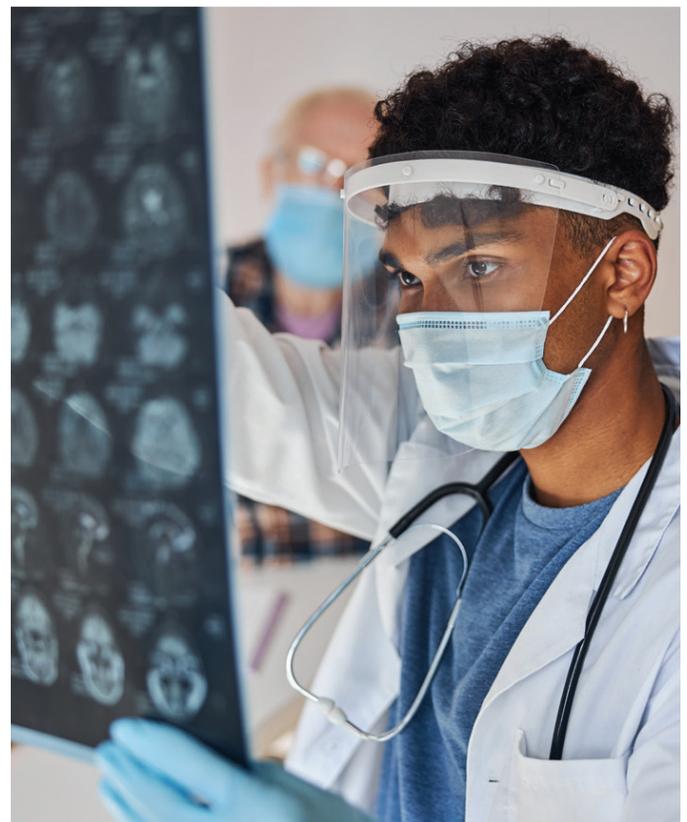


Strategies for Building and Improving State Stroke Systems of Care

A Brief Guide for State Health Decision-Makers and Practitioners | April 2022

Stroke systems of care (SSOCs) are designed to improve access to time-sensitive and lifesaving treatment for stroke victims. Since 2002, 38 states and Washington, DC, have adopted policies (i.e., legislation, regulations) to create and strengthen SSOCs.¹ From 2019 to 2021, CDC conducted an impact analysis of 19 SSOC policy interventions and found that states with at least one SSOC policy in effect demonstrated better stroke outcomes than they might have achieved without such policies. CDC also completed case studies in three states to better understand how SSOC policies lead to better stroke outcomes. This brief guide outlines four strategies for success that state health decision makers and health organizations can use to build or improve a SSOC.²



According to a CDC impact analysis, states with one or more SSOC policies had...



more availability of certified stroke care,



more brain scans within 45 minutes of hospital arrival,



lower hospital costs for stroke patients, and



fewer deaths due to stroke

...on average, compared with predicted outcomes in the absence of SSOC policies.²

Strategies for Success

- ▶ Identifying state needs and context relevant to improved stroke care.
- ▶ Securing health system buy-in to achieve statewide support.
- ▶ Educating practitioners to understand the evidence behind SSOC policies.
- ▶ Building data systems to promote continuous quality improvement (CQI).

Identifying State Needs and Context Relevant to Improved Stroke Care

States have used various combinations of legislation, protocols, and additional supports to create effective SSOCs. No single mix of interventions has been shown to be effective in every state context. Understanding the needs and context of the state is critical to building an effective SSOC.³

Actions Taken by Successful States

- ▶ Considered the population, geography, and needs of the state.
- ▶ Formed or engaged a SSOC task force to assess existing infrastructure, needs, and data systems.
- ▶ Considered how specific policies and protocols might affect other parts of the system.
- ▶ Tailored interventions to meet identified SSOC needs.
- ▶ Identified institutional supports to maximize participation in the SSOC.

