Report on the Results of BC Stroke & TIA Collaborative

12-11-01 Final Report

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EXECUTIVE SUMMARY

The Stroke & TIA Collaborative ran from September 2011 to June 2012, with a pre-work period 5 months prior to the start of the Collaborative. The purpose of the Collaborative was to improve the management of stroke and TIA (Transient Ischemic Attack) patients in the acute stage of the stroke continuum. This Collaborative was launched through the provincial Clinical Care Management initiative (CCM), and executed through the BC Patient Safety & Quality Council (BCPSQC). Furthermore, this work was one of the initiatives of the BC Stroke Strategy, which is administered by Stroke Services BC. Both BCPSQC and Stroke Services BC provided funding for this improvement Collaborative, with support from the Shared Care Committee.

The total cost of physician involvement in the Stroke and TIA Collaborative, supported by the Shared Care Committee, was $73,974.50.

The Collaborative was based on IHI Breakthrough Series Collaborative methodology with some modification. There were 4 Learning Sessions and 4 Action Periods. The Learning Session consisted of 3 face-to-face meetings and 1 virtual meeting: Learning Session 1 was held in Richmond, BC on September 19-20 2011; Learning Session 2 was held in Victoria, BC on November 14-15 2011; Learning Session 3 was held virtually on February 3 2012; and Learning Session 4 was held in Kelowna, BC on April 16-17 2012. During the action periods teams were supported through bi-weekly webinars and an online community for sharing of resources. A final face-to-face Closing Celebration was held in Surrey, BC on June 18 2012, which was supported through Canadian Stroke Network (CSN) funding.

The Collaborative had a diverse faculty group. The faculty provided feedback on key clinical content for the management of stroke & TIA patients, and delivered presentations at Learning Sessions and webinars. The faculty was made up of 4 stroke neurologists, a stroke nurse, an emergency physician, an emergency nurse, a clinical nurse educator, an occupational therapist and a stroke survivor with representation from all health authorities, with the exception of NHA.

The Collaborative also specified and defined process measures to assist teams to better understand if improvements were occurring. In total there were 11 Collaborative measures. Teams could self select which measures they wanted to collect and monitor, and the Collaborative planning team provided teams with charts for the raw data that they submitted. The key drivers for change for the Collaborative were: 1) increase the utilization of tPA; 2) decrease TIA conversion to stroke; 3) increase adherence to stroke best practices in the ED; and 4) provide appropriate transitions in care.

In total, 17 teams enrolled in the Collaborative with representation from 29 emergency departments across BC. The performance of the teams far exceeded the expected results of a typical Collaborative with 10 out of 17 teams reporting significant improvement or better (typically only 30% report this), and no teams dropping out (typically 30% of teams drop out). All teams made a number of reported improvements, and out of the 11 teams that submitted Collaborative data to the planning team, all showed improvement in at least one measure.
There were a number of presentations and videos delivered by the Collaborative Planning team, faculty and guest speakers. The subject of these presentations and videos included clinical information and improvement methodology. There were a total of 18 presentations delivered at the Learning Sessions (including the Closing Celebration), 5 presentations delivered via webinar, and 2 YouTube videos were created.

Cross-site learning is a key advantage of the Collaborative model that promotes rapid improvement. For this Collaborative, a number of methods were used to promote learning between sites. The first method was to have teams present on their improvement efforts and obtain feedback from other sites. There were a total of 31 team presentations that were delivered at the Learning Sessions and Closing Celebration. Secondly, each face-to-face Learning Session had a storyboard session, where teams brought print copies of their improvement story with them, and other teams could discover their change ideas. Finally, the Evidence to Excellence website was used to exchange resources and materials such as patient handouts and pre-printed order-sets.

The true depth of improvement can be outlined through case study analysis of specific teams:

**Victoria General Hospital:** Victoria General Hospital was a site that was able to make a number of improvements. Most notably they worked closely with BC Ambulance Service to take patients direct to the CT scanner and reduce the time to CT from around 30 minutes with high variability to around 5 minutes with low variation. They were also able to sustain this improvement over several months.

**Shuswap Lake General Hospital:** This community hospital implemented stroke order sets at their site, and collaborated with the BC Ambulance Service to ensure that hot stroke patients are properly diagnosed, have glucose checked and blood drawn in the ambulance bay, to expedite transfer directly to Royal Inland Hospital to be seen by a neurologist. For all other strokes, SLGH was able to reduce the time for vascular imaging from 2.75 days to 0.5 day, time to mobilization from 2 days to less than 0.5 days, and time to swallowing screen from 2.75 days to 0.5 days.

**Fraser Health Authority:** This health authority worked as a single team to make changes across 12 sites. They significantly improved the Emergency Department Information system to reduce ambiguities and allow for easy identification. The also reduced the time to CT and increased the education of stroke for FHA staff. FHA was able to reduce the door-to-needle time by 20%.

Based on the successes of the Stroke & TIA Collaborative, there were a number of critical success factors that were identified:

1. Coordination and oversight for Stroke & TIA quality improvement across the province.
2. Reporting out of team progress at the executive level during the Stroke Services BC Steering Committee meetings.
3. Alignment with provincial strategies around BC’s Stroke Strategy and Clinical Care Management.
4. Access to evidence and experts as needed for the Collaborative.
5. Physician support for participation through Shared Care Committee funding.
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BACKGROUND

Why Improve Stroke Care?

Stroke is the number one cause of acquired long-term disability in adults in British Columbia (BC). In 2008/2009, there were 4,526 patients in the province who experienced an incident stroke that was severe enough to require hospitalization; of which 1,610 (36%) died within a year following their stroke, making stroke the third leading cause of death in the province.¹

As shown in the Canadian Stroke Network’s The Quality of Stroke Care document from 2011,² significant improvements can be made in the delivery of stroke care across the continuum. Improvement can be made in the delivery of clot-busting treatment (thrombolytic) to reduction of complications to rehabilitation. Unfortunately British Columbia is often below the national average. For example in British Columbia, only 20% of patients receive a CT scan within 1 hour of arrival in the ED and it only improves to 63% in 24 hours the national average is 69%. In Alberta and Ontario this number is 79% and 75% respectively.

The Continuum of Stroke

As stated in the BC Stroke Strategy’s Provincial Stroke Action Plan document in 2010, improvement in stroke management should include a focus on the entire continuum using an integrated stroke strategy.³ For this reason, Phase 1 in stroke improvement work is centered in the Emergency Department, but provides linkages to Pre-Hospital and Secondary Prevention. Figure 1 shows the entire 3-phase strategy; the focus of this document is to summarize the results from Phase 1.

Coordinated and efficient emergency and pre-hospital (BC Ambulance Service) care are critical to improving stroke and transient ischemic attack (TIA) outcomes. Emergency Departments (ED) in BC are working tirelessly to provide the highest quality, evidence-based and efficient care. However, many shortfalls exist in understanding pre-hospital site designation policies, standardization and dissemination of ED stroke protocols, and linkages to existing secondary prevention (TIA) clinics.⁴

For acute ischemic stroke patients, prompt treatment of stroke with thrombolytic therapy, namely tissue plasminogen activator (tPA), can restore blood flow before major damage occurs.
However, tPA can only be used within 4.5 hours of stroke onset\textsuperscript{iii,iv,v}. The strict inclusion/exclusion criteria and delays in arriving at and within EDs mean that few patients actually receive tPA. In 2008/2009, 4.27\% of all ischemic stroke patients received tPA in BC.\textsuperscript{i}

As stated in the BC Stroke Strategy’s 2010 action plan document, there exist gaps within EMS (Emergency Medical Services) and emergency department care in BC in numerous areas. Namely, the functional capacity and associated role designations of facilities/hospitals with respect to stroke care are not always clearly understood. EMS bypass protocols are inconsistently available or partially applied. Further, some regions have specific stroke protocols while others use general guidelines. The implementation of stroke protocols and the adoption of stroke best practices need to be supported, such that stroke care is standardized. Finally, proper management and referral to secondary prevention clinics (where available) needs to occur in the ED for TIA patients.\textsuperscript{i}

\section*{BC Stroke Strategy}

British Columbia’s stroke strategy was initially led by the Heart & Stroke Foundation of BC and Yukon and supported by the BC Ministry of Health, who developed the planning and prototyping of the provincial strategy. Much of the findings from this 3-phase initiative have been summarized in their Provincial Stroke Action Plan, which provided the outline of the improvement and implementation needed in BC. In 2011, provincial stroke care oversight and planning was handed over to the Provincial Health Services Authority (PHSA) to ensure that stroke management was a provincial priority and become embedded into the health system. Stroke Services BC was formed in April 2011.

