



Central East Stroke Network

Evaluation Framework for a Redesigned System of Stroke Care Delivery in the North Simcoe Muskoka LHIN

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List of Abbreviations

ALC	Alternate Level of Care
EMS	Emergency Medical Services
ER	Emergency Room
CSS	Canadian Stroke Strategy
LHIN	Local Health Integration Network
OECD	Organization for Economic Co-operation and Development
OSA	Ontario Stroke Audit
OSN	Ontario Stroke Network
OT	Occupational Therapy
PMM	Performance Measurement Manual
PT	Physiotherapy
QBP	Quality-Based Procedures
SSPC	Secondary stroke prevention clinic
SLP	Speech-Language Pathology
TIA	Transient Ischemic Attack
tPA	Tissue Plasminogen Activator

Definitions of Terms

1) *Indicators*

Structural indicators: represent indicators of the characteristics of, or inputs to, health care. They include resources such as staff and equipment.

Process indicators: represent measures of the delivery of appropriate (or inappropriate) health care to the relevant population at risk – where appropriateness should be based on clinical evidence of the effectiveness of the process concerned and ‘consistent with current professional knowledge. Of concern with process indicators is the degree to which these measures are related to clinically desirable outcomes.

Outcome (indicator): measures of health improvements (or deterioration) attributable to medical care. The limitations of using outcomes as a measure of healthcare performance is that they may be influenced by factors other than quality of care, such as an individual’s socioeconomic condition, lifestyle factors and non-modifiable factors (e.g., genetics).

2) *Dimensions of quality of healthcare*

Accessibility: ability of patients to obtain care/service at the right place and right time, based on needs.

Appropriateness: the degree to which care/intervention/action provided is relevant to the patient’s needs and based on established standards (e.g. adherence to Canadian Best Practice Recommendations).

Capability/competence: an individual or service’s capacity to provide a health service based on skills and knowledge.

Continuity: ability to provide uninterrupted, coordinated care or service across programs, practitioners, organizations and levels over time.

Effectiveness: the degree to which care, intervention or action achieves desired outcome.

Efficiency: achieving desired results with most cost-effective use of resources.

Equity: the extent to which a system distributes healthcare and its benefits fairly among its people.

Responsiveness/acceptability: service provides respect for persons and is patient orientated: - respect for dignity, confidential, participate in choices, prompt, quality of amenities and access to social support networks.

Safety: potential risks of an intervention or the environment are identified and avoided or minimized.

3) Performance Measurement in Health Care

Performance measurement provides for the evaluation of the success of a group, program, or an organizational system's efforts by facilitating comparison of data that reflects what actually happened with what was planned or intended. Performance measurement asks "Is progress being made toward desired goals? Performance measurement uses quantitative measures, which often take the form of numbers, percentages, proportions of patients receiving particular treatments, and increases and decreases in provision of services etc.

Executive Summary

This report presents a proposed framework that can be used to evaluate the quality, equity, and efficiency of stroke care delivery within the North Simcoe Muskoka LHIN before, during and after the establishment of three dedicated, integrated stroke units located in Barrie, Orillia and Huntsville. The proposed approach includes quantitative and qualitative components, both of which are required to enable effective evaluation. While frameworks that comprise performance measures exclusively, i.e., those that include assessments of outcomes and care processes that are known to positively influence desirable outcomes are the most familiar forms of evaluation, one of their limitations is that the connection between the actual provision of care and the desired (or undesirable) outcome is lost. For example, while the results of a theoretical evaluation process in which data had been collected over many months or years may conclude that “success” was achieved or not achieved, the underpinning mechanisms responsible for the outcome are unknown. Therefore, an additional (qualitative) dimension is required to illuminate barriers and facilitators of the processes leading to the observed result(s).

To answer questions of why, how, when and for whom does the new stroke system work, the preliminary steps associated with a specific type of evaluation, a modified “realist evaluation” are presented. Using this approach, data are collected about the specific aspects of program context that might impact on program outcomes in order to better understand specific mechanisms that might be creating change. The strength of this process is the ability to identify success and failures in real time to enable timely course correction, if required. The main sources of information in this type of analysis are surveys, focus groups and interviews. Questions such as “what impact does increased driving distances have on families?” can be answered using this process.

As for quantitative evaluation, the Canadian Stroke Strategy’s Performance Measurement Manual, (2008/2010 working draft) was used as a base, and a procedure for the development of a succinct list of process indicators and outcomes, including existing and new, is described and presented. The totals from this process are presented below.

Final list of Process Indicators & Outcomes Recommended

Section	Process Indicators	Outcomes
Hyperacute	11	11
Acute	6	
Inpatient rehabilitation	5	
Outpatient and Community-based rehabilitation	5	
Applicable to >1 Area Along the Continuum	14	
Broad system-level Indicators	3	

Going forward, it is expected that additional input from stakeholders whose perspectives were not included in this process stakeholders will be required. Meetings with these groups will help to refine the definition of system success(es), set performance targets, explore and troubleshoot issues related to logistics and feasibility of data collection and to the establish the scope of evaluation. It is anticipated that there will be changes to the set of proposed indicators and outcomes that have been recommended and that amendments will be made following more comprehensive review. It is recommended that aspects of the current system of stroke care delivery be evaluated system to establish a baseline for comparison once the new system is fully implemented.

I) Background & Introduction

As of 2011, the North Simcoe Muskoka (NSM) LHIN represented a population of almost 500,000 individuals, approximately 15% of which were over the age of 65. During 2011, the LHIN's five hospitals treated approximately 850 patients following stroke and TIA. Acknowledging limitations in the way stroke care is currently provided, the NSM LHIN is in the process of developing a better coordinated system of stroke care across the region and throughout the stroke continuum.

