



A Guide to the Implementation of Stroke Unit Care

**A Resource for Implementation of
Canadian Best Practice Recommendations
for Stroke Care**



Canadian Stroke Network
Réseau canadien contre
les accidents cérébrovasculaires



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Purpose

This resource supports the Canadian Best Practice Recommendations for Stroke Care in the acute care setting (Rec. #4.1) and inpatient rehabilitation (Rec. #5.2). It provides guidance for the establishment of new stroke units and the enhancement of existing stroke units to provide optimal services and processes of care for stroke patients.

Stroke unit care has some of the strongest evidence for improved patient outcomes in the stroke research literature. Stroke unit care reduces the likelihood of death and disability in men and women of any age with mild, moderate or severe stroke by as much as 30%. Meta-analyses of the stroke unit research evidence report that stroke patients receiving organized inpatient care in a stroke unit are more likely to be alive, independent, and living at home 1 year after the stroke. The benefits were most apparent in units based in a discrete ward. No systematic increase was observed in the length of inpatient stay between patients on a stroke unit compared to non-stroke unit patients.

Project Leads and Partners:

This resource has been developed by the Canadian Stroke Strategy Best Practices and Standards Working Group together with volunteer members of the 2008 acute care and rehabilitation task groups. It has been developed in partnership with clinicians from across Canada with particular expertise and interest in stroke unit models of care in acute care and inpatient rehabilitation settings. Significant contributions have been made by the British Columbia Stroke Strategy, members of the Ontario Stroke Network, Cardiovascular Health Nova Scotia and the Nova Scotia Stroke Strategy.

Contents

This document is organized in four parts:

1. 2008 Canadian Best Practice Recommendations for Stroke Units (Rec. 4.1 and Rec. 5.2)
2. Definitions and criteria for stroke unit care, including components for an acute stroke unit, a stroke rehabilitation unit, and an integrated stroke unit
3. Creating a stroke unit, including key steps and staffing models
4. Appendix One: Canadian Best Practice Recommendations for Stroke Care, Sections 4.1 and 5.2 (including recommendations, rationale, system implications, performance measures and summary of the evidence)

Additional resource materials related to stroke unit care, such as order sets and pathways can be found under the provincial section of the Canadian Stroke Strategy website (www.canadianstrokestrategy.ca)

Part One: Canadian Best Practice Recommendations For Stroke Care

The Canadian Stroke Strategy (CSS) recognized the critical importance of stroke units, based on strong levels of evidence found in the research literature. The CSS has included recommendations for stroke unit care in both the acute care and rehabilitation sections of its stroke guidelines. The specific recommendations for both acute care and rehabilitation stroke units are provided below. For the full recommendation information, including rationale, system implications, performance measures, and summary of evidence please refer to Appendix One.

Recommendation 4.1: Acute Stroke Unit Care ^{1*}

Patients admitted to hospital because of an acute stroke or transient ischemic attack should be treated in an interdisciplinary stroke unit [Evidence Level A].

- i. A stroke unit is a specialized, geographically defined hospital unit dedicated to the management of stroke patients [Evidence Level A].
- ii. The core interdisciplinary team should consist of clinicians with appropriate levels of expertise in medicine, nursing, occupational therapy, physiotherapy, speech–language pathology, social work and clinical nutrition. Additional disciplines may include pharmacy, (neuro)psychology and recreation therapy [Evidence Level B].
- iii. The interdisciplinary team should assess patients within 48 hours of admission and formulate a management plan [Evidence Level C].
- iv. Clinicians should use standardized, valid assessment tools to evaluate the patient's stroke-related impairments and functional status [Evidence Level B].
- v. Any child admitted to hospital with stroke should be managed in a centre with pediatric stroke expertise and/or managed using standardized pediatric stroke protocols [Evidence Level B].

Recommendation 5.2: Provision of Inpatient Stroke Rehabilitation

All patients with stroke who are admitted to hospital and who require rehabilitation should be treated in a comprehensive or rehabilitation stroke unit by an interdisciplinary team [Evidence Level A].

- i. Post-acute stroke care should be delivered in a setting in which rehabilitation care is formally coordinated and organized [Evidence Level A] (ASA).
- ii. All patients should be referred to a specialist rehabilitation team on a geographically defined unit as soon as possible after admission [Evidence Level A] (RCP). Pediatric acute and rehabilitation stroke care should be provided on a specialized pediatric unit [Evidence Level B] (RCP-P).

¹ Canadian Best Practice Recommendations for Stroke Care (Update 2008). Found at www.cmaj.ca (December 2nd, 2008). Pages E45 and E54.

- iii. Post-acute stroke care should be delivered by a variety of treatment disciplines, experienced in providing post stroke care, to ensure consistency and reduce the risk of complications [Evidence Level C] (RCP).
- iv. The interdisciplinary rehabilitation team may consist of a physician, nurse, physical therapist, occupational therapist, speech-language pathologist, psychologist, recreation therapist, patient and family/caregivers [Evidence Level A] (ASA). For children, this would also include educators and child-life workers. This “core” interdisciplinary team should consist of appropriate levels of these disciplines, as identified by the Stroke Unit Trialists’ Collaboration [Evidence Level B] (AHA-P, SIGN 64).
- v. The interdisciplinary rehabilitation team should assess patients within 24 to 48 hours of admission and develop a comprehensive individualized rehabilitation plan which reflects the severity of the stroke and the needs and goals of the stroke patient [Evidence Level C] (HSFO, NZ).
- vi. Patients with moderate or severe stroke who are rehabilitation ready and have rehabilitation goals should be given an opportunity to participate in inpatient stroke rehabilitation [Evidence Level A] (HSFO).
- vii. Stroke unit teams should conduct at least one formal interdisciplinary meeting per week to discuss the progress and problems, rehabilitation goals and discharge arrangements for patients on the unit [Evidence Level B] (SIGN 64). Individualized rehabilitation plans should be regularly updated based on patient status reviews [Evidence Level C].
- viii. Clinicians should use standardized, valid assessment tools to evaluate the patient’s stroke-related impairments and functional status [Evidence Level B] (ASA, RCP). See Table 8 for a list of tools.
- ix. Where admission to a stroke rehabilitation unit is not possible, a less optimal solution is inpatient rehabilitation on a mixed rehabilitation unit (i.e., where interdisciplinary care is provided to patients disabled by a range of disorders including stroke) [Evidence Level B] (SIGN 64).

Part Two: Definitions and Criteria for Stroke Unit Care

A. Definition of Level of Stroke Services within Acute Care and Rehabilitation Facilities

Within the health care system, there are generally 3 levels of facilities that provide stroke services: comprehensive stroke centres, centres providing an intermediate level of stroke services and centres lacking stroke specific resources. These types of facilities are described below.¹

Comprehensive stroke centres are centres with specialized resources and personnel available at all times (24 hours a day, 365 days a year) to provide assessment and management of stroke patients. These facilities have established written stroke protocols for emergency services, in-hospital care and rehabilitation; the ability to offer thrombolytic therapy to suitable ischemic stroke patients; timely neurovascular imaging and expert interpretation; and coordinated processes for patient transition to ongoing rehabilitation, secondary prevention and community reintegration services. Comprehensive stroke centres also include neurosurgical facilities and interventional radiology services. Comprehensive stroke centres have a leadership role in establishing partnerships with other local hospitals for supporting stroke care services. Comprehensive stroke centres should also have a performance measurement system in place to monitor the quality of stroke care and patient outcomes. These centres may also be referred to as 'regional stroke centres' in some jurisdictions.

