PAUL Coverdell
NATIONAL ACUTE STROKE PROGRAM

# Paul Coverdell National Acute Stroke Program

# 2012–2015

## Case Study Evaluation

## State Summaries

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## Paul Coverdell National Acute Stroke Program 2012–2015 Case Study Evaluation State Summaries

The state summaries featured here present a succinct description of data that were systematically collected and analyzed for a case study evaluation of the 2012–2015 CDC Paul Coverdell National Acute Stroke Program. These summaries are intended for public health practitioners, hospital and Emergency Medical Services (EMS) staff, and evaluators who are interested in the results of the program and states' efforts to develop stroke systems of care and improve quality of care for stroke patients.

From 2012 to 2015, the Paul Coverdell National Acute Stroke Program (Coverdell Program) funded 11 state health departments to develop stroke systems of care and improve quality of care for stroke patients. All grantees worked toward improvements in hospital stroke care as well as the pre- and/or post-hospital setting. The goal of the program is to develop high-quality stroke systems of care to save lives and prevent premature disability and death. Stroke systems of care improve patient care and support throughout their health care journey—from the first symptoms of stroke, EMS transport, and hospital care to follow-up with outpatient providers.

CDC contracted with RTI International to conduct a case study evaluation of each state grantee to describe program implementation and assess program achievements. The case studies included a thematic analysis of qualitative data sources and a quantitative analysis of secondary data. The evaluation resulted in 11 state-specific reports, one for each grantee, as well as a cross-site report that highlights common themes across all grantees.

During May and June 2015, the evaluation team conducted semi-structured telephone interviews with staff and stakeholders of the 11 funded programs, representing various staff roles and stakeholder types. Qualitative data were analyzed using NVivo for coding and thematic analysis. Along with interview data, the evaluation team used other secondary data sources, such as program documents, to supplement the detailed description of each program.

The evaluation team analyzed data on intermediate outcomes of the program and coupled it with qualitative interview data. Grantee-specific trend analyses with trend *P*-values were conducted using the program's in-hospital quality-of-care performance measure data from 2012 to 2015 or 2013 to 2015, depending on the year when data were first available. There were 265,876 stroke patients in the analysis. The table in each summary shows the program's in-hospital quality of stroke care measures that significantly improved across the time period, with $P < 0.05$ as the significance level. Some states had one or more measures that started with at least 90% agreement with the 2012–2015 Coverdell Program in-hospital quality-of-care performance measures and thus had less room for improvement.

Although each grantee-specific report documented lessons learned from various activities, there was great variability depending on the program context and resources. A key lesson learned among all grantees was that state-level and health systems–level contextual factors that affect state health departments' efforts to establish stroke systems of care need to be accounted for when systems are being designed. Examples of state-level contextual factors include geography, demographics, population density, and supporting legislation. Examples of health systems–level contextual factors include centralizations of EMS authority and engagement of local stroke experts and champions.

## Additional Information to Support the Summaries

### Acronyms Used in the Summaries

**CDC:** Centers for Disease Control and Prevention

**EMS:** Emergency Medical Services

**NIHSS:** National Institutes of Health Stroke Scale

**NQF:** National Quality Forum

**QI:** Quality Improvement

### Other Terms Defined

**Primary Stroke Center:** The Joint Commission's Certificate of Distinction for Primary Stroke Centers recognizes centers that make exceptional efforts to foster better outcomes for stroke care. Achieving certification signifies that the services provided have the critical elements to achieve long-term success in improving outcomes.

The certification is based on the Brain Attack Coalition's "Revised and Updated Recommendations for the Establishment of Primary Stroke Centers" and includes the requirement to report on eight core standardized measures from the Joint Commission.

### 2012–2015 Coverdell Program In-Hospital Quality-of-Care Performance Measures

The performance measures in the table below (Table 1) represent the measures that were used for the 2012–2015 Coverdell Program cooperative agreement. Some of these measures have changed since the cooperative agreement ended in June 2015. Learn more about current NQF measures.

**Table 1. Coverdell Program Quality-of-Care Measures, 2012–2015**

| Performance Measure | Description |
|---|---|
| Venous thromboembolism (VTE) prophylaxis (NQF 0434) | Ischemic and hemorrhagic stroke patients and those with stroke not otherwise specified who received VTE prophylaxis or have documentation of why no VTE prophylaxis was given either the day of or the day after hospital admission. |
| Discharged on antithrombotic therapy (NQF 0435) | Ischemic stroke and transient ischemic attack (TIA) patients prescribed antithrombotic therapy at hospital discharge. |
| Anticoagulation therapy for atrial fibrillation/flutter (NQF 0436) | Ischemic stroke and TIA patients with atrial fibrillation/flutter who are prescribed anticoagulation therapy at hospital discharge. |

| **Performance Measure** (continued) | **Description** (continued) |
|---|---|
| Thrombolytic therapy (NQF 0437) | Acute ischemic stroke patients who arrive at this hospital within 2 hours of time last known well and for whom intravenous tPA was initiated at this hospital within 3 hours of time last known well. |
| Antithrombotic therapy by end of hospital day 2 (NQF 0438) | Ischemic stroke and TIA patients to whom antithrombotic therapy was administered by the end of hospital day 2. |
| Discharged on statin medication (NQF 0439) | Ischemic stroke and TIA patients with a low-density lipoprotein (LDL) level greater than or equal to 100 mg/dL, or whose LDL was not measured, or who were on a lipid-lowering medication prior to hospital arrival, who were prescribed a statin medication at hospital discharge. |
| Stroke education (NQF 0440) | Ischemic or hemorrhagic stroke patients, patients with stroke not otherwise specified, and TIA patients or their caregivers who were given educational materials during the hospital stay addressing activation of the emergency medical system, need for follow-up after discharge, medications prescribed at discharge, risk factors for stroke, and warning signs and symptoms of stroke. |
| Assessed for rehabilitation (NQF 0441) | Ischemic or hemorrhagic stroke patients or patients with stroke not otherwise specified who were assessed for rehabilitation services. |
| Smoking cessation counseling | Ischemic or hemorrhagic stroke patients, patients with stroke not otherwise specified, and TIA patients who are current smokers who receive or refuse smoking cessation counseling. |
| Dysphagia screening (NQF 0243) | Ischemic or hemorrhagic stroke patients or patients with stroke not otherwise specified who receive any food, fluids, or medication by mouth (PO) for whom a dysphagia screening was performed prior to PO intake, in accordance with a dysphagia screening tool approved by the institution in which the patient is receiving care. |
| Recording of NIHSS score (NQF 1955—not endorsed in 2015) | Ischemic stroke patients with an initial National Institutes of Health Stroke Scale (NIHSS) score recorded. |
| Time to intravenous thrombolytic therapy (NQF 1952) | Acute ischemic stroke patients receiving intravenous tPA therapy during the hospital stay and having a time from hospital arrival to initiation of thrombolytic therapy (door-to-needle time) of 60 minutes or less. |

## Arkansas Stroke Registry

**From 2012 to 2015, the Arkansas Stroke Registry achieved significant improvements in the percentage of stroke patients for whom an NIHSS score was recorded (39% to 69%, *P* < 0.001) and of ischemic stroke patients who were given thrombolytic therapy (alteplase) (25% to 71%, *P* < 0.001) in 42 participating hospitals through performance improvement reviews with hospitals and a pilot training program for EMS staff.**

### History of stroke care in Arkansas

In 2005, the Arkansas General Assembly created an Acute Stroke Care Task Force to combat the high prevalence of stroke in the state. The Task Force recommended that Arkansas create a statewide stroke registry and stroke telemedicine program, which later became the AR Stroke Assistance through Virtual Emergency Support (AR SAVES) program. In 2011, the Task Force secured funding to design and implement the Arkansas Stroke Registry. Early work on the stroke registry positioned the Arkansas Department of Health to receive funding from CDC through the 2012–2015 Paul Coverdell National Acute Stroke Program. With these funds, Arkansas focused on improving EMS-to-hospital transitions for stroke patients and on developing a statewide stroke system of care plan.