The goal of the Central East Stroke Network (CESN) is to “improve access to evidence-based prevention and care in order to reduce stroke incidence, mortality, and residual disability.” To this end, the CESN is working with the NSM LHIN to create a coordinated, cross-continuum stroke system that is evidence-based, accessible, efficient, and sustainable. Proposed changes involve the implementation of three dedicated, integrated stroke units located in Barrie, Orillia and Hunstville (approximately 10, 15 and 22-bed units), whereby patients will move seamlessly through all phases of care. The Canadian Stroke Strategy's Canadian Best Practice Recommendations for Stroke Care will be used to guide these changes with specific focus on ensuring timely access to appropriate services and transfer throughout the system. Greater adherence to best-practice combined with better coordination across the LHIN is expected to result in improved patient outcomes and a more efficient system. Desired outcomes for the new stroke system include:

- ✓ Reduced delays in stroke treatments
- ✓ Decreased symptom severity
- ✓ Decreased incidence of recurrent stroke
- ✓ Decreased preventable harmful events of stroke and stroke treatment
- ✓ Increased stroke survival rates
- ✓ Attainment of highest level of function after stroke
- ✓ Promotion of patient centered decision making
- ✓ Increased patient satisfaction

This report presents a proposed framework that can be used to evaluate the quality, equity, and efficiency of stroke care within the NSM LHIN, before, during and after changes to the system are implemented.

Objectives

- i) Following a systematic process, to present a set of clinical indicators and outcomes that can be used to evaluate the present and future system of stroke care delivery within the NSM LHIN that capture the complete patient path, including transport to hospital, assessment and diagnosis, admission to acute care and inpatient rehabilitation (as appropriate), discharge, and long-term recovery. Ideally, this evaluation framework will be of interest and relevant to patients/families/carers, institutions and the LHIN and also provide opportunities for research projects. The aim with respect to measurable data was to propose a succinct yet comprehensive set of performance measures to minimize the burden of data collection.

- ii) Recognizing that the selection and measurement of system indicators is insufficient, we suggest some steps that can be taken as implementation begins to better inform and understand the underlying processes associated with the indicators and outcomes to be assessed, and to identify and investigate appropriate mechanisms of change as problems arise in real time.

Strategy

To enable an effective evaluation process, both quantitative and qualitative components are required. Quantitative evaluation of performance measures includes assessment of outcomes as well as measures of care processes that are known to positively influence desirable outcomes. However, in the evaluation of an innovative system of service delivery, it is important to consider that a traditional *a priori* selection and measurement of system indicators or outcomes may not be sufficient to inform our understanding of the processes and mechanisms underlying the results obtained. To provide a more comprehensive picture of the processes underlying the indicators and outcomes, it is important to explore how the intervention components induce a change in practice (mechanisms), the environmental factors that impact on these mechanisms (contexts) and how combinations of both link to the outcomes observed.

II) Qualitative Approach

One type of evaluation framework that offers the opportunity to examine processes associated with the application of a change or change-intervention rather than the measurement of post-intervention outcomes is that of the realist evaluation. This approach explores the relationship over time among “context” (the study’s organizational setting and external constraints, including financial and human resources, prevailing policies, and technologies), “mechanisms” (the stakeholders’ ideas about how change will be achieved in an intervention), and “outcomes” (the intended and unintended consequences of the change efforts) (Pawson & Tilley 1997). In general terms, realist evaluation attempts to answer the questions of why, how, when and for whom does an intervention work by examining the processes and mechanisms that are created by the interaction of individuals within the particular contexts in which the interventions or changes are occurring (Ranmuthugala et al. 2011, Goicolea et al. 2012). Data is collected about the specific aspects of program context that might impact on program outcomes, and about the specific mechanisms that might be creating change. Rather than comparing changes for participants who have undertaken a program with a group of people who have not, as is done in experimental studies, a realist evaluation compares mechanisms and outcomes within programs. For example, it may ask whether a program works differently in different localities (and if so, how and why); or for different population groups (rural vs. urban, or for patients with differing socio-economic status or cultural backgrounds). In addition to identifying processes and mechanisms, realist evaluation can help to explore possible barriers and facilitators to implementation in real time, thereby improving the ability of the system to respond to potential problems as they arise. The realist approach has been used previously by Greenhalgh et al. (2009) to evaluate a large-scale, whole stroke system redesign of the National Health Services in the UK.

Methods used in a realist evaluation are not theory or perspective-dependent but may include:

- ✓ Ethnographic observation of management meetings, project activities and within the services itself (e.g., ER, inpatient unit, and outpatient clinics)
- ✓ Focus groups
- ✓ Semi-structured interviews with stakeholder groups (staff, patients, management/policy groups)
- ✓ Group interviews
- ✓ Informal discussions with the staff and stakeholders
- ✓ Scrutiny of minutes, papers and reports

Information collected from these sources is used to conduct thematic analyses, which are used to identify key themes (e.g., what issues are raised repeatedly by those participants who are surveyed?). Material generated from this process can then be taken back to stakeholders and used to make necessary changes to the processes under review. This procedure is repeated as necessary. Data should be collected early in the transition and completed at facilities providing stroke specific services as well as those facilities from which stroke services will be removed. It is also recommended that an advisory group help identify key stakeholders and informants.

The use of focus groups may be especially advantageous since they can provide a mechanism for engagement in order to promote sustainability and by making use of the onsite expertise available from the pool of knowledge available through local stakeholders in the development of locally relevant and contextually appropriate solutions to address identified barriers. Of course, improved identification of the processes and mechanisms associated with the implementation of system change may also help to understand between facility or program differences noted through the evaluation of quantitative indicators or outputs.

This qualitative approach will be required to evaluate areas of interest that cannot be captured through quantitative evaluation and also to better understand the mechanisms responsible for the results obtained.

Example 1: What impact does increased driving distances have on families?

For a proportion of patients who experience a stroke and whose home hospital is not one of the 3 dedicated stroke sites, the travel time/distance for their families will increase. Interviews or surveys will be the most effective means of discovering the extent to which the burden has increased for these patients and their families.

Example 2: What impact does the implementation of the new system have on other hospital services (non-stroke rehabilitation units)?

In this case, the potentially negative impact on other units can be captured quantitatively through collection of processes indicators such as changes in patient volumes, bed allocation and staffing ratios, and the proportion of total bed days occupied by stroke patients (as a total of the number of rehab bed days). Additional information can also be collected through the use of focus groups with key stakeholders conducted by an independent 3rd party. From the patient/carers' perspective, issues related to satisfaction with care or services can be captured. From the perspective of the healthcare practitioners, information on how the changes are impacting clinical practice and barriers/facilitators

of clinical practice can be identified. Also, from managers/administrator/MDs' perspective, knowledge on how the changes are impacting decisions around resource allocation and staffing can be gleaned.