Successful States Considered These Factors³ When Building and Improving SSOC:

- ▶ Geographic size of the state and remote locations.
- ▶ Number of stroke centers and other health care delivery organizations.
- ▶ Current stroke assessment, transport, and treatment protocols.
- ▶ Population density and socioeconomic characteristics.

State SSOC Policy Interventions

Pre-Hospital Interventions

See [this resource](#) for a description of policy interventions.



SSOC Task Force



EMS Stroke Assessment Protocols



Standardized EMS Stroke Assessment Tool Use



EMS Triage & Transport



Air Medical Transport



Inter-Facility Transfer



Stroke Pre-Notification



Continuing Education for EMS Providers



CQI of EMSS for Stroke

In-Hospital Interventions



Tiered Stroke Center Approach



Telestroke to Initiate Treatment



Statewide CQI Data System



CQI Data Reporting



Nationally Certified PSCs



Nationally Certified CSCs



Nationally Certified ASRHs



State Certified PSCs



State Certified CSCs



State Certified ASRHs

CQI—Continuous Quality Improvement; PSC—Primary Stroke Center; CSC—Comprehensive Stroke Center; ASRH—Acute Stroke Ready Hospital; EMS—Emergency Medical Service; EMSS—Emergency Medical Service System.

Three Approaches to a SSOC

Based on findings from the impact analysis, CDC identified three states that successfully improved stroke outcomes to participate in additional case studies. Each of these three states took different paths to establish and build a SSOC. While each SSOC was unique, all three states shared three policies in common: (1) use of a tiered stroke center approach, (2) use of standardized EMS stroke assessment protocols, and (3) use of EMS triage and transportation protocols.*



South Carolina formed a statewide Stroke Advisory Committee in 2009 to establish their SSOC. The resulting 2011 Stroke Prevention Act required EMS agencies to adhere to detailed stroke assessment and triage transport protocols directing patients to specific types of certified stroke centers. Hospitals were not required to participate in the SSOC by law; however, administrators recognized that they lose stroke patients without stroke certification. To help rural and under-resourced hospitals meet the requirements for stroke center certification, the state authorized and provided financial support for hospitals to access expert stroke care through a statewide telemedicine program. South Carolina has implemented 10 of CDC's identified stroke policies.^{a-c,j-p} Per CDC's impact analysis, the state has achieved higher brain scan rates within 45 minutes of hospital arrival, lower in-hospital mortality, and lower in-hospital costs for stroke patients than predicted without SSOC policies.



Rhode Island established many pieces of their SSOC through legislation passed in 2010. The state revamped their SSOC approach in 2015 in response to research⁴ demonstrating the effectiveness of thrombectomy in treating stroke. The Rhode Island Stroke Task Force established new EMS stroke assessment and transport protocols, as well as higher standards for designated stroke centers. Twelve of CDC's identified stroke policies have been implemented in Rhode Island.^{a-d,f,i,j,l-p} According to CDC's analysis, this has resulted in higher primary stroke center certification rates and lower in-hospital stroke mortality rates than expected without SSOC policies.



Florida established their SSOC in 2004. In 2012, the state secured funding to establish the Florida Stroke Registry (FSR) and implement a successful regional pilot test of new EMS assessment and transport protocols. Using data captured by the FSR showing the positive impact of the pilot project, the Florida Department of Health took a series of legislative steps to encourage formation of regional stroke coalitions and adoption of the EMS transport protocols statewide. Altogether, Florida has implemented 10 of CDC's identified stroke policies.^{l-s} Per CDC's impact analysis, Florida has seen lower in-hospital stroke mortality than expected without SSOC policies and lower rural/urban stroke disparities across the state over time.

State SSOC Policy Interventions: ^aState SOC Task Force, ^bEMS Stroke Assessment Protocol, ^cStandardized EMS Stroke Assessment Tool Use, ^dEMS Triage & Transport, ^eAir Medical Transport, ^fInter-Facility Transfer, ^gStroke Pre-Notification, ^hContinuing Education for EMS providers, ⁱCQI of EMSS for Stroke, ^jTiered Stroke Center Approach, ^kTelestroke to Initiate Treatment, ^lStatewide CQI Data System, ^mCQI Data Reporting, ⁿNationally Certified PSCs, ^oNationally Certified CSCs, ^pNationally Certified ASRHs, ^qState Certified PSCs, ^rState Certified CSCs, ^sState Certified ASRHs.