### Program implementation for the Arkansas Stroke Registry from 2012–2015

The Arkansas Stroke Registry engaged in three key QI activities:

1. conducting program reviews of performance measures with participating hospitals;
2. providing training and technical assistance for EMS and hospital staff; and
3. establishing a pilot program, Code Stroke, to improve the EMS-to-hospital transition of stroke patients.

#### Performance Measure Reviews with Hospitals

Through partnerships with the Task Force, the American Heart Association/ American Stroke Association, and AR SAVES, the Arkansas Stroke Registry recruited 42 hospitals to participate in program performance measure reviews. Participating hospitals received their scores on 20 key stroke care measures and were awarded certificates for excellent performance. The Arkansas Stroke Registry used the data to provide customized technical assistance during hospital site visits and to implement QI activities.

#### Training and Technical Assistance for EMS and Hospital Staff

The Arkansas Stroke Registry also provided training to hospital and EMS staff, including training for hospital staff on data abstraction, regional workshops for EMS staff on transition of stroke

patients to the Emergency Department, and training for providers on Advanced Stroke Life Support (ASLS).

### Code Stroke Pilot Program

The Code Stroke pilot program trained more than 1,000 EMS staff on the importance of time management for stroke patients and providing an early pre-notification to the hospital for suspected stroke patients. Before this initiative, Arkansas did not provide stroke-specific education to EMS staff.

## Improving outcomes among Arkansas stroke patients

QI activities and training led to systems changes that improved the transition of stroke patients from EMS agencies to hospitals. The Code Stroke pilot program improved transitions of stroke patients so that they went directly into the CT scanner upon hospital arrival. Participating hospitals also enacted changes such as administering thrombolytic therapy while the patient was in the CT scanner and streamlining the dysphagia screening process.

Arkansas Stroke Registry activities contributed to better quality care for stroke patients. Performance measure data from the state stroke registry of participating hospitals revealed significant improvements in 9 of the 12 key Coverdell Program quality-of-care measures from 2012 to 2015 (Table 2). The two measures that improved the most over time were the percentages of patients who had an initial NIHSS score recorded and of eligible patients receiving thrombolytic therapy, which improved 30% and 46%, respectively.

## Future directions for stroke care in Arkansas

Through its established partnerships, the Arkansas Stroke Registry plans to support a new stroke systems of care plan that will promote using a standard of care protocol. Additionally, potential state legislation may change the stroke system of care by mandating stroke center designations recognized by the state health department. The state health department may also establish and implement EMS standard of care protocols and destination protocols for EMS transport.

**We brought ASLS to the state through Coverdell. That was not in the state before, so now AR SAVES has instructors teaching this throughout the state, and so now we have 200 people across the state as providers.**

***— Program Staff Member***

**Table 2. Arkansas Improvements in Coverdell Program Quality-of-Care Measures, 2012–2015**

| Measure | 2012 | 2015 | *P*-value |
|---|---|---|---|
| Thrombolytic therapy (alteplase) | 25% | 71% | < 0.0001 |
| Venous thromboembolism (VTE) prophylaxis | 90% | 99% | < 0.0001 |
| Antithrombotic therapy by end of hospital day 2 | 92% | 97% | < 0.0001 |
| Assessed for rehabilitation | 92% | 97% | < 0.001 |
| Smoking cessation counseling | 87% | 93% | < 0.01 |
| Stroke education | 81% | 92% | < 0.0001 |
| Discharged on antithrombotic therapy | 96% | 98% | < 0.01 |
| Discharged on statin medication | 82% | 93% | < 0.0001 |
| Recording of NIH Stroke Scale score | 39% | 69% | < 0.0001 |

## California Stroke Registry/ California Coverdell Program (CSR/CCP)

**From 2013 to 2015, the California Stroke Registry/California Coverdell Program (CSR/CCP) achieved significant improvements in the percentage of patients who were given venous thromboembolism (VTE) prophylaxis (97% to 99%, $P < 0.05$) and who had an NIHSS score recorded (82% to 90%, $P < 0.0001$) in 50 hospitals through activities to improve agreement with specific performance measures and integration of patient-level data across hospitals and EMS agencies.**

### History of stroke care in California

In 2007, the California Department of Health collaborated with the American Heart Association/American Stroke Association to develop a state stroke registry that aligned with the objectives and scope of the CDC Paul Coverdell National Acute Stroke Program. Early work on this registry positioned California to be competitive for future funding opportunities with CDC and laid a foundation for improving stroke care in California. The California Department of Health received Coverdell funding in 2012 to support and expand their earlier efforts.

With these funds, the CSR/CCP focused on improving data collection and reporting, as well as stroke patient care in both the EMS and hospital care settings.

### Program implementation for the California Coverdell Program from 2012–2015

The CSR/CCP concentrated a majority of its resources on creating an integrated data system to support QI efforts and enable the development and evaluation of local stroke systems of care. In California, local EMS agencies establish stroke systems of care, which include hospital designation, screening and treatment practices, and patient transfer and transport protocols. The CSR/CCP worked closely with 3 of California's 33 local EMS agencies and provided summary data tables highlighting the performance of the designated hospitals. These data were essential for driving local-level QI efforts and for evaluating the local systems of care.

In addition to working toward an integrated data system, the CSR/CCP engaged in two key QI activities:

1. improving data quality and
2. sharing best practices related to time-to-treatment measures (i.e., door to CT scan and door to needle).

#### Improving Data Quality

To address issues with data quality, the CSR/CCP focused on two areas for Coverdell-participating hospitals: (1) incomplete records, which may be emblematic of other performance concerns; and (2) missing data for the time last known well variable, which is key for informing patient care for a given episode. Time last known well is the time at which the patient was last known to be without the signs and symptoms of the current stroke; it is used to calculate some of the in-hospital quality performance measures. The CSR/CCP provided technical assistance for

**If [time last known well] is not there, there's no data to support the rest of patient care for a given episode.**

*— Program Staff Member*

those hospitals with the greatest proportion of missing data and incomplete records.

### Sharing Best Practices

The CSR/CCP observed a wide range of performance on the door-to-needle time measure across Coverdell hospitals. To support improvements for time-to-treatment measures, the CSR/CCP did the following: First, for the lower-performing hospitals, the CSR/CCP conducted a survey to assess each hospital's capacity for participating in QI activities related to improving door-to-needle time. At the same time, the CSR/CCP conducted interviews with personnel from the higher-performing hospitals, to learn about the protocols implemented to improve door-to-needle times. Then the CSR/CCP shared and discussed these best practices and how they might be implemented at the lower-performing hospitals. These practices included viewing every suspected stroke as an actual stroke upon arrival, using Target: Stroke* tools, using data to inform feedback loops, and incentivizing performance. Finally, the CSR/CCP followed up with lower-performing hospitals to offer additional assistance and to track improvement.