These are 2 examples of areas of evaluation that have already been raised by the sponsor. Other areas that have been identified relate to Human Resources issues, communication, and patient flow and access. Additional areas will be identified through discussions with stakeholders and specific qualitative evaluation methods (e.g., staff and patient surveys), which will need to be developed going forward.

III) Quantitative Approach

Methods used to identify the most suitable process indicators and outcomes

Step 1. We identified current sources of process indicators/performance measures associated with stroke care provision across the continuum as recommended by a number of groups/organizations. Individual items were classified as either process indicator or outcome. Process indicators are of greatest interest to healthcare providers at the level of the individual hospital and the LHIN. Outcomes examine the impact of treatment several months after the event and are of greater interest to both patients and the LHIN and can also be used for research purposes. To capture this range of interests, it was felt to be important to include both types of measures. The results of this process are included in Table 1.

Table 1. Sources of Performance Measures

Source	Time frame	Process Indicators	Outcomes
Canadian Stroke Strategy Performance Measurement Manual (2008/2010 working document)	Cross-continuum	157	7
Canadian Stroke Strategy Core Performance Indicator Update (2010)	Cross continuum	21	0
Ontario Stroke System Stroke Rehabilitation Performance Measurement Manual (2007)	Rehabilitation	20	0
Ontario Stroke Report Card†	Cross continuum	17	3
The Danish National Indicator Project (Mainz et al. 2004)	Acute	7	1
Stroke QBP Recommended Indicators ††	Hyperacute, acute, rehab	10	3
Stroke and Stroke Rehabilitation Performance Measurement Set*	Cross continuum	13	0

† Data currently collected.

†† The 13 indicator and outcomes recommended by the QBP funding reform may become mandatory at some point and have been excluded from the selection process, although many of them are already included in the CSS PMM.

* American Academy of Neurology/ American College of Radiology/National Committee for Quality Assurance/American Medical Association.

Upon review of the results from this initial step, it was obvious that the Canadian Stroke Strategy's Performance Measurement Manual (2008/2010 working draft) was the most comprehensive and detailed. The great majority of the process indicators identified captured adherence to best practice guidelines (e.g., did the patient receive a CT/MRI prior to discharge?). The remaining documents included more abbreviated lists of performance measures, with much duplication among the sources.

Therefore, the framework developed by the Canadian Stroke Strategy's Performance Measurement Manual (CSS PMM) was used as a base for selection of appropriate process indicators and outcomes. The advantages of using this system as the basis for evaluation are:

- i) It was designed for the monitoring and evaluation of stroke care in Canada at a provincial, regional health and local level.
- ii) Its focus is on the processes of care and impacts on patient outcomes.
- iii) It will enable comparisons with other LHINs or OSN regions
- iv) It is aligned with Accreditation Canada.

There are several limitations to adopting the CSS PMM, or any other single source for evaluation. First, the list of clinical indicators and outcomes included in the CSS PMM is extensive, including 157 clinical (process) indicators (53 considered core) and 7 outcome measures (6 core) (Appendix A). Alternatively, the remaining sources of performance measures were not felt to be sufficiently comprehensive, and did not cover the stroke continuum. Finally, it was felt that several important components of care were either not accurately reflected by the process indicators included in these documents or not addressed at all.

Step 2. Using a conceptual framework developed by the Organization for Economic Co-operation and Development (OECD) Health Care Quality Indicator (HCQI) Project (2006), each process indicator was classified within one or more of the following healthcare dimensions, as appropriate: *Accessibility, Appropriateness, Capability/competence, Continuity, Effectiveness, Efficiency, Equity, Responsiveness/acceptability and Safety*. This approach used a health determinants model and was designed as a system of health system performance. Although not stroke-specific, it was chosen for its rigor, its multidimensional nature and its alignment with our objectives. Additionally, many of the healthcare dimensions identified are already included in the Canadian Institute for Health Information, Health Indicators (2005). The reasons for taking this approach were two-fold. First, it was of interest to determine if the indicators included in the identified performance documents clustered around one of more health dimensions. If so, there was likely some redundancy that could be eliminated, reducing the total number of indicators chosen for selection. The second reason was to create a multi-dimensional snapshot of assessment in order to determine whether there were gaps in any health dimensions that needed to be addressed.

Step 3. Finally, we reviewed each indicator and outcome in turn. Based on discussion and consensus among 3-4 of the consultants, a decision to maintain, reject or modify the wording of each indicator was made with consideration to the NSM LHIN's perspective. The wording of an existing indicator was modified when its precision or clarity was ambiguous. A final list of recommended process indicators and outcomes is presented, along with our recommendations for additions. Process indicators that were not thought to be useful are listed, along with our rationale for deletion or modification, in

Appendix B. Our recommendations were guided by what we considered to be the key concepts in each area along the continuum. Recommended process indicators were grouped by sector of care (hyperacute, acute, inpatient rehabilitation and outpatient/community care) when appropriate and indicators that apply to more than one sector similarly grouped. The key themes guiding the focus of evaluation in each area were identified and are presented below.

I. Applicable to Hyperacute/Acute/Inpatient Rehabilitation and/or Outpatient/Community

- ✓ Are patients being screened for dysphagia, depression and cognitive impairment at care transitions points?
- ✓ Is there continuity of care between transition points?

II. *Hyperacute*

- ✓ Do patients arrive to the ER in a timely fashion?
- ✓ Do all eligible patients receive tPA?

III. *Acute*

- ✓ Are patients cared for in the appropriate setting (stroke units)?
- ✓ Are patient assessments conducted in a timely manner and medical investigation completed prior to discharge/transfer?
- ✓ Are patients screened for eligibility for inpatient/outpatient rehabilitation candidacy?

IV. *Rehabilitation*

- ✓ Are patients who are identified as inpatient rehabilitation candidates admitted to dedicated inpatient units?
- ✓ Do patients receive 3 hours of therapy each day?

V. *Outpatient/community*

- ✓ Do patients who are discharged to the community receive appropriate, ongoing rehabilitation services of appropriate intensity and duration?

Step 4. Recommendations for indicators and outcomes not included in any of the source documents were developed based on gaps identified by the conceptual framework evaluation.

Step 5. Finally, we present some suggestions for next steps going forward.

Summary of Recommendations

Tables 2 and 3 list process indicators and outcomes recommended for inclusion in the framework within each area along the care continuum.

