website to display the CDC Stroke Interactive Atlas, VDH Stroke Hospital Locator Tool with Google Maps, and aggregate prevention, pre-hospital, in-hospital, and post-hospital data linking these data visually through maps, dashboards, and downloadable data.	**Lead Staff:** DPS, DAE, SRA, QAS **Contributing Partners:** OEMS **Key Contracts/Consultants:** N/A **SFY Start/End Qtr:** Q2-Q4
Activity C.2.4: Establish data feedback loops from VDH to CSC and PSC+ hospitals and EMS agencies for measurement, tracking, and assessment of quality of stroke care data. The statewide stroke registry created in C.2.1 integrates multiple data sources (pre-hospital, hospital, post-hospital, mortality, all-payer claims), and will be bi-directionally shared with hospitals and EMS. Facilitate hospital-EMS partnerships to allow EMS agencies to have view-only access of stroke data.	**Lead Staff:** DAE, SRA, QAS **Contributing Partners:** OEMS, Hospitals (CSC, PSC+), EMS regional councils **Key Contracts/Consultants:** N/A **SFY Start/End Qtr:** Q2-Q4

Period of Performance Short Term and Intermediate Outcome(s)	• Increased measurement, tracking, and assessment of data across stroke systems of care for those at highest risk for stroke events and stroke patients. • Increased linkage and usage of data across stroke systems of care for those at highest risk for stroke events and stroke patients.

Measure Description	**Baseline**	**Year 1 Target**	**Year 3 Target**	**Data Source**
C.2.i. # and % of stroke patient records submitted to a statewide integrated management system by hospitals and EMS agencies	0 / 21,987 (0%)	1,399 / 21,987 (6.36%)	18,989 / 21,987 (86.36%)	Hospitals, EMS regional councils
C.2.ii. # and % of hospitals and EMS agencies submitting data to a statewide integrated data management system	0 / 110 (0%) *EMS # (TBD)*	7 / 110 (6.36%) *EMS # (TBD)*	95 / 110 (86.36%) *EMS # (TBD)*	Hospitals, EMS regional councils

<u>Facilitate Data Sharing and Collaboration</u>

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 developed two surveys to 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 is used to assess a hospital's structure, process, and utilization regarding stroke care. Other capacity assessment questions 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 were scheduled to be disseminated and analyzed in 2020. However, due to delays that occurred related to the COVID-19 pandemic, these activities will occur in fiscal year 2022.

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 4. Additionally, Figure 6 below maps these priority geographic areas.

Table 4. 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)
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
	Greensville County	Crater	64.76	14.78	49.98
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

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).

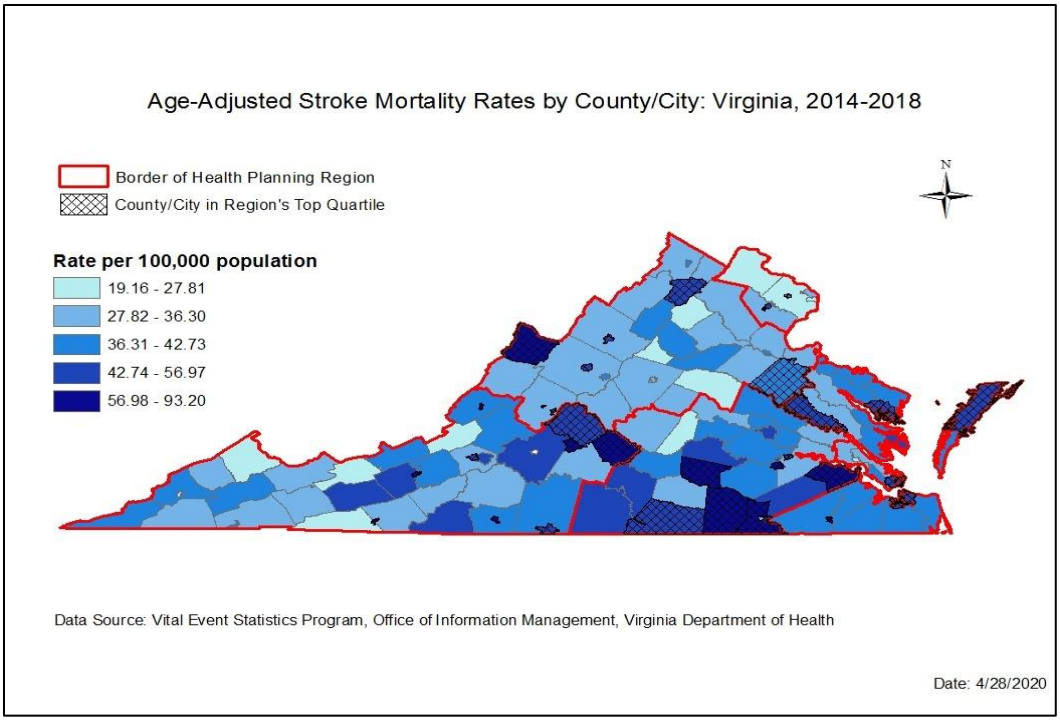

Figure 6. Age-adjusted Stroke Mortality Rates by County/City between 2014 and 2018 (Stroke Mortality by State, 2020).