## Improving outcomes among California stroke patients

The CSR/CCP activities contributed to system and practice changes in participating hospitals. For example, training and technical assistance improved data completeness in 14 hospitals, particularly for the time last known well variable.

The CSR/CCP activities contributed to better quality care for stroke patients. While performance measure data indicated that many CSR/CCP hospitals already had a high capacity for stroke care at baseline, participating hospitals achieved improvements in 2 of the 12 key Coverdell Program quality-of-care performance measures from 2013 to 2015 (Table 3). The two measures that improved were the percentages of eligible patients receiving venous thromboembolism (VTE) prophylaxis and for whom an initial NIHSS score was recorded, which improved 2% and 8%, respectively.

## Future directions for stroke care in California

The CSR/CCP plans to sustain the work accomplished during the 2012–2015 program. In addition to expanding reach and infrastructure for stroke care, the CSR/CCP aims to continue work on developing an integrated data system for stroke patient care. Additionally, initiatives and collaborations outside of Coverdell-funded activities will help maintain key partnerships with the American Heart Association/American Stroke Association and the California Emergency Medical Services Association. The CSR/CCP received 2015–2020 Coverdell funding to continue its work in stroke care.

*Target: Stroke is a national quality improvement initiative of the American Heart Association/American Stroke Association Get With the Guidelines®–Stroke program. The initiative focuses on improving acute ischemic stroke care by reducing door-to-needle times for eligible patients being treated with tPA.

**Table 3. California Improvements in Coverdell Program Quality-of-Care Measures, 2013–2015**

| Measure | 2013 | 2015 | *P*-value |
|---|---|---|---|
| Venous thromboembolism (VTE) prophylaxis | 97% | 99% | < 0.05 |
| Recording of NIHSS score | 82% | 90% | < 0.0001 |

## Georgia Coverdell Acute Stroke Registry (GCASR)

**From 2012 to 2015, the Georgia Coverdell Acute Stroke Registry (GCASR) achieved significant improvements in the percentage of patients for whom an NIHSS score was recorded (68% to 86%, *P* < 0.0001) and who received thrombolytic therapy (alteplase) within 60 minutes of arrival (46% to 65%, *P* < 0.0001) in 65 participating hospitals, through a QI pilot program with hospital and EMS staff and performance improvement reviews with hospitals.**

### History of stroke care in Georgia

In 2004, the CDC Paul Coverdell National Acute Stroke Program awarded funds to the Georgia Department of Public Health to establish GCASR. In 2008, the Georgia General Assembly passed legislation to establish a primary stroke center designation, which required hospitals to participate in GCASR to be recognized as primary stroke centers, further strengthening hospital-based care for stroke patients. Using 2012–2015 Coverdell funds, GCASR expanded its focus from in-hospital stroke care to improving EMS-to-hospital transitions for stroke patients.

### Program implementation for GCASR from 2012–2015

The main GCASR QI activities included:

1. an EMS and hospital QI pilot program,
2. technical assistance through performance reports for hospitals and bi-monthly webinars offered jointly to EMS agencies and hospitals, and
3. free Advanced Stroke Life Support (ASLS) instructor trainings.

#### EMS and Hospital QI Pilot Program

Using guidance from the Georgia Office of Emergency Medical Services, GCASR engaged nine EMS agencies and the hospitals they serve in a QI pilot program. At the in-person pilot launch meeting in February 2014, EMS and hospital representatives worked together to identify strategies to improve stroke care coordination and timely patient care. The pilot program facilitated communication between hospitals and EMS through shared activities and convening stakeholders. It also catalyzed regional QI initiatives on topics such as transporting patients to the most appropriate facility and improving pre-notification.

#### Technical Assistance and Webinars

GCASR provided technical assistance to hospitals and EMS, including bi-monthly webinars and training for hospital staff on data abstraction. GCASR used registry data to guide QI activities and to update hospitals and EMS agencies on their performance.



For more information, visit the Paul Coverdell National Acute Stroke Program website, call 800-CDC-INFO (800-232-4636), TTY: 888-232-6348, or contact CDC INFO. To learn about the evaluation of the program, e-mail arebheartinfo@cdc.gov.

**When Coverdell provided the ASLS materials to many pre- and in-hospital facilities, we taught medics and nurses in the same class. Medics practiced giving a radio report, and could get direct feedback on the best practices and effective ways of giving pre-notifications. This opens the dialogue.**

*— Medic*

### Free ASLS Instructor Trainings

GCASR trained 48 new instructors to teach ASLS courses. These courses were important not just for the content but also for the opportunity to teach EMS medics and hospital staff together in the same class, which sometimes led to joint troubleshooting of stroke care protocols across care settings.

## Improving outcomes among Georgia stroke patients

GCASR's efforts improved several stroke care practices, including encouraging the use of a single pre-hospital stroke scale and developing an inter-hospital transport protocol to standardize the treatment of patients who receive thrombolytic therapy (alteplase) at one hospital before being transferred to another hospital with greater stroke care capacity.

Participation in GCASR also contributed to better quality of care for stroke patients. Performance measure data from participating hospitals revealed improvements in 6 of the 12 key Coverdell Program quality-of-care measures (Table 4). The two measures that had the largest increase over time were the percentages of patients who received thrombolytic therapy within 60 minutes of arrival (door-to-needle time ≤ 60 minutes) and of patients for whom an NIHSS score was recorded, which increased 19% and 18%, respectively.

## Future directions for stroke care in Georgia

GCASR staff reported that future directions for stroke care in Georgia include increasing hospital and EMS ownership of stroke QI activities and implementing a remote stroke treatment hospital designation. One way that GCASR aims to increase hospital and EMS ownership is by promoting peer-to-peer learning through a professional alliance of hospital staff, EMS agencies, and other practitioners. Georgia hopes to provide greater access to stroke care for rural residents by implementing a protocol to designate remote stroke treatment centers, thereby supporting remote hospitals to work closely with more established hospitals. GCASR received 2015–2020 Coverdell funds to continue its work in stroke care.

**Table 4. Georgia Improvements in Coverdell Program Quality-of-Care Measures, 2012–2015**

| Measure | 2012 | 2015 | *P*-value |
|---|---|---|---|
| Thrombolytic therapy (alteplase) | 70% | 81% | < 0.001 |
| Venous thromboembolism (VTE) prophylaxis | 96% | 99% | < 0.0001 |
| Stroke education | 90% | 97% | < 0.0001 |
| Discharged on statin medication | 93% | 96% | < 0.0001 |
| Door-to-needle time ≤60 minutes | 46% | 65% | < 0.0001 |
| Recording of NIHSS score | 68% | 86% | < 0.0001 |

## Iowa Coverdell Stroke Program (ICSP)

**From 2012 to 2015, the Iowa Coverdell Stroke Program (ICSP) achieved significant improvements in the percentage of patients provided with stroke education (87% to 94%, *P* < 0.001) and prescribed anticoagulation therapy for atrial fibrillation/flutter (86% to 93%, *P* < 0.05) in 30 participating hospitals by establishing interdisciplinary learning communities and providing education to EMS agencies.**

### History of stroke care in Iowa

In 2008, CDC funded the Iowa Department of Public Health to develop a heart disease and stroke prevention program. The following year, the Iowa Department of Public Health received additional funding from CDC to create the Iowa Stroke Registry, and participating hospitals began collecting data on stroke-related measures on a voluntary basis. The Iowa Department of Public Health received 2012–2015 CDC Paul Coverdell National Acute Stroke Program funds to continue the registry and improve EMS-to-hospital transitions for stroke patients.