Table 2. Recommended Outcomes

#	Outcome	Comments
i) Previously proposed		
1	30-day risk-adjusted mortality rates for all stroke.	Core CSS performance measure.
2	30-day in-hospital mortality rate for all admitted patients.	Data currently available (DAD).
3	Percentage of patients requiring readmission to an acute-care hospital for stroke-related causes, within 90 days.	Data currently available.
4	Recurrence of stroke or TIA within 30, 90 and 365 days following initial event.	Data currently available.
ii) New (proposed)		
1	Death/disability at 6 months.	Disability assessed using the Modified Rankin Scale (≥ 2).
2	Death/need for institutionalization at 6 months.	Research-focused outcome.
3	Reintegration to Normal Living Scale (Wood-Dauphinee & Williams, 1987).	To be assessed 3-6 months following stroke. Patient-centred outcome.
4	EQ-5D (EuroQol Group, 1990).	To be assessed 3-6 months following stroke. Patient-centred outcome.
5	The Medical Outcomes Study Short Form 36 (SF-36) (Ware & Sherbourne, 1992).	To be assessed 3-6 months following stroke. Patient-centred outcome. Expensive, but is well-recognized and has well-established norms.
6	Bakas Caregivers Outcomes Scale (BCOS) (Bakas & Champion, 1999).	Common and well-investigated in this population.
7	Caregivers Strain Index (CSI) (Gerritsen & Van Der Ende, 1994).	Common and well-investigated in this population.

The list of 7 new outcomes we suggest were included to reflect gaps in the current system of evaluation. Other than mortality and readmission, no patient-centred outcomes are currently collected. If the new system is to be evaluated comprehensively, the patient/carer perspective must also be included. We have included 2 health-related quality of life scales, and 2 caregiver strain scales, although it is anticipated that only one of each is required. The pros/cons of the SF-36 versus the EQ-5D and the BCOS versus the CSI can be explored in future discussions with stakeholders. The RNLI was included as it captures activities of daily living and social relationships following discharge from hospital. None of the outcomes suggested are currently available but could be collected via telephone or in person interviews. The inclusion of the composite outcomes of death/disability and death/institutionalization were

included for research purposes, as these outcomes are commonly reported in the peer-reviewed literature.

Table 3. Recommended Process Indicators

#	Indicator	Health Care Dimension(s) Captured	Data Source
i) Applicable to Hyperacute/Acute/Inpatient rehabilitation and or Outpatient/Community			
1	Proportion of patients with stroke/TIA discharged home who are referred to organized secondary stroke prevention services.	Appropriateness	Chart Audit
2	Proportion of all stroke patients admitted to hospitals who are cared for on a stroke unit.	Appropriateness	Chart Audit
3	Proportion of stroke patients' total LOS that was spent on the stroke unit.	Appropriateness	Chart Audit
4	Mean time to initial contact by PT/OT/SLP/SW for patients who require their services.	Timeliness	Chart Audit
5	Mean active LOS for stroke patients admitted to hospital.	Efficiency	DAD
6	Proportion of patients who experience any medical complication during inpatient stay.	Safety	Chart Audit
7	Proportion of stroke patients who are screened for cognitive impairment using a validated tool at each care transition.	Appropriateness	Chart Audit
8	Proportion of stroke patients who are suspected to have cognitive deficits who are seen for cognitive assessment by a qualified healthcare practitioner.	Appropriateness	Chart Audit
9	Proportion of stroke patients screened for depression using a validated assessment tool at each care transition.	Appropriateness	Chart Audit
10	Proportion of stroke patients seen for assessment or intervention for a suspected diagnosis of depression by a qualified healthcare practitioner.	Appropriateness	Chart Audit
11	Proportion of stroke patients who are originally from the community who return to the community, by stroke severity (RPG for those discharged from inpatient rehabilitation).	Effectiveness	DAD

#	Indicator	Health Care Dimension(s) Captured	Data Source
12	Percentage of eligible stroke patients discharged to the community who receive a referral for outpatient rehabilitation prior to discharge from acute care and/or inpatient rehabilitation.	Continuity	Chart Audit
13	Proportion of patients for whom a discharge summary is completed within 48 hours of transition and received by the patient/family and the care provider at the next stage of care.	Continuity	Chart Audit
14	Proportion of stroke patients whose ongoing rehabilitation needs are assessed at the time of discharge from acute care, inpatient rehabilitation, and outpatient rehabilitation.	Appropriateness	Chart Audit
ii) Hyperacute (also see i 1-2)			
1	Mean number of days spent in ALC.	Efficiency	NACRS
2	Mean time from initial call received by emergency dispatch centre to patient arrival at an emergency department that provides stroke services.	Timeliness, Appropriateness	Chart Audit
3	Proportion of suspected stroke patients transported by EMS who received final diagnosis of a stroke or TIA during hospital stay.	Capability	NACRS/DAD
4	Proportion of suspected stroke patients transferred by EMS to a non-stroke ER.	Appropriateness	NACRS
5	Proportion of all eligible ischemic stroke patients who receive treatment with alteplase.	Appropriateness Accessibility	NACRS
6	Proportion of patients with symptomatic intracerebral hemorrhage following alteplase treatment.	Safety	NACRS/DAD
7	Proportion of ischemic stroke patients who receive acute aspirin therapy within the first 48 hours following a stroke event.	Timeliness Appropriateness	Chart Audit
8	Proportion of all stroke patients who receive a head CT\MRI prior to hospital discharge.	Appropriateness Accessibility	NACRS/DAD
9	Mean time from arrival in ER to CT/MRI for patients with suspected stroke.	Timeliness	NACRS
10	Proportion of eligible patients who receive in-hospital carotid imaging.	Appropriateness	NACRS
11	Proportion of stroke patients with an initial dysphagia validated screening within 48 hrs of admission.	Appropriateness	Chart Audit