Stroke was also recognized by the BC Ministry of Health’s Clinical Care Management initiative as one of 11 improvement areas along with other areas such as Surgical Checklists, Sepsis, and Medication Reconciliation. The Stroke initiative was tasked with an initial mandate to improve the care of Stroke and TIA in the emergency departments across BC. An ED Improvement Collaborative was supported to build on the ED Improvement work that had been previously completed by the provincial Evidence to Excellence initiative,\textsuperscript{vi} and the Emergency Department Protocol Working Group.

The B.C. Patient Safety & Quality Council and Stroke Service B.C. collaborated to lead an ED Stroke and TIA Improvement Collaborative from April 2011 to June 2012. Stroke Services BC provided the funding to enable teams to travel to the face-to-face workshops (Learning Sessions), and the B.C. Patient Safety & Quality Council, provided funding for the management and facilitation, event costs, and physician faculty consultation costs. Further funding was received from the Shared Care Committee to support the participating physicians’ cost to participate in improvement work and attending workshops. Finally, a $35,000 grant was received from the Canadian Stroke Network to hold a 1-day face-to-face Closing Celebration day followed by a half-day “Think Tank” session to discuss Phase 2.
TRIPLE AIM FRAMEWORK

The Stroke and TIA Collaborative improvement structure was congruent with the Triple Aim Framework. All three dimensions of Triple Aim are considered in this design:

1. **Population Health**: The overall goal of the Stroke and TIA Collaborative was to reduce mortality and morbidity due to stroke in the Province of B.C.

2. **Per Capita Cost**: Through the process of creating substantive improvement in the care of stroke and TIA patients, the cost on the health care system will be reduced. This will be realized through multiple short- and long-term endpoints: 1) Reduced inpatient deaths due to stroke; 2) Increased discharges of stroke patients to home (avoiding long-term and residential care); 3) Shorter inpatient length of stay; 4) Reduced inpatient complications due to stroke, and; 5) Reduced conversion from TIA to stroke.

3. **Experience of Care**: The Collaborative model ensures timely, effective, safe, equitable and patient-centered care. The patient experience was integrated into the Collaborative through recruitment of a stroke survivor on our Faculty. In addition, health care providers in the Collaborative had the opportunity to share change ideas, work in multi-disciplinary partnerships, collaborate across hospitals and regions, and have the support of their senior leadership.

Each of the Triple Aim Design components were integrated into the Stroke and TIA Collaborative:

1. **Individual and Family**: This improvement initiative had a primary goal to improve the quality of care for individuals who have suffered a stroke, and for the families who care for them. We involved patients as partners in this effort to ensure that their voice has been heard and integrated.

2. **Redesign Services and Structures**: We developed a comprehensive change package that provided the foundation of redesigning services and structures to ensure best quality of care for stroke and TIA patients across all Institute of Medicine aims.

3. **Population Health Management**: Working closely with the Ministry of Health, the Health Authorities and the Heart and Stroke Foundation of B.C. and Yukon, we promoted policies and public awareness to ensure that the public seeks care emergently after a stroke or TIA.

4. **Cost Control Platform**: From previous cost modeling, the cost avoidance from implementation of a coordinated provincial stroke strategy significantly offsets the small cost to deliver this Collaborative.

5. **System Integration**: Working closely with Stroke Services B.C., PHSA, and B.C. Ambulance Services, in partnership with the Health Authorities and Ministry of Health, we are in the process of developing a coordinated stroke system of care for the Province of B.C. The Stroke and TIA Collaborative was the starting point for this development.
COLLABORATIVE STRUCTURE

The BC Stroke & TIA ED Improvement Collaborative ran from April 2011 to June 2012; it was based on the principals of the IHI Collaborative Model for achieving breakthrough improvement. The model provides a structured method to combine subject matter experts in a specific clinical area with application experts who would help organizations select, test and implement changes on the front lines of care.

Figure 2 shows the structure, methodology and timeline for the Stroke & TIA Collaborative. The diagram shows the pre-Collaborative planning running from top to bottom, which ran from March 2011 to September 2011. There were two concurrent planning streams: 1) one stream involved the creation of the content and recruitment of expert faculty; and 2) the other stream involved recruiting the teams from the EDs across BC and working with them to complete the pre-work. The pre-work involved providing the participants with information on how best to recruit team members and gain an understanding of their current system through process mapping.

The Collaborative ran from September 19, 2011 to June 18, 2012. The Stroke & TIA Improvement Collaborative was structured with four Learning Sessions. Three of the Learning Sessions were face-to-face with locations around the province (Richmond, Victoria and Kelowna). One Learning Session (LS3) was a half day virtual Collaborative, but the planning team and some faculty travelled to Prince George to host the session. The final Closing Celebration was held as a one-day face-to-face session in Surrey. During the Learning Sessions, teams were presented with the following: 1) technical content about the best care for Stroke and TIA patients; 2) content about improvement methodology; and 3) presentation from teams about their success and barriers to improving stroke care in the emergency department. Action Periods occurred after each of the Learning Sessions. During the Action Periods, teams applied the model for improvement to make improvements at their site. Teams were supported through bi-weekly webinars that were delivered through WebEx™ and provided with a website to share resources.

Physicians involved in the Collaborative were asked to participate in each of the Collaborative Learning Sessions and attend the bi-weekly webinars, when they were able. In addition, physicians were charged to provide a leadership role within their site’s interdisciplinary team, to work on local improvement changes. These tasks included: meeting with team members on a regular basis to brainstorm ideas and develop a plan for changes; working on changes with their teams and auditing care; spreading knowledge and best practices to other physicians in the department, and hospital, and; advocating for implementation and spread of change within their department, and hospital.
Faculty and Planning Team

The clinical expert group of faculty was recruited from across BC. The purpose of the faculty for the Improvement Collaborative was to provide clinical content and guidance on best practice for the care of stroke and TIA patients. The faculty consisted of leading stroke neurologists, an emergency physician, an emergency nurse, a stroke nurse and a stroke survivor. The list of faculty for the Collaborative is provided in Table 1.

TABLE 1. LIST OF FACULTY MEMBERS FOR STROKE & TIA COLLABORATIVE

<table>
<thead>
<tr>
<th>Faculty Member</th>
<th>Position</th>
<th>Health Authority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Todd Collier</td>
<td>Stroke Neurologist</td>
<td>Interior Health Authority</td>
</tr>
<tr>
<td>Chris Considine</td>
<td>Stroke Survivor</td>
<td></td>
</tr>
<tr>
<td>Valorie Cunningham</td>
<td>Emergency Physician</td>
<td>Vancouver Island Health Authority</td>
</tr>
<tr>
<td>Kevin Harrison</td>
<td>Stroke Coordinator and Occupational Therapist</td>
<td>Fraser Health Authority</td>
</tr>
<tr>
<td>Kennely Ho</td>
<td>Stroke Neurologist</td>
<td>Fraser Health Authority</td>
</tr>
<tr>
<td>Melanie Montague</td>
<td>Stroke Nurse</td>
<td>Vancouver Island Health Authority</td>
</tr>
<tr>
<td>Andrew Penn</td>
<td>Stroke Neurologist</td>
<td>Vancouver Island Health Authority</td>
</tr>
<tr>
<td>Sherry Stackhouse</td>
<td>Emergency Nurse</td>
<td>Vancouver Coastal Health Authority</td>
</tr>
<tr>
<td>Philip Teal</td>
<td>Stroke Neurologist</td>
<td>Vancouver Coastal Health Authority</td>
</tr>
<tr>
<td>Brent Woodley</td>
<td>Clinical Nurse Educator</td>
<td>Fraser Health Authority</td>
</tr>
</tbody>
</table>
The planning team for the Stroke & TIA Collaborative consisted of a Clinical Lead and a position that shared the responsibility of a Quality Lead and Project Manager. The Clinical Lead for the Collaborative was Dr. Devin Harris, an emergency physician and stroke researcher at St. Paul's Hospital and Clinical Lead with the BC Patient Safety & Quality Council who has been involved with the BC Stroke Strategy as a clinical expert, he led the measurement and evaluation working group for the BC Stroke Strategy, and has been involved in numerous stroke improvement initiatives. The Quality Lead and Project Manager for the Collaborative was Noreen Kamal, who has led 4 Improvement Collaboratives with the Evidence 2 Excellence initiative for the improvement of Emergency Department care in British Columbiavi.