### Program implementation for ICSP from 2012–2015

Through a partnership with the Iowa Healthcare Collaborative, the Iowa Department of Public Health engaged 30 hospitals in data-driven QI. ICSP's two main QI activities included:

1. the development of stroke action teams through learning communities and
2. EMS education, including calls, webinars, tutorials, and trainings.

#### Learning Communities and Stroke Action Teams

Learning communities provided a forum for education on quality and performance tools for hospital staff from primary stroke centers and stroke-capable hospitals and EMS staff. The learning communities fostered the creation of stroke action teams—interdisciplinary teams within local networks that participated in educational and QI activities together.

#### EMS Education

ICSP provided educational opportunities specifically for EMS to improve treatment in the field and EMS routing. For example, ICSP created an EMS run sheet to indicate where patients will receive the best care for different kinds of strokes. The run sheet was based off ICSP-created maps of primary and stroke-capable hospitals and corresponding drive times. ICSP reviewed these maps with EMS staff. Together, they identified each EMS agency's location on the map and the facilities they should deliver patients to in order to improve drive time.



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## Improving outcomes among Iowa stroke patients

ICSP's efforts led to systems changes that improved EMS-to-hospital transitions of care for stroke patients. With CDC funds, ICSP implemented practice changes such as switching from the standard neurological assessment to a more comprehensive scale, modifying the EMS protocol to ensure that all stroke patients would eventually be transported to a primary stroke center, and increasing the number of stroke-capable facilities in the state.

ICSP's work also contributed to maintaining and improving quality of stroke care in participating hospitals. Performance measure data from the state stroke registry of participating hospitals revealed improvements in 3 of the 12 key Coverdell Program quality-of-care measures from 2012 to 2015 (Table 5). The two measures that showed the greatest improvements over time were the percentages of patients provided with stroke education and of patients prescribed anticoagulation therapy for atrial fibrillation/flutter; both increased 7%.

## Future directions for stroke care in Iowa

ICSP staff reported that future directions for stroke care in Iowa include technology and legislation changes to improve data linkages. In 2015, all EMS providers switched to new software that expands the stroke-related indicators collected by EMS providers. Furthermore, the software is able to transfer information directly into the registry, which could facilitate the use of electronic records and potentially phase out paper records. Stroke care in Iowa may also change if the Iowa Code changes to make stroke a mandatory reportable condition. This change could increase participation in the registry across the state and improve data linkages across the continuum of care.

**Some EMS would just bring people to the closest hospital, not knowing if it was stroke-capable or not. But, I think the EMS agencies we work with now know where they should go.**

***— Program Staff Member***

**Table 5. Iowa Improvements in Coverdell Program Quality-of-Care Measures, 2012–2015**

| Measure | 2012 | 2015 | *P*-value |
|---|---|---|---|
| Stroke education | 87% | 94% | < 0.0001 |
| Discharged on statin medication | 96% | 99% | < 0.01 |
| Anticoagulation therapy for atrial fibrillation/flutter | 86% | 93% | < 0.05 |

# Massachusetts Coverdell Program

**From 2012 to 2015, Massachusetts achieved significant improvements in the percentage of patients for whom an NIHSS score was recorded (73% to 84%, *P* < 0.0001) and who were screened for dysphagia (82% to 86%, *P* < 0.0001) in 56 participating hospitals through educational opportunities for hospitals and EMS agencies and technical assistance for data-driven QI.**

## History of stroke care in Massachusetts

In 2004, the Massachusetts Department of Public Health received funding from the CDC Paul Coverdell National Acute Stroke Program and has been funded for each subsequent program cycle. The Massachusetts Coverdell Program began by developing two collaborative QI groups: the Stroke Collaborative Reaching for Excellence (SCORE) for hospitals and the EMS QI Collaborative for EMS agencies. Data from the Coverdell registry complemented the activities of these collaborative QI groups by providing insights on trends in stroke patient care. In 2012, the Massachusetts Coverdell Program expanded efforts by collaborating with key partners to link facilities in the post-acute care setting with the wider data-driven QI initiative of the Massachusetts stroke system of care. The Massachusetts Coverdell Program was the only grantee to work in all three settings of stroke care, including EMS, in-hospital, and post-hospital transitions of care during 2012–2015.

## Program implementation for the Massachusetts Coverdell Program from 2012–2015

The Massachusetts Coverdell Program engaged in three key QI activities:

1. stroke system of care learning sessions,
2. regional meetings, and
3. technical assistance in data-driven QI.

### Stroke Systems of Care Learning Sessions

Stroke systems of care learning sessions were in-person, semiannual, day-long conferences with breakout sessions on various topics, including hospital best practices, EMS feedback, the time last known well variable, and chronic disease self-management. The Massachusetts Coverdell Program arranged to provide continuing medical education credits to participants, who included staff from EMS agencies, hospitals, and skilled nursing facilities.

### Regional Meetings

In addition to learning sessions, the Massachusetts Coverdell Program held in-person, semiannual regional meetings for each of the three collaborative groups related to specific care settings. Regional meetings offered networking opportunities and were less formal than learning sessions, with relevant announcements; data review; and discussion of challenges, successes, and effective QI tools.

**When we started recruiting nursing home facilities, we told them they had to develop a stroke team…. Now they are all in the beginning stages of QI projects. I was just meeting with one facility that is excited about their QI project and hoping to be able to present it to all of us in September when we get some results.**

***— Program Staff Member***

### Technical Assistance for Data-Driven QI

Program staff used registry data to create individual hospital performance reports, inform learning sessions and regional meetings, and track specific measures that reflect practice changes, such as pre-notification rates and documentation of time last known well. The Massachusetts Coverdell Program post-acute QI specialist visited the skilled nursing facilities to provide technical assistance that included stroke education, data abstraction training, and coaching.

## Improving outcomes among Massachusetts stroke patients

Massachusetts Coverdell Program's QI efforts contributed to practice and systems changes across the stroke care continuum. Major achievements in the EMS and hospital settings included development of a new statewide EMS Stroke Alert Protocol and creation of an EMS feedback form to help hospitals and EMS agencies work together to improve quality of care and care transitions. In the post-acute care setting, the Massachusetts Coverdell Program developed the framework for a post-acute collaborative similar to those for EMS agencies and hospitals, invited skilled nursing facilities to their learning sessions, deployed a post-acute care transition specialist, and created an educational module for skilled nursing staff.

QI activities and focused technical assistance also contributed to better quality care for stroke patients. Performance measure data from the state stroke registry of participating hospitals revealed improvements in 6 of the 12 key Coverdell Program quality-of-care measures (Table 6). The two measures that had the largest increases over time were the percentages of eligible patients screened for dysphagia and for whom an NIHSS score was recorded, which increased 4% and 11%, respectively.

## Future directions for stroke care in Massachusetts

Future work includes a plan to link data across the stroke system of care from EMS agencies to hospitals to post-hospital facilities, as well as continued program monitoring through inventory surveys and dissemination of facility-specific reporting, which provides feedback in identifying opportunities for continued improvement. Establishing data linkages that accommodate patient confidentiality requirements will be key to achieving an integrated, high-performing stroke system of care across the care continuum in Massachusetts. The Massachusetts Coverdell Program received 2015–2020 Coverdell funds to continue its work in stroke care.