Hospitals with intermediate stroke services are facilities with clinicians who have stroke expertise; written stroke protocols for emergency services, acute care and/or rehabilitation; ability to offer thrombolytic therapy to suitable ischemic stroke patients or protocols to transfer appropriate patients to a comprehensive stroke centre; timely neurovascular imaging and timely access to expert interpretation (e.g., telemedicine); and coordinated processes for patient transition to ongoing rehabilitation and secondary prevention services.

Hospitals without specialized stroke resources are centres that do not have in-hospital resources such as clinicians with stroke expertise or neuroimaging. These centres should have written agreements in place to facilitate timely transfer of stroke patients to centres with stroke specific levels of care as appropriate.

B. Models of Stroke Unit Care

Several models of stroke unit care have been described in the literature. A targeted literature review and an environmental scan of current models of stroke unit care were conducted. A content analysis was undertaken and resulted in the following descriptions of the key elements of the three most frequently described models of stroke unit care: integrated stroke unit (also known as 'comprehensive' stroke unit in some jurisdictions and publications); acute stroke unit; and a stand-alone inpatient rehabilitation stroke unit.

The Stroke Unit Trialists' Group (Cochrane Collaborative 2009) have identified the following main elements which were considered minimum criteria for a stroke unit in any model: ²

- dedicated geographically defined units
- interprofessional staffing – team that consists of physicians, nursing and therapy staff (usually including physiotherapy, occupational therapy, speech therapy, social work);
- co-ordinated multidisciplinary rehabilitation services
- staff with a specialized interest in stroke or rehabilitation;
- team meetings held at least once per week
- routine involvement of carers in the rehabilitation process;
- regular programmes of staff education and training

Additional stroke unit criteria that have been identified in this review include:

- procedures for diagnostic evaluation
- acute monitoring
- acute treatment
- early mobilization
- very strong focus on rehabilitation and recovery

The Canadian Stroke Strategy defines three models of stroke unit care within the Canadian Best Practice Recommendations for Stroke Care (2008). These models include integrated stroke units³, acute care stroke units and rehabilitation stroke units. Each model is presented below with a list of the core components that define the services provided.

Although it is recognized that other models of stroke patient care delivery have been implemented where resources for dedicated stroke units are currently not available (such as stroke bed clusters), this document focuses specifically on dedicated stroke unit models, which are supported by the strongest research evidence. It is also recognized that the creation of a unit does not singularly translate into improved patient outcomes. Access, timeliness, and processes/protocols of care delivery are key contributors to improved patient outcomes.

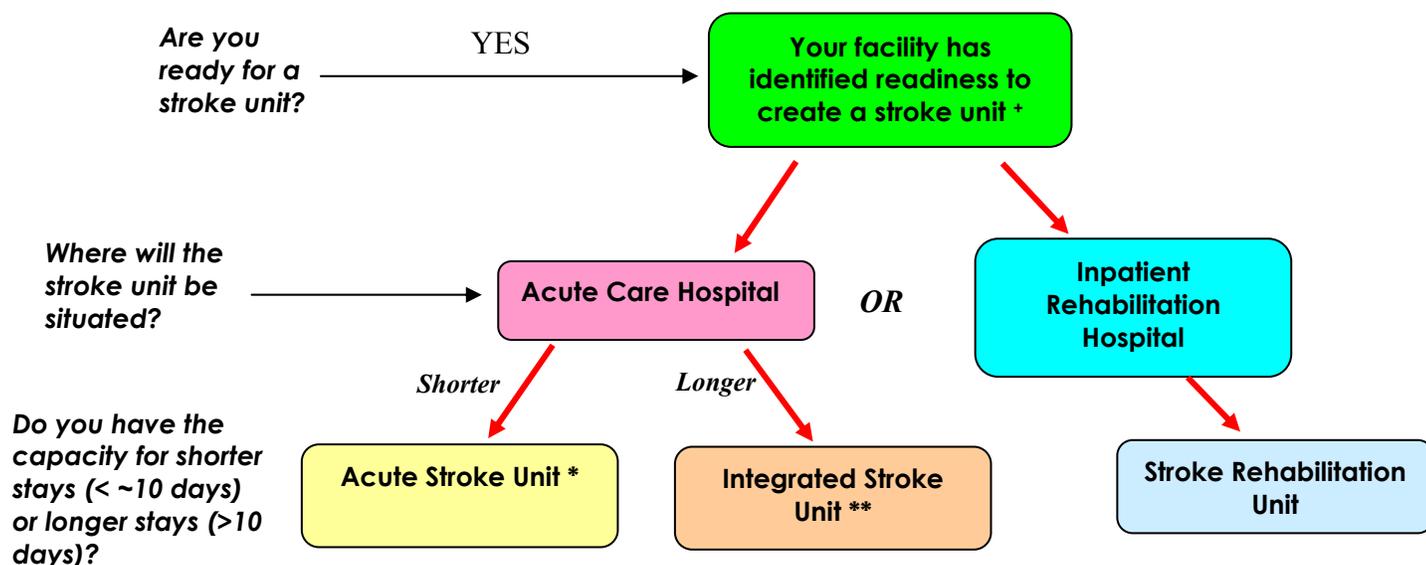
² Stroke Unit Trialists' Collaboration. Organised inpatient (stroke unit) care for stroke. *Cochrane Database of Systematic Reviews* 2007, Issue 4. Art. No.: CD000197. DOI: 10.1002/14651858.CD000197.pub2.

³ 'integrated' is the term used by the Canadian Stroke Strategy and is equivalent to the Cochrane description of a 'comprehensive' stroke unit

Which model should you choose?

Care for patients who have experienced a stroke involves the full continuum of care from pre-hospital through to recovery and end-of-life. Rehabilitation is a critical component of care and recovery following a stroke and should be initiated as early as day one based on patient tolerance, regardless of care setting. Therefore, access to rehabilitation is a primary component of stroke unit care, regardless of model. In considering the type of stroke unit to develop, the decision is primarily based on the type of facility where the unit will be situated and the capacity to provide ongoing rehabilitation services for a either shorter, defined period of time, or for an extended timeframe. Creating a stroke unit does not have to involve creating new beds. Most often hospitals establish stroke units by re-assigning or reorganizing existing beds that are in fact already being occupied by stroke patients on neuroscience, neurology, or general medicine wards. Bringing stroke patients together in closer proximity and operating within a coordinated model of care will enhance patient care, improve outcomes, and increase staff skill and expertise in caring for stroke patients.

By responding to the following questions, you should be able to identify the appropriate stroke unit care model for your setting.



+ Readiness to create a stroke unit includes a demonstrated critical stroke patient mass, physical space, availability of required staff, and support from senior management

* In choosing an acute stroke unit, you should have stroke rehabilitation service partners identified who can continue to provide inpatient or out-patient stroke rehabilitation therapy after discharge from your unit (including community-based partners).