#	Indicator	Health Care Dimension(s) Captured	Data Source
iii) Acute Care (also see i 1-11, 13-15)			
1	Mean number of days spent in ALC.	Efficiency	DAD
2	Proportion of eligible patients who were mobilized within 48 hours of hospital admission.	Appropriateness	Chart Audit
3	Time to first evaluation of inpatient/outpatient rehabilitation candidacy.	Timeliness	Chart Audit
4	Proportion of stroke patients deemed too severely impaired to be rehabilitation candidates on first assessment, who were reassessed prior to discharge.	Appropriateness	Chart Audit
5	Proportion of stroke patients admitted to a stroke unit who, upon arrival/assessment, are not candidates for stroke unit care (e.g., palliative, LTC, etc.) (new)	Appropriateness	Chart Audit
6	Mean time to repatriation to home hospital for stroke patients admitted to a stroke unit who, upon arrival/assessment, are not candidates for stroke unit care (e.g., palliative, LTC, etc.) (new)	Timeliness Appropriateness	Chart Audit
iv) Inpatient Rehabilitation (also see i 1,3-11, 13-15)			
1	Mean number of days spent in ALC.	Efficiency	NRS
2	Proportion of patient identified as inpatient rehabilitation candidates during acute stay, using a standardized tool (e.g., Alpha-FIM) who are admitted for inpatient rehabilitation.	Accessibility	Chart Audit
3	Proportion of total time during inpatient rehabilitation following an acute stroke event that is spent on a rehabilitation stroke unit.	Appropriateness	Chart Audit
4	Mean number of hours per day (7 days) of direct therapy provided by PT/OT/SLP, for patients receiving each treatment.	Appropriateness	Chart Audit Workload measurement programs (e.g., Infomed)
5	FIM efficiency from admission to an inpatient rehabilitation program to discharge, by RPG.	Effectiveness	NRS
v) Outpatient and Community Rehabilitation (also see i 5, 8-12, 14-15)			
1	Proportion of patients with stroke/TIA discharged from the ER with a referral to secondary stroke prevention services that are seen in the SSPC within 72 hours.	Timeliness, Continuity	Chart Audit

#	Indicator	Health Care Dimension(s) Captured	Data Source
2	Proportion of eligible stroke patients discharged from acute care or inpatient rehabilitation, who received outpatient services, by stroke severity.	Accessibility	Chart Audit
3	For all patients for whom outpatient rehab is required, mean length of time between referral for outpatient rehabilitation to commencement of therapy.	Timeliness Continuity	MoHLTC HCD/Chart Audit
4	Mean Frequency (hours per week) and duration (number of weeks) of therapy per discipline (PT, OT, SLP, SW) as appropriate.	Accessibility, Appropriateness	Chart Audit
5	Change in functional status scores, using a standardized measurement tool, for stroke survivors that participate in community rehabilitation programs.	Effectiveness	Chart Audit
vi) Broad System-Level Indicators			
1	Proportion of total acute and/or rehabilitation bed days occupied by a stroke patient.	Equity	DAD/NRS
2	Proportion of acute ischemic stroke patients who arrive at hospital within 3.5 hours of stroke symptom onset.	Timeliness	NACRS
3	Proportion of suspected stroke patients whose first contact with hospital ER is via EMS.	Accessibility	NACRS

Abbreviations: DAD, Discharge Abstract Database; MoHLTC HCD, Ministry of Health and Long-Term Care Home Care Database; NACRS, National Ambulatory Care Reporting System; NRS, National Rehabilitation Report System

Of the 44 process indicators recommended, 41 exist currently; many of them were reworded to enhance clarity or meaning, while three new ones were added following preliminary review by the sponsor.

Potential Facilitating Factors and Barriers to Evaluation

Although some of the process indicators and outcomes recommended are available through existing databases, many can only be retrieved through chart audits, a lengthy, time-consuming and expensive process. However, among the indicators noted as requiring chart audit, many are currently captured by the Ontario Stroke Audit, conducted every 2 years. Due to funding issues, the OSA's future is in jeopardy but this audit tool demonstrates the feasibility of prospective data collection. A coordinated revision in charting practices could be developed and implemented and used to facilitate the prospective collection of data (i.e., a NSM LHIN stroke registry). It should also be noted that the acquisition of data through surveys, interviews and focus groups is also time-consuming. The commitment of resources for system evaluation has not yet been established, so the scope of data that can be reasonably expected to be collected is not yet known. Unfortunately, because the techniques

need to be flexible, iterative and ongoing, successful evaluation cannot be achieved using a simple, straightforward approach. At the same time, steps can be taken to minimize the cost and burden of evaluation. For example, random sampling techniques can be used so that full data collection is not required for every patient and data collection can be staggered so that a limited but constant supply of data is available.

One of the facilitators of evaluation is the fact that the indicators and outcomes selected for inclusion in the evaluation framework have a strong evidence base.

Considerations for Use

Going forward, it is expected that additional input will be required from stakeholders within the CESN and the NSM LHIN whose perspectives were not included in this process. Meetings with these groups will help to:

- ✓ Refine the definition of system success(es)
- ✓ Set performance targets and standards
- ✓ Identify additional areas of interest such as structural indicators (staffing ratios, # beds available)
- ✓ Explore and troubleshoot issues related to logistics and feasibility of data collection
- ✓ To establish the scope and frequency of data collection.

It is anticipated that there will be changes to the set of proposed indicators and outcomes that have been recommended and that amendments will be made following more comprehensive review. Since stakeholders have not yet had the opportunity to participate in this process, the full scope of the areas of interest is not yet known. Some procedures among hospitals will need to be standardized to enable comparisons between sites. For example, the adoption of a harmonized method to assess baseline stroke severity will be required to enable more meaningful interpretation of results. Therefore, the sponsors may need to consider adopting the National Health Institutes of Stroke Severity Scale or the (modified) Rankin Scale.

The opportunity to evaluate part or all of the current system exists, which can help to establish a baseline for comparison once the new system is fully implemented. It is hoped that there will be improvement in areas where current performance is unsatisfactory. Baseline evaluation also serves to determine the standards of performance at each site so that the 3 stroke sites may be compared with each other once the system is in place and to compare the performance of stroke centres with non-stroke centres. Additionally, hospitals within the NSM LHIN may be compared with peer institutions outside the LHIN.

Comprehensive evaluation can help to optimize patient outcome and maximize resource efficiency; successes can be catalogued and care processes that are not working well can be identified and corrected. While a comprehensive system evaluation such as the one proposed is a daunting undertaking, the sponsors have an opportunity to be trailblazers in the field and to influence and advise the evaluation efforts of other groups within the province.