**Table 6. Massachusetts Improvements in Coverdell Program Quality-of-Care Measures, 2012–2015**

| Measure | 2012 | 2015 | *P*-value |
|---|---|---|---|
| Screened for dysphagia | 82% | 86% | < 0.0001 |
| Venous thromboembolism (VTE) prophylaxis | 96% | 98% | < 0.0001 |
| Stroke education | 93% | 96% | < 0.0001 |
| Discharged on statin medication | 94% | 97% | < 0.0001 |
| Anticoagulation therapy for atrial fibrillation/flutter | 95% | 98% | < 0.01 |
| Recording of NIHSS score | 73% | 84% | < 0.0001 |

## Michigan's Ongoing Stroke Registry to Accelerate Improvement of Care (MOSAIC)

**From 2012 to 2015, Michigan's Ongoing Stroke Registry to Accelerate Improvement of Care (MOSAIC) achieved significant improvements in the percentage of patients for whom an NIHSS score was recorded (82% to 91%, $P < 0.0001$) and who were provided with stroke educational materials (86% to 95%, $P < 0.0001$) in 26 hospitals through monthly conference calls on best practices and one-to-one technical assistance for hospitals.**

### History of stroke care in Michigan

During 2007–2012, the Michigan Department of Community Health received funding from the CDC Paul Coverdell National Acute Stroke Program to improve care for stroke patients in hospitals participating in MOSAIC. The Michigan Department of Community Health's experience with in-hospital stroke care and prior pilot work on hospital-to-post-hospital transitions of care provided the program with the organizational capacity needed to receive 2012–2015 Coverdell funds to continue its work.

### Program implementation for MOSAIC from 2012–2015

MOSAIC's main QI activities were:

1. continuing or maintaining improvement on key in-patient stroke care measures and
2. conducting a pilot program of making 30-day follow-up calls for all patients discharged.

#### Progress Reports for In-Patient Stroke Care Measures

MOSAIC continued to collect data on in-patient stroke care measures and provide progress reports for 26 participating hospitals to maintain the hospitals' gains on these measures. Hospitals then selected activities to address potential areas for improvement. MOSAIC QI staff assisted hospitals through one-on-one discussions during site visits and by presenting best practices during monthly conference calls.

#### Pilot Program of 30-Day Post-Discharge Follow-Up Calls

MOSAIC's work in the post-hospital setting centered on developing and piloting a 30-day follow-up call process for patients discharged home. Through collaboration with participating hospitals, program staff created a call sheet to identify the problems that patients commonly experience that could result in readmissions. MOSAIC piloted the protocol in 5 of the 26 Coverdell-participating hospitals, and QI specialists helped hospitals use call data to identify areas where they could improve their clinical processes

**…the quality is improved, and even formatively the relationships are improving between the discharge [hospital discharge staff] and the primary care community and the physician understanding…. And some of these issues that physicians didn't know about. They had no way to get this information. It [the follow-up call system] has provided a platform.**

***— Program Staff Member***

to reduce the readmission rate. For example, hospitals changed discharge and patient education processes to help patients better understand their diagnosis, medication regimens, and stroke preventive measures.

## Improving outcomes among Michigan stroke patients

MOSAIC's QI efforts contributed to systems and practice changes in hospitals participating in the 30-day follow-up call pilot. For example, at one participating hospital, follow-up call data revealed that patients were not meeting lifestyle and medication regimen recommendations. To overcome this challenge, the hospital began providing free medication counseling services that focused on working with the patient and caregiver to set up a medication regimen before discharge.

MOSAIC's activities also contributed to better quality of care for stroke patients. Performance measure data from the state stroke registry of participating hospitals revealed improvements in 4 of the 12 key Coverdell Program quality-of-care measures from 2012 to 2015 (Table 7). The two measures that made the largest increases over time were the percentages of patients provided with stroke education at discharge and for whom an NIHSS score was recorded, which both improved 9%.

## Future directions for stroke care in Michigan

MOSAIC's future work will focus on continuing the record of success with in-patient and post-hospital stroke care, as well as informing the passage of guidelines to establish a statewide stroke system of care, including hospital designation for primary stroke centers. MOSAIC plans to expand the patient discharge 30-day follow-up call process and resulting system changes to additional Coverdell hospitals; however, they are largely dependent on Coverdell funding for stroke care programming. MOSAIC received 2015–2020 Coverdell funding to continue its work in stroke care.

**Table 7. Michigan Improvements in Coverdell Program Quality-of-Care Measures, 2012–2015**

| Measure | 2012 | 2015 | *P*-value |
|---|---|---|---|
| Venous thromboembolism (VTE) prophylaxis | 97% | 99% | < 0.0001 |
| Stroke education | 86% | 95% | < 0.0001 |
| Discharged on statin medication | 91% | 93% | < 0.0001 |
| Recording of NIHSS score | 82% | 91% | < 0.0001 |

## Minnesota Stroke Registry

**From 2012 to 2015, the Minnesota Stroke Registry achieved significant improvements in the percentage of patients for whom an NIHSS score was recorded (62% to 84%, *P* < 0.0001) and who were screened for dysphagia (74% to 80%, *P* < 0.0001) in 61 participating hospitals through facilitation of hospital performance improvement activities and regional education workshops for hospitals and EMS agencies.**

### History of stroke care in Minnesota

Before 2007, the Minnesota Department of Health (MDH) participated in the Great Lakes Regional Stroke Network, which required that each state form a statewide body of partners from multiple sectors of the health care system to address stroke care. The resulting Minnesota Stroke Partnership contributed to establishing relationships with partners, building capacity for stroke care delivery, and developing a statewide plan for stroke systems of care. Building on this groundwork, MDH established the Minnesota Stroke Registry during the 2007–2012 CDC Paul Coverdell National Acute Stroke Program funding cycle to support efforts to implement the statewide plan. MDH then received funds from the 2012–2015 Coverdell Program to improve EMS-to-hospital transitions of care for stroke patients. During this time, Minnesota passed legislation authorizing MDH to designate hospitals as stroke centers; the state later passed an amendment requiring designated hospitals to participate in the stroke registry. The American Heart Association and other partners led the advocacy efforts for the new legislation; MDH supported these efforts with voluntary QI initiatives.

### Program implementation for the Minnesota Stroke Registry from 2012–2015

Using Coverdell funds, MDH focused on improving EMS-to-hospital transitions of care for stroke patients at 61 participating hospitals by implementing the following QI activities:

1. facilitating regional education workshops with hospitals and EMS, and
2. providing technical assistance through site visits and quarterly conference calls, and guiding performance improvement projects at participating hospitals.

#### Regional Education Workshops with Hospitals and EMS

The regional education workshops provided an opportunity to engage participating hospitals and EMS agencies in rural settings, and to feature local experts on stroke care. Workshop topics included stroke care guidelines, the NIHSS, and acute stroke-ready designation. During these workshops, hospital and EMS staff shared lessons and examples. One of these examples was the MDH EMS data collection pilot. A comprehensive stroke center (covering 20% of the state population) and five EMS agencies in the same county participated in the pilot, which proved to be a valuable model for stroke system changes across the state.

**We had dedicated time for EMS and hospitals to talk through some of the processes, including patient handoff, pre-hospital stroke protocols, and feedback tools.**

***— Regional Workshop Participant***

### Technical Assistance and Performance Improvement Projects

MDH conducted quarterly conference calls and site visits and maintained regular communication with leadership at participating hospitals. As part of the performance improvement project, MDH provided a toolkit of performance improvement activities, encouraging hospitals to tailor the activities to their own needs and capacity. Another component, the Performance Improvement Collaborative, helped catalyze meaningful system changes, including decreased door-to-imaging time. The Emergency Care for Stroke Initiative of the Performance Improvement Collaborative also encouraged hospitals to coordinate EMS protocols, improve the coordination of patient handoff, provide EMS feedback, and enhance stroke education and awareness for EMS.