** Choosing an integrated stroke unit implies that you will be providing complete rehabilitation services for an extended duration for stroke patients with moderate to severe strokes.

i. Integrated Stroke Unit

An integrated stroke unit provides both acute and rehabilitation care to patients during their inpatient stays following a stroke. The patient also remains on the same unit for an extended period of time – usually beyond the first seven days of an acute care inpatient stay. *(Note: the Stroke Unit Trialists Group refer to comprehensive stroke units and they are similar to the way integrated is used in the Canadian Best Practice Recommendations for Stroke Care and in this document.)*

The following elements would be considered key components of an integrated stroke unit:^{4,5}

- ☑ A specialized, geographically defined hospital unit dedicated to the management of stroke patients.
- ☑ A dedicated core interprofessional team which includes neurology, nursing, occupational therapy, physiotherapy, speech-language pathology, social work, psychiatry, and clinical nutrition. The team may also include other disciplines such as internal medicine, pharmacy and (neuro)psychology. The team have a special interest in stroke and advanced training in stroke management.
- ☑ Patients should move to the Stroke Unit as soon as possible, ideally within 3 hours of presentation to the Emergency Department.
- ☑ Patients will receive both their acute medical care and rehabilitation on the same ward/unit from an interprofessional team experienced in the care of stroke patients.
- ☑ The interprofessional team should assess patients and formulate a management plan within 24- 48 hours of admission.
- ☑ Clinicians use standardized, valid assessment tools to evaluate the patient's stroke-related impairments and functional status (as defined in the Canadian Best Practice Recommendations for Stroke Care, Section 5.1)
- ☑ Comprehensive, evidence based, written protocols, order sets and care pathways/algorithms should be in place to guide acute stroke care and rehabilitation.
- ☑ Shared decision making and goal setting involving the treating team, patients, and carers is an integral part of stroke care delivery.
- ☑ Interprofessional team meetings will be held at least once per week to review all stroke patients.
- ☑ Patient and carer education are an important component of acute and post acute stroke care.

⁴ CSS BPR Summaries of evidence 4.1, 5.2

⁵ Collier, Todd. *Minimum Standards for an Evidence-Based Comprehensive Stroke Unit*. Document developed for the Kamloops Stroke Program.

ii. Acute Stroke Unit

An acute stroke unit provides acute and initial rehabilitation care to stroke patients during the acute phase following a stroke. This has been reported in the research literature as the first 7 to 10 days following a stroke event. This period may be longer for hemorrhagic stroke patients. An acute stroke unit provides acute care as well as early rehabilitation. Patients requiring longer term rehabilitation may be transferred to another location within the same facility, to a stroke rehabilitation unit in another facility, or to a specialized rehabilitation facility to receive ongoing rehabilitation according to their needs.

The following elements would be considered key components of an acute stroke unit:

- ☑ A specialized, geographically defined hospital unit dedicated to the management of stroke patients during the first 7 – 10 days (may be longer) following an acute stroke event.
- ☑ A dedicated core interprofessional team which includes medicine, nursing, occupational therapy, physiotherapy, speech-language pathology, social work, psychiatry, and clinical nutrition. The team may also include other disciplines such as pharmacy and (neuro)psychology. The team have a special interest in stroke and advanced training in stroke management.
- ☑ Patients should move to the Stroke Unit as soon as possible, ideally within 3 hours of presentation to the Emergency Department.
- ☑ Patients will receive both their acute medical care and early rehabilitation from an interprofessional team experienced in the care of acute stroke patients.
- ☑ The interprofessional team should assess patients and formulate a management plan within 24- 48 hours of the acute admission, including an assessment of the patient's rehabilitation needs.
- ☑ Clinicians use standardized, valid assessment tools to evaluate the patient's stroke- related impairments and functional status (as defined in the Canadian Best Practice Recommendations for Stroke Care, Section 5.1)
- ☑ Comprehensive, evidence based, written protocols, order sets and care pathways/algorithms should be in place to guide acute stroke care and rehabilitation.
- ☑ Shared decision making and goal setting involving treating team, patients, and carers is an integral part of stroke care delivery.
- ☑ Interprofessional team meetings will be held once per week to review all stroke patients.
- ☑ Patient and carer education are an important component of acute and post acute stroke care.

iii. Stroke Rehabilitation Unit

A stroke rehabilitation unit provides stroke care to patients during the post-acute recovery phase following a stroke. Patients are usually transferred to a stroke rehabilitation unit once they are medically stable (based on individual unit admission criteria). A stroke rehabilitation unit may exist within a general hospital or in a separate specialized rehabilitation facility. The length of stay on a stroke rehabilitation unit has been reported on average from 3 to 6 weeks. The goal of stroke rehabilitation units is to maximize the stroke client's potential for recovery so that they may be able to function at the highest level of physical and mental ability they can achieve post stroke.⁶

The following elements would be considered key components of a stroke rehabilitation unit:^{7,8}

- ☑ A specialized, geographically defined rehabilitation unit dedicated to the rehabilitation of stroke patients.
- ☑ A dedicated core interprofessional team which includes physiatry, nursing, occupational therapy, physiotherapy, speech-language pathology, social work, and clinical nutrition. The team may also include other disciplines such as internal medicine, pharmacy and (neuro)psychology. The team have a special interest in stroke and advanced training in stroke management.
- ☑ Patients should move to the stroke rehabilitation unit as soon as possible, ideally within 5 days of stroke onset. (Note: hemorrhagic stroke patients may require more time in acute care before transfer to rehab care).
- ☑ The interprofessional team should assess patients and formulate a management plan within 24- 48 hours of admission.
- ☑ Clinicians use standardized, valid assessment tools to evaluate the patient's stroke- related impairments and functional status (as defined in the Canadian Best Practice Recommendations for Stroke Care, Section 5.1)
- ☑ Comprehensive, evidence based, written protocols, order sets and care pathways/algorithms should be in place to guide stroke rehabilitation.
- ☑ Interprofessional team meetings will be held once per week to review all stroke patients.
- ☑ Shared decision making and goal setting involving treating team, patients, and carers is an integral part of stroke care delivery.
- ☑ Patient and carer education are an important component of acute and post acute stroke care.

⁶ Saskatchewan Stroke Program, Definition of a Stroke Rehabilitation Program. 2009

⁷ CSS BPR Summaries of evidence 4.1, 5.2

⁸ Collier, Todd. *Minimum Standards for an Evidence-Based Comprehensive Stroke Unit*. Document developed for the Kamloops Stroke Program.

Part Three: Creating a Stroke Unit

Planning Considerations for Developing a Stroke Unit:

These considerations are based on published literature on stroke unit care as well as information gathered through a consultation process with front-line healthcare professionals and managers directly involved in the development and operational management of stroke units across Canada.

Note: This resource is designed to provide a comprehensive set of considerations and guidance for the development and enhancement of stroke units. It is recognized that local considerations may impact the degree to which the components listed here can be addressed, and it is further acknowledged that not all components presented here are applicable or feasible for all facilities. The implementation of stroke units can be a dynamic process that starts on a smaller scale and continues to develop as increased capacity (resources and expertise) becomes available. It is also important to note that creating a stroke unit does not have to involve creating new beds. Most often hospitals establish stroke units by re-assigning or reorganizing existing beds that are in fact already being occupied by stroke patients on neuroscience, neurology, or general medicine wards. Bringing stroke patients together in closer proximity and operating within a coordinated model of care will enhance patient care; improve outcomes, and increase staff skill and expertise in caring for stroke patients.