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Appendix A

Summary Table of Canadian Stroke Strategy's Performance Measures

Area	Subsection	Process indicator	Outcome
Hyperacute Management	Outpatient Management of Transient Ischemic Attack and Non-Disabling Ischemic Stroke	3 (1 c)	
	Emergency Medical Services Management of Acute Stroke Patients	8 (1 c)	
	Emergency Department Evaluation and Management of Patients with Transient Ischemic Attack and Ischemic Stroke	7 (4c)	
	Acute Thrombolytic Therapy	6 (4c)	
	Acute Aspirin Therapy	2 (1c)	
	Early Management of Acute Subarachnoid Hemorrhage	2	2 (1c)
	Early Management of Intracerebral Hemorrhage	4 (2c)	1(c)
Acute Inpatient Stroke Care	Stroke Unit Care	4 (2c)	
	Components of Acute Inpatient Care	9 (3c)	
	Advance Care Planning, Palliative and End-of-Life Care	6 (2c)	
Stroke Rehabilitation	Initial Stroke Rehabilitation Assessment	8 (2c)	
	Stroke Rehabilitation Unit Care	6 (3c)	
	Delivery of Inpatient Stroke Rehabilitation	12 (5c)	
	Management of the Arm and Hand	6 (2c)	
	Range of Motion and Spasticity in the Shoulder, Arm and Hand	4 (2c)	
	Management of Shoulder Pain following Stroke	7 (1c)	
	Lower Limb Mobility and Transfer Skills	5 (2c)	
	Lower Limb Spasticity Following Stroke	4 (2c)	
	Lower Limb Gait Following Stroke	4 (2c)	
	Outpatient and Community-Based Stroke Rehabilitation	8 (1c)	
Managing Stroke Care Transitions	Supporting Patients, Families and Caregivers Through Transitions	1	1 (c)
	Patient and Family Education	2 (1c)	
	Interprofessional Communication	2 (1c)	
	Discharge Planning	2 (1c)	
	Early Supported Discharge	1	3 (c)
	Community Reintegration following Stroke	15 (2c)	
Cross-Continuum Topics in Stroke Management	Telestroke	7 (1c)	
	Dysphagia Assessment	3 (2c)	
	Identification and Management of Post-Stroke Depression	3 (1c)	
	Vascular Cognitive Impairment and Dementia	3 (1c)	
	Falls Prevention and Management	3 (1c)	
Totals		157 (53c)	7 (6c)

c (core)

Appendix B

Discarded and Redundant Indicators

#	Indicator	Primary Dimension	Rational for Discarding
i) Hyperacute			
1	Median time (in minutes) from patient arrival in the emergency department to administration of alteplase.	Timeliness	An indirect indicator of delayed tPA administration: direct indicators, such as time to CT/MRI, should capture the same information.
2	Median time from time INR drawn to results available.	Timeliness	Unlikely to have a significant impact on patient care (administration of tPA is more likely to be delayed for other reasons)
3	Proportion of all thrombolysed ischemic stroke patients who receive acute thrombolytic therapy within one hour of hospital arrival.	Timeliness	An indirect indicator of delayed tPA administration: direct indicators, such as time to CT/MRI, should capture the same information.
4	Proportion of stroke patients who receive a brain CT within 25 minutes of hospital arrival potential (t-PA-eligible patients only), 24 hours for all others.	Timeliness	Provides redundant information.
5	Proportion of acute ischemic stroke and TIA patients who receive acute antiplatelet therapy within the first 48h hours of hospital arrival.	Timeliness	Provides redundant information.
6	Percentage of patients referred to organized secondary stroke prevention services who are seen within 72 hours.	Timeliness	Provides redundant information.
7	Median time from patient arrival in the emergency department to initial swallowing screening by a trained clinician.	Timeliness	Provides redundant information.
8	Proportion of stroke and TIA patients discharged directly from the ER who receive a referral to the stroke prevention clinic.	Appropriateness	Provides redundant information.
9	Proportion of hemorrhagic stroke patients treated on an acute stroke unit.	Appropriateness	Provides redundant information.
10	Proportion of total time in hospital spent on an acute stroke unit.	Appropriateness	Provides redundant information.

11	Proportion of patients in rural or remote communities who receive alteplase through the use of telestroke technology (as a proportion of all ischemic stroke cases in that community and as a proportion of all telestroke consults for ischemic stroke cases).	Equity	Telestroke not yet implemented in NSM.
12	Number of suspected stroke patients transported by EMS directly to a comprehensive or intermediate stroke centre where EMS personnel provided prenotification of transport to the receiving emergency department.	Capability	A standard of care that is not specific to stroke care and would not be expected to vary by institution.
13	Proportion of patients with blood glucose levels documented during the assessment in the ER or on the inpatient ward.	No dimension	A standard of care that is not specific to stroke care and would not be expected to vary by institution.
14	Percentage of intracerebral hemorrhage patients who require surgical intervention.	No dimension	Does not provide information about a care process.
ii) Acute Care			
1	Proportion of admitted stroke patients who have hydration problems or dysphagia identified on screening who are seen by a dietitian within 48 hrs of admission.	Timeliness	Unlikely to have a significant impact on patient care.
2	Proportion of total time in hospital for an acute stroke event spent on a stroke unit.	Appropriateness	Provides redundant information.
3	Proportion of admitted stroke patients prescribed venous thrombo-embolism prophylaxis while in hospital.	Appropriateness	More detailed information would be required to make this a useful indicator.
4	Proportion of patients with a documented elevated temperature during hospital stay who are treated with antipyretics in hospital.	Appropriateness	A standard of care that is not specific to stroke care and would not be expected to vary by institution.
5	Proportion of admitted stroke patients who have bladder or bowel incontinence concerns identified on screening who have an individualized continence management plan documented and implemented.	Appropriateness	Unlikely to have a significant impact on patient care.
6	Proportion of admitted stroke patients who have oral problems identified on screening and receive a referral to dentistry or other oral health professional for ongoing assessment and management.	Appropriateness	Unlikely to have a significant impact on patient care.
7	Percentage of stroke patients who complete a personal or advance care directive documented on their chart.	Appropriateness	Not specific to stroke patients and of limited value as an indicator of patient care.