## Improving outcomes among Minnesota stroke patients

MDH's efforts led to changes that improved the transition of stroke patients from EMS to hospital care. The pilot comprehensive stroke center enacted practice changes such as regularly disseminating stroke care guidelines to staff, providing EMS with feedback forms, and standardizing the use of the Cincinnati Prehospital Stroke Scale. The EMS Council active in the same county also standardized care protocols for its five local EMS agencies.

MDH's focused technical assistance and QI initiatives also contributed to improvements in the quality of stroke care. Performance measure data from the state stroke registry of participating hospitals show improvements in 6 of the 12 key Coverdell Program quality-of-care performance measures from 2012 to 2015 (Table 8). The two measures that showed the greatest improvement over time were the percentages of patients for whom an initial NIHSS score was recorded and who were screened for dysphagia, which increased 22% and 6%, respectively.

## Future directions for stroke care in Minnesota

The Minnesota Stroke Registry reported that federal and state funding is critical to the sustainability of current program efforts, along with having the necessary data to demonstrate improved outcomes. The long-standing partnership with American Heart Association/American Stroke Association and other partners demonstrated the importance of collaboration to implement stroke systems of care. Continuing these partnerships will be instrumental to sustain efforts in supporting hospitals and EMS agencies in stroke care. The Minnesota Stroke Registry planned to continue building relationships with hospitals throughout the state and providing technical assistance to hospitals interested in improving stroke systems of care, focusing on smaller, rural hospitals with limited capacity. The Minnesota Stroke Registry received 2015–2020 Coverdell funding to continue its work in stroke care.

**Table 8. Minnesota Improvements in Coverdell Program Quality-of-Care Measures, 2012–2015**

| Measure | 2012 | 2015 | *P*-value |
|---|---|---|---|
| Screened for dysphagia | 74% | 80% | < 0.0001 |
| Assessed for rehabilitation | 98% | 99% | < 0.05 |
| Stroke education | 81% | 86% | < 0.05 |
| Discharged on antithrombotic therapy | 98% | 99% | < 0.0001 |
| Anticoagulation therapy for atrial fibrillation/flutter | 91% | 95% | < 0.01 |
| Recording of NIHSS score | 62% | 84% | < 0.0001 |



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## New York Coverdell Program

**From 2012 to 2015, the New York Coverdell Program achieved significant improvements in the percentage of patients who received stroke education (75% to 95%, *P* < 0.0001) and who were administered thrombolytic therapy (alteplase) within 60 minutes of hospital arrival (48% to 69%, *P* < 0.0001) in 47 participating hospitals through tailored technical assistance to hospitals based on performance measure data and a hospital learning collaborative.**

### History of stroke care in New York

In 2004, the New York State Department of Health developed a voluntary stroke hospital designation program to begin improving the quality of care among suspected stroke patients in the state. Additionally, New York was one of the first states to have a statewide EMS protocol for suspected stroke patients. These programs provided a foundation for improving stroke care in the state. After receiving funding through the 2012–2015 CDC Paul Coverdell National Acute Stroke Program, the health department built upon the existing EMS protocols and hospital designation system to establish the New York Coverdell Stroke Quality Improvement and Registry Program (hereafter called the New York Coverdell Program). With this funding, the New York Coverdell Program expanded its focus from in-hospital stroke care to improving EMS-to-hospital transitions of care for stroke patients.

### Program implementation for the New York Coverdell Program from 2012–2015

The New York Coverdell Program engaged in three key QI activities:

1. one-on-one technical assistance with hospitals,
2. best practice calls with stroke coordinators, and
3. learning collaborative webinars with hospitals.

#### One-on-One Technical Assistance

The New York Coverdell Program focused its QI efforts on five priority measures including stroke education, prescription of statins at discharge, dysphagia screening, door-to-needle time within 60 minutes, and arrival to hospital within 2 hours and treatment within 3 hours following stroke onset. Program staff had one-on-one interactions with Coverdell-participating hospitals that were below an 85% performance level on any of the five priority measures, and helped them to develop 3-month, 6-month, and 12-month action plans.

#### Best Practice Calls

Additionally, the New York Coverdell Program hosted bi-weekly—and later, monthly—best practice calls with stroke coordinators from participating hospitals. On these calls, hospitals

shared strategies and challenges they were facing.

### Learning Collaborative Webinars

Finally, the New York Coverdell Program held numerous learning collaborative webinars with hospitals. Webinar topics included, but were not limited to, best practices and interventions, data quality, and data re-abstraction.

## Improving outcomes among New York stroke patients

The New York Coverdell Program supported practice and systems changes in participating hospitals. For example, individual hospitals implemented best practices learned through the collaborative meetings, such as using a tool to provide feedback to EMS and keeping alteplase kits in the CT scanner room to improve the timeliness of alteplase administration.

New York Coverdell Program activities contributed to better quality of care for stroke patients. Performance measure data from the state stroke registry of participating hospitals revealed improvements in 4 of the 12 key Coverdell Program quality-of-care measures from 2012 to 2015 (Table 9). The two measures that made the largest increases over time were the percentages of patients who received stroke education and who received thrombolytic therapy (alteplase) within 60 minutes of arrival (door-to-needle time), which increased 20% and 21%, respectively.

## Future directions for stroke care in New York

Using a foundation of stroke designation and EMS protocols in the state and programmatic activities funded by Coverdell, the New York Coverdell Program was able to bring together partners and stakeholders to improve stroke systems of care. Program leadership lauded their partners for their work and pointed to a common vision as the foundation for their successful partnerships. Success in the 2012–2015 funding cycle leaves the New York Coverdell Program poised to implement further system change efforts across the stroke care continuum. The New York State Department of Health received 2015–2020 Coverdell funds to continue its work in stroke care.

**Teams were most engaged in work around [alteplase] tPA, and the outcomes show that. It is our biggest success.**

***— Program Staff Member***

**Table 9. New York Improvements in Coverdell Program Quality-of-Care Measures, 2012–2015**

| Measure | 2012 | 2015 | *P*-value |
|---|---|---|---|
| Venous thromboembolism (VTE) prophylaxis | 98% | 99% | < 0.05 |
| Stroke education | 75% | 95% | < 0.0001 |
| Door-to-needle time ≤60 minutes | 48%* | 69% | < 0.0001 |
| Recording of NIHSS score | 88% | 93% | < 0.0001 |

*Data are from 2013 for door-to-needle time only.

## North Carolina Stroke Care Collaborative (NCSCC)

**From 2012 to 2015, the North Carolina Stroke Care Collaborative (NCSCC) achieved significant improvements in the percentage of patients provided with stroke education (75% to 91%, *P* < 0.0001) and for whom an NIHSS score was recorded (71% to 80%, *P* < 0.0001) in 57 participating hospitals through educational outreach with hospitals and EMS agencies and grant awards for collaborative QI projects.**

### History of stroke care in North Carolina

In 2004, CDC awarded funds to the North Carolina Division of Public Health (NC DPH) through the CDC Paul Coverdell National Acute Stroke Program. This funding helped establish the NCSCC to use data from the registry to drive QI in stroke care. NC DPH received 2012–2015 Coverdell funds to improve EMS-to-hospital transitions of care for stroke patients.