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 April 1, 2021, 59 out of 93 (63.4%) Virginia hospitals are certified by TJC, DNV, and HFAP. Of those with stroke certification, two hospitals are certified TSC or PSC+; seven hospitals are certified CSC; 45 hospitals are PSC; and five hospitals are ASRH.

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.

CDC PCNASP Virginia Work Plan: Data Sharing and Collaboration

The CDC PCNASP Virginia work plan aligns with the legislative goal of data sharing and collaboration through strategies C7 and C9 as outlined below in the work plan. Strategies C7 and C9 include activities that make the data actionable between hospitals and EMS and further foster collaboration across stakeholders. In strategy C7, VDH will utilize the Unite Virginia initiative, a statewide technology platform designated to connect vulnerable Virginians to health and social services, as a nexus for collaboration between hospitals, primary care, pharmacy, EMS, and community-based organizations to form an integrated network of medical and social care providers. Data provided to hospitals through the statewide stroke registry will provide a population health perspective on patient disease burden and system-wide gaps in care or

resources. This information will inform hospitals on identifying new partnerships to form, allocating resources, or outsourcing to Unite Us' referral network.

In strategy C9, VDH and stakeholders will launch a two-part stroke awareness campaign called Stroke Smart Virginia and Stroke Smart Virginia: Cities and Towns. The goal of both campaigns is to foster collaboration around a marketing campaign to educate residents about the signs and symptoms of stroke. Raising awareness about the signs and symptoms of stroke will lead to earlier calls to 9-1-1 and ultimately reduce time of last known well, a determining factor in deciding the treatment window and course of action. Within Stroke Smart Virginia, VDH will disseminate Stroke Smart Virginia magnets and pamphlets to hospitals through VHHA; primary care practices, FQHCs, and free clinics through MSV; and pharmacies through VPhA. In Stroke Smart Virginia: Cities and Towns, Kwikpoint and EMS regional councils will create a promotional video to engage municipalities to adopt being a "stroke smart" city or town. The City of Alexandria was the first city to become "stroke smart." By engaging municipalities, VDH can effectively promote Stroke Smart Virginia statewide and locally. VDH will use data to prioritize cities and towns in high burden areas.

<table>
<tr><td colspan="2">Strategy C7: Establish and strengthen partnerships with relevant state or local stroke coalitions, initiatives, professional organizations, providers, and health systems that provide resource support for stroke patients, as well as those at highest risk for stroke events.</td></tr>
<tr><td rowspan="4">Activity C.7.1: In the defined coverage areas of the 8 CSC and PSC+ hospitals and EMS regions, identify clinical and community resources and integrate them into the Unite Us referral system network as part of the Unite VA, an initiative to form an integrated network of medical and social care providers.</td><td>Lead Staff: DPS</td></tr>
<tr><td>Contributing Partners: VSSTF, VSCC, MSV, VPhA</td></tr>
<tr><td>Key Contracts/Consultants: Unite Us, EMS regional councils</td></tr>
<tr><td>SFY Start/End Qtr: Q1-Q4</td></tr>
<tr><td rowspan="4">Activity C.7.2: Strengthen partnerships with VSSTF and VSCC to broaden membership to include organizations that provide resource support for stroke patients and create a toolkit of stroke resources for caregivers.</td><td>Lead Staff: DPS</td></tr>
<tr><td>Contributing Partners: VSSTF, VSCC, VHHA, MSV, VPhA, Unite Us</td></tr>
<tr><td>Key Contracts/Consultants: N/A</td></tr>
<tr><td>SFY Start/End Qtr: Q1-Q4</td></tr>
</table>

Period of Performance Short Term and Intermediate Outcome(s)	• Increased establishment of community resources and clinical services for those at highest risk for stroke events and stroke patients across stroke systems of care. • Increased provision of community resources and clinical services to those at highest risk for stroke events and stroke patients across stroke systems of care.

Measure Description	**Baseline**	**Year 1 Target**	**Year 3 Target**	**Data Source**
C.7.i. # of partnerships established with community organizations and resources for the purposes of providing resource support for stroke patients and those at highest risk for stroke events	0 / 330 (0%)	21 / 330 (6.36%)	285 / 330 (86.36%)	Unite Us, EMS regional councils

Strategy C9: Coordinate and/or promote stroke messaging/education within communities and clinical settings around the importance of addressing the needs of those at highest risk for stroke events and the appropriate response during a stroke event, including utilizing EMS for stroke transport.

