



# CANADIAN STROKE BEST PRACTICE RECOMMENDATIONS

## Rehabilitation, Recovery and Community Participation following Stroke

Part One:

### Rehabilitation and Recovery following Stroke Update 2019

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#### Part One: Rehabilitation and Recovery following Stroke

Sixth Edition (Updated 2019)

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## INTRODUCTION AND OVERVIEW

### Introduction to the Canadian Stroke Best Practice Recommendations

The *Canadian Stroke Best Practice Recommendations (CSBPR)* are intended to provide up-to-date evidence-based guidelines for the prevention and management of stroke, and to promote optimal recovery and reintegration for people who have experienced stroke (patients, families and informal caregivers). The CSBPR are under the leadership of Heart & Stroke. They are intended for use by all members of the interdisciplinary team members who, together, care for people with stroke across the continuum from prevention and symptom onset to long term recovery. These best practice recommendations address issues relevant to all stroke types, including acute ischemic stroke, transient ischemic attack, intracerebral hemorrhage and subarachnoid hemorrhage.

The theme of the Sixth Edition of the CSBPR is **Partnerships and Collaborations**. This theme stresses the importance of integration and coordination across the healthcare system to ensure timely and seamless care of people who have experienced a stroke to optimize recovery and outcomes. Working with people with stroke, their family and caregivers, stroke experts, emergency medical services, other vascular care groups, community care providers, educators and researchers will strengthen our ability to reduce risk factor prevalence and mortality from stroke. This theme also includes consideration of people with stroke who may also have multiple comorbidities such as heart conditions, as well as collaborations to support stroke care in rural and remote settings.

The goal of disseminating and implementing these recommendations is to optimize stroke care across Canada, reduce practice variations in the care of people with stroke, and close the gap between current knowledge and scientific evidence and clinical practice.

Heart & Stroke works closely with national and provincial stakeholders and partners to develop and implement a coordinated and integrated approach to stroke prevention, treatment, rehabilitation, and community participation in every province and territory in Canada. The CSBPR provides a common set of guiding principles for stroke care delivery, and describes the infrastructure necessary at a system level, as well as the clinical protocols and processes that are needed to achieve and enhance integrated, high-quality and efficient stroke services for all people in Canada. Through the innovations embodied within the stroke best practices, these guidelines contribute to health system reform in Canada and internationally.

The CSBPR are developed and presented within a continuous improvement model and are written for health system planners, funders, administrators, and healthcare professionals, all of whom have important roles in the optimization of stroke prevention and care and who are accountable for results. A strong stroke research literature base is drawn upon to guide the optimization of stroke prevention and care delivery. Several implementation tools are provided to facilitate uptake into practice and are used in combination with active professional development programs. By monitoring performance, the impact of adherence to best practices is assessed and the results are then used to direct ongoing improvement. Recent stroke quality monitoring activities have compelling results which continue to support the value of adopting evidence-based best practices in organizing and delivering stroke care in Canada.

### Profile of Stroke Care in Canada

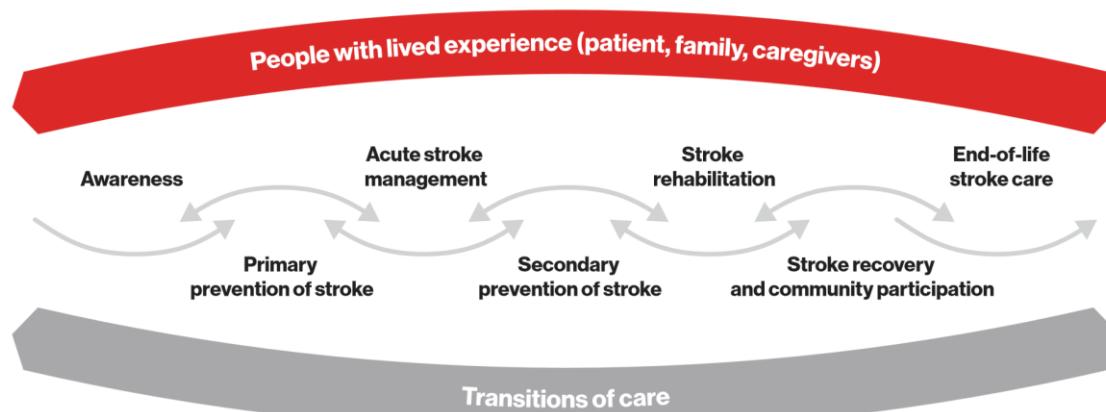
- Every year, approximately 62,000 people with stroke and transient ischemic attack are treated in Canadian hospitals. Moreover, it is estimated that for each symptomatic stroke, there are approximately nine covert strokes that result in subtle changes in cognitive function and processes.
- Approximately 50,000 patients are admitted to acute care hospitals each year in Canada. (CIHI 2017)
- Stroke is the third leading cause of death in Canada and the second leading cause of death globally (CANSIM Table 2014, GBD 2017).

- Stroke is a leading cause of adult disability, with over 400,000 people in Canada living with the effects of stroke. (Krueger 2015)
- In Canada (2016-2017), of all people admitted to acute inpatient care with stroke, 42% will be discharged to their homes independently, and an additional 17% will be discharged home with arrangements for home care services, 16% will be transferred to an inpatient rehabilitation service, 10% will be transferred to long-term care or complex continuing care, and 13% will be transferred to another acute care facility (usually back to community hospital from a tertiary hospital).
- The annual cost of stroke is approximately \$3.6 billion, taking into account both healthcare costs and lost economic output. (Krueger 2012)
- The human cost of stroke on families and communities is immeasurable.
- Less than half of people with stroke who participate in rehabilitation are women (46%), putting them at a disadvantage for making the best recovery possible.

## Rehabilitation, Recovery and Community Participation following Stroke

### Part One: Rehabilitation and Recovery Following Stroke Module Overview

The **CSBPR Rehabilitation and Recovery following Stroke** module provides guidance to health professionals caring for people with stroke and is applicable to people with a range of impairments and limitations from very mild to very severe. Stroke rehabilitation applies across the continuum of care from the early rehabilitation assessments soon after the stroke occurs, throughout the early recovery phase (usually the first 90 days) and continues beyond that to ensure that each individual achieves optimal recovery and is able to maintain and sustain recovery and minimize deterioration over time. This applies across all functional domains, including physical, cognitive, psychological and social domains, and across a range of inpatient and community settings. People with stroke may move back and forth between different stages of care as their healthcare needs and situations change and it is important that ongoing rehabilitation needs to be reassessed and individual rehabilitation plans be updated at all transition points and when there is a change in health status.



**Figure 1:** Stroke Continuum of Care, 2018

## Definition and Considerations

**Stroke Rehabilitation** is a progressive, dynamic, goal orientated process aimed at enabling a person with stroke-related impairment to reach their optimal physical, cognitive, emotional, communicative, and social functional level.

Rehabilitation is NOT a setting, rather, it is a process that includes a set of activities that begins soon after the initial event, once the patient is medically stable to participate and can identify goals for rehabilitation, recovery and participation.

Rehabilitation occurs across the continuum of stroke care in a variety of settings such as acute care or sub-acute care; rehabilitation units, on general or mixed rehabilitation units; in ambulatory or community settings, such as outpatient or day clinics, home-based services (includes early supported discharge services), recreation centres, and outreach teams. In the chronic stage of stroke, rehabilitation may also focus on maintaining current functional abilities and preventing or slowing future functional decline and secondary health conditions (such as contractures, and depression

## Considerations Regarding Stroke Rehabilitation

**Settings:** Rehabilitation interventions and therapies, key component of comprehensive stroke care, are provided in a range of settings such as: acute inpatient care or sub-acute care; inpatient rehabilitation units, on general or mixed rehabilitation units; in ambulatory or community settings, such as outpatient, day clinics, and recreation centres; and home-based services such as early supported discharge services and homecare rehabilitation or outreach teams.

**Duration:** Length of service or stay for stroke rehabilitation varies depending upon factors such as the types of services required, accessibility of those services, and the goals and needs of the person with stroke, their families and caregivers.

**Timeframe:** Stroke rehabilitation requirements often continue for many months and even years after an index stroke. Current healthcare systems tend to allow for stroke rehabilitation interventions within the first six months following stroke onset, even though many people with stroke will require some of these services beyond that arbitrary time frame, since rehabilitation is an ongoing process.

**Available Evidence:** The research literature in this area is rapidly evolving, with new evidence emerging for innovative therapies applicable at different stages of care. The writing group has carefully and thoughtfully examined all therapies with respect to the evidence regarding timing of the interventions and have clearly stated where the evidence differs between early and later stages of rehabilitation and recovery. *Refer to methodology section for further details.*

## Notable Changes in the Rehabilitation and Recovery Following Stroke Module, Update 2019

With each update edition of the CSBPR modules, the most current evidence on the included topics are reviewed by the writing group members and internal and external reviewers. Some recommendations from the previous edition have been continued unchanged, others have been modified to reflect updated evidence (either wording or evidence levels) or removed based on decisions of the writing group regarding ongoing relevance and or changes in supporting evidence. New recommendations have also been added to address emerging evidence and practice changes.

***The Canadian Stroke Best Practice Recommendations (CSBPR) Rehabilitation and Recovery following Stroke 2019 Sixth Edition module supersedes all recommendations from the CSBPR Stroke Rehabilitation 2015 Fifth Edition module.***

The 2019 update of the CSBPR Rehabilitation and Recovery following Stroke module reinforces the growing and changing body of research evidence available to guide assessment, diagnosis and management of stroke related impairments in the days, weeks and months following a stroke.

**Highlights of the moderate and significant updates as well as new additions to the Rehabilitation and Recovery following Stroke module recommendations for 2019 include:**

- ✓ New clinical considerations have been added to each section, acknowledging emerging therapies and consensus-based practices where there is a lack of sufficient evidence to qualify as a recommendations, yet users of CSBPR have requested some expert guidance on the topic.
- ✓ The module contents were reviewed by a new Community Consultation and Review Panel (CCRP), consisting of a group of people with stroke, their families, and caregivers. This group reviewed all modules immediately following the writing group's review and edits, and provided personal experiences and context. Their inputs were received and integrated into appropriate sections throughout the module, such as the rationale, system implications, and resource sections throughout the module.
- ✓ New recommendations provided to address people who are unable to produce any voluntary muscle activity in the affected upper limb. These statements focus on compensatory techniques using the non-paretic arm and associated adaptive equipment to ensure basic activities of daily living.
- ✓ Updates on the recommendations on the use of slings stating that they are discouraged except for the flaccid stage. Previous recommendations described the use of slings as controversial.
- ✓ New recommendation added regarding taping of a hemiplegic shoulder to reduce pain.
- ✓ New recommendation added addressing the insufficient evidence for or against the use of compression garments (e.g. compression gloves) for hand edema. Additionally, for hand edema, a statement was added recommending elevation of the arm when at rest if possible.
- ✓ More detailed recommendations are provided on biofeedback to improve gait training and improve functional recovery.
- ✓ Increased detail on balance-related recommendations.
- ✓ Gait aid recommendations have been integrated into lower-limb gait training, balance, and aerobic training, rather than being a specific subheading of recommendations.
- ✓ Significant updates made to recommendations on visual perceptual deficits, including that limb activation and trunk rotation do not appear to be effective at improving neglect and that virtual reality and computer-based interventions for neglect are effective for improving visual perception and alleviating right-hemisphere bias.
- ✓ New recommendation added addressing augmentative alternative communication (e.g. tablets, electronic devices, alphabet boards) and other technology for patients with language and communication challenges.
- ✓ Rehabilitation approaches, therapies and interventions for topics related to life roles and community participation have been removed from this module. They are now contained in the Rehabilitation, Recovery and Community Participation module Part 2: Transitions and Community

Participation module, to streamline information and reduce redundancy. These recommendations can be found at <https://www.strokebestpractices.ca/recommendations/managing-stroke-transitions-of-care>.

## Guideline Development Methodology

The CSBPR present high-quality, evidence-based stroke care guidelines in a standardized framework to support healthcare professionals across all disciplines. Implementation of these recommendations is expected to reduce practice variations and close the gaps between evidence and practice.

The recommendations are targeted to health professionals throughout the health system who care for those affected by stroke. Health system policy makers, planners, funders, senior managers, and administrators who are responsible for the coordination and delivery of stroke services within a province or region will also find this document relevant and applicable to their work.

The methodology for updating the recommendations includes 14 distinct steps to ensure a thorough and rigorous process. These include the following (details available online):

1. Establish an expert interprofessional writing group representing relevant disciplines across the continuum of care and range of settings ([Appendix One](#));
2. Establish Community Consultation and Review Panel comprised of people with lived experience, including people with stroke, caregivers and family members;
3. Systematic search, appraisal and update of research literature up to May 2019;
4. Systematic search and appraisal of external reference guideline recommendations;
5. Create and/or update of evidence summary tables;
6. Writing group review and revision of existing recommendations, development of new recommendations as required, adhering to all elements defined within the Agree 2 criteria where appropriate. Please see <https://www.agreertrust.org/resource-centre/agree-ii/> for more information.
7. Writing group review and revision of existing recommendations, development of new recommendations as required, then final voting to achieve consensus;
8. Submission of proposed module update to the;
9. Internal review of proposed module update by the Canadian Stroke Best Practice and Quality Advisory Committee.
10. External review by leading experts in Canada and internationally, and final edits as required ([Appendix One](#));
11. Update of educational materials and implementation resources;
12. Final approvals, endorsement and translation of chapter;
13. Publication, public release and dissemination of final module update;
14. Continue with ongoing review and update process.

The detailed methodology and explanations for each of these steps in the development and dissemination of the CSBPR is available in the *Canadian Stroke Best Practice Recommendations Overview and Methodology* manual available on the Canadian stroke best practices website at <https://www.strokebestpractices.ca/recommendations/overview-methods-and-knowledge-exchange>

**Management of Conflicts of Interest within CSBPR:** All potential participants in the recommendation development and review process are required to sign confidentiality agreements and to declare all actual and potential conflicts of interest in writing prior to participation. Any conflicts of interest that are declared are reviewed by the Chairs of the CSBPR Advisory Committee and appropriate Heart & Stroke staff members for their potential impact. Potential members of any writing group who have conflicts that are considered to be significant with respect to the topics within the module of interest are not selected for writing group or reviewer roles. Participants who have conflicts for one particular topic area are identified at the beginning of discussions for that topic and are recused from voting. If the persons in conflict are one of the cochairs then they are recused from chair responsibilities for that discussion, and another non-conflicted participant assumes the chair role for that discussion and voting to ensure balanced and unbiased discussions. Heart & Stroke senior staff members, who do not have any conflicts of interest, participate in all writing group discussions and will intervene if there is any perceived untoward bias by a writing group member. Declarations of Conflict of interest for writing group members can be found in [Appendix One](#).