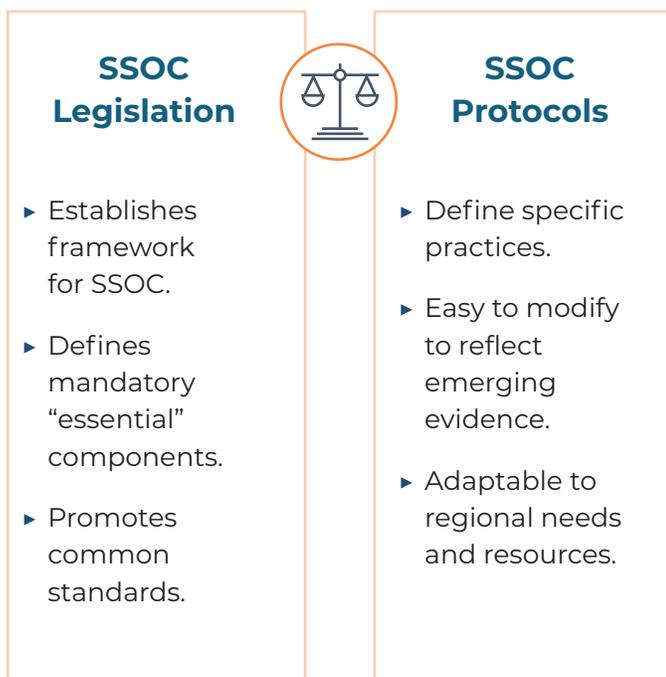
*All referenced statutes and dates were identified through legal document review and confirmed during interviews with knowledgeable informants from each state as part of the case studies.

Achieving Statewide Support Through the Legislative Process

States noted that incorporating systems such as telemedicine and using the legislative process strategically helped build consensus and statewide support for new SSOCs.

Actions Taken by Successful States

- ▶ Understood how the legislative system works in the state.
- ▶ Considered forming a Stroke Advisory Committee (SAC) to help coordinate efforts across the state.
- ▶ Brought representatives from across stroke care to the table to help identify inclusive policies to support the SSOC.
- ▶ Paired purposefully broad legislation with detailed SSOC protocols that can be adapted by region and updated to reflect emerging evidence.



We had [to] give and take on all sides and just built a really good, solid consensus.... You have to be a bridge builder in South Carolina to get stuff through the legislature.

—South Carolina SAC Member



South Carolina’s Approach to SSOC Legislation

South Carolina’s 2011 Stroke Act⁵ was “purposefully broad” and modest in scope to promote support and ensure applicability across all regions of the state. The state’s Stroke Advisory Committee engaged stroke practitioners to help draft the bill, which passed unanimously in the House and Senate. Finer aspects of the SSOC are further defined in state-level protocols for EMS and hospitals.

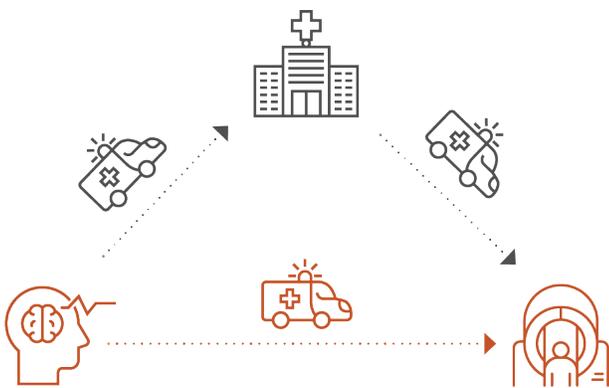
Educating Practitioners to Understand the Evidence Behind SSOC Policies

Protocols to bypass the closest hospital in order to take patients to a certified stroke center may seem counterintuitive for EMS professionals. Understanding the science behind specific SSOC policies and practices may facilitate adherence by professionals who want to do what is best for patients.⁶

Actions Taken by Successful States

- ▶ Built SSOC policies and protocols on the science for best care for stroke patients.
- ▶ Whether required by law or not, built strong EMS education into the SSOC.
- ▶ Trained health practitioners “on the ground” about why each policy and protocol matters and the science behind them.