**Measures**

British Columbia has several strategies for measurement and evaluation of Stroke care. One of these strategies is part of the CCM initiative, whose purpose is to improve the quality of patient care in BC through a well-supported system-wide approach to establishing, promoting implementation of, and reporting out on evidence-based clinical best practices.

The Collaborative also had a series of process measures that were designed to provide granular visibility into the care of stroke & TIA patients, so that improvements could be discerned.

**A) CCM Stroke & TIA Measures:**

CCM has 3 quality measures for each of the 11 areas that are its focusviii. The quality measures for Stroke & TIA are shown in Table 2.

**TABLE 2. QUALITY MEASURES FOR STROKE & TIA.**

<table>
<thead>
<tr>
<th>Type</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outcome</td>
<td>Percent of patients who die in hospital or Transitional Care Units (TCU) who have a diagnosis of ischemic stroke</td>
</tr>
<tr>
<td>Outcome</td>
<td>Final discharge disposition for ischemic stroke patients following acute inpatient admission: percentage discharged to their original place of residence; percentage discharged to long-term care facility or nursing home.</td>
</tr>
<tr>
<td>Process</td>
<td>Percent of ischemic stroke patients who receive acute thrombolytic therapy.</td>
</tr>
<tr>
<td>Process</td>
<td>Time from first encounter with medical care in an Emergency Department to neurological assessment by a stroke expert (in clinic or other setting) for transient ischemic attack (TIA) patients.</td>
</tr>
</tbody>
</table>

The collection of these CCM measures was not the responsibility of the participants of the Collaborative; the data was available to the Collaborative participants so that they can better understand the larger global measures for Stroke & TIA care at their hospital and Health Authority. These measures were embedded in Health Authority agreements to provide a longitudinal measurement strategy for subsequent phases of the CCM Initiative.
B) The Collaborative Measures:

A foundation to the model for improvement is to collect clinical patient-level data to better understand if changes are resulting in improvement. Previously validated stroke improvement measures that were emergency department specific, were collated and provided to Collaborative teams, with a data dictionary. There were eleven measures in total; participating teams had the option of auditing measures that aligned to the improvements that they were targeting. The Collaborative measures are shown in Table 3.

<table>
<thead>
<tr>
<th>Name</th>
<th>Measure</th>
<th>Description</th>
<th>Definition of Key Terms</th>
</tr>
</thead>
</table>
| Door-to-needle      | Percent of all thrombolysed ischemic stroke patients who receive acute thrombolytic therapy within 60 minutes from arrival to the ED | * All ischemic stroke patients that received tPA within one-hour to entry into the ED provides an indication of ED efficiency (door to needle)  
* We only want to include patients that received tPA |  
* Numerator = number of ischemic stroke patients that received tPA in less than 60 min  
* Denominator = total number of ischemic stroke patients that received tPA |
| Time to CT          | Percent of ischemic stroke patients who receive neurovascular imaging within 60 minutes from arrival to the ED | * All ischemic stroke patients should receive urgent imaging in the ED  
* We only want to include patients that received tPA |  
* Numerator = number of all ischemic stroke patients that receive CT/MRI in less than 60 min  
* Denominator = total number of ischemic stroke patients |
| Blood glucose check | Percent of patients with suspected acute stroke & TIA who have their blood glucose concentration checked at point-of-care (e.g. Glucometer) on arrival to the emergency department | * All stroke and TIA patients should have their blood glucose checked at the bedside on arrival to diagnose hypoglycemia and rule out stroke mimics |  
* Numerator = number of stroke and TIA patients that had their blood glucose checked  
* Denominator = total number of stroke and TIA patients |
| Electrocardiogram completed | Percent of patients with suspected acute stroke & TIA who have an electrocardiogram performed in the emergency department | * All stroke and TIA patients should have an electrocardiogram performed to identify atrial fibrillation or other dysrhythmia |  
* Numerator = number of stroke and TIA patients that had an electrocardiogram performed  
* Denominator = total number of stroke and TIA patients |
<table>
<thead>
<tr>
<th>Name</th>
<th>Measure</th>
<th>Description</th>
<th>Definition of Key Terms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspirin given</td>
<td>Percent of patients with suspected acute stroke &amp; TIA who are given at least 160 mg of acetylsalicylic acid (ASA) or other antiplatelet agent in the emergency department, unless contraindicated</td>
<td>* All ischemic stroke and TIA patients should be given &gt;= 160 mg of ASA, or another antiplatelet agent, when no contraindications exist</td>
<td>* Numerator = number of ischemic stroke and TIA patients that were given &gt;= 160 mg ASA&lt;br&gt; * Denominator = total number of ischemic stroke and TIA patients</td>
</tr>
<tr>
<td>Mobilization</td>
<td>Percent of patients with suspected acute stroke who are mobilized within 24 hours of stroke symptom onset, unless contraindicated</td>
<td>* All stroke patients should be mobilized within 24 hours of symptom onset to decrease chance of deep vein thrombosis and reduce pain</td>
<td>* Numerator = number of stroke who were mobilized within 24 hours of symptom onset&lt;br&gt; * Denominator = total number of stroke patients</td>
</tr>
<tr>
<td>Swallowing screen</td>
<td>Percent of patients with suspected acute stroke who receive an initial dysphagia screen (swallowing screen) within 24 hours of stroke symptom onset, where appropriate</td>
<td>* All stroke patients should have a swallowing screen performed within 24 hours of symptom onset&lt;br&gt; * All stroke patients with suspected swallowing difficulties should have nothing by mouth until swallowing screen performed to prevent aspiration pneumonia</td>
<td>* Numerator = number of stroke patients who were administered a swallowing screen within 24 hours of symptom onset&lt;br&gt; * Denominator = total number of stroke patients</td>
</tr>
<tr>
<td>Vascular imaging</td>
<td>Percent of patients with suspected acute stroke &amp; TIA who have vascular imaging of the carotid and vertebral arteries within 24 hours of symptom onset (unless the patient is clearly not a candidate for revascularization)</td>
<td>* All ischemic stroke and TIA patients should have vascular imaging of the carotid and vertebral arteries within 24 hrs of symptom onset to diagnose carotid and vertebrobasilar stenosis</td>
<td>* Numerator = number of Ischemic stroke and TIA patients who has vascular imaging performed within 24 hours of symptom onset&lt;br&gt; * Denominator = total number of stroke &amp; TIA patients</td>
</tr>
</tbody>
</table>
Areas of Stroke Improvement

Four primary drivers for reducing stroke mortality and disability in the emergency department were identified for the Collaborative. These four drivers are increasing tPA utilization, decreasing TIA conversion to stroke, increasing adherence to stroke best practices in the ED, and ensuring proper transitions in care. These drivers and secondary drivers are shown in Figure 3.

These drivers provided the foundation for the Change Package that was developed. Each of the secondary drivers had a number of change ideas for the teams to implement at their sites. Further, teams could easily understand the driver and foundation for each change idea through its presentation as a driver diagram.

The primary drivers also provided the Collaborative with a structured schedule for delivering the content. During the first Learning Session, we delivered the content to assist teams to increase ischemic stroke patients receiving thrombolytic therapy. During the second Learning Session, content was delivered on providing teams on diagnosing and treating TIA patients to ensure that fewer TIA patients convert to a stroke. The third Learning Session provided content on ED best practice for stroke care. Finally, the fourth Learning Session provided content on appropriate transitions especially to Stroke Units.
FIGURE 3. KEY PRIMARY AND SECONDARY DRIVERS TO IMPROVE THE CARE OF STROKE & TIA PATIENTS IN THE EMERGENCY DEPARTMENT.
COLLABORATIVE RESULTS

The 2011/2012 BC Stroke & TIA Collaborative significantly impacted patient care within B.C. Interim results are presented here; it is not expected that the full impact of this quality improvement collaborative will not be measurable until a sufficient follow-up period has passed. Further evaluation activities are planned to assess the impact.

Results are categorized into participation measures, progress measures and improvement (patient outcome) measures.