### Program implementation for the NCSCC from 2012–2015

NCSCC's key QI activities included:

1. developing an EMS and hospital data linkage portal,
2. providing educational events and peer-to-peer sharing among hospitals and EMS agencies, and
3. awarding grants for collaborative QI activities.

#### EMS and Hospital Data Linkage Portal

From 2012 to 2015, NCSCC focused significant resources on improving data linkages between EMS agencies and hospitals. NCSCC launched a data linkage pilot program, giving participating hospitals and their EMS counterpart agencies the opportunity to select data elements to be included in online data linkage reports. NCSCC contracted with a data vendor to develop a portal that linked specific stroke-related EMS and hospital electronic medical record data elements. After testing the portal, EMS agencies and hospitals provided survey feedback on the usefulness of the pilot data to NCSCC. Simultaneously, NCSCC also continued to improve its custom data tool to address and improve in-hospital care.

#### Education and Peer-to-Peer Sharing

NCSCC coordinated regional workshops, monthly webinars, and 20-minute informal discussions as requested about stroke treatment and care, four listservs to connect stroke care professionals, and a peer-to-peer mentoring network for stroke care coordinators. These activities provided opportunities for hospital and EMS staff to network and share knowledge. Registry data guided the selection of QI topics and speakers. By leveraging its partners' education network, NCSCC was able to increase the percentage of EMS professionals



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attending regional workshops from 17% to 40%.

### Collaborative QI Grant Program

Using additional funding from the state of North Carolina, the NCSCC was able to award grants in amounts up to $20,000 to hospitals to improve stroke care, requiring that they partner with their local EMS counterparts. Two examples of QI projects funded through the grant program included a hospital collaborating with local EMS agencies to develop an EMS education module and another hospital working with a local EMS agency on a blood draw pack labeling system to ensure that the samples were collected and transferred efficiently between care settings.

## Improving outcomes among North Carolina stroke patients

NCSCC's efforts contributed to stroke care systems and practice changes in participating hospitals. For example, as a result of attending a regional workshop, one participating hospital worked with the local EMS agency to implement a standardized stroke screening process and to develop a better defined transfer of care protocol.

Participation in NCSCC also contributed to better care for stroke patients. Performance measure data from the state stroke registry of participating hospitals revealed significant improvements in 6 of the 12 key Coverdell Program quality-of-care measures from 2012 to 2015 (Table 10). The two measures with the greatest improvement over time were the percentages of patients who received stroke education and for whom an NIHSS score was recorded, which increased 16% and 9%, respectively.

## Future directions for stroke care in North Carolina

Future proposed directions for stroke care in North Carolina included an expansion of the data linkage pilot program and efforts to raise public awareness of stroke symptoms and the existence of the registry. Through its partnerships, NCSCC aims to raise awareness about stroke prevention, especially in rural parts of the state, and to communicate the value of the registry within the stroke system of care to the public. In addition, NCSCC plans to collaborate with key stakeholders across the state to move across the care continuum to improve transitions of care in the post-discharge stroke care arena.

**We [hospital and associated EMS agencies] moved to the MEND exam* so that what we're doing and what they're doing is the same. Before this QI workshop, we weren't communicating the specifics.**

*— Hospital Staff Member*

*The Miami Emergency Neurological Deficit (MEND) exam is a focused neurological assessment that can be used in both the pre-hospital setting and the in-hospital setting.

**Table 10. North Carolina Improvements in Coverdell Program Quality-of-Care Measures, 2012–2015**

| Measure | 2012 | 2015 | *P*-value |
|---|---|---|---|
| Venous thromboembolism (VTE) prophylaxis | 98% | 99% | < 0.05 |
| Assessed for rehabilitation | 90% | 96% | < 0.0001 |
| Stroke education | 75% | 91% | < 0.0001 |
| Discharged on statin medication | 84% | 91% | < 0.0001 |
| Anticoagulation therapy for atrial fibrillation/flutter | 90% | 92% | < 0.01 |
| Recording of NIHSS score | 71% | 80% | < 0.0001 |

## Ohio Coverdell Stroke Program

**From 2012 to 2015, the Ohio Coverdell Stroke Program achieved significant improvements in the percentage of patients for whom an NIHSS score was recorded (77% to 90%, *P* < 0.0001) and who received thrombolytic therapy (alteplase) within 60 minutes of arrival (41% to 59%, *P* < 0.0001) in 46 participating hospitals through education, training, and consultation with hospitals based on aggregated data reports.**

### History of stroke care in Ohio

The Ohio Department of Health received Paul Coverdell National Acute Stroke Program funding from CDC in 2007 and in 2012. From 2007 to 2012, the Ohio Coverdell Stroke Program focused on acute care QI initiatives and achieved high levels of in-hospital quality of stroke care. In 2012, the Ohio Coverdell Stroke Program determined that 27 of the 42 participating hospitals were already working toward improving transitions of care, either hospital-wide or for conditions other than stroke, through various federally funded initiatives. Ohio Coverdell established a data collection component within their American Heart Association Get With the Guidelines (GWTG)—Stroke platform to collect data on follow-up appointment scheduling. This strategically poised the Ohio Coverdell Stroke Program to expand its focus to include improving transitions of care from hospitals to post-hospital facilities using 2012–2015 Coverdell funds.

### Program implementation for the Ohio Coverdell Stroke Program from 2012–2015

The Ohio Coverdell Stroke Program's main QI activities included:

1. providing technical assistance and report development to hospitals for in-hospital and post-hospital stroke care initiatives, and
2. scheduling follow-up appointments for patients discharged home to improve transitions of care from acute care to post-hospital settings.

#### Technical Assistance to Hospitals

During 2012–2015, the program expanded the number of participating hospitals from 42 to 46. Program staff supported hospitals' stroke care efforts by providing technical assistance and aggregate data reports of GWTG care quality measures. The Ohio Coverdell Stroke Program used baseline hospital data to identify QI needs and opportunities. Based on the needs and opportunities identified, the Coverdell QI specialist collaborated with partners to offer education, training, and consultation to hospitals to continually improve the quality of data entered into GWTG.

#### Follow-Up Appointments for Patients Discharged from the Hospital

To address stroke transitions of care from hospital to post-hospital settings, the Ohio Coverdell Stroke Program focused on increasing the rate at which participating hospitals scheduled

**…[A] local hospital…did a great job of 60% to 70% [patients] leaving the hospital with an appointment. Then they took it further to see of those that had an appointment how many actually went to it. And they had phenomenal success, they had 80% to 90% show up to that appointment. And it was exciting for them to see how many actually showed up.**

***— Program Staff Member***

follow-up appointments for stroke patients discharged home and to other health care facilities. Hospitals developed scheduling processes and recorded the number of follow-up appointments in a GWTG tab. The Ohio Department of Health provided reports to hospitals on the percentage of patients discharged home who had a follow-up appointment scheduled with their primary care provider or neurology provider. Hospitals used the data to drive increases in scheduling rates. The Ohio Coverdell Stroke Program also designed and facilitated a pilot project with four hospitals to determine whether patients were keeping their follow-up appointments. The pilot included a root-cause analysis that hospitals used to identify where the breakdown in the scheduling process might be occurring.