Hospital Bypass Policies Can Lead to Faster Treatment for Stroke Patients



When EMS transports stroke patients to the closest hospital first, stroke patients often have to be transferred to stroke centers later. Triage and transport protocols save time by directing stroke patients to expert stroke care immediately.

“

Being able to get education out quickly and in an easily disseminated format was helpful.

—Rhode Island EMS leader

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Rhode Island’s Approach to EMS Education

Interventional radiologists on Rhode Island’s Stroke Task Force recognized that EMS personnel needed to better understand how their decision making on the ground directly impacts patient outcomes in the hospital. Although EMS education was not legally required, radiologists from the task force created an educational video for EMS professionals and traveled to more than 80 EMS agencies in the state to train personnel on the new EMS protocols. EMS directors and hospital staff credit this training effort as instrumental in the successful implementation of Rhode Island’s SSOC.

Building Data Systems to Promote Continuous Quality Improvement

Whether states are building a new stroke system of care or improving and expanding an existing system, data related to stroke outcomes may be helpful to understand what's working and where more help may be needed.³ Strong data systems may also provide important feedback to EMS personnel and hospital staff that can be used to improve performance and coordination of care across the system.⁷

Actions Taken by Successful States

Supported participation in the [American Stroke Association's Get With the Guidelines](#) and report performance data.

- ▶ Used data dashboards to monitor performance, demonstrate impact, and motivate improvement among healthcare organizations.
- ▶ Linked pre-hospital and in-hospital data whenever possible.
- ▶ Used data to identify areas of persistent stroke disparities.
- ▶ Dismantled organizational silos to enhance data sharing and best practices.
- ▶ Provided consistent support to CQI data users.



Our belief is that the more you follow evidence-based guidelines or the Florida quality improvement programs, the better, and the fewer disparities we see. That's what quality improvement is all about.

—FSR Staff Member



Florida's Use of Data Systems

The Florida Stroke Registry (FSR) provides data dashboards to regional stroke coalitions throughout the state to inform and guide their work. Individuals involved in Florida's SSOC emphasized that FSR data were critical in demonstrating the effectiveness of new EMS protocols and SSOC policies and identifying areas of persistent stroke outcome disparities.

Racial Disparities in Standardized Stroke Mortality Rate by County Over Two Time Periods

After the start of the FSR in 2013, Florida has seen reduced racial disparities in stroke mortality rates that state experts have attributed to better directing of resources and targeted performance improvement efforts.[†]



[†] This graphic depicts the absolute difference in age-adjusted stroke mortality rate between white and non-white populations for each time frame and county, calculated from state data collected as part of the National Vital Statistics System. Therefore, a difference of 1.00 indicates the mortality rate is the same for both populations.

Study Notes and Resources

This brief guide was informed by an impact analysis of SSOC policies in 50 states and Washington, DC. Case studies also were conducted in South Carolina, Rhode Island, and Florida, three states that were identified as having successfully improved stroke outcomes in the impact analysis. Additional information about this study, including supporting information about SSOCs, can be found in the resources listed here.

[CDC's Stroke System of Care Webpage](#)

More information about SSOCs, including related resources.

[SSOC Policy Evidence Assessment Reports](#)

CDC's summarized evidence for specific SSOC policy interventions.

[SSOC Evaluation Brief](#)

Additional information about the SSOC policy impact assessment and case studies.

[About the Coverdell Program](#)

More information about the Paul Coverdell National Acute Stroke Program.

[Stroke Outcomes Data](#)

Interactive stroke outcomes maps and recommended data sources.

[SSOC Policy Statement From the American Stroke Association](#)

The American Stroke Association's 2019 recommendations for establishing SSOCs.

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