RESULTS – Participation: Provincial Emergency Departments Involved

The call-to-action for the Stroke & TIA Collaborative was distributed to various provincial networks in May 2011. In total there were 17 teams that enrolled in the Collaborative with representation from all five Health Authorities. Table 4 shows the list of all the teams that participated in the Collaborative with their Health Authority. It should be noted that two of the teams represented more than one site. The South Peace Team was a joint team that represented hospitals in both Dawson Creek and Chetwynd. Fraser Health Authority also had a single team working to improve the management of hyper acute stroke and TIA throughout all emergency departments in the Fraser Health Authority (12 hospitals). Therefore, there were a total of 29 emergency departments working towards improving the care of Stroke and TIA patients in this Collaborative.

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Health Authority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lion's Gate Hospital</td>
<td>VCHA</td>
</tr>
<tr>
<td>Richmond General Hospital</td>
<td>VCHA</td>
</tr>
<tr>
<td>St. Paul's Hospital</td>
<td>VCHA (PH)</td>
</tr>
<tr>
<td>Shuswap Lake General Hospital</td>
<td>IHA</td>
</tr>
<tr>
<td>Royal Inland Hospital</td>
<td>IHA</td>
</tr>
<tr>
<td>Kelowna General Hospital</td>
<td>IHA</td>
</tr>
<tr>
<td>Kootenay Boundary Regional Hospital</td>
<td>IHA</td>
</tr>
<tr>
<td>East Kootenay Regional Hospital</td>
<td>IHA</td>
</tr>
<tr>
<td>Victoria General Hospital</td>
<td>VIHA</td>
</tr>
<tr>
<td>St. Joseph's General Hospital</td>
<td>VIHA</td>
</tr>
<tr>
<td>Campbell River Hospital</td>
<td>VIHA</td>
</tr>
<tr>
<td>Cowichan District Hospital</td>
<td>VIHA</td>
</tr>
<tr>
<td>University Hospital of Northern BC</td>
<td>NHA</td>
</tr>
<tr>
<td>Mills Memorial Hospital</td>
<td>NHA</td>
</tr>
<tr>
<td>North Peace Team (Fort St. John Hospital)</td>
<td>NHA</td>
</tr>
<tr>
<td>South Peace Team*</td>
<td>NHA</td>
</tr>
<tr>
<td>Fraser Health Team**</td>
<td>FHA</td>
</tr>
</tbody>
</table>

*Team represents hospitals in both Dawson Creek and Chetwynd
**Team represents hospitals from all 12 sites in the Fraser Health Authority
Teams were interdisciplinary in their composition, and it was recommended that each team have an emergency physician, nurse and department administrator such as a manager or director. Many teams had a broader make-up of professions that included improvement specialists, clinical nurse educators, neurologists, information technology specialists, and physical therapists. Figure 4 shows the overall distribution of the professions for all participants of the Collaborative. Another key role within each Health Authority were the Stroke Leads. There was one in each Health Authority, and they were instrumental in coordinating teams within each Health Authority. In total, there were 120 participants in the Collaborative.

![Overall Distribution of Professions](image)

**FIGURE 4. OVERALL DISTRIBUTION OF THE PROFESSIONS FOR ALL THE PARTICIPANTS OF THE COLLABORATIVE.**

Participation during the Learning Sessions and Action Period Webinars remained high throughout the Collaborative although some decline was observed. The highest attendance was observed during the Face-to-Face Learning Sessions. Figure 5 shows the participation level for all the Learning Sessions and Webinars.

![Attendance of Collaborative Participants](image)

**FIGURE 5. ATTENDANCE OF COLLABORATIVE PARTICIPANTS FOR EACH LEARNING SESSION AND WEBINAR.**

Representation of each team at each of the Learning Sessions and webinars was very good with near perfect attendance at the face-to-face sessions and the majority of teams attending the webinars. Figure 6 shows the percent of teams that attend the Learning Sessions and webinars.
FIGURE 6. PERCENT OF TEAMS ATTENDING LEARNING SESSIONS AND WEBINARS.

RESULTS – Participation: Physician Engagement

The table below shows the number of physicians that attended each Learning Session and action period call. Please note that we are not including physicians that were part of our faculty group, as they were supported through the BC Patient Safety & Quality Council.

TABLE 5. NUMBER OF PHYSICIANS PARTICIPATING IN LEARNING SESSIONS AND ACTION PERIOD CALLS

<table>
<thead>
<tr>
<th>Name of Session</th>
<th>Physicians in Attendance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning Session 1 (2 days face-to-face)</td>
<td>9</td>
</tr>
<tr>
<td>Learning Session 2 (2 days face-to-face)</td>
<td>11</td>
</tr>
<tr>
<td>Learning Session 3 (1/2 day virtual)</td>
<td>4</td>
</tr>
<tr>
<td>Learning Session 4 (2 days face-to-face)</td>
<td>9</td>
</tr>
<tr>
<td>Action Period 1 call 3 (1 hour virtual)</td>
<td>3</td>
</tr>
<tr>
<td>Action Period 2 call 2 (1 hour virtual)</td>
<td>1</td>
</tr>
<tr>
<td>Action Period 3 call 2 (1 hour virtual)</td>
<td>2</td>
</tr>
</tbody>
</table>

There were also two sites that engaged their physician champion in local meetings. Kelowna General Hospital had meetings on November 1\textsuperscript{st}, 8\textsuperscript{th} and 16\textsuperscript{th} 2011 for a total of 4 hours with 1 physician attending each meeting. Interior health also had a Stroke and TIA planning meeting for 1 hour on October 26, 2011 and they had 3 physicians attend.
RESULTS – Progress: Teams’ Progression towards Improvement

Team progress toward improvement was measured using a standardized self-reporting scale called the Self Assessment Score, which is used in the IHI Collaborative Model methodology. The self-assessment scale is shown in Table 6. Each was expected to report back monthly on their progress and also report their self-assessment of their progress towards improvement. Figure 7 shows the progression of the teams over the course of the Collaborative based on monthly median self-assessment score. This figure also shows the number of teams that were reporting, and as shown the number of teams reporting does drop over time, which does introduce a bias toward higher self-assessment score. The number of teams that achieved a score of 4.0, or significant improvement increased over time with 10 teams out of 17 reporting significant improvement (see Figure 8).

TABLE 6. SELF-ASSESSMENT SCALE DESCRIPTION.

<table>
<thead>
<tr>
<th>Scale</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>Forming the team</td>
</tr>
<tr>
<td>1.5</td>
<td>Planning for the project has begun</td>
</tr>
<tr>
<td>2.0</td>
<td>Activity but not changes</td>
</tr>
<tr>
<td>2.5</td>
<td>Changes but no improvements</td>
</tr>
<tr>
<td>3.0</td>
<td>Modest Improvements</td>
</tr>
<tr>
<td>3.5</td>
<td>Improvement</td>
</tr>
<tr>
<td>4.0</td>
<td>Significant Improvement</td>
</tr>
<tr>
<td>4.5</td>
<td>Sustainable Improvement</td>
</tr>
<tr>
<td>5.0</td>
<td>Outstanding Sustainable Improvement</td>
</tr>
</tbody>
</table>

FIGURE 7. MEDIAN SELF-ASSESSMENT SCORE (LEFT AXIS AND BLUE LINE) AND PERCENT OF TEAMS REPORTING (RIGHT AXIS AND RED LINE).
FIGURE 8. NUMBER OF TEAMS REPORTING 4.0 OR SIGNIFICANT IMPROVEMENT ON THEIR SELF-ASSESSMENT SCORE EACH MONTH.

RESULTS – Outcome (CCM Quality) Measures

The four CCM quality measures were collected concurrently during the period of the Collaborative implementation (see Table 2). It was not expected that an emergency department intervention such as the Collaborative would have any significant impact in the short-term on such global outcomes as death or disability. These measures were chosen as long-term indicators, to allow comparative measurement longitudinally. Of note, the fourth indicator (regarding referral to TIA clinics) was not collected in a comprehensive structure provincially; this indicator is currently being implemented.

INDICATOR IA: INPATIENT MORTALITY

FIGURE 9. INDICATOR IA: ADJUSTED INPATIENT 30-DAY ALL-CAUSE MORTALITY RATE OF PATIENTS WHO HAVE A DIAGNOSIS OF ISCHEMIC STROKE
INDICATOR IB: DISCHARGE DISPOSITION (PERCENT DISCHARGED HOME)

FIGURE 10. INDICATOR IB: FINAL DISCHARGE DISPOSITION FOR ISCHEMIC STROKE PATIENTS FOLLOWING ACUTE INPATIENT ADMISSION: PERCENTAGE DISCHARGED TO THEIR ORIGINAL PLACE OF RESIDENCE.