Activity C.9.1: Distribute tailored Stroke Smart Virginia materials to hospitals via VHHA, primary care clinics / FQHCs / Free Clinics via MSV, pharmacies via VPhA, EMS agencies via EMS regional councils, and community-based organizations to target patients at high risk of stroke and those who had a stroke event.	**Lead Staff:** DPS **Contributing Partners:** VHHA, MSVF, VPhA, EMS regional councils **Key Contracts/Consultants:** Kwikpoint **SFY Start/End Qtr:** Q1-Q4
Activity C.9.3: Develop a Stroke Smart Virginia: Cities and Towns video through a partnerships with Kwikpoint and three EMS regional councils to increase adoption of Stroke Smart Virginia in municipalities and ultimately reduce time of last known well among Virginians.	**Lead Staff:** DPS **Contributing Partners:** N/A **Key Contracts/Consultants:** Kwikpoint, EMS regional councils **SFY Start/End Qtr:** Q1-Q4

Period of Performance Short Term and Intermediate Outcome(s)	• Increased establishment of community resources and clinical services for those at highest risk for stroke events and stroke patients across stroke systems of care. • Increased provision of community resources and clinical services to those at highest risk for stroke events and stroke patients across stroke systems of care.

Measure Description	**Baseline**	**Year 1 Target**	**Year 3 Target**	**Data Source**
C.9.i. # of individuals within communities and/or clinical settings reached through stroke messaging and education, including populations at high risk for stroke events	0	191,750	767,485	KwikPoint, VHHA, MSVF, VPhA

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 all 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.

A workshop scheduled to be held in state fiscal year 2021 for stroke coordinators to further explore best practice strategies for effectively implementing transitions of care guidelines was delayed due to the COVID-19 pandemic. VDH and Unite Us will hold the workshop in

state fiscal year 2022. 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.

CDC PCNASP Virginia Work Plan: Community-Based Follow-up Care

On December 18, 2020, Virginia Governor Ralph S. Northam announced that Virginia will partner with Unite Us to create a statewide infrastructure connecting health and social services. The announcement detailed that Virginia will allocate $10 million in federal Coronavirus Aid, Relief, and Economic Security (CARES) Act funding to create Unite Virginia, a statewide technology platform designated to connect vulnerable Virginians to health and social services. Working with Unite Us, a technology company that builds coordinated care networks of health and social service providers, the Commonwealth will implement an integrated e-referral system that unites government agencies, healthcare providers, and community-based partners and supports Virginia's continuing COVID-19 response and recovery efforts.

Building on the rapid expansion of the statewide referral network, VDH has partnered with Unite Us to focus specifically on stroke transitions of care and community-based referrals for follow-up care. The activities outlined in strategies C3 and C8 of the work plan below address community-based follow up care. Unite Us will work with the CSC and PSC+ hospitals to define and identify specific pathways to medical, rehabilitation, social, and mental health services and community-based resources for patients who are discharged from a hospital after a stroke event. For underserved and under resourced counties and cities, Unite Us' forthcoming health equity dashboard will identify patient clinical and social needs, leading to hospital and community stakeholders to find ways to fill such gaps in care. Patients will be connected to

patient navigators who will assist with connecting to the appropriate resource through the Unite Us network. The advantage of utilizing Unite Us is two-fold. Health systems can have access to a unified, statewide network of clinical and community resources through Unite Us, whose reach extends to where the patient lives in Virginia. This is particularly beneficial when the patient lives beyond the hospital service area or lacks awareness of local resources. Second, the patient will be assisted by dedicated patient navigators within Unite Us. This is beneficial when the patient is discharged, allowing a hospital's social workers or patient navigators to focus their attention on the patients remaining within the hospital. Moving forward, VDH will explore how Unite Us can become a standardize referral and transitions of care resource from the point of discharge to resuming activities of daily living at home.