- 3.1 Determine readiness of organization to create a stroke unit:
 - a. Historical patient volumes and forecasted needs
 - b. Proximity and capacity of other stroke services
 - c. Health human resources with stroke expertise
 - d. Physical resources for stroke unit – space, ability to dedicate beds, monitoring equipment, therapy equipment, staff amenities
 - e. Financial resources to support start-up and sustainability
 - f. Support within hospital and role within broader regional/provincial stroke system of care

- 3.2 Identify a Stroke Champion group – should include at a minimum a physician and nursing champion as well as an administrative champion (manager or executive level). Additional members of the interprofessional stroke team should be involved as early as possible in the planning of a stroke unit as well.

- 3.3 Build a business case based on the hospital's stroke volumes, catchment and leadership role in their region for stroke services
 - a. Quantify and project stroke volumes and service volumes in catchment area
 - i. Conduct a review of annual stroke admission rates to your facility annually over the past 3 years
 - ii. Consider overall admission rates, changes in rates over time frame and any expected system changes or population-related changes

- that might impact projections for volumes in next 2 – 3 years (e.g., shifting population age, other hospital closures, etc)
- iii. Ensure data is considered overall, then stratified by stroke type
 - iv. Also consider the availability and accessibility of external inpatient rehabilitation beds.
 - v. May also take into consideration annual tPA rates as part of projections, although these should not be considered the main drivers of decision-making for a stroke unit.
- b. Determine # stroke beds needed
 - i. Use data obtained in (a) and also include number of stroke days per year, and % stroke bed occupancy (weekly, monthly, annual)
 - ii. As a general guide, at minimum, a 6 bed unit would be appropriate for a stroke case-volume of about 100 patients/year.
 - c. Determine location in facility where most stroke patients are currently being managed
 - d. Consider whether new beds are required or whether existing beds could be reallocated
 - e. Consider what a projected expected length of stay would be for the acute phase and rehab phases of care as a component of determining model of unit and minimum number of beds required
 - i. In Canada, some LOS ranges for acute stroke units average from 10 – 21 days; rehabilitation units average from 30 – 45 days.
 - f. Consider medium and longer range needs (e.g. need for more capacity as stroke system matures) and plan flex or swing space
- 3.4 Determine type and location of unit according to your hospital needs:
- a. Integrated Stroke Unit (Acute patients and Rehab Patients)
 - i. Determine acuity levels and expected length of stay (need for monitored beds)
 - ii. recommended minimum of 6 beds to support dedicated complement of nursing and allied healthcare professions (such as OT, PT, SLP and SW)
 - b. Acute Stroke Unit
 - i. Determine acuity levels and expected length of stay (need for monitored beds)
 - ii. Based on current literature, it is recommended that acute or integrated stroke units have a minimum of 6 beds to support dedicated complement of nursing and allied health (this may vary depending on overall stroke volumes. Smaller hospitals could consider a 4 bed unit minimum)
 - c. Rehab Stroke Unit
 - i. Determine acuity levels and expected length of stay (based on functional status at discharge from acute care)
 - ii. Based on current literature, it is recommended that stroke rehabilitation units minimum of 10 beds to support dedicated complement of nursing and allied healthcare professions (such as OT, PT, SLP and SW)

- 3.5 Establish Implementation Team:
- a. Involve Human Resources regarding staffing and labour relations
 - b. Unit manager
 - c. Physicians (neurology, internal medicine, radiology, and general practice, geriatric medicine, physical medicine and rehabilitation)
 - d. Nurses and allied healthcare professionals
 - e. Educators
 - f. Pharmacists
 - g. Emergency department representative
 - h. Bed management and/or utilization management analyst
- 3.6 Implementation team to address:
- a. Human resources
 - i. Need for stroke coordinator
 - ii. Identification of designated stroke physician
 - iii. Staffing mix
 - iv. See additional information in Table 1 below
 - v. Interview and hiring process
 - vi. Orientation and training
 - b. Guiding principles (Best Practices, philosophy, inter-disciplinary scope of practice)
 - c. Alignment and positioning within broader stroke management model (e.g., regional or provincial).
 - i. Repatriation issues where applicable; formal signed agreements to be established
 - d. Alignment and organization of services within facility
 - i. For acute care, alignment with ED, ICU, inpatient and outpatient rehabilitation services, and stroke prevention clinics
 - ii. For Rehab units, alignment of inpatient and outpatient rehab services and prevention clinics
 - e. Documentation and communication tools – evidence-based stroke care protocols, pathways, standing orders, check-lists, patient charts
 - f. Medical model of care and physician coverage model
 - g. Model of interprofessional care– including protocols, standardized assessment tools, team meetings, patient plans (align with provincial/regional measures where available)
 - h. Criteria for patient admission to unit, accepted acuity levels and associated expected length of stay; web based referral and triage system
 - i. Equipment, supplies
 - j. Unit identification and signage
 - k. Staff education needs
 - l. Clinical Research opportunities
 - m. Consider the use of Tele-video conferencing technology for education and clinical consultation or outreach.

- 3.7 Communication plan regarding services available within stroke unit to disseminate information to all service providers at all administrative and service delivery levels within the organization and within the broader catchment area
 - a. Include regional partners and referral sources
 - b. Involve EMS services

- 3.8 Establish program of ongoing professional education for all disciplines involved in caring for patients on stroke units
 - a. Include program of interprofessional education rounds within the unit
 - b. Process for stroke unit staff to participate in regional, provincial national and international educational opportunities in the care and management of stroke patients
 - c. Encourage networking with interprofessional stroke teams in other facilities, regions and nationally. This will facilitate knowledge sharing, problem solving, collaboration, and increase consistency of stroke care delivery across sites and nationally

- 3.9 Establish an ongoing measurement and monitoring system
 - a. Identify key process and outcome performance measures for stroke unit care (align with recommended CSS best practice performance measures, and provincial/regional measures where available – See Appendix One)
 - b. Establish data sources for data collection – including optimizing use of administrative data systems within the facility, and identifying the need and feasibility of specific, targeted data collection of stroke unit indicators
 - c. Determine frequency of monitoring and accountabilities for reporting on performance measures (to staff, patients, and administration)
 - d. Examples: Variance tracking, LOS, RIW, Patient satisfaction, Staff satisfaction, Discharge Disposition, readmissions, mortality

- 3.10 Celebrate Opening of the stroke unit

Table 1: Summary of Reported Staffing Ratios for Stroke Units

The following table includes information from references identified during the literature reviews and environmental scan that explicitly provide staffing ratios/models for stroke units. It is important to note that this is a summary of existing published ratios and the numbers provided are not based on a consistent evidence-based formula or approach to staffing ratios, as this information could not be found in the research literature. Most numbers provided here are based within a local context and a range of existing health care delivery models. The intent of presenting this information is to provide examples from stroke centres that have calculated the staffing ratios for stroke units to meet the needs of their sites, and hopefully this will provide guidance and reference for other groups involved in stroke unit development and management.