INDICATOR II: THROMBOLYSIS RATES

FIGURE 11. INDICATOR II: PERCENT OF ISCHEMIC STROKE CASES THAT RECEIVE THROMBLYTIC THERAPY
RESULTS – Improvement (Collaborative Measures) Data

The Collaborative Measures described earlier (Table 3) were submitted to the Collaborative planning team by 11 teams. The planning team analyzed and charted the data in MS Excel and provided feedback to the teams to assist them in their improvement journey. Many teams also collected and charted their own data without submitting, but presented findings at learning sessions. Table 8 shows a summary of the 11 teams that submitted data and the main measures where improvements were seen.

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Measures where Improvement was seen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lion's Gate Hospital</td>
<td>- Mobilization within 24 hrs</td>
</tr>
<tr>
<td></td>
<td>- Imaging within 24 hrs</td>
</tr>
<tr>
<td></td>
<td>- Swallowing screen within 24 hrs</td>
</tr>
<tr>
<td>Shuswap Lake General Hospital</td>
<td>- Mobilization within 24 hrs</td>
</tr>
<tr>
<td></td>
<td>- Imaging within 24 hrs</td>
</tr>
<tr>
<td></td>
<td>- Swallowing screen within 24 hrs</td>
</tr>
<tr>
<td>Royal Inland Hospital</td>
<td>- Door-to-needle time</td>
</tr>
<tr>
<td></td>
<td>- Glucose checked at point-of-care</td>
</tr>
<tr>
<td></td>
<td>- Anti-platelet given</td>
</tr>
<tr>
<td></td>
<td>- Mobilization within 24 hrs</td>
</tr>
<tr>
<td></td>
<td>- Imaging within 24 hrs</td>
</tr>
<tr>
<td>Kelowna General Hospital</td>
<td>- Time to CT Scanner</td>
</tr>
<tr>
<td>Kootenay Boundary Regional Hospital</td>
<td>- Glucose checked at point-of-care</td>
</tr>
<tr>
<td>Victoria General Hospital</td>
<td>- Time to CT Scanner</td>
</tr>
<tr>
<td></td>
<td>- Glucose checked at point-of-care</td>
</tr>
<tr>
<td></td>
<td>- Patients admitted to stroke unit</td>
</tr>
<tr>
<td></td>
<td>- Patient education provided</td>
</tr>
<tr>
<td>Campbell River Hospital</td>
<td>- Glucose checked at point-of-care</td>
</tr>
<tr>
<td></td>
<td>- Swallowing screen within 24 hrs</td>
</tr>
<tr>
<td></td>
<td>- Mobilization within 24 hrs</td>
</tr>
<tr>
<td>Cowichan District Hospital</td>
<td>- Mobilization within 24 hrs</td>
</tr>
<tr>
<td></td>
<td>- Anti-platelet given</td>
</tr>
<tr>
<td></td>
<td>- Patient education provided</td>
</tr>
<tr>
<td>Mills Memorial Hospital</td>
<td>too few patients to assess improvement</td>
</tr>
<tr>
<td>North Peace Team (Fort St. John Hospital)</td>
<td>too few patients to assess improvement</td>
</tr>
<tr>
<td>Fraser Health Team</td>
<td>- Door-to-needle time</td>
</tr>
<tr>
<td></td>
<td>- Glucose checked at point-of-care</td>
</tr>
<tr>
<td></td>
<td>- Anti-platelet given</td>
</tr>
</tbody>
</table>

RESULTS – Overview of Key Changes Made at Each Site

There was a great deal of work done at each site that is difficult to quantify by self-assessment scores. All teams worked on a number of changes, and there were key changes at each site that contributed to the most significant changes. Table 8 lists the key changes that were implemented by each participating team.
## TABLE 8. SUMMARY OF KEY IMPROVEMENTS MADE BY EACH TEAM

<table>
<thead>
<tr>
<th>Team</th>
<th>Most Significant Changes</th>
</tr>
</thead>
</table>
| **Fraser Health Authority**| • Created one stroke order set for 12 acute sites  
• Regional stroke triage recognition and response to Hot Stroke  
• Regional computer software update for entering tPA administration  
• Regional swallowing screening tool  
• Regional diagnostic lab order sets  
• Regional data collection and evaluation process  
• Regional education for ER nurses |
| **Shuswap Lake General Hospital** | • Created an stroke education session and spread teaching to 9/12 rural sites in their region  
• Created a stroke order set  
• Created a hot stroke protocol  
• Worked with BCAS to have proper call ahead for hot strokes  
• Ensure all hot stroke are met in the ambulance bay, glucose is check, INR is drawn in ambulance, physician assessment at ambulance (if hot stroke patient sent directly to Royal Inland Hospital for tPA) |
| **Kelowna General Hospital** | • Updated education for nurses and paramedics on Stroke & TIA  
• Improved various process for stroke patient care  
• New TIA clinic location and improved referral process so that TIA patients are seen within 24-48 hours, and referral information was sent out to all local GP’s, clinics, and regional hospitals to improve process and encourage timely access to neurology |
| **East Kootenay Regional Hospital** | • Created a trigger tool to act as a reminder of stroke symptoms at triage by placing green dot triggers at triage to flag patients that presented with symptoms (including vague and non-specific)  
• Charts were passed directly to ERP  
• Green dots were expanded to Green Stroke/TIA alert sheet, which allows ER RN’s to ensure all diagnostics, labs and referrals are completed before chart is signed off  
• Increased bedside swallowing assessments in ER  
• Increased referral to SLP for more thorough swallowing assessments |
| **Kootenay Boundary Regional Hospital** | • Reorganized triage for easy access to pertinent information for Stroke & TIA patients  
• Increased the consistent use of PPO’s  
• Continued chart audits of stroke & TIA patients to monitor progress and assess performance  
• Created education sessions for Stroke & TIA care |
| **Royal Inland Hospital** | • Created communication mechanisms to staff by:  
  • Sending eye-catchy funny email about Stroke improvements  
  • Creating briefing notes  
  • Creating a Stroke Collaborative board about PDSA trials  
  • Having 1-on-1 education with CNE  
  • Having stroke champions to support PDSAs and answer questions  
  • Increase consistency in use of PPO and proper charting  
  • Bundled forms, PPOs and handouts together to ease burden of accessing the required information  
  • Organized stroke material  
  • Created checklists to ensure all pieces were completed  
  • Created procedures and policies  
  • Educated paramedics  
  • Created pocket cards for BCAS  
  • Updated policies with BCAS  
  • Obtained support from BCAS Unit Chief |
<table>
<thead>
<tr>
<th>Team</th>
<th>Most Significant Changes</th>
</tr>
</thead>
</table>
| Richmond Hospital           | • Held videoconference to support all staff in Region  

• Created a stroke pathway for their patients  

• Created a swallowing screen tool plus an online teaching video on how to screen a patient  

• Introduced the Stroke/TIA order set  

| St. Paul’s Hospital         | • Education was done on multiple levels:  

  • Physician presentations to interdisciplinary teams at monthly rounds  

  • Develop education simulations in the ED  

  • ED poster and presentation on Stroke/TIA  

  • Nursing education on swallowing screens  

  • Updated Emergency Department TIA pathway and physicians educated on its use  

  • Improved process for rapid transport to CT in this large urban hospital by obtaining elevator key, and intensified lobby for CT scanner in ED  

  • Implemented an Omnicell in Trauma room for rapid access to tPA and other medication  

| Lion’s Gate Hospital        | • Created “Did You Know?” posters in the ED to increase awareness of the incidence and occurrence of stroke and its consequences  

• Created a Code Hot Stroke protocol  

• 57 people at this hospital participating in Hemispheres education  

| University Hospital of Northern BC | • Algorithm and prompt cards posted in ER to act as reminders of proper stroke care  

• Swallowing screen tool modified  

• Cerebrovascular working group reviewing all regional order sets  

• Staff education  

• Reviewing and updating the “Hot Stroke” CT process  

| Mills Memorial Hospital    | • BCAS calls ahead with Hot Stroke and ERP is informed  