**Assigning Evidence Levels:** The writing group was provided with comprehensive evidence tables that include summaries of all high-quality evidence identified through the literature searches. The writing group discusses and debates the value of the evidence and through consensus develops a final set of proposed recommendations. Through their discussions, additional research may be identified and added to the evidence tables if consensus on the value of the research is achieved. All recommendations are assigned a level of evidence ranging from A to C, according to the criteria defined in Table 1. When developing and including “C-Level” recommendations, consensus is obtained among the writing group and validated through the internal and external review process. This level of evidence is used cautiously, and only when there is a lack of stronger evidence for topics considered important system drivers for stroke care (e.g., transport using ambulance services or some screening practices). An additional category for Clinical Considerations has been added for the Sixth Edition. Included in this section are expert opinion statements in response to reasonable requests from a range of healthcare professionals who seek guidance and direction from the experts on specific clinical issues faced on a regular basis in the absence of any evidence on that topic.

As noted earlier, some therapies and management strategies included in this rehabilitation module of the CSBPR have evidence only for specific time periods. In consideration of these realities, some of the recommendations provided in this module may have two different levels of evidence accompanying them.

We have grouped the evidence into two categories for certain recommendations to better reflect what is known at this time and provide more specific guidance to clinicians:

- ‘**Early**’ stages of rehabilitation describe the strength of research evidence for a given therapy tested in patients from stroke occurrence through the first six months post-stroke;
- ‘**Late**’ stages of rehabilitation describe the strength of research evidence for a given therapy tested in patients beyond the first six months following an index stroke.

**Table 1: Summary of Criteria for Levels of Evidence Reported in the *Canadian Stroke Best Practice Recommendations* (Sixth Edition):**

Level of Evidence	Criteria*
<b>A</b>	Evidence from a meta-analysis of randomized controlled trials or consistent findings from two or more randomized controlled trials. Desirable effects clearly outweigh undesirable effects or vice versa.
<b>B</b>	Evidence from a single randomized controlled trial or consistent findings from two or more well-designed non-randomized and/or non-controlled trials, and large observational studies. Meta-analysis of non-randomized and/or observational studies. Desirable effects outweigh or are closely balanced with undesirable effects or vice versa.
<b>C</b>	Writing group consensus on topics supported by limited research evidence. Desirable effects outweigh or are closely balanced with undesirable effects or vice versa, as determined by writing group consensus.
<b>Clinical Consideration</b>	Reasonable practical advice provided by consensus of the writing group on specific clinical issues that are common and/or controversial and lack research evidence to guide practice.

\* (adapted from Guyatt et al. 2008) [12]

## Acknowledgements

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## Community Consultation and Review Panel (CCRP) Members

H&S is grateful to the CCRP members who reviewed all sections of this module in parallel to the expert writing group, shared their personal experiences and insights on what did or would have made their journey optimal. The members of the Rehabilitation, Recovery and Community Participation CCRP included: Steve Archer, Rob Claydon, Debbie Chow, Daniel Franco, Amanda Horner, Bruce Hughes, Edith Lambert, Cathy Livingstone, David Livingstone and Michelle McGroty.

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## Citing the Rehabilitation and Recovery following Stroke Module Update 2019 (Sixth Edition):

Robert Teasell (First Author), Nancy M Salbach (Co-First Author), Nicole Acerra, Diana Bastasi, Sherri L Carter, Joyce Fung, Mary-Lou Halabi, Jocelyn Harris, Esther Kim, Andrea Noland, Sepideh Pooyania, Annie Rochette, Bridget D Stack, Erin Symcox, Debbie Timpson, Suja Varghese, and Sue Verrilli on behalf of the Rehabilitation and Recovery following Stroke Writing Group. Rehabilitation and Recovery Following Stroke module 2019. In M. Patrice Lindsay, Anita Mountain, Gord Gubitz, Dar Dowlatshahi, Leanne K Casaubon, Andrea de Jong and Eric E Smith (Editors) on behalf of the Canadian Stroke Best Practices Advisory Committee. Canadian Stroke Best Practice Recommendations, 2019; Ottawa, Ontario Canada: Heart and Stroke Foundation.

The recommendations included in this module are also published in the International Journal of Stroke:

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## Comments

We invite comments, suggestions, and inquiries on the development and application of the CSBPR. Please forward comments to the Heart and Stroke Foundation's Stroke Team at [strokebestpractices@heartandstroke.ca](mailto:strokebestpractices@heartandstroke.ca)

## CANADIAN STROKE BEST PRACTICE RECOMMENDATIONS

### Rehabilitation, Recovery and Community Participation following Stroke

#### Part One: Rehabilitation and Recovery following Stroke, Sixth Edition (Updated 2019)

#### PART A: Organization of a Stroke Rehabilitation System for Optimal Service Delivery

##### Section 1: Initial Stroke Rehabilitation Assessment (Sixth Edition, 2019)

###### Recommendations

- 1.0** All patients with acute stroke should be assessed to determine the severity of stroke and early rehabilitation needs.
- i. All patients **admitted to hospital** with acute stroke should have an initial assessment, conducted by rehabilitation professionals, as soon as possible after admission [Evidence Level A].
    - a. The core rehabilitation professional team should include physiatrists, or other physicians with expertise/core training in stroke rehabilitation, occupational therapists, physiotherapists, speech-language pathologists, nurses, social workers and dietitians [Evidence Level A]. The patient and family are also included as part of the core team [Evidence Level C].
    - b. Additional team members may include recreation therapists, psychologists, vocational therapists, educational therapists, kinesiologists, rehabilitation therapy assistants, and pharmacists. [Evidence level C].
    - c. All professional members of the rehabilitation team should have specialized training in stroke care and recovery [Evidence Level A].
    - d. All professional team members should be trained in supported conversation to be able to interact with patients with communication limitations such as aphasia [Evidence Level B].
  - ii. Initial screening and assessment should ideally be commenced within 48 hours of admission by rehabilitation professionals in direct contact with the patient [Evidence Level C].
    - a. Initial assessment may include: an evaluation of patient function, safety, physical readiness, and ability to learn and participate in rehabilitation therapies [Evidence Level C].
    - b. It is reasonable to consider issues related to transition planning during the initial rehabilitation assessment [Evidence Level C].
  - iii. Assessments of impairment, functional activity limitations, role participation restrictions and environmental factors should be conducted using standardized, valid assessment tools [Evidence Level B]; tools should be adapted for use with patients who have communication

- differences or limitations where required [Evidence Level B]. [Refer to Appendix Two, Table 1: Stroke Rehabilitation Screening and Assessment Tools.](#)
- iv. For patients who do not initially meet criteria for rehabilitation, weekly reassessment of rehabilitation needs may be considered weekly during the first month, and at intervals as indicated by their health status thereafter [Evidence Level C]. [Refer to Box One for more information.](#)
  - v. All patients who present with acute stroke or TIA who are **not admitted to hospital** should be screened for the need to undergo a comprehensive rehabilitation assessment to determine the scope of deficits from index stroke event and any potential rehabilitation requirements [Evidence level C].
    - a. Priority screening areas, including evaluation of safety (cognition, fitness to drive), swallowing, communication and mobility, should be completed by a clinician with expertise in stroke rehabilitation where feasible *before the patients leave the emergency department or in the primary care setting* [Evidence Level C]. [Refer to CSBPR Secondary Prevention of Stroke module.](#)
    - b. Additional screening of impairments, including onset of depression, cognitive ability, functional activity limitations, role participation restrictions, environmental factors and the presence of modifiable stroke risk factors (such as lifestyle behaviours) should be considered within two weeks of stroke onset [Evidence Level C].
  - vi. Once a patient with stroke has undergone assessments, a standardized approach is recommended to determine the appropriate setting for rehabilitation (inpatient, outpatient, community, and/or home-based settings) [Evidence Level C].
    - a. This standardized criteria for admission to any rehabilitation setting is ideally communicated to all referring centres and services [Evidence Level C]. [Refer to Box One for key elements of rehabilitation admission criteria](#)

### Box One: Eligibility and Admission Criteria for Stroke Rehabilitation

#### DETERMINING IF A PATIENT IS A CANDIDATE FOR REHABILITATION

The following criteria has been developed as part of the Canadian Stroke Best Practice Recommendations to provide guidance and increase consistency on key elements that should be considered in decision-making regarding stroke rehabilitation for individual patients. Criteria for access to rehabilitation services should be agreed upon by all relevant stakeholders in each region, be clearly stated and communicated to all referral sites to improve patient access and admission to stroke rehabilitation programs in an efficient and transparent manner. This applies to all rehabilitation settings, including inpatient rehabilitation, outpatient and community-based rehabilitation, and home-based rehabilitation. [Refer to the CSBPR Transitions and Community Participation module, Section 5 for information on stroke care in long-term care settings.](#)

#### General Inclusion Criteria for Stroke Rehabilitation

- All acute or recent stroke patients:
  - Who require inpatient or outpatient interdisciplinary rehabilitation to achieve functional goals to improve independence;
  - Who would benefit from interdisciplinary rehabilitation assessment and treatment from staff with stroke expertise (including disciplines such as physiotherapy, occupational therapy, speech-language pathology, nursing, social work, psychology, and recreation therapy);
  - And whose stroke etiology and mechanisms have been clarified and appropriate prevention interventions started (exceptions noted below under 'medically stable').

- Goals for rehabilitation can be established and are specific, measurable, attainable, realistic and timely.
- The patient is **medically stable**:
  - A confirmed diagnosis of stroke has been identified, although the mechanism or etiology may not be initially clear, such as in cryptogenic stroke; these situations should not cause delays in access to rehabilitation;
  - All medical issues and/or co-morbidities (e.g. excessive shortness of breath, and congestive heart failure) are being managed and are not precluding active participation in the rehabilitation program
  - All key medical investigations have been completed **or** scheduled follow-up appointments made by time of discharge from acute care.
- The patient demonstrates the ability to participate, which includes:
  - Stamina to participate in the program demands/schedule;
  - Ability to follow at minimum one-step commands, with communication support if required;
  - Sufficient attention, and short-term memory to progress through rehabilitation process.
- The patient has consented to treatment in the program and demonstrates a willingness and motivation to participate in the rehabilitation program.
- Establish and meet standards for time from receipt of referral to decision regarding intake (suggest 24-48 hours)

#### **General Exclusion Criteria for Stroke Rehabilitation**

- Medically unstable.
- Severe cognitive impairment preventing patient from learning and participating in therapy;
- Behaviour is inappropriate and putting self or others at risk, such as physical and verbal aggression;
- Not willing to participate in program.

#### **DETERMINING IF A PATIENT IS A SUITABLE CANDIDATE FOR OUTPATIENT (HOSPITAL or HOME BASED) REHABILITATION:**

- Patient meets the criteria for rehabilitation candidacy, medical stability, and rehabilitation readiness as defined above.
- The patient's current medical, personal care, or rehabilitation needs can be met in the community.
- The patient can attend therapy alone or if assistance is required a caregiver is available to attend therapy sessions.

#### **Characteristics to Consider in Planning Rehabilitation of Stroke Patients**

##### **Stroke Characteristics:**

- Initial stroke severity
- Location, etiology and type of stroke (ischemic versus hemorrhagic)

- Functional deficits and functional status – using FIM ® Instrument, Alpha FIM ® Instrument scores, Barthel Index, Rankin Score, and/or Iso- Functional Autonomy Measuring System (Iso-SMAF).
- Types of therapy required based on assessment of deficits (e.g., OT, PT, SLP, and others as required)
- Cognitive status – patient is able to learn and actively participate in rehabilitation
- Time from stroke symptom onset.

**Additional Patient Characteristics:**

- Medical stability
- Rehabilitation goals can be identified by patient and/or health care team in order to increase independence in all activities of daily living. Some examples of goals may include: transfer unassisted, walk independently with aids, use involved arm, improve communication skills, and provide personal self-care
- Adequate tolerance and endurance to actively participate in stroke rehabilitation therapy
- Age and pre-stroke frailty
- Existing co-morbidities such as dementia, palliative care status for another medical condition/terminal illness
- Caregiver availability for patients with severe impairment is important

**System Characteristics:**

- Efficient referral process for rehabilitation.
- Rehabilitation professionals knowledgeable about stroke should be responsible for reviewing intake applications.
- Family members and informal caregivers should be included as part of the rehabilitation process, including decisions regarding inpatient and/or outpatient rehabilitation.
- Standards for time from receipt of referral to decision regarding intake (suggest 24-48 hours).
- Available services and resources at different inpatient rehabilitation sites within a geographic region; types and levels of rehabilitation services available at those sites.
- Presence of an early supported discharge (ESD) program and criteria for patient appropriateness for ESD.

**Rationale**

The goal of the first interdisciplinary assessment a patient receives after admission for stroke is to identify impairments in physical, functional, cognitive, and communication functioning which will guide decisions on rehabilitation services and therapies required, and potential discharge needs. Early consultation with rehabilitation professionals enhances the process of discharge planning, whether patients are going to transition from acute care to specialized rehabilitation units or back to the community.

People with stroke express that their experiences with inpatient rehabilitation admission and eligibility assessment reflect what is within these recommendations. However, people with stroke also discuss concerns about the potential for people to be excluded from inpatient rehabilitation based on the criteria presented. It is essential that people with stroke who do not meet the criteria for inpatient rehabilitation are appropriately referred to other services to meet post-stroke rehabilitation needs.

## System Implications

To ensure patients receive timely stroke rehabilitation assessments, the acute care, rehabilitation, and community organizations require:

- An adequate complement of clinicians experienced in stroke and stroke rehabilitation.
- A clear process referral of patients to rehabilitation professionals and programs after acute admission.
- An interdisciplinary team that is resourced to provide prescribed levels of rehabilitation therapy.
- A defined geographic area or unit where individuals with stroke are assured access to an experienced team.
- Standardized, validated, and expert consensus-based screening assessment tools and training.
- A process for timely referral to specialized stroke inpatient services in all centres (for example, electronic referral system and standardized assessment tools).
- Access to a follow-up clinic for secondary stroke prevention to ensure assessment of mild stroke-related difficulties and referral to rehabilitation services and programs when deficits and issues are identified that are amenable to rehabilitation.
- Development or expansion of stroke rehabilitation expertise in children's hospitals and children's treatment centres, as needed; and integration of stroke rehabilitation needs into school supports.
- Mechanisms to periodically re-evaluate those patients with severe stroke who are admitted to nursing homes, continuing care, or other settings to ensure that they have access to rehabilitation as appropriate, if the patient progresses sufficiently and has goals amenable to rehabilitation.
- Coordination and development of strong partnerships in the community, and adequate resources to ensure access to comprehensive stroke rehabilitation. This is especially important in more rural and remote geographic locations where telehealth technologies should be optimized.