Reference Source	Findings Regarding Stroke Unit Staffing Ratios
<p><i>British Association of Stroke Physicians. Service Development & Quality Committee 2005</i></p>	<p>The minimum staffing levels on the Stroke Unit should be:</p> <ul style="list-style-type: none"> ➤ 8.0 trained or untrained nurses/10 beds; ➤ 1.0 junior doctors/10 beds for an acute unit; ➤ 0.9 sessions of physiotherapy/bed; ➤ 0.7 sessions of occupational therapy/bed; ➤ 0.35 sessions of SLP/bed.
<p><i>Scottish Intercollegiate Guideline Network CPG #64, 2007</i></p> <p><i>(Based on Stroke Unit Trialists Group report)</i></p>	<p>The typical staffing structure within stroke unit trials was as follows (approximated to a <u>10-bed stroke unit</u> and based on Stroke Unit Trialists' Evidence 1+)</p> <ul style="list-style-type: none"> ➤ Nursing: 10 whole time equivalents (WTE) per 24 hour shift; ➤ Medical: 0.6-1.5 WTE of medical input (divided between consultant and junior staff). Staffing levels tended to be higher in units with acute admission than in second line rehabilitation units ➤ Physiotherapy: one to two WTE divided between qualified and assistant staff ➤ Occupational therapy: one to two WTE divided between qualified and assistant staff ➤ Speech and language therapy: 0.2-0.6 WTE ➤ Social work: part-time social work input <p><i>Levels of nursing staff required to provide good stroke unit care:</i></p> <p>The levels of nursing staff relate directly to the provision of good stroke unit care. Nursing staffing levels and skill mix should be appropriate to the size of the stroke unit and dependency of the patients.</p>

	<p>Individual studies have defined and calculated staffing levels in different ways, with different degrees of cross-cover from other departments. The level of nursing staff also depends on the size of the stroke unit. An estimate for a hypothetical ten-bed stroke unit requires the input of 10 WTE nurses with a skill mix ratio of 2:1 trained/assistant staff.</p> <p><i>Evidence Level B: A minimum nursing level of 10 whole time equivalents per 10 beds is recommended.</i></p>																																												
<p>Meyer M. et al. (Teasell)</p> <p>Blueprint for Transforming Stroke Rehabilitation in Ontario: Research Synthesis of Effectiveness and Cost-Benefits</p> <p>2009</p>	<p>In Stroke Rehabilitation Units:</p> <p>It is important to note that although length of stay is significantly shorter in the United States, total FIM gains are similar as are staffing ratios. In the United States, each therapist is responsible for 5 to a maximum of 8 patients [35]. In comparison, Parkwood Hospital reported therapist to patient ratios of 1:7 PT and 1:7 OT in 2006 [38]. Also, American centers tend to make more use of less expensive therapist aides to assist the therapists and ensure that stroke patients receive optimal therapeutic exposure [35]; this is lacking in Ontario rehabilitation centers.</p> <p>[35] Conroy BE, DeJong G, Horn SD. Hospital-Based Stroke Rehabilitation in the United States. Top Stroke Rehabil. In press 2009</p> <p>[38] Willems D. Southwestern Ontario Stroke Rehabilitation Action Planning Day November 28, 2006 ; Summary Report. 2007 Jan.</p>																																												
<p>Rudd et al. Staffing levels and patient dependence in English stroke units. Clin Med 2009</p>	<p>Of 140 randomly selected stroke units, the median number of beds was 18 (interquartile range 12-24). Staffing levels per 10 beds were</p> <ul style="list-style-type: none"> ➤ a median of 10.9 nurses, ➤ 1.7 physiotherapists, ➤ 1.3 occupational therapists ➤ 0.4 speech and language therapists. 																																												
<p>Phillips, Corning, Gill, Edwards. Stroke Unit sizing and staffing: stroke system planning in Nova Scotia, Canada. Poster</p> <p>2008</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="4" style="text-align: center;">Estimated Size of Stroke Units in Nova Scotia</th> </tr> <tr> <th style="text-align: center;">DHA</th> <th style="text-align: center;">No. Stroke, Admissions/Year</th> <th style="text-align: center;">Estimated No. Stroke Beds</th> <th style="text-align: center;">Size of Stroke Unit</th> </tr> </thead> <tbody> <tr><td style="text-align: center;">1</td><td style="text-align: center;">80</td><td style="text-align: center;">4</td><td style="text-align: center;">4</td></tr> <tr><td style="text-align: center;">2</td><td style="text-align: center;">121</td><td style="text-align: center;">6</td><td style="text-align: center;">6</td></tr> <tr><td style="text-align: center;">3</td><td style="text-align: center;">152</td><td style="text-align: center;">8</td><td style="text-align: center;">8</td></tr> <tr><td style="text-align: center;">4</td><td style="text-align: center;">95</td><td style="text-align: center;">5</td><td style="text-align: center;">7</td></tr> <tr><td style="text-align: center;">5</td><td style="text-align: center;">46</td><td style="text-align: center;">2</td><td style="text-align: center;">7</td></tr> <tr><td style="text-align: center;">6</td><td style="text-align: center;">76</td><td style="text-align: center;">4</td><td style="text-align: center;">7</td></tr> <tr><td style="text-align: center;">7</td><td style="text-align: center;">52</td><td style="text-align: center;">3</td><td style="text-align: center;">7</td></tr> <tr><td style="text-align: center;">8</td><td style="text-align: center;">245</td><td style="text-align: center;">13</td><td style="text-align: center;">13</td></tr> <tr><td style="text-align: center;">9</td><td style="text-align: center;">520</td><td style="text-align: center;">30</td><td style="text-align: center;">30</td></tr> </tbody> </table>	Estimated Size of Stroke Units in Nova Scotia				DHA	No. Stroke, Admissions/Year	Estimated No. Stroke Beds	Size of Stroke Unit	1	80	4	4	2	121	6	6	3	152	8	8	4	95	5	7	5	46	2	7	6	76	4	7	7	52	3	7	8	245	13	13	9	520	30	30
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Stroke unit staffing:

Using the data in the table below, we derived a funding formula based on a 10-bed stroke unit requiring: 0.8 full-time equivalent (FTE) dietitian; 14 FTE nurses; 1.0 FTE specialty nurse practitioner; 1.0 (FTE) each occupational therapist, physiotherapist, and speech-language pathologist; and 0.5 FTE social worker.

Discipline	Information source					
	SIGN ⁵	Langhorne et al ⁶		Hamilton, Ontario ⁹	QEI Acute Stroke Team ^b	Parkwood Hospital ⁸ London, Ontario
		acute & rehab	rehab only	acute & rehab	acute & rehab	rehab only
Dietitian				0.3 ^c + tech 0.1	0.5 ^c + tech 0.3	0.3
Neuropsychology				0.16	0.1	
Nursing	10.0 ^d				14.4 ^e	
Occupational therapy		0.6 – 1.7 ^f	1.0 – 1.3 ^f	1.0	1.0	1.5 + 0.3 tech
Pharmacy				0.16 + tech 0.32	0.5	0.2
Physiotherapy		1.2 – 1.7 ^f	1.0 – 2.0 ^f	1.0	0.7 + tech 0.3	1.5 + 0.3 tech
Social work		0.6	0.4 – 0.6	0.6	0.5 – 0.6	0.7
Speech-Language Pathology		0.25 – 0.75	0.2 – 0.6	0.6	1.0 ^g	0.7

- a Unpublished data from Canadian Stroke Strategy.
- b Updated from reference 7.
- c Dietitian does dysphagia assessments in Halifax but not Hamilton.
- d Trained-to-assistant ratio 2:1.
- e Includes 1.0 FTE Specialty Nurse Practitioner, 10.7 RNs and 2.7 LPNs. Nurse-to-patient ratio 1:3.3 day and evenings; 1:5 nights.
- f Includes trained and assistant (technician) staff.
- g Includes dysphagia, and communication assessments and therapy.