• ERP makes decision to have rapid CT at triage  

• Nurses turn on CT scanner after hours  

• Stroke Best Practice is ensured in the ED especially in ensuring ECG, control of blood glucose, normal temperature and swallowing screen  

• Made linkages with local First Nations to increase awareness of Stroke & TIA symptoms and encourage rapid treatment in ED  

| North Peace (Fort St. John) | • Implementation of all NH Regional Stroke Order Sets  

• Consistent usage of the NIH Stroke Scale sheet  

• Utilization of TIA documents as part of the TIA Order Set  

• Staff education of NIH Stroke Scale ongoing  

• Increase communication between facilities to facilitate access of CT Scan  

  • i.e. when CT down in FSJ, staff are aware and are linking with Dawson Creek facility to access CT  

| South Peace (Dawson Creek & Chetwynd) | • Improved Fast Tracking of patients  

• Bypass radiology for CT approval  

• 45 certified staff in Canadian Hemispheres  

• Rehabilitation Program – Stroke Education  

• Swallowing– dysphagia assessment training  

• TIA outpatient education/referral  

| Cowichan District Hospital | • Triage nurses have increases awareness of Hot Stroke patients  

• Patients with stroke symptoms within the 4.5 hour window are expedited into the department and seen by an ERP as soon as possible  

• Glucometers are done for all patients experiencing TIA and stroke symptoms at triage  

• ECG’s are being done for almost all patients experiencing TIA and stroke symptoms  

• We moved our Stroke Order Sets into individual shelves and in a highly visible area. The result is that the ERP’s are using more Stroke Order Sets now because they are easy to access


### Most Significant Changes

- **Campbell River Hospital**
  - Improved patient and family education by using educational material, with the referral sticker added the percentage of visits to the stroke clinic has improved
  - 33 nurses and 14 therapists have completed Hemispheres training
  - Created staffroom education and report cards to inform staff on how they are performing
  - Created waiting room education to inform public about stroke symptoms
  - Created stroke checklist to improve care of stroke patients and ensure best practice is adhered to
  - Created a “Brain Box” with complete supplies, medication and dosing information for giving tPA to ensure ease and accuracy
  - Improved the frequency and quality of swallowing screen through improving the usability of the screening tool

- **St. Joseph’s General Hospital**
  - Developed stroke order sets for all Stroke and TIA patients
  - Educated staff on stroke best practice
  - Physicians turned on CT after hours

- **Victoria General Hospital**
  - Improved process for hot stroke including BCAS direct to CT and clinical order sets to greatly reduce time to CT
  - Created a nursing position for navigation of stroke patients
  - Refined criteria for Secondary Prevention Rapid Access Unit
  - Improved Triage of urgent TIA patients
  - Decreased wait times for urgent TIA patients
  - Created multiple communication mechanisms to increase awareness of stroke and the improvements made at Victoria General hospital including Health Authority Newsletter and weekly email bulletin, as well as a news release

### RESULTS - Collaborative Presentations and Videos

The planning team and faculty for the Stroke & TIA Collaborative provided high-quality presentations and videos for the participants to assist in the rapid dissemination of knowledge. This included clinical technical presentations at Learning Sessions and via WebEx™ during the bi-weekly webinars. All the presentations are available in the community section of the Evidence 2 Excellence website (www.evidence2excellence.ca), and recording of the webinars are available on the BC Patient Safety and Quality Council website (www.bcpsqc.ca). Table 9 lists a summary of the presentations and videos created by the Collaborative.

**TABLE 9. SUMMARY OF PRESENTATIONS AND VIDEO DELIVERED BY COLLABORATIVE PLANNING TEAM, FACULTY AND GUESTS**

<table>
<thead>
<tr>
<th>Presenter</th>
<th>Topic</th>
<th>Modality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noreen Kamal</td>
<td>Pre-Work: Forming a Team, Understanding Your Current Situation, Introduction to the Improvement Model and Creating Your Aim Statement</td>
<td>Webinar</td>
</tr>
<tr>
<td>Dan Froom &amp; Devin Harris</td>
<td>Pre-Hospital Care and Site Designation</td>
<td>Learning Session 1: Face-to-Face</td>
</tr>
<tr>
<td>Devin Harris, Phil Teal &amp; Kennely Ho</td>
<td>Thrombolysis in Acute Ischemic Stroke</td>
<td>Learning Session 1: Face-to-Face</td>
</tr>
<tr>
<td>Phil Teal, Brent</td>
<td>Telesstroke</td>
<td>Learning Session 1:</td>
</tr>
</tbody>
</table>
RESULTS - Promotion of Cross-Site Learning

A key factor to the success of Improvement Collaboratives is the promotion of learning between sites. This Collaborative provided multiple modalities to promote cross-site learning. The first methodology was to have successful teams present at Learning Sessions. These presentations were typically 20 to 30 minutes long and teams showed the changes that they were trailing as well as success and barriers that they were encountering. The number of team presentations increased at each face-to-face session.

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<table>
<thead>
<tr>
<th>Presenter</th>
<th>Topic</th>
<th>Modality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Woodley &amp; Kevin Harrison</td>
<td>Improvement Methods – Model for Improvement and Process Mapping</td>
<td>Face-to-Face</td>
</tr>
<tr>
<td>Noreen Kamal, Katie Procter &amp; Sherry Stackhouse</td>
<td>PDSA Cycles – Accelerating Improvements</td>
<td>Learning Session 1: Face-to-Face</td>
</tr>
<tr>
<td>Noreen Kamal, Katie Procter &amp; Sherry Stackhouse</td>
<td>Measurement: Why and how do you do it?</td>
<td>Learning Session 1: Face-to-Face</td>
</tr>
<tr>
<td>Lawrence Cheng</td>
<td>Code Stroke – Branding and Process: how this can help the ED</td>
<td>Learning Session 1: Face-to-Face</td>
</tr>
<tr>
<td>Rhonda Whiteman (Hamilton Health Services)</td>
<td>Change Makes Change: Using a Quality Improvement Process to Create Measurable Improvement in Care Delivery for Acute Stroke Care</td>
<td>Webinar</td>
</tr>
<tr>
<td>Andrew Penn</td>
<td>TIA/ACVS – Risks, Diagnoses &amp; Management</td>
<td>Learning Session 2: Face-to-Face</td>
</tr>
<tr>
<td>Noreen Kamal</td>
<td>Implementing Changes – Planning for Sustainment</td>
<td>Learning Session 2: Face-to-Face</td>
</tr>
<tr>
<td>Melanie Montague</td>
<td>Stroke Best Practices – Nursing</td>
<td>Learning Session 2: Face-to-Face</td>
</tr>
<tr>
<td>Valorie Cunningham</td>
<td>Stroke Best Practices – Emergency Physician</td>
<td>Learning Session 2: Face-to-Face</td>
</tr>
<tr>
<td>Todd Collier</td>
<td>Video: Quick Neuro Exam for Stroke (<a href="http://youtu.be/GB2U8baZUCE">http://youtu.be/GB2U8baZUCE</a>)</td>
<td>YouTube</td>
</tr>
<tr>
<td>Brent Woodley</td>
<td>Stroke Best Practice</td>
<td>Learning Session 3: Webinar</td>
</tr>
<tr>
<td>Noreen Kamal</td>
<td>Second Order Change – What does this mean?</td>
<td>Learning Session 3: Webinar</td>
</tr>
<tr>
<td>Kevin Harrison</td>
<td>The Swallowing Screen</td>
<td>Webinar</td>
</tr>
<tr>
<td>Kevin Harrison</td>
<td>Video: Swallowing Screen (<a href="http://youtu.be/HWppunNlhJU">http://youtu.be/HWppunNlhJU</a>)</td>
<td>YouTube</td>
</tr>
<tr>
<td>Kennely Ho</td>
<td>Current Management of Carotid Stenosis</td>
<td>Webinar</td>
</tr>
<tr>
<td>Devin Harris &amp; Andrew Penn</td>
<td>Transition to in-patient units</td>
<td>Learning Session 4: Face-to-Face</td>
</tr>
<tr>
<td>Noreen Kamal</td>
<td>Spreading Changes</td>
<td>Learning Session 4: Face-to-Face</td>
</tr>
<tr>
<td>Todd Collier</td>
<td>When the CT shows blood: Hemorrhagic Stroke</td>
<td>Learning Session 4: Face-to-Face</td>
</tr>
<tr>
<td>Ian Joiner (Heart &amp; Stroke Canada)</td>
<td>Celebrate and Sustain Momentum: Some perspectives on stroke and stroke strategies in Canada</td>
<td>Closing Celebration: Face-to-Face</td>
</tr>
<tr>
<td>Michael Suddes (Calgary Stroke Program)</td>
<td>Calgary Stroke Program: Is this what quality care looks like?</td>
<td>Closing Celebration: Face-to-Face</td>
</tr>
<tr>
<td>Sydney Tomchenko (PHSA)</td>
<td>Communication 101: a process for sharing your good news stories</td>
<td>Webinar</td>
</tr>
</tbody>
</table>
because teams were more mature in their improvements. The number of team presentations at each face-to-face session is shown in Table 10.