## Performance Measures

1. Proportion of stroke patients with a rehabilitation assessment within 48 hours of hospital admission for acute stroke by at least one stroke rehabilitation specialist as appropriate to patient needs (core).
2. Median time from hospital admission for stroke to initial rehabilitation assessment for each of the rehabilitation disciplines (Target is within 48 hours of hospital admission).
3. Proportion of acute stroke patients discharged from acute care to inpatient rehabilitation (core).
4. Percentage of stroke patients discharged to the community who receive a referral for outpatient rehabilitation before discharge from acute and/or inpatient rehabilitation (either facility-based or community- based programs).
5. Median length of time between referral for outpatient rehabilitation and admission to a facility- based or community rehabilitation program.
6. Median length of time between referral for outpatient rehabilitation to commencement of therapy (Target is within 30 days).
7. Percentage of those patients with severe stroke reassessed for rehabilitation following initial assessment within one month, 3 months and six months of index stroke event.
8. Percentage of patients with severe stroke admitted to inpatient rehabilitation (as a change in patterns that may be directly result of implementation of endovascular thrombectomy).

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| <p>9. Percentage of Telehealth/Telestroke coverage to remote communities to support organized stroke care across the continuum, including providing rehabilitation assessments and therapies for stroke patients.</p> <p>10. Number of severe strokes and change in volume potentially as a direct result of EVT</p> |
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**Measurement Notes:**

- Referral information may be found through primary audit of inpatient charts (nurses' notes, discharge summary notes, copies of referral forms) or through databases maintained by organizations that receive and process referrals. These community databases will vary in the amount of information included, and there may be challenges in accessing information contained in these databases.
- Most home care organizations monitor when the first service started but cannot determine easily the onset of rehabilitation therapy.
- For Performance Measure 3, when analyzing these data consider also looking at appropriateness of referral and location of facility.
- Performance Measure 5, the timing being measured is from referral to acceptance into a program, and not specifically the start of therapy (Performance Measure 6 measures time to start of therapy).
- For Performance Measure 7, this reassessment should be done at all transition points and ideally at least monthly thereafter. This includes admission to complex care, long-term care or return to other community setting. The denominator will be a challenge and should be clearly identified and applied consistently by all groups who adopt this measure (e.g., denominator could be all severe stroke patients admitted to a long term care facility).

**Implementation Resources and Knowledge Transfer Tools**

**Health Care Provider Information**

- [Table 1: Stroke Rehabilitation Screening and Assessment Tools \(Appendix Two\)](#)
- FIM® Instrument: <http://www.strokengine.ca/assess/fim/>
- AlphaFIM® Instrument: <https://www.udsmr.org/>
- Iso-SMAF: <http://www.demarchesmaf.com/en/>
- Modified Rankin Scale: [http://strokengine.ca/assess/module\\_mrs\\_family-en.html](http://strokengine.ca/assess/module_mrs_family-en.html)
- Evidence-Based Review of Stroke Rehabilitation (Triage Module):  
<http://www.ebrsr.com/evidence-review/4-managing-stroke-rehabilitation-triage-process>
- Aphasia United Best Practice Recommendations: <http://www.aphasiaunited.org/best-practice-recommendations/>
- Aphasia Institute: <http://www.aphasia.ca/home-page/health-care-professionals/>
- Stroke Engine: <http://www.strokengine.ca/>

**Information for People with Stroke, their Families and Caregivers**

- Rehabilitation and Recovery infographic: Guide to taking charge of your stroke recovery:  
<https://www.heartandstroke.ca/-/media/1-stroke-best-practices/rehabilitation-nov2019/csbp-infographic-rehabilitation.ashx>

- Transitions and community participation infographic: Guide to taking charge of your stroke recovery: <https://www.heartandstroke.ca/-/media/1-stroke-best-practices/transition-of-care-nov2019/csbp-infographic-transitions-and-participation.ashx>
- Post Stroke Checklist: <https://www.strokebestpractices.ca/resources/patient-resources>
- Living with Stroke Program: <https://www.heartandstroke.ca/stroke/recovery-and-support/living-with-stroke>
- Stroke Resources Directory: <https://www.heartandstroke.ca/services-and-resources>
- Your Stroke Journey: <https://www.strokebestpractices.ca/-/media/1-stroke-best-practices/resources/patient-resources/en-your-stroke-journey-v21.ashx>
- Stroke Engine: <http://www.strokengine.ca/>
- Heart and Stroke Foundation Canadian Partnership for Stroke Recovery: <https://www.canadianstroke.ca/>

## Summary of the Evidence

Comprehensive assessment of a patient's cognitive and functional status conducted within the first few days following a stroke is essential to guide the development of individualized care plans. These assessments should be conducted using a standardized approach with validated tools. Areas of evaluation should include a person's ability to perform basic self-care activities (such as dressing, grooming, personal hygiene, feeding, functional mobility and communication) and instrumental activities of daily living (including meal preparation, home management, communication activities, financial management, shopping and community living skills).

Admission to an interprofessional program should be limited to patients who have more than one type of disability and who, require the services of two or more rehabilitation disciplines. Patients with a single disability can usually benefit from outpatient or community-based services, and generally do not require an interprofessional program. Hakkennes et al. (2013) surveyed 14 clinicians responsible for assessing the suitability of patients for inpatient rehabilitation. A questionnaire was administered to assess factors that were used to assess a patient's suitability for rehabilitation. Potentially relevant items included 15 patient-related factors (e.g. age, pre-morbid mobility) and 2 organization factors (bed availability and funding source). Using data from 8,783 Veterans admitted to a Veterans Affairs Medical Center with a primary diagnosis of stroke, Stineman et al. (2013) reported that 11.2% of veterans were selected for comprehensive-level rehabilitation. Patients at the lowest grades of physical independence and the middle cognitive stages had significantly higher odds of admission to a comprehensive rehabilitation unit. Other independent factors associated with higher odds of admission for comprehensive rehabilitation included patients who were age <70 years, married, living at home pre-stroke and the presence of a comprehensive rehabilitation unit at admitting hospital. In the CERISE study (Putman et al. 2007), the presence of pre-morbid cognitive disability, depression and severe behavioral problems were identified as factors where the probability of being admitted for inpatient rehabilitation was lowered.

**Initial Stroke Rehabilitation Assessment Evidence Tables and Reference List available at [www.strokebestpractices.ca](https://www.strokebestpractices.ca)**

## Section 2: Stroke Rehabilitation Unit Care

### Recommendations

#### 2.1 Stroke Rehabilitation Unit Care

- i. All people who require inpatient rehabilitation following stroke should be treated on a specialized stroke rehabilitation unit [Evidence Level A], characterized by the following elements:
  - a. Rehabilitation care is formally coordinated and organized [Evidence Level A].
  - b. The rehabilitation unit is geographically defined [Evidence Level A].
  - c. The rehabilitation unit is staffed by an interdisciplinary rehabilitation team with expertise/core training in stroke rehabilitation consisting of physicians (i.e., physiatrist, neurologist, or other physicians with training in stroke rehabilitation), nurses, physiotherapists, occupational therapists, speech-language pathologists, social workers, and clinical dietitians [Evidence Level A].
  - d. Additional members of the interdisciplinary team may include pharmacists, transition planners, (neuro) psychologists, palliative care specialists, recreation and vocational therapists, kinesiologists, therapy assistants, spiritual care providers, peer supporters and stroke recovery group liaisons [Evidence Level C].
  - e. People who have experienced a stroke, their families and caregivers should have early and active involvement in the rehabilitation process [Evidence Level B].
  - f. The interdisciplinary rehabilitation team follows evidence-based best practices as defined by current consensus-based clinical practice guidelines [Evidence Level B].
  - g. Transition and discharge planning is initiated on admission to the unit [Evidence Level B]. *Refer to [CSBPR Transitions and Community Participation module, Section 3](#) for additional information on care planning.*
  - h. Education for the person who experienced a stroke, the family and caregivers is provided both formally and informally, with consideration given to individual and group settings as appropriate [Evidence Level A]. *Refer to the [CSBPR Transitions and Community Participation module, Section 2](#) for additional information on education following stroke.*
    - i. All team members should be trained and capable of interacting with people with communication limitations such as aphasia, by using supported conversation techniques [Evidence Level C].
- ii. People who have experienced a moderate or severe stroke, who are ready for rehabilitation and have goals amenable to rehabilitation, should be given an opportunity to participate in inpatient stroke rehabilitation [Evidence Level A].
- iii. Where admission to a stroke rehabilitation unit is not possible, inpatient rehabilitation provided on a general rehabilitation unit is the next best alternative (i.e., where interdisciplinary care is provided to patients disabled by a range of disorders including stroke), where a physiatrist, occupational therapist, physiotherapist and speech-language pathologist are available on the unit or by consultation [Evidence Level B].
  - a. Patients treated on general rehabilitation units should receive the same levels of care and interventions as patients treated on stroke rehabilitation units, as described in section 2.1 (I and ii).

## 2.2 Stroke Rehabilitation Team:

*Note: Applicable for all stroke rehabilitation settings (acute care hospital, outpatient clinic, community-based services and programs)*

- 2.2 Stroke rehabilitation should be delivered by an interdisciplinary team of health professionals, experienced in providing post-stroke care, regardless of where services are provided, to ensure consistency and reduce the risk of complications [Evidence Level B].
- i. The interdisciplinary rehabilitation team should assess patients within 48 hours of admission and together with the patient and family develop and document a comprehensive individualized rehabilitation plan which reflects the severity of the stroke and the needs and goals of the patient, the best available research evidence, and clinical judgment [Evidence Level C].
  - ii. Stroke unit teams should conduct at least one formal interdisciplinary meeting per week to identify ongoing or new rehabilitation problems, set goals, monitor progress, and plan discharge for patients on the unit [Evidence Level B]. Individualized rehabilitation plans should be regularly updated based on review of patient status [Evidence Level C].
  - iii. Clinicians should consider use of standardized, valid assessment tools to evaluate the patient's stroke-related impairments, functional activity limitations, and role participation restrictions. Tools should be adapted for use in patients with communication limitations due to aphasia [Evidence Level C]. *Refer to Appendix Two, Table 1: Stroke Rehabilitation Screening and Assessment Tools.*
  - iv. Personal factors (such as coping) and environmental factors could also be considered. [Evidence Level C].

### Rationale

There is strong and compelling evidence in favour of admitting patients with moderate and severe stroke to a geographically defined stroke rehabilitation unit staffed by an interdisciplinary team. Death and disability are reduced when post-acute stroke patients receive coordinated, interdisciplinary evaluation and intervention on a stroke rehabilitation unit. For every 100 patients receiving organized inpatient interdisciplinary rehabilitation, an extra five return home in an independent state (Stroke Unit Trialists' Collaboration, 1997).

### System Implications

To ensure patients receive best practice stroke rehabilitation care, health systems funders and organizations must plan for:

- Timely access to specialized inpatient stroke rehabilitation services.
- An adequate number of geographically defined stroke rehabilitation units with a critical mass of trained staff with expertise in stroke rehabilitation interdisciplinary team care during the rehabilitation period following stroke.
- Resources to enable patient access to appropriate type and intensity of rehabilitation professionals throughout their stay (including weekends when required).
- Protocols and strategies to prevent complications and the recurrence of stroke developed and communicated to all staff.
- System and process changes to allow therapists to ensure effective therapist to patient ratios in rehabilitation settings, with the goal of therapists spending approximately 80% of their time providing direct care to patients.

Performance Measures
<ol style="list-style-type: none"><li>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).</li><li>2. Final discharge disposition for stroke patients 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; percentage of patients discharged back to the community who were residing in a community setting prior to their stroke (core).</li><li>3. Number of stroke patients assessed by a physiotherapist, occupational therapist, speech-language pathologist, dietitian, and social workers during inpatient rehabilitation.</li><li>4. Proportion of total time during inpatient rehabilitation following an acute stroke event that is spent on a stroke rehabilitation unit.</li><li>5. Frequency, duration and intensity of therapies received from rehabilitation professionals while in an inpatient rehabilitation setting following stroke.</li><li>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.</li></ol>
<b>Measurement Notes:</b> <ul style="list-style-type: none"><li>• Performance measure 1: The denominator should be the total number of stroke patients admitted to inpatient rehabilitation.</li><li>• Performance measure 2: Data should be correlated with stroke severity scores during analysis.</li><li>• To determine the duration and intensity of services by rehabilitation professionals, a chart review is required or the availability of consistent use of reliable workload measurement tools that are implemented locally or regionally.</li></ul>
Implementation Resources and Knowledge Transfer Tools
<b>Health Care Provider Information</b> <ul style="list-style-type: none"><li>• <a href="#">Table 1: Stroke Rehabilitation Screening and Assessment Tools (Appendix Two)</a></li><li>• FIM® Instrument: <a href="http://www.strokengine.ca/assess/fim/">http://www.strokengine.ca/assess/fim/</a></li><li>• AlphaFIM® Instrument: <a href="https://www.udsmr.org/">https://www.udsmr.org/</a></li><li>• Iso-SMAF: <a href="http://www.demarchesmaf.com/en/">http://www.demarchesmaf.com/en/</a></li><li>• Modified Rankin Scale: <a href="http://strokengine.ca/assess/module_mrs_family-en.html">http://strokengine.ca/assess/module_mrs_family-en.html</a></li><li>• Evidence-Based Review of Stroke Rehabilitation (Triage Module): <a href="http://www.ebrsr.com/evidence-review/4-managing-stroke-rehabilitation-triage-process">http://www.ebrsr.com/evidence-review/4-managing-stroke-rehabilitation-triage-process</a></li><li>• Aphasia United Best Practice Recommendations: <a href="http://www.aphasiaunited.org/best-practice-recommendations/">http://www.aphasiaunited.org/best-practice-recommendations/</a></li><li>• Australian Aphasia Rehabilitation Pathway: <a href="http://www.aphasiopathway.com.au/?name=About-the-statements">http://www.aphasiopathway.com.au/?name=About-the-statements</a></li><li>• Aphasia Institute: <a href="http://www.aphasia.ca/home-page/health-care-professionals/">http://www.aphasia.ca/home-page/health-care-professionals/</a></li><li>• Stroke Engine: <a href="http://www.strokengine.ca/">http://www.strokengine.ca/</a></li></ul>