Discipline	FTE/4 Bed Stroke Unit	FTE/8 Bed Stroke Unit	FTE/30 Bed Stroke Unit
Specialty Nurse Practitioner	0.4	0.8	3.0
Nursing	5.6	11.2	42.0
Occupational Therapy	0.4	0.8	3.0
Physiotherapy	0.4	0.8	3.0
Social Work	0.2	0.4	1.5
Dietitian	0.3	0.7	2.4
Speech Language Pathology	0.4	0.8	3.0

Hamilton Health Sciences Integrated Stroke Unit (32 bed Unit: 16 Acute and 16 Rehab stroke beds)

Discipline	FTE
Nursing RN	21 fte (acute) 1 RN covering Rehab 24/7
Nursing RPN	12 fte (rehab)
Physiotherapy	2 fte (1 acute, 1 rehab)
Occupational Therapy	2 fte (1 acute, 1 rehab)
OTA/PTA	2 fte (1 acute, 1 rehab)
Speech Language Pathologist	1.5 fte (acute & rehab)
Social Work	1.5 fte (acute & rehab)
Dietitian	0.6 fte (acute)
Dietetic Assistant	0.4 fte (rehab)
Pharmacy	0.5 fte (acute & rehab)
Pharmacy Tech	0.5 fte (acute & rehab)
Neuropsychology	0.5 fte (rehab)
MD Model (monthly coverage schedule)	4.0 fte (acute - 2 stroke neurologists & 2 internal medicine) 2.0 fte (rehab - 2 stroke neurologists)

Appendix One: Canadian Best Practice Recommendations For Stroke Care: Stroke Unit Care

Best practice recommendation 4.1: Stroke unit care

Patients admitted to hospital because of an acute stroke or transient ischemic attack should be treated in an interprofessional stroke unit [Evidence Level A] (CSQCS, ESO, SCORE, SIGN 64).

- i. A stroke unit is a specialized, geographically defined hospital unit dedicated to the management of stroke patients [Evidence Level A] (AU, RCP).
- ii. The core interprofessional team should consist of people with appropriate levels of expertise in medicine, nursing, occupational therapy, physiotherapy, speech–language pathology, social work and clinical nutrition. Additional disciplines may include pharmacy, (neuro)psychology and recreation therapy [Evidence Level B] (AU, SCORE, SIGN 64).
- iii. The interprofessional team should assess patients within 48 hours of admission and formulate a management plan [Evidence Level C].
- iv. Clinicians should use standardized, valid assessment tools to evaluate the patient's stroke-related impairments and functional status [Evidence Level B] (ASA, RCP).
- v. Any child admitted to hospital with stroke should be managed in a centre with pediatric stroke expertise and/or managed using standardized pediatric stroke protocols [Evidence Level B] (ACCP, AHA-P, RCP-P).

Rationale

Stroke unit care reduces the likelihood of death and disability in men and women of any age with mild, moderate or severe stroke by as much as 30%. Stroke unit care is characterized by a coordinated interprofessional team approach for preventing stroke complications, preventing stroke recurrence, accelerating mobilization and providing early rehabilitation therapy. Evidence suggests that stroke patients treated on acute stroke units have fewer complications, earlier recognition of pneumonia and earlier mobilization. Patients should be treated in a geographically defined unit, as roving stroke teams do not provide the same benefit as stroke units. Refer to Recommendation 5.3 for the components of inpatient stroke rehabilitation (which commences in the acute care hospital) and for additional information on stroke rehabilitation units.

System implications

- Organized system of stroke care including stroke units with a critical mass of trained staff (interprofessional team). If stroke unit not feasible, then mechanisms for coordinating the care of stroke patients to ensure application of best practices and optimization of outcomes.
- Protocols and mechanisms to enable the rapid transfer of stroke patients from the emergency department to an interprofessional stroke unit as soon as possible after arrival in hospital, ideally within the first 3 hours, as delays in transfer may result in adverse patient outcomes.
- Information on geographic location of stroke units and other specialized stroke care models need to be made available to community service providers. This will facilitate navigation to appropriate resources and strengthen the relationship among sectors along the stroke continuum of care.

Performance measures

1. Number of stroke patients treated on a stroke unit at any time during their inpatient hospital stay for an acute stroke event (numerator), as a percentage of total number of stroke patients admitted to hospital (denominator) (core).
2. Percentage of patients discharged to their home or place of residence following an inpatient admission for stroke (core).
3. Proportion of total time in hospital for an acute stroke event spent on a stroke unit.
4. Percentage increase in Telehealth or telestroke coverage to remote communities to support organized stroke care across the continuum.

Measurement notes

- Performance measure 1 could be calculated for all cases, then stratified by type of stroke.
- Definition of stroke unit varies widely from institution to institution. Where stroke units do not exist that meet the criteria defined in the recommendation, then a hierarchy of other stroke care models could be considered: (1) dedicated stroke unit, (2) designated area within a general nursing unit where clustering of stroke patients occurs, (3) mobile stroke team care and (4) management on a general nursing unit by staff using guidelines and protocols.
- The operational definition of “stroke unit” being used by any institution collecting these data must be noted to ensure standardization and validity when data are collected and reported across institutions.

Summary of the evidence

As noted in the recent Australian Clinical Practice Guidelines for Acute Stroke Management,¹² several models of stroke unit care have been described in the literature. These include an acute stroke unit within a discrete ward, a comprehensive stroke unit encompassing the stroke acute and rehabilitation unit within a discrete ward, or a stroke rehabilitation unit and a mixed rehabilitation ward providing rehabilitation for stroke patients on a ward with a general caseload.

The typical components of care in the stroke unit trials, as evidenced in one study, included several components: (1) assessment medical evaluation and diagnostic testing (including CT scanning) and early assessment of nursing and rehabilitation therapy needs; (2) early management policies—early mobilization, prevention of complications (e.g., pressure area care, careful positioning and handling), treatment of hypoxia, hyperglycemia, fever and dehydration; and (3) ongoing rehabilitation policies (coordinated interprofessional team care, early assessment of needs after discharge).¹⁹⁹

The Stroke Unit Trialists' systematic review included 31 randomized and quasi-randomized trials containing outcome information on 6936 patients comparing stroke unit care with alternative service.²⁰⁰ Of the 31 trials, 26 trials (n = 5592) compared stroke unit care with care on general wards. The alternative service was usual care provided on an acute medical ward without routine interprofessional input. Organized inpatient (stroke unit) care typically involved (1) coordinated interprofessional rehabilitation, (2) staff with a specialist interest in stroke or rehabilitation, (3) routine involvement of caregivers in the rehabilitation process and (4) regular programs of education and training. The core characteristics that were invariably included in the stroke unit setting were interprofessional staffing, i.e., medical, nursing and therapy staff (usually including physiotherapy, occupational therapy, speech therapy, social work), and coordinated interprofessional team care with meetings at least once per week. Stroke unit care showed reductions in the odds of death recorded at final (median 1 year) follow-up (OR 0.86, 95% CI 0.76–0.98; p = 0.02), the odds of death or institutionalized care (OR 0.82, 95% CI 0.73–0.92;

$p = 0.0006$), and death or dependency (OR 0.82, 95% CI 0.73–0.92; $p = 0.001$). The authors concluded that stroke patients receiving organized inpatient care in a stroke unit are more likely to be alive, independent, and living at home 1 year after the stroke. The benefits were most apparent in units based in a discrete ward. No systematic increase was observed in the length of inpatient stay.