### TABLE 10. NUMBER OF TEAM PRESENTATIONS AT EACH FACE-TO-FACE SESSION.

<table>
<thead>
<tr>
<th>Face-to-Face session</th>
<th>Number of Team Presentations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning Session 1</td>
<td>2 team presentations</td>
</tr>
<tr>
<td>Learning Session 2</td>
<td>4 team presentations</td>
</tr>
<tr>
<td>Learning Session 4</td>
<td>5 team presentations</td>
</tr>
<tr>
<td>Closing Celebration</td>
<td>16 teams (3-minute madness presentations)</td>
</tr>
<tr>
<td></td>
<td>4 team presentations</td>
</tr>
</tbody>
</table>

The Collaborative also had storyboards at each of the face-to-face learning sessions, where teams prepared presentations (around 12 slides) on their improvement work. These presentations were printed and posted on poster boards. Many teams also brought additional materials that could be taken by other participants to trial at their own site. Each of the Learning Sessions had dedicated time, where participants can explore the storyboards and network with the other team member. Figure 12 shows a photograph of one of the storyboard exploration periods.

![Figure 12. Picture of Storyboard Exploration Period During Learning Session 1.](image-url)
Cross-site learning was also promoted during the bi-weekly webinars. A number of the virtual sessions were dedicated for teams to report on the work that they were doing, and also time to discuss the barriers that they were facing. During these session participants were encouraged to ask questions and to exchange experiences.

Finally, an online website (www.evidence2excellence.ca) provided a means to exchange information. All presentations and recordings of the bi-weekly webinars were posted to the community section of the website, so that participants could have access to the Collaborative material on-demand. Furthermore, other artifacts from the other sites were also posted to the website including: PPOs, triage posters, patient educations material, clinical pathways and patient assessment forms.

RESULTS - Case Studies

The true stories of improvement are highly variable by site. Some sites were able to achieve significant improvements, while other sites were able to raise the awareness of stroke, but had limited resources to make substantive improvements. The following case studies show three successful teams, who are very diverse. Victoria General Hospital shows an urban thrombolytic site that has an in-patient Stroke Unit. Shuswap Lake General Hospital is a non-thrombolytic community hospital and Fraser Health Authority shows implementation of changes from a systematic Health Authority Level.

Victoria General Hospital

Victoria General Hospital is the Comprehensive Stroke centre for southern Vancouver Island, and serves a diverse population. The Victoria General Hospital team was able to assemble a large multi-disciplinary team that included: ED managers, educators, nurses, a stroke nurse, an emergency physician, a stroke neurologist, CT technologist and regional stroke leads. The team also took a systematic phased approach to improvement. They initially aimed to improve time to CT scanner to ensure more patients are eligible for tPA. They also added the role of a Stroke Nurse to assist with various areas of coordination. Victoria General was also providing the latest education to their nurses. Finally, they focused on communicating their achievements outside of their emergency department.

Victoria General Hospital worked with BCAS and their own staff to coordinate the pre-hospital and hyper acute stage such that hot stroke patients could be taken directly to the CT. The increase in efficiency is realized by reducing the time to CT, which ensures that more hot stroke patients can be eligible to life saving clot-busting drug. Figure 13 shows the improvements that Victoria General Hospital made in reducing mean time to CT from over 24 minutes to 6 minutes. They also created a system that had much tighter control and less variation. The control limit from the mean dropped from 53 minutes to 17 minutes.
Victoria General Hospital created a position of a Stroke Nurse, who was instrumental in the coordination of stroke patients. The Stroke Nurse provided connection between the emergency physician and the neurologist. S/he was responsible for ensuring the completion of the NIHSS. The Stroke Nurse also ensured better triage assessment of high risk TIA’s and mild strokes, and finally, s/he was responsible for better flow and management of thrombolytic therapy. Victoria General is also increasing the institutional knowledge of Stroke by putting a total of 82 staff through the Hemispheres training. Based on these changes, Victoria General was able to increase the number of Ischemic Stroke Patients receiving tPA by 5%. Furthermore, they were able to increase the number of TIA patients that were seen through their Stroke Rapid Assessment Unit (SRAU).

Finally, Victoria General Hospital worked to ensure that their improvements were communicated to their Health Authority. They were able to utilize June as stroke month to communicate their work through 3 different ways: VIHA intranet, VIHA newsletter and a news release. Figure 14 shows a screen capture of their feature in the VIHA newsletter.
Shuswap Lake General Hospital

Shuswap Lake General Hospital (SLGH) is a small community hospital that does not deliver tPA. Furthermore, prior to the start of the Collaborative, they had not implemented the IH standardized stroke order sets. Their goal was to implement the order set and ensure that patients were receiving evidence-based care. Upon implementing the stroke order sets, a key objective for SLGH was to raise the awareness of stroke for the various disciplines, within the ED and in the community (local GP’s). They held multi-disciplinary meetings with all stakeholders, which were very well attended and had great energy; they said, “we had to ask them to leave as the room was booked for another meeting!” They also created an educational display on Stroke/TIA warning symptoms in their ED and rotated through the educational display boards around the hospital throughout the Collaborative. They conducted physician clinic visits and distributed information on stroke/TIA. When they audited physician offices that they had visited, all the GPs offices had the information prominently displayed in their patient waiting areas. They then took their TIA clinic referral information to all physician clinics in surrounding towns including Sicamous, Chase, Scotch Creek, Merritt and Logan Lake.

SLGH was also very successful in educating their staff, as well as other neighboring sites. They created a Stroke/TIA Nursing Education Module that had the following learning objectives: 1) understand why the stroke protocol is important; 2) describe the difference between ischemic and hemorrhagic stroke and understand what a TIA is; 3) list common stroke-like symptoms and use of tPA; 4) understand the Cincinnati Stroke Scale; 5) Learn the importance of fever and glucose management, swallowing screen, early mobilization and bladder/bowel management; 6) understand TIA admission and follow-up; and 7)
unveil the stroke/TIA admission PPO. They had 66 staff from SLGH attend their education modules. They also delivered site-specific education to 9 out of 12 of their rural sites in their region with plans to complete the remaining 3 by fall 2012. Furthermore, their outreach also included public awareness through the participation at a local radiothon in Salmon Arm with Stroke/TIA education and BP checks offered to the public. They have made significant improvement through the use of the order set in reducing the time to imaging, mobilization and swallowing screen, as shown in figures 15 to 17.

![Figure 15](image1.png)

**FIGURE 15. SLGH REDUCTION IN AVERAGE DAYS TO VASCULAR IMAGING OVER THREE AUDITS**

![Figure 16](image2.png)

**FIGURE 16. SLGH REDUCTION IN AVERAGE DAYS TO MOBILIZATION OVER THREE AUDITS**
Through the implementation of the order sets, SLGH worked to streamline the process for hot strokes. They now meet the patient in the ambulance bay, check glucose, draw blood work, do physician assessment and send the patient to Royal Inland Hospital for CT and tPA. They are interested in becoming a tPA enabled site in the near future.

**Fraser Health Authority**

The Fraser Health Authority (FHA) is unique in BC, as they have implemented a program management structure, where all hospitals within a FHA function under specific programs such as emergency and medicine. For this reason FHA, had a single team participate in the Collaborative to make changes over the entire region, which represented 12 sites. A key objective for FHA was to improvement access to timely care for hot strokes, which started with proper identification. They worked with their existing Emergency Department Information System (EDIS) to reduce the total number of chief complaints that were available. They reduced the number of chief complaints from 27 to 17, and the number of patients admitted with intracranial pathology increase to 34% from 22%. Another change to improve identification was to create a new triage poster to include impaired gaze, visual field, impaired gait and vertigo. They also updated EDIS to have a triage assessment of “Hot Stroke” from the previous “CVA, onset of symptoms 1 hour…” which increased the recognition of hot stroke as a priority.