## Improving outcomes among Ohio stroke patients

Ohio Coverdell Stroke Program activities contributed to practice and systems changes in participating hospitals. For example, scheduling process changes resulted in an increase in the number of follow-up appointments made for patients before discharge, and documenting data in the GWTG tool facilitated QI within partnering hospitals.

Performance measure data from the state stroke registry of participating hospitals revealed improvement in all 12 Coverdell Program quality-of-care performance measures (Table 11). The two measures with the greatest increase over time were the percentages of eligible patients treated with thrombolytic therapy (alteplase) within 60 minutes of hospital arrival (door-to-needle time) and for whom an initial NIHSS score was recorded, which increased 18% and 13%, respectively.

## Future directions for stroke care in Ohio

In the future, the Ohio Coverdell Stroke Program aims to collaborate with hospitals to address contextual factors, such as transportation and caregiver education, that could prevent patients from attending follow-up appointments. Additionally, the Ohio Coverdell Stroke Program plans to sustain its networking activities to ensure that stroke care providers have future opportunities to share information on best practices. The program also plans to develop workforce capacity by providing education, training, clinical consultation, and technical assistance to hospital stroke teams. Further, the program wants to continue providing data reports to participating hospitals. These reports are valuable as stroke coordinators often do not have time to aggregate program data or create reports for administrative and stroke center certification purposes. The Ohio Department of Health received 2015–2020 Coverdell funding to continue its work in stroke care.

**Table 11. Ohio Improvements in Coverdell Program Quality-of-Care Measures, 2012–2015**

| Measure | 2012 | 2015 | *P*-value |
|---|---|---|---|
| Thrombolytic therapy (alteplase) | 80% | 87% | < 0.05 |
| Screened for dysphagia | 85% | 88% | < 0.0001 |
| Venous thromboembolism (VTE) prophylaxis | 98% | 100% | < 0.0001 |
| Antithrombotic therapy by end of hospital day 2 | 97% | 98% | < 0.0001 |
| Assessed for rehabilitation | 98% | 99% | < 0.0001 |
| Smoking cessation counseling | 96% | 99% | < 0.0001 |
| Stroke education | 93% | 96% | < 0.0001 |
| Discharged on antithrombotic therapy | 98% | 99% | < 0.0001 |
| Discharged on statin medication | 95% | 98% | < 0.0001 |
| Anticoagulation therapy for atrial fibrillation/flutter | 94% | 97% | < 0.01 |
| Door-to-needle time ≤60 minutes | 41% | 59% | < 0.0001 |
| Recording of NIHSS score | 77% | 90% | < 0.0001 |

## Wisconsin Coverdell Stroke Program (WCSP)

**From 2013 to 2015, the Wisconsin Coverdell Stroke Program (WCSP) achieved significant improvements in the percentage of eligible patients who were given thrombolytic therapy (alteplase) (69% to 86%, $P < 0.05$) and who received thrombolytic therapy (alteplase) within 60 minutes of arrival (26% to 55%, $P < 0.001$) in 29 participating hospitals through the development of toolkits to support QI activities and educational outreach events for hospital and EMS staff.**

### History of stroke care in Wisconsin

In 2012, the Wisconsin Department of Health Services received Paul Coverdell National Acute Stroke Program funds from CDC. Prior to 2012, the Wisconsin Department of Health Services participated in the 2005–2009 Great Lakes Regional Stroke Network. Through this network, the Wisconsin Department of Health Services developed the Wisconsin Stroke Coalition and a statewide stroke system of care plan. Using 2012–2015 Coverdell funds, WCSP was able to reconvene the coalition and revive partnerships developed through the Great Lakes Regional Stroke Network to improve the transition of care from EMS to hospitals for stroke patients.

### Program implementation for WCSP from 2012–2015

WCSP's key QI activities included:

1. providing technical assistance to hospital staff through performance reviews and data abstraction training,
2. developing toolkits for hospitals and EMS agencies, and
3. conducting outreach events to facilitate relationship building between EMS agencies and hospitals.

#### Hospital Performance Reviews and Data Abstraction Training

WCSP provided training on data abstraction to 29 hospitals participating in Coverdell, along with a quarterly QI report on the re-abstracted data. To help hospitals identify target goals and develop action plans, WCSP used performance data from the registry.

#### Toolkits for Hospitals and EMS Agencies

WCSP developed two toolkits to support QI efforts: the Building Blocks toolkit and the EMS toolkit. The Building Blocks toolkit is a compilation of recommendations for hospitals on how to build a stroke program. The EMS toolkit provides resources, including video recordings of presentations about best practices from educational outreach events.

#### Educational Outreach Events with Hospital and EMS Staff

WCSP hosted several types of educational events to meet the needs of different stakeholder groups. Together with the American Heart Association/American



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**Over [the] course of 2 years working with this grant, the movement that has happened has been significant. We've had success in the outreach, in bringing hospital and EMS together so they know each other and understand how to work together… now the relationship is there and it will be easier to make changes.**

***— Program Staff Member***

Stroke Association, WCSP organized five half-day regional stroke conferences to bring certified stroke centers, referral hospitals, and EMS agencies together. WCSP also hosted 17 educational outreach events with hospital and EMS staff across the state. At these events, program staff presented best practices and participants provided solutions to overcoming barriers in establishing stroke systems of care. To meet the needs of smaller, rural hospitals, WCSP collaborated with the Wisconsin Office of Rural Health to provide free online stroke education to critical access hospitals.

## Improving outcomes among Wisconsin stroke patients

WCSP's efforts led to practice changes including the development of new protocols and improved data linkages between EMS and hospitals. WCSP worked with the state EMS unit, physician advisory group, and stroke coordinators to develop and distribute a transfer protocol for patients needing thrombolytic therapy (alteplase) to 450 EMS agencies and 127 hospitals in the state. Additionally, WCSP developed a communication form for hospitals to provide feedback to EMS on transitions of care, thereby creating a data feedback loop and overcoming barriers to real-time data access.

Participation in WCSP also contributed to better quality of stroke care for patients. Performance measure data from the state stroke registry of participating hospitals revealed improvements in 7 of the 12 key Coverdell Program quality-of-care measures from 2013 (the first year that data were available) to 2015 (Table 12). The two measures with the greatest improvement over time were the percentages of eligible patients who were given thrombolytic therapy (alteplase) and who received that therapy within 60 minutes of hospital arrival (door-to-needle time), which increased 17% and 29%, respectively.

## Future directions for stroke care in Wisconsin

Using CDC funding, WCSP established itself as a convener and coordinator of the stroke care stakeholders and efforts in the state. To sustain this function, WCSP staff are writing a charter for the Wisconsin Stroke Coalition that will outline organizations' roles and responsibilities going forward and working to identify a partner with the capacity to coordinate future stroke care activities in the state. WCSP received 2015–2020 Coverdell funding to continue its work in stroke care.

**Table 12. Wisconsin Improvements in Coverdell Program Quality-of-Care Measures, 2013–2015**

| Measure | 2013 | 2015 | *P*-value |
|---|---|---|---|
| Thrombolytic therapy (alteplase) | 69% | 86% | < 0.05 |
| Assessed for rehabilitation | 97% | 99% | < 0.0001 |
| Stroke education | 90% | 95% | < 0.05 |
| Discharged on statin medication | 96% | 98% | < 0.05 |
| Anticoagulation therapy for atrial fibrillation/flutter | 92% | 98% | < 0.05 |
| Door-to-needle time ≤60 minutes | 26% | 55% | < 0.001 |
| Recording of NIHSS score | 89% | 96% | < 0.0001 |