A recent study examined the frequency and timing of predefined medical complications in stroke patients ($n = 489$) treated in an acute comprehensive stroke unit and an early supported discharge service.²⁰¹ During the first week, nearly 64% of patients experienced one or more complications, with the most common complications being pain (23.9%), temperature 38°C (23.7%), progressing stroke (18.4%), urinary tract infection (16.0%), troponin T elevation without criteria of myocardial infarction (11.7%), chest infections (11.2%), non-serious falls (7.4%) and myocardial infarction (4.5%). Stroke recurrence, seizure, deep vein thrombosis, pulmonary embolism, shoulder pain, serious falls, other infections and pressure sores were each present in $\leq 2.5\%$ of patients. During the 3-month follow-up, 82% of patients experienced at least one complication, the most common of which was pain (53.3%), followed by urinary tract infection (27.9%) and non-serious falls (25.0%). The severity of stroke on admission was the most important risk factor for complications.

Within clinical trials, stroke patients assigned to receive organized inpatient (stroke unit) care are more likely to survive, return home and regain independence than those assigned to conventional care. However, there are concerns that the benefits seen in clinical trials may not be replicated in routine practice. Seenan and associates²⁰² carried out a systematic review of observational studies of stroke unit implementation, comparing the outcomes of stroke patients managed in a stroke unit versus non-stroke unit care. The primary outcome was death within 1 year, and poor outcome was recorded as institutional care or dependency. Twenty-five studies were eligible for review (18 provided data on case fatality or poor outcome). Stroke unit care was associated with significantly reduced odds of death (OR 0.79, 95% CI 0.73–0.86; $p < 0.00001$) and of death or poor outcome (OR 0.87, 95% CI 0.80–0.95; $p = 0.002$) within 1 year of stroke. Results were complicated by significant heterogeneity ($p < 0.05$), mainly in single-centre studies. Although these results are complicated by potential bias and heterogeneity, the observed benefit associated with stroke unit care in routine practice was comparable to that in clinical trials.

In a synthesis of evidence demonstrating the benefits of organized stroke care, Kalra and Langhorne²⁰³ noted that an important challenge for stroke units is a conceptual shift in the philosophy of stroke care from being predominantly engaged with patient-oriented interventions to a strategy in which the patient and the caregiver are seen as a combined focus for intervention, with the objective of empowering and equipping caregivers to be competent facilitators of activities of daily living when caring for disabled patients after stroke. Research has consistently shown that better outcomes are associated with comprehensive and early processes of stroke-specific assessments, particularly assessments for swallowing and aspiration risk, early detection and management of infections, maintenance of hydration and nutrition, early mobilization, clear goals for function and communication with patients and their families.

The use of standardized and validated tools for stroke severity and functional assessment enables sound decision-making and care planning. The Canadian Neurological Scale was designed to monitor mentation and motor functions in stroke patients. This scale was initially validated by Côté and associates^{204,205} and was found to be internally consistent and to have a high level of inter-rater reliability. Initial scores were found to be a significant predictor of death, morbidity and recovery of activities of daily living. Patients with high initial scores were at lower

risk of poor outcomes at 6 months. This relationship held even after adjustments for other covariates.²⁰⁴

The National Institutes of Health Stroke Scale is another validated scale used in clinical practice.²⁰⁶ In the original validation study, inter-rater reliability for the scale was found to be high (mean kappa = 0.69), and test-retest reliability was also high (mean kappa = 0.66–0.77).²⁰⁶ Test-retest reliability did not differ significantly among a neurologist, a neurology house officer, a neurology nurse and an emergency department nurse. The stroke scale validity was assessed by comparing the scale scores obtained prospectively on 65 acute stroke patients to the patients' infarction size as measured by CT scan at 1 week and to the patients' clinical outcome as determined at 3 months. These correlations (scale-lesion size $r = 0.68$, scale-outcome $r = 0.79$) suggested acceptable examination and scale validity. Of the 15 test items, the most inter-rater reliable item (pupillary response) had low validity. Less reliable items such as upper or lower extremity motor function were more valid.

A more recent study assessed the reliability of 2 stroke scales at academic medical centres and community hospitals.²⁰⁷ The intra-class correlation coefficient for the National Institutes of Health Stroke Scale and the Canadian Neurological Scale, respectively, were 0.93 (95% CI 0.82–1.00) and 0.97 (95% CI 0.90–1.00) for the academic medical centres, 0.89 (95% CI 0.75–1.00) and 0.88 (95% CI 0.73–1.00) for community hospitals with neurologic services and 0.48 (95% CI 0.26–0.70) and 0.78 (95% CI 0.60–0.96) for community hospitals without neurologic services. More items on the National Institutes of Health Stroke Scale were missing at the community hospitals without neurologic services (62%) than at the academic medical centres (27%) and the community hospitals with neurologic services (23%, $p = 0.0001$). In comparison, 33%, 0% and 8% of Canadian Neurological Scale items were missing from records from community hospitals without neurologic services, academic medical centres and the community hospitals with neurologic services, respectively ($p = 0.0001$). The study found that the levels of inter-rater agreement were almost perfect for retrospectively assigned National Institutes of Health Stroke Scale and Canadian Neurological Scale scores for patients initially evaluated by a neurologist at both an academic medical centre and a community hospital. Levels of agreement for the Canadian Neurological Scale were substantial at a community hospital without neurologic services, but inter-rater agreement for the National Institutes of Health Stroke Scale was only moderate in this setting. The proportions of missing items were higher for the National Institutes of Health Stroke Scale than the Canadian Neurological Scale in each setting, particularly limiting its application in the hospital without acute neurologic consultative services. (Functional assessment tools are described in section 5, "Stroke rehabilitation and community reintegration.")

Best practice recommendation 5.2: Provision of inpatient stroke rehabilitation

All patients with stroke who are admitted to hospital and who require rehabilitation should be treated in a comprehensive or rehabilitation stroke unit by an interprofessional team [Evidence Level A] (AU-R).

- i. Post-acute stroke care should be delivered in a setting in which rehabilitation care is formally coordinated and organized [Evidence Level A] (ASA).
- ii. All patients should be referred to a specialist rehabilitation team on a geographically defined unit as soon as possible after admission [Evidence Level A] (RCP). Pediatric acute and rehabilitation stroke care should be provided on a specialized pediatric unit [Evidence Level B] (RCP-P).
- iii. Post-acute stroke care should be delivered by a variety of treatment disciplines, experienced in providing post-stroke care, to ensure consistency and reduce the risk of complications [Evidence Level C] (RCP).

- iv. The interprofessional rehabilitation team may consist of a physician, nurse, physical therapist, occupational therapist, speech–language pathologist, psychologist, recreation therapist, patient and family/caregivers [Evidence Level A] (ASA). For children, this would also include educators and child-life workers. This “core” interprofessional team should consist of appropriate levels of these disciplines, as identified by the Stroke Unit Trialists’ Collaboration [Evidence Level B] (AHA-P, SIGN 64).
- v. The interprofessional rehabilitation team should assess patients within 24 to 48 hours of admission and develop a comprehensive individualized rehabilitation plan which reflects the severity of the stroke and the needs and goals of the stroke patient [Evidence Level C] (HSFO, NZ).
- vi. Patients with moderate or severe stroke who are rehabilitation ready and have rehabilitation goals should be given an opportunity to participate in inpatient stroke rehabilitation [Evidence Level A] (HSFO).
- vii. Stroke unit teams should conduct at least one formal interprofessional meeting per week to discuss the progress and problems, rehabilitation goals and discharge arrangements for patients on the unit [Evidence Level B] (SIGN 64). Individualized rehabilitation plans should be regularly updated based on patient status reviews [Evidence Level C].
- viii. Clinicians should use standardized, valid assessment tools to evaluate the patient’s stroke-related impairments and functional status [Evidence Level B] (ASA, RCP). See Table 8 for a list of tools.
- ix. Where admission to a stroke rehabilitation unit is not possible, a less optimal solution is inpatient rehabilitation on a mixed rehabilitation unit (i.e., where interprofessional care is provided to patients disabled by a range of disorders including stroke) [Evidence Level B] (SIGN 64).