8	Percentage of dying patients who were placed on an end-of-life care pathway.	Appropriateness	Not specific to stroke patients and of limited value as an indicator of patient care.
9	Percentage of deceased stroke patients who accessed specialist palliative care services.	Continuity	Of limited value as an indicator of patient care.
10	Length of stay for stroke patients admitted to hospital and discharged alive.	Efficiency	Provides redundant information.
11	Percentage of stroke patients discharged to their home or place of residence following an inpatient admission for stroke.	Effectiveness	Applicable to >1 area along the continuum.
12	Percentage increase in Telehealth/ telestroke coverage to remote communities to support organized stroke care across the continuum.	Equity	Telestroke not yet implemented in NSM.
13	Percentage of stroke patients who have been approached to participate in advance care planning and/or who have a documented conversation with a healthcare provider about resuscitation, hydration, or feeding preferences.	Acceptability/patient-centeredness	Not specific to stroke patients and of limited value as an indicator patient care.
14	Percentage of stroke patients who die in the location specified in their personal or advance care directive.	Acceptability/patient-centeredness	Not specific to stroke patients and of limited value as an indicator of patient care.
15	Proportion of patients with diabetes who have blood glucose levels in therapeutic range during hospitalization.	Effectiveness	Not specific to stroke patients and of limited value as an indicator of patient care.
16	Proportion of stroke patients who receive a comprehensive assessment by a speech-language pathologist or other appropriately trained healthcare professional.	Appropriateness	Provides redundant information.
17	Percentage of stroke patients who identify a substitute decision-maker.	No dimension	Not specific to stroke patients and of limited value as an indicator of patient care.
iii) Inpatient Rehabilitation			
1	Median length of time from stroke admission to an acute care hospital to assessment of rehabilitation potential by a rehabilitation healthcare professional.	Timeliness	Provides redundant information.
2	Median length of time from stroke admission in an acute care hospital to assessment of rehabilitation potential by a rehabilitation healthcare professional.	Timeliness	Duplicate indicator.
3	Median length of time from stroke admission in an acute care hospital to assessment of rehabilitation potential by a rehabilitation healthcare professional.	Timeliness	Duplicate indicator.

4	Median length of time between referral for outpatient rehabilitation and admission to a community stroke rehabilitation program.	Timeliness	Provides redundant information.
5	Median length of time between stroke onset and admission to stroke inpatient rehabilitation.	Timeliness	Acute care LOS provides similar information, particularly within an integrated stroke unit.
6	Time from stroke onset to mobilization: sitting, standing upright, walking with/without assistance.	Timeliness	Provides redundant information.
7	Number or percentage of patients admitted to a stroke unit - either a combined acute care and rehabilitation unit, or a rehabilitation stroke unit in an inpatient rehabilitation facility - at any time during their hospital stay (acute and/or rehabilitation).	Appropriateness	Provides redundant information.
8	Average days per week (minimum of five) of direct task specific therapy provided by the interprofessional stroke team.	Appropriateness	Provides redundant information.
9	Average days per week (minimum of five) of direct task specific therapy provided by the interprofessional stroke team.	Appropriateness	Duplicate indicator.
10	Average hours per day (minimum of three) of direct task-specific therapy provided by the interprofessional stroke team.	Appropriateness	Provides redundant information.
11	Number/percentage of organizations using sit-to-stand as a standard treatment modality for post-stroke functional gain.	Appropriateness	Unlikely to have a significant impact on patient care.
12	Number of stroke patients treated in a geographically defined stroke rehabilitation unit at any time during their inpatient rehabilitation phase following as acute stroke event.	Accessibility	Provides redundant information within an integrated stroke unit.
13	Median number of days spent in "alternate level of care" in an acute care setting before arrival in inpatient rehabilitation setting.	Efficiency	Should not occur within an integrated stroke unit.
14	Median length of time spent on a stroke unit during inpatient rehabilitation.	Efficiency	Duplicate indicator.
15	Median length of time spent on a stroke unit during inpatient rehabilitation.	Efficiency	Duplicate indicator.
16	Median length of time spent on a stroke unit during inpatient rehabilitation.	Efficiency	Duplicate indicator.

17	Length of stay during acute care hospitalization and inpatient rehabilitation for patients experiencing shoulder pain (as compared with patients not experiencing shoulder pain).	Efficiency	Too many variables confound the association between shoulder pain and LOS to make this a useful indicator.
18	Change in functional status measured with a standardized measurement tool, from time of admission to an inpatient rehabilitation unit for stroke patients, to the time of discharge.	Effectiveness	Duplicate indicator.
19	Change (improvement) in functional status using a standardized measurement tool, from admission to an inpatient rehabilitation program to discharge.	Effectiveness	Duplicate indicator.
20	Change (improvement) in functional status scores using a standardized assessment tool from admission to an inpatient rehabilitation program to discharge.	Effectiveness	Duplicate indicator.
21	Change (improvement) in functional status scores using a standardized assessment tool from admission to an inpatient rehabilitation program to discharge.	Effectiveness	Duplicate indicator.
22	Change (improvement) in functional status scores (FIM® Instrument sub scores transfers and locomotion) from admission to an inpatient rehabilitation program to discharge.	Effectiveness	Provides redundant information.
23	Change (improvement) in functional status score (Berg balance) from admission to an inpatient rehabilitation program to discharge.	Effectiveness	Requires standardized collection of a measure that is only applicable to a subset of stroke patients.
24	Motor score change, from baseline to defined measurement periods.	Effectiveness	Provides redundant information.
25	Change in arm and hand functional status scored using a standardized assessment tool from admission to an inpatient rehabilitation program to discharge.	Effectiveness	Requires standardized collection of a measure that is only applicable to a subset of stroke patients.
26	Change in shoulder, arm and hand functional status scored using a standardized assessment tool (such as the Chedoke-McMaster Stroke Assessment pain scale) from admission to an inpatient rehabilitation program to discharge.	Effectiveness	Requires standardized collection of a measure that is only applicable to a subset of stroke patients.
27	Pain intensity rating change, from baseline to defined measurement periods.	Effectiveness	Pain is not stroke specific.