### Information for People with Stroke, their Families and Caregivers

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- Transitions and community participation infographic: Guide to taking charge of your stroke recovery: <https://www.heartandstroke.ca/-/media/1-stroke-best-practices/transition-of-care-nov2019/csbp-infographic-transitions-and-participation.ashx>
- Aphasia Institute: <http://www.aphasia.ca/people-with-aphasia-and-families/>
- Post Stroke Checklist: <https://www.strokebestpractices.ca/resources/patient-resources>
- Living with Stroke Program: <https://www.heartandstroke.ca/stroke/recovery-and-support/living-with-stroke>
- Stroke Resources Directory: <https://www.heartandstroke.ca/services-and-resources>
- Your Stroke Journey: <https://www.strokebestpractices.ca/-/media/1-stroke-best-practices/resources/patient-resources/en-your-stroke-journey-v21.ashx>
- Stroke Engine: <http://www.strokengine.ca/>
- Heart and Stroke Foundation Canadian Partnership for Stroke Recovery: <https://www.canadianstroke.ca/>

### Summary of the Evidence

It is now well-established that patients who receive stroke unit care are more likely to survive, return home, and regain independence compared to patients who receive less organized forms of care. Stroke unit care is characterized by an experienced interdisciplinary stroke team, including physicians, nurses, physiotherapists, occupational therapists, speech therapists, among others, dedicated to the management of stroke patients, often located within a geographically defined space. Other features of stroke units include staff members who have an interest in stroke, routine team meetings, continuing education/training, and involvement of caregivers in the rehabilitation process. In an updated Cochrane Review, the Stroke Unit Trialists' Collaboration (2013) identified 28 randomized and quasi-randomized trials ( $n=5,855$ ) comparing stroke unit care with alternative, less organized care (e.g., an acute medical ward). The different forms of rehabilitation services varied and included acute, intensive and semi-intensive models, comprehensive models, which combined acute and rehabilitation services, comprehensive stroke units that integrated Traditional Chinese Medicine, stroke rehabilitation units (with post-acute transfer to a separate unit or facility), mobile stroke units and mixed rehabilitation units, where patients with other neurological conditions are admitted. The majority of trials in this updated review compared stroke wards with general medical wards. Overall, compared to less organized forms of care, stroke unit care was associated with a significant reduction in the odds of death ( $OR=0.81$ , 95% CI 0.69 to 0.94,  $p = 0.005$ ), death or institutionalization ( $OR=0.78$ , 95% CI 0.68 to 0.89,  $p = 0.0003$ ), and death or dependency ( $OR=0.79$ , 95% CI 0.68 to 0.90,  $p = 0.0007$ ) at a median follow-up period of one year. Based on the results from a small number of trials, the authors also reported that the benefits of stroke unit care are maintained for periods up to 5 and 10 years post stroke. Moreover, subgroup analyses demonstrated benefits of stroke unit care regardless of sex, age, or stroke severity.

In subgroup analysis of 3 trials that compared stroke rehabilitation units versus an alternative service, the odds of death at end of follow-up were reduced significantly ( $OR=0.51$ , 95% CI 0.29-0.90,  $p=0.019$ ), while the odds of death or institutionalization dependency, death or dependency and hospital LOS, were not reduced. In another systematic review, Foley et al. (2007) examined the effectiveness of 3 different models of stroke rehabilitation including acute stroke unit care, comprehensive models and stroke rehabilitation units. Using data from the 5 studies that compared stroke rehabilitation unit care with either general medical ward or community-based care, post-acute rehabilitation stroke units were associated with reduced odds of death ( $OR=0.60$ , 95% CI 0.44 to 0.81,  $p<0.05$ ) and death or

dependency (OR=0.63, 95% CI 0.48 to 0.83, p<0.05), but without a significant reduction in hospital LOS.

To determine if the benefits of stroke unit care demonstrated in clinical trials can be replicated in routine clinical practice, Seenan et al. (2007) conducted a systematic review of 25 observational studies (n=42,236) comparing stroke unit care to non-stroke unit care. In most cases, studies compared acute stroke units with conventional care. Stroke unit care was associated with a reduction in the risk of death (OR=0.79, 95% CI 0.73 to 0.86, p<0.001) and of death or poor outcome (OR=0.87, 95% CI=0.80 to 0.95; p=0.002) within one-year of stroke. Similar findings were reported for the outcome of death at one year in a secondary analysis limited to multi-centered trials (OR=0.82, 95% CI 0.77 to 0.87, p<0.001).

**Stroke Rehabilitation Unit Care Evidence Tables and Reference List available at**  
**[www.strokebestpractices.ca](http://www.strokebestpractices.ca)**

## Section 3: Delivery of Inpatient Stroke Rehabilitation

### Recommendations

- i. All patients with stroke should receive rehabilitation therapy as early as possible once they are medically stable and able to participate in active rehabilitation [Evidence Level A]. [Refer to Section One, Box One: Eligibility and Criteria for Stroke Rehabilitation for more information.](#)
- ii. **Early prolonged mobilization** of patients within the first few days after a stroke, especially a severe stroke, is not recommended (Evidence Level A).
- iii. **Earlier mobilization** may be reasonable for select patients with acute stroke (for instance people with more mild strokes or transient ischemic attack) but caution is advised, and clinical judgement should be used (Evidence Level C)
- iv. Once deemed to be medically and neurologically stable, patients should receive a recommended three hours per day of direct task-specific therapy, five days a week, delivered by the interdisciplinary stroke team [Evidence Level C]; more therapy results in better outcomes [Evidence Level A].
- v. **Individualized rehabilitation plans** should include a patient-centered approach, shared decision-making, culturally appropriate and agreed-upon goals and preferences of the patient, family, caregivers and the healthcare team [Evidence Level C].
- vi. Patients should receive rehabilitation therapies of appropriate intensity and duration, individually designed to meet their needs for optimal recovery and tolerance levels [Evidence Level A].
- vii. Therapy should include repetitive and intense use of patient-valued tasks that challenge the patient to acquire the necessary skills needed to perform functional tasks and activities [Evidence Level A].
- viii. The team should promote the practice and transfer of skills gained in therapy into the patient's daily routine during inpatient stay [Evidence Level A] and continue after discharge to the community [Evidence Level C].
- ix. A pre-transition (discharge to another setting) needs assessment should be conducted to ensure a smooth transition from rehabilitation back to the community [Evidence level B].
- x. Elements of **transition planning** may include:
  - a. A home visit by a healthcare professional, ideally conducted before discharge, for patients where the stroke rehabilitation team and/or family have concerns regarding changes in functional, communication and/or cognitive abilities that may affect patient safety [Evidence Level C].
  - b. Assessment of the safety of the patient's home environment and the need for equipment and home modification [Evidence Level C].
  - c. Caregiver education, training and access to resources to assist the patient with activities of daily living and increase the patient's level of independence [Evidence Level B].
- xi. Patients in stroke rehabilitation should be considered for referral to transition planners (such as stroke navigators) where these roles are available [Evidence Level B]. [Refer to CSBPR Transitions and Community Participation following Stroke module for additional information.](#)

## Rationale

In order to obtain maximum benefit from inpatient stroke rehabilitation, a number of essential elements are required. These elements include adequate intensity of therapy, task-oriented training, excellent team coordination and early discharge planning. Both animal and human research suggests that the earlier rehabilitation starts, the better the outcome. Early, intensive rehabilitation care for patients in both the acute and subacute stage of stroke helps to improve arm and leg motor recovery, language and communication function, which in turn improves mobility, independence in self-care and participation in leisure activities. It is important that the rehabilitation therapies be tailored to the tasks that need to be retrained and developed, as well as to the activities of the patient's choice and to their social roles. The need for a highly-coordinated, specialized team, who meet regularly to discuss the rehabilitation goals and progress, is also vital. Early discharge planning, including a home assessment and caregiver training, support and education, is required to identify and remove potential barriers to discharge and facilitate efficient transition back to the community.

People with stroke, their families and caregivers state that they really appreciate being regularly informed about their care, including the assessment tools, timelines and decision-making regarding specialist referrals.

Feedback received from people with stroke emphasized the need for support and guidance as they navigate the health care system following release from hospital. Dedicated staff members, such as stroke navigators, was considered valuable by people with stroke and family members and perceived to aid the recovery process. During the inpatient stay, people with stroke often feel the meetings regarding their care could be intimidating and stated that a dedicated staff member to support them at this stage would be helpful and improve their experience. They also note that having a peer mentor who has also experienced a stroke as an asset, specifically one that they are connected to from the beginning of their inpatient admission.

An individualized approach that focused on self-management was important to people with stroke, including inclusion of family members into therapy sessions. Teaching the family members and caregivers how to safely support and engage in exercise therapy is an important aspect of self management outside the hospital.

People with stroke have reported that the return back home after inpatient rehabilitation can be overwhelming. One step in preparing for this transition could include meeting with appropriate therapists to support the physical, emotional and mental transition, anticipating potential challenges and planning ahead for solutions

## System Implications

Working together to achieve optimal functional outcomes after stroke requires the health system and organizations to ensure:

- Timely access to specialized, interdisciplinary stroke rehabilitation services, regardless of geographic location of the patients' home community and the patient's financial means.
- A critical mass of trained healthcare providers functioning as a coordinated team during the rehabilitation period following stroke.
- Adequate clinician resources to provide the recommended intensity of individualized therapies for stroke patients. Current estimates suggest the ratio of patients to therapists should be no more than 6:1 in order to achieve these targets.
- Establishment of protocols and partnerships between inpatient rehabilitation and community care providers to ensure safe and efficient transitions between hospital and community. Particular considerations should be made for patients residing in more rural or remote locations.

- Communication strategies to facilitate the sharing of all information concerning the patient, including assessments, rehabilitation goals and results between healthcare providers and settings.
- Access to all stroke rehabilitation services for patients who have communication limitations such as aphasia.
- Optimization of strategies to prevent the recurrence of stroke through health promotion and education.
- Stroke rehabilitation support initiatives for caregivers to increase patient/caregiver understanding of rehabilitation plans and improve adherence.
- Processes for patients and caregivers to re-access the rehabilitation system as required. Financial barriers should not limit access to rehabilitation services.
- All rehabilitation hospital services have mechanisms established to contribute to the CIHI National Rehabilitation Reporting System.

## Performance Measures

1. Median length of time from stroke admission to an acute care hospital to assessment of rehabilitation potential by a rehabilitation healthcare professional.
2. Median length of time from stroke onset to stroke rehabilitation referral.
3. Median length of time from stroke rehabilitation referral to and admission to stroke inpatient rehabilitation.
4. Percentage of stroke patients who are discharged from acute care without rehabilitation referrals in place.
5. 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) (core).
6. Final discharge disposition for stroke patients following inpatient rehabilitation: percentage discharged to their original place of residence, percentage discharged to a long-term care facility or nursing home, percentage discharged to supportive housing or assisted living (core).
7. Percentage of patients requiring readmission to an acute care hospital for stroke-related causes (core).
8. Median length of time spent on a stroke rehabilitation unit during inpatient rehabilitation.
9. Average number of days spent in active rehabilitation (i.e., length of stay less days unable to participate due to service interruptions, such as illness or short-term readmission to acute care).
10. Median number of days spent waiting for transfer to an inpatient rehabilitation setting (i.e. from the time a patient is ready for rehabilitation to the time of admission to inpatient rehabilitation).
11. Change (improvement) in functional status scores using a standardized assessment tool from admission to an inpatient rehabilitation program to discharge (e.g., FIM® Instrument, AlphaFIM®, Modified Rankin Scale).
12. Median number of hours of direct therapy for each type of service received while in inpatient rehabilitation.
13. Total number of days spent in inpatient rehabilitation, by stroke type.
14. Number of patients screened for cognitive impairment using valid screening tool during inpatient rehabilitation.
15. Number of patients screened for depression using valid screening tool during inpatient rehabilitation.

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| <p>16. Time from stroke onset to mobilization: sitting, standing upright, and walking with or without assistance.</p> <p>17. Time from stroke onset to independence in feeding, dressing, grooming, toileting and bathing and other self-care.</p> <p>18. Median number of days spent in alternate level of care or inpatient rehabilitation while waiting for return to home or placement in a residential or long-term care setting.</p> |
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**Measurement Notes:**

- Some acute care hospitals provide combined acute and rehabilitation stroke units, where patients progress to being ready to start rehabilitation, and may not actually move beds, or change locations. This information could be found in patient records through primary chart audit.
- Many performance measures require primary chart audit of inpatient rehabilitation records. Quality of documentation (good or poor) by rehabilitation staff will impact validity of these measures.
- The Canadian Institute for Health Information has a database known as the National Rehabilitation Reporting System. This database includes data on inpatient rehabilitation encounters to designated rehabilitation beds. It is mandated in some provinces to submit data to the National Rehabilitation Reporting System; in other provinces, it is optional. The National Rehabilitation Reporting System (NRS) has information on an estimated 80% of all inpatient rehabilitation encounters in Canada and can distinguish stroke cases from other rehabilitation patients by diagnosis.
- Duration or intensity of services by rehabilitation professionals requires a chart review or consistent use of reliable workload measurement tools implemented locally or regionally.
- For performance measure 2, efforts should be made to collect information on reasons for delay, if any, in admission to inpatient rehabilitation from acute care. These may include such issues as bed availability, patient health status and other aspects of the referral and transfer process. This information may provide direction on areas to target quality improvement initiatives.
- Workload measurement systems are a key source of data and information on intensity and frequency of services, but these are not consistently or widely implemented in Canada. Use of such systems should be encouraged in addition to the NRS.
- Performance measures 8 and 9 can be combined to calculate a FIM® efficiency value: Change in FIM® score from admission to discharge/total days in stroke rehabilitation.