<table>
<tr><td colspan="3">Strategy C3: Coordinate the development and implementation of a referral tracking system to support transitions of care for stroke patients post-discharge.</td></tr>
<tr><td colspan="2" rowspan="4">Activity C.3.1: Develop a stroke transitions of care track in the Unite Us statewide referral system linking hospitals, primary care, other clinical, social, and mental health services, community-based resources. The CSC and PSC+ hospitals will guide the process of developing by tailoring to patient needs and adhering to CMS discharge planning regulations.</td><td>Lead Staff: DPS, CIS</td></tr>
<tr><td>Contributing Partners: N/A</td></tr>
<tr><td>Key Contracts/Consultants: Unite Us, VHHA</td></tr>
<tr><td>SFY Start/End Qtr: Q1-Q2</td></tr>
<tr><td colspan="2" rowspan="4">Activity C.3.2: Coordinate the onboarding of hospitals to the Unite Us statewide referral tracking system through the Unite VA statewide initiative. Expand Unite Us' integration by 8 CSC and PSC+ hospitals, beyond their existing network of 14 hospitals and 130 community-based organizations that were funded through CARES Act and VA's CDC DP18-1815 and CDC DP18-1817.</td><td>Lead Staff: DPS, CIS</td></tr>
<tr><td>Contributing Partners: Hospitals (CSC, PSC+)</td></tr>
<tr><td>Key Contracts/Consultants: Unite Us, VHHA</td></tr>
<tr><td>SFY Start/End Qtr: Q1-Q4</td></tr>
<tr><td colspan="2" rowspan="4">Activity C.3.3: Pilot implementation of Unite Us statewide referral system with 8 CSC and PSC+ hospitals, as well as SAI, to support transitions of care for stroke patients post-discharge.</td><td>Lead Staff: DPS, CIS</td></tr>
<tr><td>Contributing Partners: Hospitals</td></tr>
<tr><td>Key Contracts/Consultants: Unite Us, Sheltering Arms Institute (SAI)</td></tr>
<tr><td>SFY Start/End Qtr: Q2-Q4</td></tr>
<tr><td>Period of Performance Short Term and</td><td colspan="2">• Increased measurement, tracking, and assessment of data across stroke systems of care for those at highest risk for stroke events and stroke patients.</td></tr>
</table>

Intermediate Outcome(s)	• Increased linkage and usage of data across stroke systems of care for those at highest risk for stroke events and stroke patients.			
Measure Description	**Baseline**	**Year 1 Target**	**Year 3 Target**	**Data Source**
C.3.i. # and % of hospitals with an implemented referral tracking system to support transitions of care for stroke patients post-discharge	3 / 110 (2.73%)	7 / 110 (6.36%)	95 / 110 (86.36%)	Hospitals, Unite Us
Strategy C8: Facilitate engagement of patient navigators/community health workers in the management of those at highest risk for stroke events and post-event discharge support and follow-up of stroke patients across clinical and community settings.				
Activity C.8.1: Create and offer a stroke education Continuing Education (CE) training through VPhA to pharmacy technicians trained as CHWs in community pharmacy settings through DP18-1815 and DP18-1817. Scale the CE training to all CHWs in target areas across the Commonwealth through VPhA's learning portal. Display network on the Stroke Resource Locator tool on the VDH Stroke webpage.	**Lead Staff:** DPS **Contributing Partners:** Kwikpoint **Key Contracts/Consultants:** Virginia Pharmacists Association (VPhA) **SFY Start/End Qtr:** Q1-Q4			
Activity C.8.2: Establish partnership and integration between SAI, 8 Sheltering Arms Facilities and Unite Us to refer patients to Unite Us' patient navigators post-discharge from in-patient stroke rehabilitation. Partnership includes gaining access to Unite Us referral network, establishment of SAI protocols for patient navigation and follow-up, and including patient navigators / CHWs on the SAI and Unite Us care teams.	**Lead Staff:** CIS **Contributing Partners:** N/A **Key Contracts/Consultants:** SAI, Unite Us **SFY Start/End Qtr:** Q1-Q4			
Activity C.8.3: Increase engagement of patient navigators to manage patients at high risk of stroke through SDOH screening, education, and post-event discharge support among 8 hospitals through the Unite Us platform. Establish a referral pathway and filter for stroke patients to clinical and community based CHWs.	**Lead Staff:** DPS **Contributing Partners:** MSV, VPhA **Key Contracts/Consultants:** Unite Us **SFY Start/End Qtr:** Q2-Q4			
Period of Performance Short Term and Intermediate Outcome(s)	• Increased establishment of community resources and clinical services for those at highest risk for stroke events and stroke patients across stroke systems of care. • Increased provision of community resources and clinical services to those at highest risk for stroke events and stroke patients across stroke systems of care.			
Measure Description	**Baseline**	**Year 1 Target**	**Year 3 Target**	**Data Source**
C.8.i. # of patients at high risk for stroke events or post-acute stroke within clinical and/or community settings that engage with	0	1,399	18,989	Unite Us

patient navigators or community health workers for follow up and support				
C.8.ii. # and % of patients linked to community resources and clinical services appropriate to their medical, social and functional determinants of health	0 / 21,987 (0%)	1,399 / 21,987 (6.36%)	18,989 / 21,987 (86.36%)	Unite Us

Establish a Process for Continuous Quality Improvement

Legislation Implementation Process

In 2019, the VSCQI Advisory group established the 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.