The second strategy to increase access was to improve the initial management of hot stroke patients. They ensured standardized stroke protocols for all ERs in FHA, which included: patient presents with signs of stroke/TIA less than 4.5 hours from symptom onset; RN initiates labs; tPA inclusion/exclusion criteria prints at triage; ERP sees patient immediately; CT decision is made; and patient goes to CT on EHS stretcher.

FHA also increased access through educations sessions, which include the use of material by FHA stroke neurologist, and use of Dr. Todd Collier’s and Kevin Harrison’s YouTube video that was produces as part of this Collaborative. They also created a stroke report card to show how the site performed for each hot stroke, which was based on the presentation provided by the Collaborative given by Hamilton Health Service’s Rhonda Whiteman.

A key result of their work to improve access is shown in Figure 18, where door-to-needle times were reduced by 20%. The mean time to tPA dropped from 122 minutes to 89 minutes, and there was also
slight reduction in variation with the control limit from the mean dropping from 159 minutes to 130 minutes.

**FIGURE 18. DOOR-TO-NEEDLE FOR FHA WAS IMPROVED 20% FROM 120 MINUTES TO 90 MINUTES**
COSTS AND COST AVOIDANCE

The total cost of physician involvement in the Stroke and TIA Collaborative, supported by the Shared Care Committee, was $73,974.50.

The 2011/2012 BC Stroke & TIA Collaborative did not have a cost impact measurement strategy. Instead, the impact of a coordinated system of stroke care has been modeled and published as part of the B.C. Stroke Strategy, Provincial Stroke Action Plan (Nov. 23, 2010).

Based on the modeling performed previously, the Stroke and TIA Collaborative would realize significant cost avoidance in two areas of the B.C. Stroke Strategy: TIA Rapid Assessment Services and Thombolysis for Acute Ischemic Stroke.

TIA Rapid Assessment Services: Ensuring that a patient is diagnosed and treated as quickly as possible is a key step in reducing the risk of converting from a TIA to a full stroke. This is the reason for the focus on TIA Rapid Assessment within emergency departments. Due to the high incidence of stroke following a TIA, there can be a substantial economic burden related to TIA that reflects both the hospitalization and inpatient rehabilitation rates. Overall, the result of providing optimal care in this area (80% of all TIA patients are seen and managed appropriately, under 48 hours) in the province would mean 148 fewer hospitalizations, a total of 3,699 fewer acute care days and 11,637 fewer residential care days resulting in an annual direct care cost avoidance of $5.13 million. In addition, 38 fewer early deaths would be expected each year with 1,242 life years saved.

Thombolysis for Acute Ischemic Stroke: Prompt treatment of stroke with thrombolytic therapy can restore blood flow before major damage occurs. One such therapy, recombinant tissue plasminogen activator (tPA) thrombolysis, may only be used within 4.5 hours of stroke onset. The strict inclusion/exclusion criteria and delays in arriving at an emergency department mean the few patients actually receive tPA. Increasing the use of this therapy among eligible patients may be achieved by ensuring early arrival of the patient at an emergency department followed by an accurate and timely diagnosis. Overall, the result of providing optimal care in this area (10% of all acute ischemic stroke patients receive tPA), would mean 26 fewer hospitalizations, 1,255 fewer acute care days and 10,888 fewer residential care days resulting in an annual direct care cost avoidance of $2.89 million. In addition, 10 fewer early deaths would be expected each year with 249 life years saved.
DISCUSSION

The 2011/2012 BC Stroke & TIA Collaborative was able to provide a structured methodology for emergency departments to improve the quality of care for Stroke and TIA patients using the IHI Collaborative Model. All participating teams in the Collaborative were able to make multiple changes to improve the quality of care; however, the number of substantive changes varied across the teams.

Ovretveit et al. reported that an Improvement Collaborative will see 30% of teams drop out of the Collaborative and only 30% achieve significant improvement, and they published 10 recommendations for increasing the chances of success, which is shown in Figure 19. By comparison, this Collaborative has far exceeded this with no teams dropping out the Collaborative and 10 teams (58.8%) achieving significant improvement, nearly doubles the success rate of this Collaborative.

The impact on patient outcomes is showing improvements even at this interim stage. Further evaluation activities are planned, on an ongoing basis, to measure impact and provide ongoing surveillance of the stroke care system in B.C.

![Figure 19. Recommendations for increasing the chances of successful improvement and spread through a collaborative from Ovretveit et al.](image)

This Collaborative was able to obtain the key recommendations that were suggested by Ovretveit et al. However, a follow-up audit after 6 months and 1 year would better inform us if the gains made during the Collaborative were sustained. Furthermore, there were also a number of other factors that contributed to the success of this Collaborative. A key-contributing factor was the collaboration with Stroke Services BC. In addition, the success of the Collaborative can be directly attributed to:

1. Coordination and oversight for Stroke & TIA facilitation across the province
2. Reporting out of team progress at the executive level during the Stroke Services BC Steering Committee meetings
3. Alignment with provincial strategies around BC’s Stroke Strategy
4. Access to evidence and experts as needed for the Collaborative

5. Physician support for participation through Shared Care Committee funding.

Another contributing factor to the success of this Collaborative was the Clinical Lead. By having a dedicated content matter physician expert, who was involved in the day-to-day planning of the Collaborative greatly contributed to having proper content as critical times throughout the Collaborative.

There were, however, many areas where this Collaborative could have performed even better. By analyzing the data that is presented in the results section, we can see that attendance during the bi-weekly webinars varied and dropped significantly. This speaks to the need for tailored content during the webinars to meet the needs of participants at the time that they occur. However, we do understand that teams likely felt that they needed less support as the Collaborative progressed, which is especially true as teams were moving to implementing the changes that they had trialed earlier in the Collaborative.

The success criterion for the teams can also be discerned from the data that is collected. The 7 teams that were less successful in this Collaborative had lacked similar attributes that the successful team had. The include the following:

- Visible support from their department administrators
- Hands-on participation from a physician champion
- Some level of technical support to assist with data collection and other requirements of the Collaborative such as completing monthly reports
- Some degree of constancy during the Collaborative especially as it pertained to staff retention

Through Stroke Services BC, the work in the hyper acute stage of the stroke continuum will continue. Ongoing monthly webinars continue to support team with continued improvement work and sustainment of gains made. The webinars will also provide a mechanism to keep the community of practice that the collaborative has developed connected, and provide a means to disseminate new information and evidence to the hyper acute healthcare practitioners in BC.

CLINICAL CARE MANAGEMENT: PHASE 2 PROPOSAL

The work done provincially for the improvement of care in the emergency department provided a good basis for the next phase: implementation in-hospital. During the 2011 transition year where the BC Stroke Strategy moved from the Heart & Stroke Foundation of BC & Yukon to PHSA’s Stroke Services BC, the B.C. Patient Safety & Quality Council Stroke and TIA Collaborative was an excellent initiative to maintain stroke improvement momentum within the province. The next phase of the B.C. Stroke Strategy will focus on in-patient stroke care, with Stroke Services B.C. leading this collaborative.

Level A evidence indicates that Stroke Units save lives and reduce recovery time. Stroke Units are defined as a specialized, geographically defined hospital unit dedicated to the management of stroke patients and staffed by an interdisciplinary team. Unfortunately, BC ranks among the worst in Canada for the number of patients that are admitted to a Stroke Unit with only 4% of patients admitted to Stroke
Units according to National Stroke Audit. This contrasts with Alberta, Nova Scotia and Ontario, who admitted 52%, 42% and 31% respectively.

Stroke Services BC is working closely with Health Authorities for this next phase of stroke improvement. A ½ day planning conference was held directly following the Closing Celebration of the Collaborative, where executive and clinical leaders from all Health Authorities were brought together to discuss improving in-patient care. The cost of stroke and overview stroke units was presented, and then tables were allowed to discuss barriers, supports and action for the in-patient phase. Findings from this day have informed the next phase of work. Scoping and fact-finding over July and August 2012 was performed to better understand the current state of Stroke Units in BC and the requirements necessary. These findings will then provide a means to plan for another Collaborative for the in-patient phase.
REFERENCES