Rationale

All patients with moderate and severe stroke should be admitted to a geographically defined stroke rehabilitation unit that is staffed by an interprofessional team of healthcare providers. When post-acute stroke patients receive coordinated, interprofessional evaluation and intervention on a stroke rehabilitation unit there is a reduction in death and disability.²²⁸ The benefits of this approach are substantial and, compared with a general hospital ward, coordinated and organized rehabilitation care in a stroke unit has been shown to reduce hospitalization length of stay and to increase the stroke patient’s walking mobility, functional status and quality of life. For every 100 patients receiving organized inpatient interprofessional rehabilitation, an extra 5 returned home in an independent state.²²⁸ Stroke patients should be admitted early to stroke rehabilitation units as this also enhances functional outcomes.²⁵ Stroke is multifaceted and requires a wide range of rehabilitation health professionals. It is important that rehabilitation beds and resources are protected, to provide sufficient intensity of treatment during the inpatient rehabilitation phase. Mobile stroke teams that do not work in a geographically defined unit do not achieve the same benefits. Evidence suggests that a specialized stroke rehabilitation unit is superior to a general rehabilitation unit; however, this may not be possible due to a lack of a critical mass of stroke patients in a smaller hospital.

System implications

- Timely access to specialized inpatient stroke rehabilitation services.
- Adequate number of geographically defined stroke units with critical mass of trained staff; interprofessional team during the rehabilitation period following stroke.
- Clinicians with expertise in stroke rehabilitation.
- Timely access to appropriate type and intensity of rehabilitation professionals.
- Optimization of strategies to prevent complications and the recurrence of stroke.

- Consistent implementation of evidence-based best practices for stroke rehabilitation across the continuum of care.

Performance measures

1. Number of stroke patients treated in a geographically defined stroke rehabilitation unit at any time during their inpatient rehabilitation phase following an acute stroke event (core).
2. Final discharge disposition for stroke survivors following inpatient rehabilitation: percentage discharged to their original place of residence; percentage discharged to a long-term care facility or nursing home; percentage requiring readmission to an acute care hospital for stroke-related causes (core).
3. Number of stroke patients assessed by physiotherapist, occupational therapist, speech-language pathologist and social workers during inpatient rehabilitation.
4. Proportion of total time during inpatient rehabilitation following an acute stroke event that is spent on a stroke rehabilitation unit.
5. Frequency, duration and intensity of therapies received from rehabilitation professionals while in an inpatient rehabilitation setting following stroke.
6. 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.

Measurement notes

- Some acute care hospitals provide combined acute and rehabilitation stroke units, where patients progress to “rehabilitation status” and may not actually move or change locations. This information could be found in patient records through primary chart audit.
- For performance measure 1, the denominator should be the total number of stroke patients admitted to inpatient rehabilitation.
- For duration and intensity of services by rehabilitation professionals, this would require a chart review or consistent use of reliable workload measurement tools that are implemented locally or regionally.
- Data for performance measure 2 should be correlated with stroke severity scores during analysis.

Summary of the evidence

Langhorne and Duncan²²⁸ conducted a systematic review of a subset of the studies identified by the Stroke Unit Trialists' Collaboration, those dealing with post-acute rehabilitation stroke services. They defined intervention as “organized inpatient multidisciplinary rehabilitation commencing at least one week after stroke” and sought randomized trials that compared this model of care with an alternative. In a heterogeneous group of 9 trials (6 involving stroke rehabilitation units and 3 involving general rehabilitation wards) that recruited a total of 1437 patients, organized inpatient multidisciplinary rehabilitation was associated with a reduced odds of death (OR 0.66, 95% CI 0.49–0.88; $p < 0.01$), death or institutionalization (OR 0.70, 95% CI 0.56–0.88; $p < 0.001$) and death or dependency (OR 0.65, 95% CI 0.50–0.85; $p < 0.001$), which was consistent across a variety of trial subgroups. This review of post-acute stroke care concluded there can be substantial benefit from organized inpatient interprofessional rehabilitation in the post-acute period, which is both statistically significant and clinically important.

The Stroke Unit Trialists' Collaboration determined that comprehensive units, rehabilitation stroke units and mixed assessment–rehabilitation units all tended to be more effective than care in a general medical ward.²⁰⁰ Apparent benefits were seen in units with acute admission policies as well as those with delayed admission policies and in units that could offer a period of rehabilitation lasting several weeks. Both the Cochrane review and a subsequent meta-analysis showed that care provided on a dedicated ward is superior to care provided by a mobile stroke team.^{228,233}

Teasell and collaborators²⁵ concluded from another metaanalysis that there is strong (Level A) evidence that combined acute and rehabilitation stroke units are associated with a reduction in the odds of combined death or dependency (OR 0.56), length of stay in hospital and the need for long-term institutionalization (OR 0.55), but not with reductions in mortality alone.

Stroke rehabilitation units, which admit patients from a different ward or facility following acute stroke, help to improve functional outcomes compared with standard care. Based on the results from meta-analyses, there is strong (Level A) evidence that specialized, interprofessional rehabilitation provided in the subacute phase of stroke is associated with reductions in mortality (OR 0.60) and the combined outcome of death or dependency (OR 0.63).²⁵ Patients treated on a stroke rehabilitation unit are more likely to be discharged home and less likely to require institutionalization. Kalra and Eade²³⁴ reported that a larger percentage of patients who were treated in a stroke rehabilitation unit were discharged home (47% v. 19% on a general medical ward, $p < 0.01$). Kalra and coworkers²³⁵ reported that patients with moderate stroke receiving stroke unit care were less likely to require long-term care (22% v. 44%).

A systematic review by the Ottawa Panel showed that stroke unit rehabilitation reduced length of stay and significantly improved functional status (including an increase in the proportion of patients able to walk long distances independently at the end of 6 weeks of treatment) and enhanced quality of life.²⁴ That review also showed that stroke unit rehabilitation was superior to home care.

There is strong evidence that subgroups of patients will benefit from subacute rehabilitation in different ways. Patients with more severe strokes have reduced mortality and those with moderate strokes experience improved functional outcomes.²⁵

The proportions of patients who had experienced death, death or institutionalization, and death or dependency at the end of scheduled follow-up were similar between studies that compared mobile stroke teams with general medical ward care. There was strong evidence that mobile stroke teams do not reduce mortality (OR 1.13, 95% CI 0.83–1.55), the combined outcome of death or dependency (OR 0.97 95% CI 0.72–1.32), the need for institutionalization (OR 1.23, 95% CI 0.70–2.17) or the length of hospital stay (OR 7.0, 95% CI –1.73 to 15.73).²⁵ Patients receiving mobile stroke team care fared significantly poorer than patients who had been managed on a comprehensive stroke unit. Although the total number of patients included in the review was relatively small, the authors concluded that mobile stroke team care did not have a major impact on clinically important outcomes.

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