**Implementation Resources and Knowledge Transfer Tools**

**Health Care Provider Information**

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- Modified Rankin Scale: [http://strokengine.ca/assess/module\\_mrs\\_family-en.html](http://strokengine.ca/assess/module_mrs_family-en.html)
- Evidence-Based Review of Stroke Rehabilitation (Triage Module): <http://www.ebrsr.com/evidence-review/4-managing-stroke-rehabilitation-triage-process>
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### Information for People with Stroke, their Families and Caregivers

- Rehabilitation and Recovery infographic: Guide to taking charge of your stroke recovery: <https://www.heartandstroke.ca/-/media/1-stroke-best-practices/rehabilitation-nov2019/csbp-infographic-rehabilitation.ashx>
- Transitions and community participation infographic: Guide to taking charge of your stroke recovery: <https://www.heartandstroke.ca/-/media/1-stroke-best-practices/transition-of-care-nov2019/csbp-infographic-transitions-and-participation.ashx>
- Aphasia Institute: <http://www.aphasia.ca/people-with-aphasia-and-families/>
- Post Stroke Checklist: <https://www.strokebestpractices.ca/resources/patient-resources>
- Living with Stroke Program: <https://www.heartandstroke.ca/stroke/recovery-and-support/living-with-stroke>
- Stroke Resources Directory: <https://www.heartandstroke.ca/services-and-resources>
- Your Stroke Journey: <https://www.strokebestpractices.ca/-/media/1-stroke-best-practices/resources/patient-resources/en-your-stroke-journey-v21.ashx>
- Stroke Engine: <http://www.strokengine.ca/>
- Heart and Stroke Foundation Canadian Partnership for Stroke Recovery: <https://www.canadianstroke.ca/>

### Summary of the Evidence

#### Early mobilization

Early mobilization post stroke is intended to reduce the risk of medical complications including deep vein thrombosis, pressure sores, painful shoulders, and respiratory infections. The potential benefits of early mobilization have been examined in several RCTs, with ambiguous results. One of the potential sources of variability, which may account for conflicting results, is the difference in the definitions of early mobilization. Early mobilization was defined as early as 12 hours following stroke to as long as 52 hours, while patients in the delayed group were mobilized from time periods ranging from 48 hours to 7 days. Small sample sizes (i.e. under-powered samples sizes) may also have contributed to null findings. In the Akerhus Early Mobilization in Stroke Study (AKEMIS), 65 patients were randomized to a very early mobilization (VEM) group or to a control group following ischemic or hemorrhagic stroke (Sundseth et al. 2012). Patients in both groups received standard stroke unit care. Patients in the VEM group were mobilized as soon as possible (within 24 hours post stroke), while patients in the control group were mobilized between 24 and 48 hours. The median time to first mobilization from stroke onset was significantly shorter for patients in the VEM group (13.1 vs. 33.3 hrs, p<0.001); however, there were no significant differences between groups on any of the outcomes of interest, including poor outcome at 3 months (mRS score of 3-6), death or dependency, dependency, or number of complications at 3 months. Diserens et al. (2011) randomized 50 patients with ischemic stroke to either an “early mobilization” group who were mobilized out of bed after 52 hours or to a “delayed mobilization” group where patients were mobilized after 7 days. While there were significantly fewer severe complications among patients in the early mobilization group (8% vs. 47%, p < 0.006), there were no significant differences between groups in the numbers of minor complications, neurological deficits, or blood flow modifications.

Several publications are associated with the A Very Early Rehabilitation Trial for Stroke (AVERT) trial. The safety and feasibility of an early mobilization intervention was first established by Bernhardt et al. (2008) in Phase I, in which 71 patients were randomized to receive either very early and frequent mobilization (upright, out of bed, activity – 2x/day, for 6 days a week until discharge beginning within 24 hours of stroke), or usual multi-disciplinary stroke team care. There was a non-significant increase in the number of patient deaths in the early mobilization group at 3 months (21% vs. 9%, absolute risk difference = 12.0%, 95% CI, 4.3% to 28.2%, p=0.20). After adjusting for age, baseline NIHSS score and premorbid mRS score, the odds of experiencing a good outcome were significantly higher at 12 months for the very early mobilization (VEM) group (OR= 8.15, 95% CI 1.61-41.2, p<0.01), although

not at 3 or 6 months. In AVERT II, examining medical complications associated with VEM, Sorbello et al. (2009) reported there were no differences in the total number of complications between groups. Severe complications or stroke-related complications occurred in 91 patients in the control group compared with 87 in the VEM group. Cumming et al. (2011) reported that patients in the VEM group returned to walking significantly sooner than patients in the standard care group (median of 3.5 vs. 7.0 days,  $p=0.032$ ). While there were no differences between groups in proportions of patients who were independent in ADL, or who experienced a good outcome at either 3 or 12 months, VEM group assignment was a significant, independent predictor of independence in ADL at 3 months and of good outcome at both 3 and 12 months.

Pooling the results from both the AVERT and VERITAS trials, which used similar protocols for early mobilization, Craig et al. (2010) reported that, compared with patients receiving standard care, patients in the VEM group were more likely to be independent in activities of daily living at 3 months ( $OR= 4.41$ , 95% CI 1.36-14.32), and were less likely to experience immobility related complications ( $OR= 0.20$ , 95%CI 0.10-0.70). The most recent replication of AVERT examined the effectiveness of a protocol of more intensive, early out-of-bed activity. Bernhardt et al. (2015) randomized 2,104 adults (1:1) to receive early mobilization, a task-specific intervention focused on sitting, standing, and walking activity, initiated within 24 hours of stroke onset, or to usual care for 14 days, or until hospital discharge. The median time to first mobilization was significantly earlier in the early mobilization group (18.5 vs. 22.4 hrs,  $p<0.0001$ ). Patients in the early mobilization group received significantly more out of bed sessions (median of 6.5 vs. 3,  $p<0.0001$ ) and received more daily therapy (31 vs. 10 min,  $p<0.0001$ ). However, significantly fewer patients in the early mobilization group had a favourable outcome, the primary outcome, defined as mRS 0-2, at 3 months (46% vs. 50%; adjusted  $OR=0.73$ , 95% CI 0.59-0.90,  $p=0.004$ ). There were no significant differences between groups for any of the secondary outcomes (shift in distribution of mRS, time to achieve assisted-free walking over 50m, proportion of patients able to walk unassisted at 3 months, death or serious adverse events), nor were any interactions identified based on pre-specified sub groups for the primary outcome (age, stroke type, stroke severity, administration of t-PA, or geographical region of recruitment). Further analysis of AVERT data (Bernhardt et al. 2016), controlling for age and stroke severity, suggested that shorter, more frequent mobilization early after acute stroke was associated with improved odds of favorable outcome at 3 months, while increased amount (minutes per day) of mobilization reduced the odds of a good outcome.

Finally, in a recent systematic review (Li et al. 2018), the results from 6 RCTs including AVERT and AKEMIS, were pooled. At 3 months, there was no significant difference between groups in the proportion of patients with an mRS score of 0-2, although early mobilization was associated with higher Barthel Index scores at 3 months ( $SMD=0.66$ , 95% CI 0.0-1.31) and a significantly reduced LOS ( $WMD=-1.97$ , 95% CI -2.63 to -1.32).

### Intensity

Adequate intensity of therapy is another important element associated with successful inpatient rehabilitation outcomes. An early systematic review of the effects of intensive rehabilitation interventions (Kwakkel et al. 1997) suggested that greater treatment intensity was associated with significantly higher ADL scores ( $ES=0.28$ , 95% CI 0.16-0.41), and better neuromuscular outcomes ( $ES=0.37$ , 95% CI 0.13-0.62), but not better functional outcome ( $ES=0.10$ , 95% CI -0.10 to 0.30). Several studies since then have found a similar positive relationship between therapy intensity and patient outcomes. Wang et al. (2013) reviewed the charts of 360 patients who were discharged from an inpatient rehabilitation facility following a stroke and found that more than 3 hours of daily total combined therapy time from a physiotherapist (PT), occupational therapist (OT) and speech language pathologist (SLP) was associated with improved functional outcomes when compared to patients receiving less than 3 hours of therapy. Controlling for age, sex, comorbidities, and total baseline motor and cognition scores, patients who received a total therapy time of  $<3.0$  hours per day had significantly lower total FIM gains compared with those treated for  $\geq 3.0$  hours per day. In another retrospective study, Foley et al (2012) found that in a multivariate model, including daily time spent in physiotherapy, occupational therapy (OT) and speech-language pathology, only total OT time and total FIM at admission were significant predictors of total FIM gain. The prospective study, Post-Stroke Rehabilitation Outcomes Project (Horn et al. 2005), included a cohort of 830 patients with moderately,

or severely-disabling stroke. The authors found that more intensive therapy (based on number of minutes of therapy per day) and more intensive therapy in the early stages (first therapy session) were associated with higher discharge FIM scores. These findings applied to patients with both moderate and severe strokes.

In a more recent systematic review of trials comparing additional dose of rehabilitation interventions vs. standard amount of the same rehabilitation interventions, aimed at improving upper or lower activity, or both, Schneider et al. (2016) reported that the immediate effect of additional rehabilitation was significantly improved measures of activity ( $SMD=0.39$ , 95% CI 0.07-0.71,  $p=0.02$ ). Small increases in additional therapy were not associated with significant improvement in measures of activity, while large increases were.

**Delivery of Inpatient Stroke Rehabilitation Evidence Tables and Reference List available at**  
**[www.strokebestpractices.ca](http://www.strokebestpractices.ca)**

## Section 4: Outpatient and In-Home Stroke Rehabilitation (including Early Supported Discharge)

### Recommendations

#### 4.1 Outpatient & In-Home Rehabilitation

- i. Following stroke, people with ongoing rehabilitation goals should continue to have access to specialized stroke services after leaving hospital [Evidence Level A].
  - a. This should include facility-based outpatient services and/or in-home rehabilitation services [Evidence Level A].
- ii. Outpatient and/or in-home rehabilitation services should be provided by specialized interdisciplinary team members as appropriate to patient needs and in consultation with the patient and family [Evidence Level C].
  - a. Services should ideally begin within 48 hours of discharge from an acute hospital or within 72 hours of discharge from inpatient rehabilitation [Evidence Level C].
- iii. The choice of setting for outpatient and/or in-home rehabilitation service delivery should be based on patient functional rehabilitation needs, participation-related goals, availability of family/social support, patient and family preferences [Evidence Level C].
  - a. Patients and families should be involved in their management, goal setting, and transition planning [Evidence Level A].
- iv. Outpatient and/or in-home rehabilitation services should include the same elements as coordinated inpatient rehabilitation services [Evidence Level B], and include:
  - a. An interdisciplinary stroke rehabilitation team [Evidence Level A].
  - b. A case coordination approach including regular team communication to discuss assessment of new clients, review client management, goals, and plans for discharge or transition [Evidence Level B].
  - c. Therapy provided for a minimum of 45 minutes per day [Evidence Level B] per required discipline, 2 to 5 days per week, based on individual patient needs and goals [Evidence Level A]; ideally for at least 8 weeks [Evidence Level C].
  - d. Interprofessional care planning and communication is essential to ensure continuity of care, patient safety, and to reduce risk of complications and adverse events during stroke care particularly at transition points. [Evidence Level C]. Refer to [Transitions and Community Participation Module, Section 3](#) for more information.
- v. At any point in their recovery, people with stroke who have experienced a change in functional status and who would benefit from additional rehabilitation services should be offered a further period of outpatient rehabilitation if they meet the requirements outlined in [Box One: Eligibility and Criteria for Stroke Rehabilitation](#) [Evidence Level B].

#### 4.2 Early Supported Discharge (ESD)

- i. Early supported discharge services, designed to reduce length of hospital stay and still provide same intensity of inpatient rehabilitation, are an acceptable form of rehabilitation and should be offered to a select group of patients when available and provided by a well-resourced, coordinated specialized team [Evidence Level A].
- ii. Criteria for ESD candidacy include:
  - a. Mild to moderate disability [Evidence Level A];

- b. Ability to participate in rehabilitation from the point of discharge [Evidence Level A];
  - c. Medically stable, availability of appropriate nursing care, necessary resources and support services (e.g., family, caregivers, and home care services) [Evidence Level A].
- iii. ESD services should be provided within 48 hours of discharge from an acute hospital or within 72 hours of discharge from inpatient rehabilitation [Evidence Level C].
  - iv. Services should be provided five days per week at the same level of intensity as they would have received in the inpatient setting to meet patient needs [Evidence Level B]. *Refer to Section 3 for more information.*
    - a. Where possible, it should be provided by the same team that provided inpatient rehabilitation to ensure smooth transition [Evidence Level A]
    - b. Where different therapists are providing the home-based rehabilitation, close communication with the hospital-based rehabilitation team is important during the transition and processes to facilitate communication should be implemented [Evidence Level C].

## Rationale

Some patients with mild impairments can be safely transferred back to their homes to continue their rehabilitation and achieve outcomes that are as good as or better than those that would have been attained had they remained in hospital. This form of service provision, known as early-supported discharge (ESD) may be desirable where resources exist and may have the added benefit of being less costly.

Many patients who have completed a course of inpatient rehabilitation will still require ongoing therapy provided in the community to achieve their desired goals once discharged from hospital. Community-based rehabilitation may be defined as care received once the patient has passed the acute stage and has transitioned back to their home and community environment. In smaller communities and rural and remote settings, access to outpatient and/or community rehabilitation presents a significant challenge, and as such, innovative measures such as in-home therapy and telemedicine technology should be utilized.

The evidence suggests that community reintegration and participation takes up to one-year or more post-stroke and individuals make the most gains within the first 6 months post-stroke.

When physical limitations are minor, people with stroke emphasize the need to still receive psychological support and care. In addition, people with stroke state that education is required to ensure expectations for recovery are understood and that the steps for how to re-access rehabilitation services are clear. A stroke navigator or similar role has been recognized as an effective model during this stage to help link people with stroke to the appropriate local services or telehealth services, including accessing transportation assistance if required. Furthermore, post discharge from inpatient rehabilitation, people with stroke emphasized the importance of education relating to available support groups, including local groups and groups via telehealth or social media.

## System Implications

There is a marked lack of available outpatient and community-based rehabilitation resources. Therefore, the health system should aim to provide the following:

- Timely access to stroke rehabilitation services in the community following discharge.
- Organized and accessible stroke care in communities, including for patients with communication challenges.
- Increased numbers of skilled clinicians who have experience practicing in outpatient and community rehabilitation.

- Optimization of strategies to prevent the recurrence of stroke, including regular screening for stroke risk factors and use of standardized screening tools.
- Stroke rehabilitation support for caregivers to increase patient/caregiver understanding of rehabilitation plans and improve adherence.
- Long-term rehabilitation services widely available, and without financial barriers, in nursing and continuing care facilities, and in outpatient and community programs, including in-home visits.
- Increased use of telemedicine technologies to broaden access to outpatient rehabilitation services.
- Mechanisms for prospective data collection for evaluation and monitoring. All programs should have these in place or be developing them.