CDC PCNASP Virginia Work Plan: Process for Continuous Quality Improvement

In 2019, VDH and the VSCQI Advisory Group developed capacity needs assessment surveys for both hospitals and EMS concerning stroke care and quality improvement. The surveys were scheduled to be disseminated to all hospitals and EMS agencies in February 2020, however they were ultimately postponed due to the COVID-19 pandemic. As cases of COVID-19 began to increase in early 2020, hospitals and EMS agencies were preoccupied with prioritizing COVID-19 response measures. The VSCQI Advisory Group decided to postpone

distribution of the hospital and EMS stroke care capacity surveys until October 2021. Survey activities are included below in C.4.1 and C.4.3 of the work plan.

Within the hospital setting, VDH has determined which hospitals to work and which quality improvement needs exist within those hospitals. Table 2 lists the counties and cities within each health planning region with the highest stroke mortality per 100,000 population, along with a breakdown of hospitals with the highest % of hospitalizations from that county or city. The VSCQI Advisory Group will know the specific quality improvement needs of the identified hospitals from the survey administered in activity C.4.1 of the work plan. The established quality improvement process then requires the ASTS workgroup, a subgroup of VSCQI Advisory Group, to meet with the lead stroke providers at the hospital and propose the ASTS *Recommendations for Establishing a Process for Continuous Quality Improvement for Stroke Care along the Continuum of Care* that were developed in 2020 and the AHA/ASA Target Stroke Action Strategies (Appendix C), as described in activities C.4.2 and C.6.2. The process will then be repeated for the counties and cities with the highest stroke mortality rate as listed in Table 4.

The VSCQI Advisory Group will support the VSCC in their TPA quality improvement study. As described in activity C.4.3, this voluntary quality improvement study allows hospitals to submit quality improvement data surrounding the administration of TPA for ischemic strokes. By comparing data across hospitals, the VSCC created a quality improvement process for sharing best practices, resources, and tools to assist hospitals in improving TPA quality metrics. This VSCC quality improvement initiative was first reported in the *2019 Annual Report to the Virginia General Assembly–Data-Driven Action Steps and Statewide Capacity Building Pursuant to Stroke Care Quality Improvement in Virginia*.

Complementing the hospital quality improvement process, the VSCQI Advisory Group will work with EMS regional councils and EMS agencies to further refine quality improvement processes as outlined in the Virginia Stroke Triage Plan and regional stroke triage plans. VDH will follow a similar process for identifying EMS agencies whose service areas cover the counties and cities with the highest stroke mortality rates per 100,000 population (Table 4). VDH and the VSCQI Advisory Group will identify EMS capacity and needs for stroke-related quality improvement through the EMS survey administered per activity C.4.4. In activity C.6.1, VDH will lead EMS regional councils and EMS agencies in implementing the Post-IV-TPA Interfacility Transfer Form. The Post IV-TPA Interfacility Transfer Form, located in the Virginia Stroke Triage Plan, allows the transferring physician to sign orders and the nurse to document patient information as a standardized hand-off for EMS. EMS then continues the documentation on the same form and hands the form to the receiving hospital for continuity and documentation of care provided en route.

<table>
<tr><td colspan="2">Strategy C4: Analyze data and identify areas to improve the efficiency and quality of care within EMS and hospital settings and to improve transitions of care between settings through systematic quality improvement methods and interventions (e.g. PDSA, Lean, Six Sigma).</td></tr>
<tr><td rowspan="4">Activity C.4.1: Disseminate an annual Hospital inventory / quality improvement survey to all VA hospitals to identify efficiency and quality of care gaps, and compare with data through VDH Stroke Registry (C.2.1.) to validate and identify additional areas of improvement for in-hospital and post-hospital stroke metrics to improve quality and transitions of care. This survey was created by VSSTF based on the CDC Paul Coverdell National Acute Stroke Program’s hospital survey examples from previous state awardees.</td><td>Lead Staff: CIS, DPS, ES, DAE</td></tr>
<tr><td>Contributing Partners: VA Stroke Systems Task Force (VSSTF), VA Stroke Coordinators Consortium (VSCC), Hospitals</td></tr>
<tr><td>Key Contracts/Consultants: VDH</td></tr>
<tr><td>SFY Start/End Qtr: Q3-Q4</td></tr>
<tr><td rowspan="4">Activity C.4.2: Upon completion of C.4.1., analyze results, prioritize hospitals based on need and capacity, and partner with the VSSTF, VSCC, and VSCQI’s Acute Stroke Treatment Advisory Group (ASTS) to test (PDSA) quality improvement interventions/guidelines in 7 hospitals with low</td><td>Lead Staff: CIS, DPS, DAE</td></tr>
<tr><td>Contributing Partners: VSSTF, VSCC, VA Stroke Care Quality Improvement Advisory Group (VSCQI), Hospitals</td></tr>
<tr><td>Key Contracts/Consultants: VHHA</td></tr>
</table>