28	Proportion of stroke patients who report shoulder pain at three-month and six-month follow-up.	Effectiveness	Requires follow-up for a subset of patients.
29	Range of shoulder external rotation before and after treatment for shoulder pain.	Effectiveness	Too specific for an assessment of stroke care.
30	Percentage of those with severe stroke admitted to inpatient rehabilitation.	Equity	Provides redundant information.
31	Percentage increase in Telehealth/telestroke coverage to remote communities to support organized stroke care across the continuum and provide rehabilitation assessments for stroke patients.	Equity	Telestroke not yet implemented in NSM.
32	Number of stroke patients initially assessed by physical therapist, occupational therapist, speech language pathologist and social workers during inpatient rehabilitation.	Appropriateness	Provides redundant information.
33	Number of patients screened for cognitive impairment using valid screening tool at all transition points.	Appropriateness	Provides redundant information.
34	Frequency, duration, and intensity of therapies received from each relevant rehabilitation professional while in an inpatient rehabilitation setting following stroke.	No dimension	Provides redundant information.
35	Proportion of stroke patients who experience shoulder pain in acute care hospital, inpatient rehabilitation and following discharge into the community (NRS tool has a self report question about pain on admission/discharge).	No dimension	The number of patients who experience shoulder pain is more reflective of the patient population than a process of care.
36	Proportion of patient with restricted range of motion related to shoulder pain.	No dimension	Unlikely to have a significant impact on patient care.
iv) Outpatient And Community Rehabilitation			
1	Median length of time between referral for outpatient rehabilitation and admission to a community rehabilitation program.	Timeliness	Provides redundant information.
2	Length of time between referral for ongoing rehabilitation to commencement of therapy.	Timeliness	Provides redundant information.
3	Length of time from hospital discharge (whether from acute care or inpatient rehabilitation) to initiation of community health services.	Timeliness	Provides redundant information.

4	Percentage of stroke patients discharged to the community who receive a referral for outpatient rehabilitation prior to discharge from hospital (acute care and/or inpatient rehabilitation).	Appropriateness	Access to services is a better indicator than referral for services
5	Proportion of patients who are discharged from acute care who receive a referral for home care or community supportive services.	Appropriateness	Access to services is a better indicator than referral for services
6	Documentation to indicate that assessment of fitness to drive and related patient counseling was performed.	Appropriateness	Unlikely to have a significant impact on patient care.
7	Number of patients referred for driving assessment by occupational therapist in the community.	Appropriateness	Unlikely to have a significant impact on patient care.
8	Number of stroke patients initially assessed by physiotherapy, occupational therapy, speech-language pathologists and social workers in the community.	Accessibility	Provides redundant information.
9	Number of visits to primary care within specified time frames for stroke-related issues.	Accessibility	Difficult to isolate a single reason for a primary care visit
10	Number of readmissions from stroke rehabilitation to acute care for stroke-related causes.	Effectiveness	Already included as a recommended outcome.
11	Percentage increase in Telehealth/telestroke coverage to remote communities to support organized stroke care across the continuum and provide rehabilitation assessments and ongoing rehabilitation monitoring and management for stroke survivors in the community.	Equity	Telestroke not yet implemented in NSM.
12	Percentage of stroke patients with documentation that information was given to patient or family on formal and informal educational programs, care after stroke, available services, proves to access available services, and services covered by health insurance.	Acceptability/patient-centeredness	Documentation that educational information was provided does not adequately capture the quality of the interaction: qualitative methods may be better suited to assess the provision of patient education.
13	Mean wait time from referral to admission to nursing home, complex continuing care or long-term care facility.	Timeliness	An indicator of access to continuing care and not directly related to stroke care.
14	Percentage of eligible stroke pts who receive outpatient therapy.	Accessibility	Provides redundant information.
15	Proportion of stroke patients with readmissions to acute care for stroke-related causes following discharge to the community, stratified by type of stroke.	Effectiveness	Already included as a recommended outcome.

16	Number of visits to an emergency department within specified time frames.	No dimension	Not all future ED visits are related to stroke.
17	Percentage of patients who return home following stroke rehabilitation who require community health services (e.g., home care or respite care).	No dimension	Provides redundant information.
18	Frequency and duration of community health services, stratified by the type of service provided.	No dimension	Provides redundant information.
19	Measure of burden of care for family and caregivers of stroke survivors living in the community.	No dimension	Provides redundant information.
20	The change in burden of care for family members and informal caregivers, using a standardized measurement tool, measured at defined interval throughout the recovery period following stroke and at transition points.	Effectiveness	Provides redundant information.
v) Cross-Continuum			
1	Median time from patient arrival in the emergency department to initial swallowing screening by a trained clinician.	Timeliness	Provides redundant information.
2	Proportion of stroke patients treated with antidepressants at 1 month, 3 months, 6 months and one year following initial stroke event.	Appropriateness	The number of patients treated with antidepressants is more reflective of the patient population than a process of care.
3	Percentage improvement in control of high blood pressure and other vascular risk factors in patients with vascular cognitive impairment.	Effectiveness	Represents several possible indicators: provides requires further specification.
4	Fall incidence rate for stroke patient admitted to hospital (acute care or rehabilitation).	Safety	Represents both negative (the fall) and positive (e.g. early mobilization) aspects of care without differentiating.
5	Patient's and/or family's experience and satisfaction with care received.	Acceptability/patient-centeredness	Qualitative methods are better suited to capture the concept of patient satisfaction.
6	Percentage of stroke patients with documentation that information was given to patient or family on formal and informal educational programs, care after stroke, available services, proves to access available services, and services covered by health insurance.	Acceptability/patient-centeredness	Documentation that educational information was provided does not adequately capture the quality of the interaction: qualitative methods may be better suited to assess the provision of patient education.

7	Proportion of patients who have a plan of care established at discharge from acute care, inpatient rehabilitation, and/or outpatient rehabilitation, and with the patient's primary care provider after discharge to the community.	Continuity	Provides redundant information.
8	The number and percentage of patients diagnosed with post-stroke depression, measured at each transition point as a proportion of all stroke patients.	No dimension	The number of patients with depression is more reflective of the patient population than a process of care.
9	Total time spent on patient/family education during a healthcare encounter for stroke.	No dimension	Difficult to collect this information: qualitative methods may be better suited to assess the provision of patient education.
10	Provider's experience and satisfaction with the quality of interaction and collaboration among providers involved in care transitions.	No dimension	Does not relate to patient care.
11	Percentage of patient with falls who experience injuries during the fall.	No dimension	Represents both negative (the fall) and positive (e.g. early mobilization) aspects of care without differentiating.
12	Percentage of patients with falls who experience a prolonged length of stay as a result of the fall.	No dimension	Difficult to isolate a single cause of prolonged LOS.