## Performance Measures

1. Percentage of stroke patients discharged to the community who receive a referral for ongoing rehabilitation before discharge from hospital (acute and/or inpatient rehabilitation) (core).
2. Median length of time between referral for outpatient rehabilitation to admission to a community rehabilitation program.
3. Frequency and duration of services provided by rehabilitation professionals in the community.
4. Magnitude of change in functional status scores, using a standardized measurement tool, for stroke survivors engaged in community rehabilitation programs.
5. Length of time between referral for ongoing outpatient/community rehabilitation to commencement of therapy.
6. Percentage of persons with a diagnosis of stroke who receive outpatient or community-based therapy following completion of a hospital admission to hospital for an acute stroke event.
7. Percentage of persons receiving ambulatory rehabilitation assessment, follow-up and treatment in all districts/sections/communities served by the stroke rehabilitation service/program. (This would include telehealth, clinic, in-home).
8. Number of stroke patients assessed by physiotherapy, occupational therapy, speech-language pathologists and social workers in the community.
9. Use of health services related to stroke care provided in the community for stroke rehabilitation, including timing and dose of services.

## Measurement Notes:

- Many performance measures require targeted data collection through audits of rehabilitation records and community program records. Documentation quality may create concerns about data availability and data quality.
- For performance measure 3, information regarding frequency and duration of services by rehabilitation professionals requires a chart review or consistent use of reliable workload measurement tools that are implemented locally or regionally. This data should include the total number of visits or therapy sessions by discipline that the patient receives over a defined time frame (such as first 6 weeks post stroke) and the median length of each session.
- Data availability regarding community programs varies considerably across programs, regions and provinces. Efforts should be made to introduce standard audit tools for collection of these data.
- FIM® Instrument data is available in the National Rehabilitation Reporting System (NRS) database at the Canadian Institute of Health Information (CIHI) for participating organizations.

## Implementation Resources and Knowledge Transfer Tools

### Health Care Provider Information

- FIM® Instrument: <http://www.strokengine.ca/assess/fim/>
- AlphaFIM® Instrument: <https://www.udsmr.org/>
- Chedoke-McMaster Stroke Assessment Scale: [http://strokengine.ca/assess/module\\_cmmsa\\_intro-en.html](http://strokengine.ca/assess/module_cmmsa_intro-en.html)
- Evidence-Based Review of Stroke Rehabilitation (Triage Module): <http://www.ebrsr.com/evidence-review/4-managing-stroke-rehabilitation-triage-process>
- Reintegration to Normal Living Index: [http://strokengine.ca/assess/module\\_rnli\\_family-en.html](http://strokengine.ca/assess/module_rnli_family-en.html)
- Leisure section of the Assessment if Life Habits (LIFE-H):  
[http://strokengine.ca/assess/module\\_lifeh\\_family-en.html](http://strokengine.ca/assess/module_lifeh_family-en.html)
- Stroke Impact Scale: <http://strokengine.ca/assess/module sis family-en.html>
- Stroke Engine: <http://www.strokengine.ca/>

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## Summary of the Evidence

### Outpatient Rehabilitation

Outpatient therapy is often required following discharge from acute and/or rehabilitation inpatient services to help patients continue to make gains towards their rehabilitation goals. Continuing therapy may take several forms, depending on resource availability and patient considerations and include such models as hospital-based “day” hospital programs, community-based programs, or home-based rehabilitation. There is strong evidence that any form of continuing rehabilitation therapy is superior to no additional therapy. The Outpatient Service Trialists (2003) identified 14 RCTs that included patients who were living at home prior to their stroke and whose stroke had occurred within the previous year. In 12 of these trials, participants were recruited from a hospital setting, while in the remaining two trials, participants were recruited from home. Patients were randomized to receive specialized outpatient therapy-based interventions or usual care (often no additional treatment). Service interventions examined included those that were home-based (n=2), day hospital or outpatient clinics (n=12). In

these trials, provision of services included physiotherapy, occupational therapy services or interdisciplinary staff, aimed primarily at improving performance in activities of daily living (ADL). Therapy duration in these trials ranged from 5 weeks to 6 months. At the end of scheduled follow-up (mean of 3–12 months), outpatient therapy was associated with reduced odds of a poor outcome, defined as deterioration in ability to perform ADLs, dependency or institutionalization (OR=0.72 95% CI 0.57–0.92; p=0.009) and with small, but significantly greater improvements in ADL, extended ADL and mood scores compared with usual care (SMD=0.14, 95% CI 0.02–0.25; p=0.02, SMD=0.17, 95% CI 0.04–0.30; p=0.01 and SMD=0.11, 95% CI -0.04–0.26; p=0.02, respectively). The authors estimated that for every 100 persons with stroke in the community receiving therapy-based rehabilitation services, 7 (95% CI 2–11) patients would avoid a poor outcome, assuming 37.5% would have had a poor outcome with no treatment.

In terms of establishing the relative superiority of outpatient-based rehabilitation programs compared with continued inpatient services, the differences between service models appears minimal. In a systematic review (Hillier & Inglis-Jassiem 2010) including the results of 11 RCTs of patients who were discharged from inpatient rehabilitation to home following a stroke and who had been living in the community prior to the event, home-based therapy was associated with a 1-point mean difference in Barthel Index gain at 6–8 weeks following the intervention and a 4-point difference at 3–6 months, compared with hospital-based rehabilitation. By 6 months following treatment, there were no longer significant differences between groups. Overall, there were no significant differences in outcomes reported in 4 of the included trials, with some benefits noted in favour of home-based therapy reported in 7 trials (lower cost, less carer strain, lower readmission). No trials reported any benefits in favour of hospital-based rehabilitation. Lincoln et al. (2004) reported no significant differences between groups randomized to receive hospital-based care (outpatient or day hospital) compared with community stroke teams, staffed with multidisciplinary therapists in measures of ADLs, extended ADLs or Euro-QoL scores with the exception of the emotional support item, favouring the community stroke team group. Carer strain and satisfaction scores were higher in the CST group.

#### *Early Supported Discharge*

Early-supported discharge (ESD) is a form of rehabilitation designed to accelerate the transition from hospital to home through the provision of rehabilitation therapies delivered by an interdisciplinary team, in the community, as soon as possible following discharge. It is intended as a lower-cost alternative to a complete course of inpatient rehabilitation and is best suited for patients recovering from mild to moderate stroke. Key components of effective ESD programs include in-hospital and discharge planning, a case manager or 'key worker' based in the stroke unit who represents the essential link between the stroke unit and the outpatient care, guaranteeing continuity of care and enabling the smooth transition from the hospital to the home. Patients who participated in ESD programs have been shown to achieve similar outcomes compared with those who received a course of inpatient rehabilitation. The effectiveness of ESD programs following acute stroke has been evaluated most comprehensively by the Early Supported Discharge Trialists. In the most updated version of the review (Langhorne et al. 2017), the results from 17 RCTs were included. The majority of the trials evaluated ESD using a multidisciplinary team which, coordinated discharge from hospital, and provided rehabilitation and patient care at home. ESD services were associated with a reduction in the odds of death or dependency at end of scheduled follow-up after a median duration of follow-up of was 6 months (OR=0.80, 95% CI 0.67 to 0.95). The associated NNT per 100 patients was 5. The benefits were greatest among patients with mild-moderate disability. ESD services were also associated with slightly greater improvement in extended ADL performance (SMD= 0.17, 95% CI 0.04-0.30), greater patient satisfaction and a significantly shorter LOS (MD=-5.5, 95% CI -2.9 to -8.2 days).

Langhorne et al. (2005) reported additional patient level analysis from their original Cochrane review, which examined the effects of patient characteristics and differing levels of service provision (more coordinated v. less organized) on the outcome of death and dependency. The levels of service provision evaluated were: (1) early supported discharge team with coordination and delivery, whereby an interdisciplinary team coordinated discharge from hospital and post discharge care and provided rehabilitation therapies in the home; (2) early supported discharge team coordination, whereby discharge and immediate post-discharge plans were coordinated by an interdisciplinary care team, but rehabilitation therapies were provided by community-based agencies; and (3) no early supported

discharge team coordination, whereby therapies were provided by uncoordinated community services or by healthcare volunteers. There was a reduction in the odds of a poor outcome for patients with a moderate initial stroke severity (BI 10-20), (OR= 0.73; 0.57-0.93), but not among patients with severe disability (BI< 9) and also among patients who received care from a coordinated multidisciplinary ESD team (0.70; 0.56- 0.88) compared to those without an ESD team. Based on the results of this study, it would appear that a select group of patients, with mild to moderately disabling stroke, receiving more coordinated ESD could achieve better outcomes compared to organized inpatient care on a stroke unit.

#### *Home Exercise Programs*

The effectiveness of home-based exercise programs for mobility improvement was recently the subject of a Cochrane review (Coupar et al. 2012). The results from four RCTs (n=166) examining home-based therapy program targeted at the upper limb were included. The effectiveness of therapy was compared with usual care in three studies (Duncan et al. 1998, 2003; Piron et al. 2009). The primary outcomes were performance on ADL and functional movement of the upper limb. The results were not significant for both outcomes (MD 2.85 95% CI -1.43–7.14 and MD 2.25 95% CI -0.24–4.73, respectively). No significant treatment effect was observed for secondary outcome measures as well (performance on extended ADL and upper limb motor impairment). The authors concluded that there was insufficient evidence to draw conclusions regarding the effectiveness of home-based therapy programs compared to usual care.

A number of individual trials, not included in the aforementioned Cochrane review, compared the effectiveness of home-based therapy with usual care, placebo, or no intervention. Nadeau et al. (2013) randomized 408 patients admitted to inpatient rehabilitation within 45 days of stroke, to receive locomotor training program (LTP), home exercise program (HEP), or standard care, for up to 12 to 16 weeks. Both LTP and HEP groups improved significantly in functional walking level and balance, compared to the usual therapy group, with no significant difference separating the two treatment groups. Harris et al. (2009) compared the effectiveness of home-based self-administered program to that of non-therapeutic education program and found significant treatment-associated effects on paretic upper limb performance, which was maintained for up to 3 months post treatment. In a RCT by Langhammer et al. (2007), the intensive exercise group demonstrated significantly greater improvements in motor assessment scale from admission to discharge from acute care, as well as from 6 months to 1 year post stroke, compared with the regular exercise group.

**Outpatient and In-Home Stroke Rehabilitation (including Early Supported Discharge) Evidence Tables and Reference List available at [www.strokebestpractices.ca](http://www.strokebestpractices.ca)**

## Part B. Providing Stroke Rehabilitation to Address Physical, Functional, Cognitive and Emotional Issues to Maximize Participation in Usual Life Roles

*This section includes recommendations that address therapies for specific functional areas of stroke recovery and direct clinical care.*

## Section 5.0 Management of the Upper Extremity following Stroke

### Section 5.1: Management of the Upper Extremity following Stroke – General Principles and Therapies

#### Recommendations

**Evidence Grading System:** For the purposes of these recommendations ‘**early**’ refers to strength of evidence for therapies applicable to patients who are less than 6 months post stroke, and ‘**late**’ refers to strength of evidence for therapies applicable to patients who are more than 6 months from index stroke event.

#### A. General Principles

- i. Patients should engage in training that is meaningful, engaging, repetitive, progressively adapted, task-specific and goal-oriented in an effort to enhance motor control and restore sensorimotor function [Evidence Level: Early-Level A; Late-Level A].
- ii. Training should encourage the use of patients’ affected limb during functional tasks and be designed to simulate partial or whole skills required in activities of daily living (e.g. folding, buttoning, pouring, and lifting) [Evidence Level: Early-Level A; Late-Level A].

#### B. Specific Therapies

*Note: Selection of appropriate therapies will differ between patients and depend on the severity of the impairment. This should be considered when establishing individualized rehabilitation plans.*

- i. **Range of motion exercises** (passive and active assisted) that includes placement of the upper limb in a variety of appropriate and safe positions within the patient’s visual field should be provided [Evidence Level C]. *Refer to Recommendation 5.3 for additional information.*
- ii. Following assessment to determine if they are suitable candidates, patients should be encouraged to engage in **mental imagery** to enhance upper-limb, sensorimotor recovery [Evidence Level: Early-Level A; Late-Level B].
- iii. **Functional Electrical Stimulation (FES)** targeted at the wrist and forearm muscles should be considered to reduce motor impairment and improve function [Evidence Level: Early-Level A; Late-Level A].
- iv. **Traditional or modified constraint-induced movement therapy (CIMT)** should be considered for a select group of patients who demonstrate at least 20 degrees of active wrist extension and 10 degrees of active finger extension, with minimal sensory deficits and normal cognition [Evidence Level: Early-Level A; Late-Level A].
- v. **Mirror therapy** should be considered as an adjunct to motor therapy for patients with very severe paresis. It may help to improve upper extremity motor function and ADLs. [Evidence Level: Early-Level A; Late-Level A].

- vi. Despite mixed evidence, **sensory stimulation** (e.g., transcutaneous electrical nerve stimulation [TENS], acupuncture, biofeedback) can be considered as an adjunct to improve upper extremity function [Evidence Level B].
- vii. **Virtual reality**, including both immersive technologies such as head mounted or robotic interfaces and non-immersive technologies such as gaming devices can be used as adjunct tools to other rehabilitation therapies as a means to provide additional opportunities for engagement, feedback, repetition, intensity and task-oriented training [Evidence Level: Early-Level A; Late-Level A].
- viii. Therapists should consider **supplementary training programs** aimed at increasing the active movement and functional use of the affected arm between therapy sessions, e.g. Graded Repetitive Arm Supplementary Program (GRASP) suitable for use during hospitalization and at home [Early - Evidence Level B ; Late – Evidence Level C].
- ix. **Strength training** should be considered for persons with mild to moderate upper extremity impairment for improvement in grip strength [Evidence Level: Early-Level A; Late-Level A]. Strength training does not aggravate tone or pain [Evidence Level A].
- x. **Bilateral arm training** is not recommended over unilateral arm training to improve upper extremity motor function [Evidence Level A].
- xi. **Non-invasive brain stimulation, including** repetitive transcranial magnetic stimulation (rTMS) and transcranial direct current stimulation (tDCS) could be considered as an adjunct to upper extremity therapy [Evidence Level A (rTMS); Evidence Level B (tDCS)].
- xii. For patients who are unable to produce any voluntary muscle activity in the affected upper limb, the patient (and caregiver) should be taught **compensatory techniques** and be provided with adaptive equipment to enable basic activities of daily living (ADLs) [Evidence Level B].
  - a. It is reasonable to continue teaching compensatory techniques until the patient can manage basic ADLs independently or until recovery of active movement occurs [Evidence Level C].
- xiii. Retraining trunk control should accompany functional training of the affected upper extremity [Evidence Level C].