capacity in underserved areas. Utilize the VSCQI ASTS' *Recommendations for Establishing a Process for Continuous Quality Improvement for Stroke Care along the Continuum of Care* as recommended interventions incorporating AHA/ASA Target: Stroke (Phase I, II, III) and best practices from VSSTF and CSC hospitals.	**SFY Start/End Qtr:** Q4
Activity C.4.3: Disseminate annual EMS inventory / quality improvement survey to all VA EMS agencies to identify efficiency and quality of care gaps, and compare with data through VDH Stroke Registry (C.2.1.) to validate and identify additional areas of improvement. This survey was created by VSSTF and EMS Regional Councils based on the CDC Paul Coverdell National Acute Stroke Program's hospital survey examples from previous state awardees.	**Lead Staff:** CIS, DPS, DAE **Contributing Partners:** OEMS, VSSTF **Key Contracts/Consultants:** EMS Regional Councils **SFY Start/End Qtr:** Q1-Q2
Period of Performance Short Term and Intermediate Outcome(s)	• Increased implementation of data-driven Quality Improvement activities across stroke systems of care for those at highest risk for stroke events and stroke patients. • Increased coordination of care across stroke systems of care for those at highest risk for stroke events and stroke patients.

Measure Description	**Baseline**	**Year 1 Target**	**Year 3 Target**	**Data Source**
C.4.i. # and % of EMS agencies and hospitals implementing improvements in stroke care practices or patient care protocols as a result of quality improvement activities	0 / 110 (0%) *EMS # (TBD)*	7 / 110 (6.36%) *EMS # (TBD)*	95 / 110 (86.36%) *EMS # (TBD)*	Hospitals, EMS regional councils
C.4.ii. # and % of EMS agencies and/or hospitals reporting an improvement in a selected performance measure of care based on identified performance gaps and quality improvement activities	0 / 110 (0%) *EMS # (TBD)*	7 / 110 (6.36%) *EMS # (TBD)*	95 / 110 (86.36%) *EMS # (TBD)*	Hospitals, EMS regional councils

Strategy C6: Develop and implement patient care practices/patient care protocols within EMS and hospital systems to coordinate patient handoff and transitions in care throughout the stroke systems of care.	
Activity C.6.1: Create a Stroke Hospital Locator tool using Word Press on the VDH Stroke Webpage to assist EMS agencies with a real-time stroke triage tool. Engage hospitals and EMS in target counties and cities to collaborate on creating stroke triage protocols that enhance patient handoff and transitions in care utilizing this tool.	**Lead Staff:** DPS **Contributing Partners:** Hospitals **Key Contracts/Consultants:** VDH **SFY Start/End Qtr:** Q1-Q4
	Lead Staff: DPS, CIS

Activity C.6.2: Test and implement a PDSA among EMS agencies and hospital systems using the VDH Stroke Hospital Locator tool on the VDH Stroke Website created in C.6.1. and made accessible in C.2.3. Using the hospital locator, EMS will be able to determine the closest hospital and determine their level of stroke certification and services. EMS and the hospitals will collaborate on creating stroke triage protocols that enhance patient handoff and transitions in care utilizing this tool.	**Contributing Partners:** Hospitals, EMS Regional Councils **Key Contracts/Consultants:** VDH **SFY Start/End Qtr:** Q2-Q4
Period of Performance Short Term and Intermediate Outcome(s)	• Increased implementation of data-driven Quality Improvement activities across stroke systems of care for those at highest risk for stroke events and stroke patients. • Increased coordination of care across stroke systems of care for those at highest risk for stroke events and stroke patients.

Measure Description	**Baseline**	**Year 1 Target**	**Year 3 Target**	**Data Source**
C.6.i. # and % of EMS agencies and hospitals with established processes (e.g. patient care protocols, feedback loops) for coordination of transitions of care for those at highest risk for stroke events and stroke patients across systems of care	59 / 110 (53.64%) *EMS # (TBD)*	76 / 110 (69.10%) *EMS # (TBD)*	95 / 110 (86.36%) *EMS # (TBD)*	Hospitals, EMS regional councils

CDC PCNASP Virginia Work Plan Summary in Years 2 – 3

In subsequent years, VDH and partners will scale and sustain the activities from the first year. VHHA will scale the predictive modeling dashboard to eight non-stroke hospitals in the second year and another eight hospitals in the third year so that target populations in these hospitals are identified (strategy C1). VDH will expand the statewide stroke registry to all 46 PSCs, and approximately three to five non-stroke centers in the second year and all five ASRHs and 20 non-stroke hospitals in the third year (strategy C2). VDH and Unite Us will expand the Unite Us referral system network to include all 46 PSCs and three to five non-stroke centers in the third year and all five ASRHs and 20 non-stroke hospitals in the third year (strategies C3, C7 and C8). VDH will plan to create mentorship partnerships between CSCs/PSC+ from the first year and eight non-stroke hospitals plus hospitals in health system in the second year. VDH will