### C. Adaptive Devices

- i. Adaptive devices designed to improve safety and function may be considered if other methods of performing specific functional tasks are not available or tasks cannot be learned [Evidence Level C].
- ii. Functional dynamic orthoses may be offered to patients to facilitate repetitive task-specific training [Evidence Level B].

### Rationale

Arm and hand function is frequently reduced following stroke, limiting stroke survivors' ability to perform activities of daily living. Unfortunately, a large number of stroke survivors with initial arm weakness do not regain normal function; however, many therapeutic techniques have been developed for those individuals who have minimal arm movement.

People with stroke provided feedback that emphasized the importance of education on adaptive devices and to ensure their families and caregivers are included in this education. This education should include the potential costs of the devices.

### System Implications

To achieve timely and appropriate assessment and management of upper extremity function the organization requires:

- Initial standardized arm and hand function assessment performed by clinicians experienced in the field of stroke.
- Timely access to specialized, interdisciplinary stroke rehabilitation services where therapies of appropriate type and intensity are provided.
- Access to appropriate equipment (such as functional electrical stimulation).
- Long-term rehabilitation services widely available in nursing and continuing care facilities, and in outpatient and community programs.
- Robotics are an emerging and developing area and stroke rehabilitation programs should begin to build capacity to integrate robotic technology into stroke rehabilitation therapy to appropriate patients as the research evidence suggests, and in the future incorporate this therapy as part of comprehensive therapy where available.

## Performance Measures

1. Extent of change (improvement) in functional status scores using a standardized assessment tool from admission to an inpatient or community-based rehabilitation program to discharge.
2. Extent of change in arm and hand functional status scores using a standardized assessment tool from admission to an inpatient or community-based rehabilitation program to discharge.
3. Median length of time from stroke admission in an acute care hospital to assessment of rehabilitation potential by a rehabilitation healthcare professional.
4. Median length of time spent on a stroke unit during inpatient rehabilitation
5. Median hours per day of direct task-specific therapy provided by the interdisciplinary stroke team.
6. Average days per week of direct task specific therapy provided by the interdisciplinary stroke team (target is a minimum of five days).

## Measurement Notes:

- A data entry process will need to be established to capture the information from the outcome tools such as the Chedoke-McMaster Stroke Assessment (e.g., **ARAT** or **WMFT**).
- FIM® Instrument data is available in the National Rehabilitation Reporting System (NRS) database at the Canadian Institute of Health Information (CIHI) for participating organizations.
- For Performance Measure 5, the direct therapy time is considered 1:1 time between therapist and patient and does not include group sessions or time spent on documentation.

## Implementation Resources and Knowledge Transfer Tools

### Health Care Provider Information

- [Table 1: Stroke Rehabilitation Screening and Assessment \(Appendix Two\)](#)
- FIM® Instrument: <http://www.strokengine.ca/assess/fim/>
- AlphaFIM® Instrument: <https://www.udsmr.org/>
- Chedoke-McMaster Stroke Assessment Scale: [http://strokengine.ca/assess/module\\_cmmsa\\_intro-en.html](http://strokengine.ca/assess/module_cmmsa_intro-en.html)
- Chedoke-McMaster Arm and Hand Activity Inventory: [http://strokengine.ca/assess/module\\_cahai\\_intro-en.html](http://strokengine.ca/assess/module_cahai_intro-en.html)

- Modified Ashworth Scale: [http://strokengine.ca/assess/module\\_mashs\\_intro-en.html](http://strokengine.ca/assess/module_mashs_intro-en.html)
- Box and Block Test: [http://strokengine.ca/assess/module\\_bbt\\_intro-en.html](http://strokengine.ca/assess/module_bbt_intro-en.html)
- Nine Hole Peg Test: [http://strokengine.ca/assess/module\\_nhpt\\_intro-en.html](http://strokengine.ca/assess/module_nhpt_intro-en.html)
- Fugl-Myer Assessment of Sensory-Motor Recovery: <https://www.sralab.org/rehabilitation-measures/fugl-meyer-assessment-motor-recovery-after-stroke>
- Chedoke-McMaster Arm and Hand Activity Inventory (CAHAI): [http://strokengine.ca/assess/module\\_cahai\\_intro-en.html](http://strokengine.ca/assess/module_cahai_intro-en.html)
- Action Research Arm Test: [http://strokengine.ca/assess/module\\_arat\\_intro-en.html](http://strokengine.ca/assess/module_arat_intro-en.html)
- Wolf Motor Function Test: [http://strokengine.ca/assess/module\\_wmft\\_family-en.html](http://strokengine.ca/assess/module_wmft_family-en.html)
- Stroke Engine: <http://www.strokengine.ca/>

### Information for People with Stroke, their Families and Caregivers

- Rehabilitation and Recovery infographic: Guide to taking charge of your stroke recovery: <https://www.heartandstroke.ca/-/media/1-stroke-best-practices/rehabilitation-nov2019/csbp-infographic-rehabilitation.ashx>
- Transitions and community participation infographic: Guide to taking charge of your stroke recovery: <https://www.heartandstroke.ca/-/media/1-stroke-best-practices/transition-of-care-nov2019/csbp-infographic-transitions-and-participation.ashx>
- Aphasia Institute: <http://www.aphasia.ca/people-with-aphasia-and-families/>
- Post Stroke Checklist: <https://www.strokebestpractices.ca/resources/patient-resources>
- Living with Stroke Program: <https://www.heartandstroke.ca/stroke/recovery-and-support/living-with-stroke>
- Stroke Resources Directory: <https://www.heartandstroke.ca/services-and-resources>
- Your Stroke Journey: <https://www.strokebestpractices.ca/-/media/1-stroke-best-practices/resources/patient-resources/en-your-stroke-journey-v21.ashx>
- Stroke Engine: <http://www.strokengine.ca/>
- Heart and Stroke Foundation Canadian Partnership for Stroke Recovery: <https://www.canadianstroke.ca/>

### Summary of the Evidence

#### Task-Specific Training

Task-specific training involves the repeated practice of functional tasks, which combines the elements of intensity of practice and functional relevance. The tasks should be challenging and progressively adapted and should involve active participation. French et al. (2016) included the results from 11 randomized controlled trials (RCTs) that included an upper limb rehabilitation component. Repetitive task-specific training was associated with a small treatment effect on arm and hand function, assessed post intervention. (SMD=0.25, 95% CI 0.01 to 0.49, p=0.045 and SMD=0.25, 95% CI 0.00 to 0.51, p=0.05, respectively). The benefits appeared to persist up to 6 months follow-up. Patients treated from 16 days to 6 months post stroke derived the greatest value. In contrast to these findings, in an earlier systematic review of motor recovery following stroke, Langhorne et al. (2009) identified 8 RCTs of repetitive task training, specific to the upper-limb. In these trials, treatment duration varied widely from a total of 20 to 63 hours provided over a 2 week to 11-week period. Therapy was not associated with significant improvements in arm function (SMD=0.19, 95% CI -0.01 to 0.38) or hand function (SMD=0.05, 95% CI -0.18 to 0.29). Perhaps the inclusion of trials that evaluated repetitive task training in addition to task-oriented training was, in part, responsible for the null result. In a crossover RCT,

Shimodozone et al. (2013) randomized 49 participants in the sub-acute phase of stroke to one of two groups: 1) repetitive facilitative exercise (RFE), or 2) control-conventional rehabilitation program. Both groups received 40 min sessions 5x/wk. for 4 weeks of their allocated treatment. Both groups performed 30 min/day of dexterity-related training immediately after each treatment session and continued their participation in a standard inpatient rehabilitation program. Action Research Arm Test (ARAT) and the Fugl-Meyer Assessment (FMA) were assessed at baseline, and at week 2 and 4. After 4 weeks of treatment, significantly greater improvements on the ARAT ( $p=0.009$ ) and FMA ( $p=0.019$ ) were demonstrated by the RFE group compared to the control group.

### Mental Practice

Mental practice is the process whereby an individual repeatedly rehearses tasks mentally without physically performing them, with the goal of improving actual performance. When used in addition to structured therapy, mental practice can improve measures of upper-limb impairment and disability. A large treatment effect (upper-extremity function: SMD=1.37, 95% CI 0.60 to 2.15,  $p<0.0001$ ) was reported by Barclay-Goddard et al. (2011) in a Cochrane review, which included the results from 6 RCTs. The length of treatment ranged from 3 to 10 weeks.

### Constraint Induced Movement Therapy

Traditional constraint-induced movement therapy (CIMT) involves restraint of the unaffected arm for at least 90 percent of waking hours, in addition to a minimum of six hours a day of intense upper-extremity (UE) training of the affected arm every day for two weeks. This form of therapy may be effective for a select group of patients who demonstrate some degree of active wrist and arm movement and have minimal sensory or cognitive deficits. Evidence from the VECTORS trial (Dromerick et al. 2009) suggests that traditional (intensive) CIMT should not be used for individuals in the first month post stroke, and in fact may be associated with worse outcomes. Patients who were randomized to receive 3 hours of intensive therapy in addition to wearing a constraint for 6 hours/day had lower ARAT scores at 3 months compared with patients who had received conventional occupational therapy or standard CIMT for 2 hours each day. In the largest RCT of conventional CIMT (Wolf et al. 2006), which included 222 patients, recruited 3-9 months post stroke, patients in the CIMT group had significantly greater improvement in Wolf Motor Function Tests (WMFT) scores and Motor Activity Log (MAL) (Amount of Use and Quality of Movement sub scores) at 12 months, compared with patients in the control group who received usual care, which could range from no therapy to a formal structured therapy program.

Modified constraint-induced movement therapy (m-CIMT) is a more feasible therapy option when resources are limited. In the most common variation of traditional CIMT, the unaffected arm is restrained with a padded mitt or arm sling for five hours a day, and with half-hour blocks of 1:1 therapy provided for up to 10 weeks (Page et al. 2013). The results from several good-quality RCTs suggest that patients who received mCIMT in the subacute or chronic phase of stroke experienced greater functional recovery compared with patients who received traditional occupational therapy. In the EXPLICIT trial (Kwakkel et al. 2016) 58 participants in the acute phase of stroke were randomized to a usual care group of a modified CIMT (mCIMT), which involved restraint for 3 hours, 5 days a week for 3 weeks in addition to 60 minutes of supervised intensive graded practice focused on improving task-specific use of the paretic arm and hand. There was significantly greater improvement in the mCIMT group on ARAT scores, the primary outcome, from baseline to 5, 8- and 12-weeks following treatment, but not at 26 weeks. There were no significant differences between groups on impairment measures, such as the FMA of the arm, or Motricity Index scores.

Liu et al. (2017) included the results of 16 RCTs examining m-CIMT or CIMT in the acute or subacute stage of stroke and reported significantly greater gains in Action Research Arm Test, Barthel Index, Fugl-Meyer Assessment, and Motor Activity Log scores (amount of use and quality of use) compared

with the control condition. A Cochrane review (Corbetta et al. 2015) included the results from 42 RCTs examining both CIMT and m-CIMT, across the spectrum of the stroke recovery continuum. Overall, neither form of CIMT (traditional or modified) was associated with a significant improvement in standardized measures of disability ( $SMD=0.24$ , 95% CI -0.05 to 0.52) at the end of treatment, or at 6 to 12 months follow-up ( $SMD=-0.21$ , 95% CI -0.57 to 0.16), compared with usual care. CIMT was associated with significant improvements in arm motor function, dexterity and measures of arm motor impairment. The results from this review are difficult to interpret since trials of all forms of CIMT were included as were patients in all stages of stroke recovery.

### **GRASP**

Evidence from a single trial evaluating the Graded Repetitive Arm Supplementary Program (GRASP) program suggests that additional therapy, performed outside of regular therapy can improve upper-limb function (Harris et al. 2009). In this multi-site RCT, 103 patients recruited an average of 21 days following stroke with upper-extremity Fugl Meyer scores between 10 and 57, were randomized to participate in a 4 week (one hour/day x 6 days/week) homework-based, self-administered program designed to improve ADL skills through strengthening, ROM and gross and fine motor exercises or to a non-therapeutic education control group. At the end of the treatment period, participants in the GRASP group had significantly higher mean Chedoke Arm & Hand Activity Inventory, ARAT and MAL scores compared with the control group. The improvement was maintained at 3 months follow-up.

### **Virtual Reality**

Laver et al. (2017) included the results of 22 RCTs in a Cochrane review examining the effectiveness of virtual reality, mainly using commercially available gaming consoles. Compared with conventional treatment, virtual reality interventions were not associated with significant improvements in measures of upper-limb function, at either the end of treatment, or at 3 months, ( $SMD=0.07$ , 95% CI -0.05 to 0.20 and  $SMD=0.11$ , 95% CI -0.10 to 0.32, respectively). However, when virtual reality was used in addition to usual care (providing a higher dose of therapy for those in the intervention group) there was a statistically significant difference between groups ( $SMD= 0.49$ , 0.21 to 0.77, 10 studies). When assessments were conducted using the FMA (upper-extremity) at the end of treatment, there was a significant treatment effect of virtual reality. The results from several recent RCTs (Aide et al., 2017, Brunner et al. 2017, Kong et al., 2016, Saposnik et al. 2016) indicated that virtual reality was not associated with significant improvements in Action Research Arm Test scores, or a variety of other outcomes, including Canadian Occupational Performance Measure, Stroke Impact Scale, Functional Independence Measure, or FMA.

### **Mirror Therapy**

Mirror therapy is a technique that uses visual feedback about motor performance to enhance upper-limb function following stroke and reduce pain. Zeng et al. (2017) included the results from 11 RCTs and reported that mirror therapy was associated with significantly increased motor impairment compared with the control condition ( $SMD=0.51$ , 95%CI 0.29-0.73). Evidence from a Cochrane review (Thieme et al. 2012), which included the results from 14 RCTs, indicated a modest treatment effect associated with mirror therapy. There were significant improvements in motor function, the primary outcome, both immediately following treatment ( $SMD=0.61$ ; 95% CI 0.22 to 1.0,  $p= 0.002$ ) and at 6 months ( $SMD=1.09$ ; 95% CI 1.09 to 1.87,  $p= 0.0068$ ). There were also improvements in performance of ADLs ( $SMD=0.33$ , 95% CI 0.05 to 0.60,  $p=0.02$ ) and pain ( $SMD= -1.1$ , 95% CI -2.10 to -0.09,  $p=0.03$ ). Radajewska et al. (2013) randomized 60 participants 1:1 (mean 9.25 wk post stroke) to a mirror therapy (MT) or a control group, in addition to standard rehabilitation. Within each group, participants were divided into left- versus right-arm paresis subgroups. The treatment group received 15-minute sessions of mirror therapy 2x/day, 5d/wk for 3 wk. In the left-hand subgroups, those in the MT group showed a significantly greater improvement in Frenchay Arm Test scores compared with controls ( $p=0.035$ ), but there were no significant between-group differences on Motor Status Scale

scores or Functional Index 'Repty'. In the right-hand subgroups, there were no significant between-group differences over time for any of the outcomes.