add another eight non-stroke hospitals plus additional hospitals in health systems in the third year. These partnerships will scale and spread quality improvement interventions to improve stroke care and patient practice protocols for transitions of care for stroke triage, interfacility transfer, and post-discharge transitions of care (strategies C4 and C6). VDH will scale Stroke Smart Virginia into professional develop opportunities through VSSTF, VSCC and local stroke coalitions in high burden and low resource areas identified by the Unite Us health equity dashboard. In the second and third years, all 11 EMS regional councils will disseminate the Regional Stroke Smart Virginia: Cities and Towns video and train liaisons to engage municipalities in becoming "stroke smart," which will spread community awareness and move the needle on time of last known well, an indicator that EMS feels could most be improved in the pre-hospital setting (strategy and C9).

Summary of Recommendations

Following is a summary of VSCQI Advisory Group recommendations, which are detailed in the preceding sections of this report for each of the legislative requirements, targeted to stakeholder entities:

- 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.
- All work plan strategies and activities adopted from the CDC PCNASP Virginia Work Plan should be implemented by VDH, the VSSTF, and stakeholders.

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, 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 ASTS work group. The strategies and activities are outlined in the work plan and demonstrate continued commitment to a collaborative and integrated approach to improve stroke care, prevent disease and reduce healthcare disparities. VDH and key stakeholder partners 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.

References

1. § 32.1-111.3. (2018). Statewide Emergency Medical Services Plan; Trauma Triage Plan; Stroke Triage Plan. Code of Virginia. https://law.lis.virginia.gov/vacode/title32.1/chapter4/section32.1-111.3/ (March 12, 2019).

2. Allen K.R., Hazelett S., Jarjoura D., Wickstrom G.C., Hua K., Weinhardt J., Wright K. (2002). Effectiveness of a postdischarge care management model for stroke and transient ischemic attack: a randomized trial. J Stroke Cerebrovasc Dis. 2002 Mar-Apr;11(2):88-98.

3. Benjamin E.J., Blaha M.J., Chiuve S.E., et al. (2017). on behalf of the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. Heart disease and stroke statistics—2017 update: a report from the American Heart Association. Circulation. 135:e229-e445.

4. Get With The Guidelines. (2019). American Heart Association Quality Improvement. https://www.heart.org/en/professional/quality-improvement. (February 24, 2019).

5. Gonzales S., Mullen MT., Skolarus L., Thibault DP., Udoeyo U., Willis AW. Progressive rural-urban disparity in acute stroke care. 2017 Jan, 4. *Neurology*. doi:10.1212/WNL.0000000000003562.

6. "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." Stroke. 2014 Jul;45(7):2160-236. doi: 10.1161/STR.0000000000000024. Epub 2014 May 1.

7. HB 1197. (2018). 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. Code of Virginia. http://lis.virginia.gov/cgibin/legp604.exe?181+ful+CHAP0276+pdf (February 22, 2019).

8. Hong, I., PHD, OTR, Goodwin, J., MD, Reistetter, T., PhD, OTR. Comparison of Functional Status Improvements Among Patients With Stroke Receiving Postacute Care in Inpatient Rehabilitation vs Skilled Nursing Facilities. *JAMA.* 2019;2(12):e1916646. doi:10.1001/jamanetworkopen.2019.16646

9. Institute of Medicine. https://www.uptodate.com/contents/overview-of-clinical-practice-guidelines (2011).

10. Jahan, R., Saver, J., Schwamm, Association between Time to Treatment with Endovascular Reperfusion Therapy and Outcomes in Patients with Acute Ischemic Stroke Treated in Clinical Practice. *JAMA.* 2019; 322(3):252-263.

11. Josephson, S.A., Kamel, H. (2018, September 10). The Acute Stroke Care Revolution Enhancing Access to Therapeutic Advances. *JAMA.* doi:10.1001/jama.2018.11122

12. McIlvennan, C.K., DNP, ANP, Eapen, Z.J., MD, MHS, and Allen, L.A., MD, MHS. Hospital Readmission Reduction Program. Circulation. 2015 May 19; 131(20): 1796–1803.

13. Minnesota Health Department. https://www.health.state.mn.us/diseases/cardiovascular/stroke/transitions.html (December 5, 2019).

14. Nogueira R, Ribo M. Endovascular Treatment of Acute Stroke: A Call for Individualized Patient Selection. *Stroke.* 50(9):2612-2618, September 2019.

15. Nouh AM, McCormick L, Modak J, Fortunato G, Staff I. High mortality among 30-day readmission after stroke: Predictors and etiologies of readmission. *Front Neurol*. 2017; 8(DEC):1-5. doi:10.3389/fneur.2017.00632

16. Ovbiagele B, Nguyen-Huynh MN. Stroke Epidemiology: Advancing Our Understanding of Disease Mechanism and Therapy. *Neurotherapeutics*. 2011; 8(3):319-329. doi:10.1007/s13311-011-0053-1

17. Paul Coverdell National Acute Stroke Program. (2019). Division for Heart Disease and Stroke Prevention. https://www.cdc.gov/dhdsp/programs/stroke_registry.htm (November 2, 2019).

18. Powers W, Rabinstein A, Ackerson T, *et al*. Guidelines for the Early Management of Patients with Acute Ischemic Stroke: 2019 Update to the 2018 Guidelines for the Early Management of Acute Ischemic Stroke. A Guideline for Healthcare Professionals from the AHA/ASA. Powers et al. *Stroke*. 50:e344-e418, October 2019.

19. Saver J. Time is Brain—Quantified. *Stroke.* Volume 37, Issue 1, Pages 63-266, January 2006.

20. Saver JL, Fonarow GC, Smith EE, *et al.* Time to treatment with intravenous tissue plasminogen activator and outcome from acute ischemic stroke. *JAMA* 2013; 309: 2480

21. SB 867 (2018). Department of Health shall be responsible for quality improvement initiatives. Code of Virginia. https://lis.virginia.gov/cgi-bin/legp604.exe?181+sum+SB867 (February 25, 2019).

22. Stratis Health. https://www.stratishealth.org/providers/care-resources.html (January 13, 2020)

23. Stroke Mortality by State. (2020). National Center for Health Statistics. *CDC*. https://www.cdc.gov/nchs/pressroom/sosmap/stroke_mortality/stroke.htm (March 1, 2020).

24. Stroke Mortality by State. (2021). National Center for Health Statistics. *CDC*. https://www.cdc.gov/nchs/pressroom/sosmap/stroke_mortality/stroke.htm (March 5, 2021).

25. Stuntz M, Busko K, Irshad S, Paige T, Razhkova V, Coan T. Nationwide trends of clinical characteristics and economic burden of emergency department visits due to acute ischemic stroke. *Open Access Emerg Med*. 2017;9:89-96. doi:10.2147/OAEM.S146654
26. Sweid A, Hammoud B, Ramesh S, *et al.* Acute ischaemic stroke interventions: large vessel occlusion and beyond. *Stroke and Vascular Neurology*:svn-2019-000262. doi: 10.1136/svn-2019-000262, 2019.

27. Task Force Members. (2005). Recommendations From the American Stroke Association's Task Force on the Development of Stroke Systems. *Stroke*. 36:690–703. https://doi.org/10.1161/01.STR.0000158165.42884.4F

28. Target: Stroke Phase II 12 Key Best Practice Strategies, January 2017.

29. Target: Stroke Phase III Door-to Device Time Key Best Practice Strategies, January 2019.

30. VDH Division of Population Health Data, Behavioral Risk Factor Surveillance Survey, 2015

31. Vital Event Statistics Program, Office of Information Management, Virginia Department of Health, 2019

32. Vital Event Statistics Program, Office of Information Management, Virginia Department of Health, 2020

33. VHI Inpatient Discharge Database 2020. Virginia Health Information (2020).

34. Virginia Stroke Coordinators Consortium. (2009). VDH LiveWell. http://www.vdh.virginia.gov/stroke/virginia-stroke-coordinators-consortium/ (March 10, 2019).

35. Virginia Stroke Coordinators Consortium. (2018). VDH LiveWell. http://www.vdh.virginia.gov/content/uploads/sites/133/2018/11/VA-Stroke-Coordinators_October-23-for-VDH-website.pdf (March 1, 2019)

36. Virginia Stroke Systems Task Force. (2007). VDH LiveWell. http://www.vdh.virginia.gov/stroke/virginia-stroke-systems-task-force/ (March 10, 2019).

37. Wechsler LR, Demaerschalk BM, Schwamm LH, *et al.* Telemedicine Quality and Outcomes in Stroke: A Scientific Statement for Healthcare Professionals from the American Heart Association/American Stroke Association. *Stroke:* 48:e3-e25, 2017.

38. Xian Y, Xu H, Lytle B, Blevins J, *et al*. Use of strategies to improve door-to-needle times with tissue-type plasminogen activator in acute ischemic stroke in clinical practice: findings from Target: Stroke. *Circ Cardiovasc Qual Outcomes*: 10:e003227. doi:10.1161/CIRCOUTCOMES.116.003227, 2017.

39. Yang Q, Tong X., Schieb L., et al. Vital Signs: Recent Trends in Stroke Death Rates — United States, 2000-2015. MMWR Morbidity and Mortal Weekly Report 2017; 66:933–939. DOI: http://dx.doi.org/10.15585/mmwr.mm6635e1.

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.