### **Functional Electrical Stimulation**

While functional electrical stimulation (FES) has been investigated extensively in the rehabilitation of the lower extremity and for preventing/treating shoulder subluxation, there is a smaller literature base for its use as a modality to improve upper-extremity function. Eraifej et al. (2017) included the results of 20 RCTs in a systematic review that evaluated the ability of FES to improve activities of daily living and motor function. Pooling data from 8 trials, there was no significant difference between groups in ADL performance ( $SMD=0.64$ , 95% CI -0.02 to 1.30,  $p=0.06$ ); however, in sub group analysis including 5 trials, persons who received FES during the acute phase of stroke (within 2 months) did improve their ADL performance with FES ( $SMD=1.24$ , 95% CI 0.46 to 2.03,  $p=0.002$ ). FES was associated with significant improvement in Fugl-Meyer Assessment scores ( $MD=6.72$ , 95% CI 1.76, 11.68,  $p=0.008$ ). In the EXPLICIT trial, Kwakkel et al. (2016) reported the group that received EMG-triggered neuromuscular electrical stimulation on finger extensors for 60 minutes a day for 3 weeks did not have significantly better outcomes on a wide variety of outcome measures compared with the group that received conventional rehabilitation only. Vafadar et al. (2015) pooled the results from 10 trials evaluating the use of FES for the rehabilitation of shoulder subluxation, pain, and upper arm motor function. Pooling the results from 5 trials, FES was not associated with significant improvements in arm motor function when initiated early post stroke, compared with conventional therapy ( $SMD=0.36$ , 95% CI -0.27 to 0.99,  $p=0.26$ ). Pooling of results was not possible for an evaluation of FES in the chronic stage of stroke.

### **Bilateral/Unilateral Arm Training**

The evidence that bilateral arm training is superior to conventional rehabilitation, is conflicting, and very much dependent on the outcome used for assessment. A Cochrane review (Coupar et al. 2010), which included the results from 18 RCTs, indicated that, compared with conventional care, bilateral training was not associated with significantly better scores on measures of arm function, ADL performance or extended ADL, but did improve motor impairment. In another systematic review, Van Delden et al. (2012) reported significantly greater improvements in measures of function ( $SMD=0.20$ , 95% CI 0.0–0.4;  $p=0.05$ ), but not impairment or performance.

### **Strength Training**

In a systematic review, including 13 RCTs, (Harris & Eng (2010) reported that therapy programs including a strength training or resistance training component were associated with significant improvements in motor function ( $SMD=0.21$ , 95%CI 0.03–0.39,  $p=0.03$ ), grip strength ( $SMD=0.95$ , 95% CI 0.05 to 1.85,  $p=0.04$ ), but not performance of ADLs ( $SMD=0.26$ , 95% CI -0.10 to 0.63,  $p=0.16$ ). Improvements were noted in both the acute and chronic stages of stroke.

### **Non-invasive brain stimulation**

Non-invasive brain stimulation using either transcranial direct-current stimulation (tDCS) or repetitive transcranial magnetic stimulation (rTMS) have been shown to be potential useful forms of treatment for upper-extremity rehabilitation. Chhatbar et al. (2016) included the results from 8 RCTs (213 subjects) investigating the role of tDCS ( $\geq 5$  sessions) in post stroke recovery of upper limb, compared with a sham condition. tDCS was associated with significantly greater improvements in FMA (upper extremity scores) compared with sham treatment ( $SMD=0.61$ , 95% CI 0.08 to 1.13,  $p=0.02$ ). Treatment effects were more pronounced in the chronic vs. acute stage of stroke ( $SMD=1.23$  vs.  $SMD=0.18$ ). However, the results from another systematic review (Triccas et al. 2016) using many of the same trials and which also used FMA as an outcome, did not find that tDCS improved upper-extremity Fugl-Meyer Assessment scores, immediately following intervention ( $SMD=0.11$ , 95% CI -0.17 to 0.38,  $p=0.44$ ), or

after short- or long-term follow-up (n=2: SMD=0.27, 95% CI -0.40 to 0.95, p=0.43 and SMD=0.23, 95% CI-0.17 to 0.62, p=0.26, respectively).

In the Navigated Inhibitory rTMS to Contralesional Hemisphere Trial (NICHE), Harvey et al. (2018) randomized 199 patients with a unilateral ischemic or hemorrhagic stroke occurring within 3 to 12 months of enrollment, with a Chedoke assessment stage of 3-6 for both arm and hand, to receive low-frequency (1 Hz) active or sham rTMS to the noninjured motor cortex before each 60-minute therapy sessions, delivered over 6-weeks. At the end of 6 months, 67% of the experimental group and 65% of sham group improved  $\geq 5$  points on 6-month upper extremity FMA (p=0.76). There was also no difference between experimental and sham groups in the ARAT (p=0.80) or WMFT (p=0.55) scores. Li et al. (2016) reported no differences between high and low frequency rTMS (10 and 1 Hz), provided for 20 minutes for 2 weeks. Compared with sham stimulation, patients in both active rTMS groups experienced significantly greater improvement in mean FMA (upper extremity) scores at the end of the treatment period, with no significant differences between groups in mean Wolf Motor Function Test scores. Graef et al. (2016) included the results of 11 RCTs evaluating the effect of rTMS on upper limb motor function. Active rTMS was not associated with significantly greater improvement in FMA (upper extremity) scores compared with sham treatment (MD=0.5, 95% CI -0.2 to 3.20, p=0.72), ARAT, WMFT or Box & Block Test scores.

**Management of the Upper Extremity following Stroke – General Principles and Therapies**  
**Evidence Tables and Reference List available at [www.strokebestpractices.ca](http://www.strokebestpractices.ca)**

## Section 5.2: Range of Motion and Spasticity in the Shoulder, Arm and Hand

### Recommendations

**Definition:** For the purposes of these recommendations ‘early’ refers to strength of evidence for therapies applicable to patients who are less than 6 months post stroke, and ‘late’ refers to strength of evidence for therapies applicable to patients who are more than 6 months from index stroke event.

- i. Spasticity and contractures may be managed by antispastic pattern positioning, range-of-motion exercises, and/or stretching [Evidence Levels: Early- Level C; Late-Level C].
  - a. Routine use of splints is not recommended [Evidence Levels: Early- Level A; Late- Level B].
  - b. In some select patients, the use of splints may be useful and should be considered on an individualized basis [Evidence Level C]. A plan for monitoring the splint for effectiveness should be implemented and followed [Evidence Level C].
- ii. Chemo-denervation using botulinum toxin can be used to increase range of motion and decrease pain for patients with focal symptomatically distressing spasticity [Evidence Levels: Early-Level B; Late-Level A].
- iii. Oral medications can be considered for the treatment of disabling spasticity, but side effects of fatigue and drowsiness are common and the benefits for treating spasticity appear to be marginal:
  - a. Tizanidine can be used to treat more generalized, disabling spasticity. [Evidence Levels: Early-Level C; Late-Level B].
  - b. Baclofen can be used as a lower cost alternative to treat more generalised disabling spasticity [Evidence Levels: Early-Level C; Late-Level C].
  - c. Benzodiazepines should be avoided due to sedating side effects, which may impair recovery [Evidence Level: Early-Level C; Late-Level C].

### Rationale

Spasticity, defined as a velocity dependent increase of tonic stretch reflexes (muscle tone) with exaggerated tendon jerks can be painful, interfere with functional recovery and hinder rehabilitation efforts. If not managed appropriately, people who have had a stroke may experience a loss of range of motion at involved joints of the arms, which can result in contracture and decreased quality of life.

### System Implications

To achieve timely and appropriate assessment and management of shoulder, arm and hand range and spasticity the organization requires:

- Availability of and access to organized stroke care, including stroke rehabilitation units with critical mass of trained interdisciplinary staff during the rehabilitation period following stroke.
- Timely access to specialized, interdisciplinary stroke rehabilitation services, where assessments and therapies of appropriate type and intensity are provided.
- Expertise within the interdisciplinary stroke team to prevent and/or ameliorate post stroke spasticity and remediate its complications and functionally related limitations.
- Optimization of strategies to prevent or manage spasticity both initially post stroke and at follow-up assessments.

- Funding for chemo-denervation and associated post injection rehabilitation services where necessary.
- Long-term rehabilitation services widely available in nursing and continuing care facilities, and in outpatient and community programs.
- The development and implementation of an equitable and universal pharmacare program, implemented in partnership with the provinces, designed to improve access to cost-effective medicines for all people in Canada regardless of geography, age, or ability to pay. This program should include a robust common formulary for which the public payer is the first payer.

## Performance Measures

1. Change (improvement) in functional status scores using a standardized assessment tool from admission to an inpatient rehabilitation program to discharge.
2. Change in shoulder, arm and hand functional status scores using a standardized assessment tool (such as the Chedoke-McMaster Stroke Assessment pain scale or the Modified Ashworth Scale) from admission to an inpatient rehabilitation program to discharge.
3. Median length of time from stroke admission in an acute care hospital to assessment of rehabilitation potential by a rehabilitation healthcare professional.
4. Median length of time spent on a stroke rehabilitation unit during inpatient rehabilitation

## Measurement Notes:

- A data entry process will need to be established to capture the information from the outcome tools such as the Disability Assessment Scale
- FIM® Instrument data is available in the National Rehabilitation Reporting System (NRS) database at the Canadian Institute of Health Information (CIHI) for participating organizations.

## Implementation Resources and Knowledge Transfer Tools

### Health Care Provider Information

- [Table 1: Stroke Rehabilitation Screening and Assessment Tools \(Appendix Two\)](#)
- FIM® Instrument: <http://www.strokengine.ca/assess/fim/>
- AlphaFIM® Instrument: <https://www.udsmr.org/>
- Modified Ashworth Scale: [http://strokengine.ca/assess/module\\_mashes\\_intro-en.html](http://strokengine.ca/assess/module_mashes_intro-en.html)
- Pain scales: <http://pami.emergency.med.jax.ufl.edu/resources/pain-assessment-scales/>
- Stroke Engine: <http://www.strokengine.ca/>

### Information for People with Stroke, their Families and Caregivers

- Rehabilitation and Recovery infographic: Guide to taking charge of your stroke recovery: <https://www.heartandstroke.ca/-/media/1-stroke-best-practices/rehabilitation-nov2019/csbp-infographic-rehabilitation.ashx>
- Transitions and community participation infographic: Guide to taking charge of your stroke recovery: <https://www.heartandstroke.ca/-/media/1-stroke-best-practices/transition-of-care-nov2019/csbp-infographic-transitions-and-participation.ashx>

- Aphasia Institute: <http://www.aphasia.ca/people-with-aphasia-and-families/>
- Post Stroke Checklist: <https://www.strokebestpractices.ca/resources/patient-resources>
- Living with Stroke Program: <https://www.heartandstroke.ca/stroke/recovery-and-support/living-with-stroke>
- Stroke Resources Directory: <https://www.heartandstroke.ca/services-and-resources>
- Your Stroke Journey: <https://www.strokebestpractices.ca/-/media/1-stroke-best-practices/resources/patient-resources/en-your-stroke-journey-v21.ashx>
- Stroke Engine: <http://www.strokengine.ca/>
- Heart and Stroke Foundation Canadian Partnership for Stroke Recovery: <https://www.canadianstroke.ca/>

## Summary of the Evidence

Spasticity can be painful, interfere with functional recovery and hinder rehabilitation efforts. If not managed appropriately, stroke survivors may experience a loss of range of motion at involved joints of the arms, which can result in contracture. Although it is a common in clinical practice to use range-of-motion or stretching exercises and splints to prevent or treat spasticity or contracture following stroke, there is a lack of evidence supporting their benefit. Harvey et al. (2017) included the results of 49 RCTs in a Cochrane review including participants with neurological condition, advance age, those with a history of trauma and those with underlying joint or muscle pathology. Of these, 11 trials included stroke cohorts treated for upper limb impairment. Trials evaluated the effect of stretching programs (casting, splinting, self-administered, positioning, and sustained passive stretch) on preventing contractures. Stretching programs did not significantly increase joint mobility, improve spasticity, activity limitations, or pain either after the intervention or at follow-up, when compared with usual care. Splints have been widely-used in clinical practice with the aim of the prevention of contractures and reducing spasticity; however, evidence of their effectiveness is lacking. Basaran et al. (2012) randomized 39 participants to participate in a 5-week, home-based exercise program in which patients were advised to stretch wrist and finger flexors for 10 repetitions and to try reaching and grasping an object for 10 repetitions 3x/day, in addition to conventional therapy. Patients in the 2 experimental groups wore either a volar or dorsal splint for up to 10 hours overnight throughout the study period, while patients in the control group wore no splint. At the end of the study period, there were no significant differences among groups in terms of reductions in spasticity or wrist passive range of motion.

While it is well-established that treatment with Botulinum toxin-type A (BTX-A) reduces focal spasticity in the finger, wrist and elbow, it remains uncertain whether there is also improvement in upper-limb function. In the BOTOX® Economic Spasticity Trial (BEST), 273 persons with chronic post-stroke upper and lower limb spasticity were randomized to receive a single dose of BTX-A with an optional second dose offered  $\geq$  12 weeks after the first, or placebo in addition to usual care. Dosing and site of injection was based on clinician judgement. In the publication of the trial that was dedicated to functional outcomes (Ward et al. 2014), there were no significant differences between groups at weeks 12, 24 or 52 with respect to the percentage of patients who achieved their principal active functional goal (33.1% vs. 28.9%, 40.9% vs. 33.3% and 45.0% vs. 52.4%, respectively), although a higher number of persons in the BT-XA groups achieved their secondary passive functional goals at 24 weeks, (60.6% vs. 38.6%, p=0.016), but not at weeks 12 or 52. BTX-A was more effective than placebo in reducing pain from baseline to week 12 (Wissel et al. 2016). Higher proportions of patients with pain in the BTX-A group achieved  $\geq$ 30% and  $\geq$ 50% reductions in pain. Shaw et al. (2011) randomized 333

subjects < 1 month following stroke with spasticity of the elbow (MAS>2) and/or spasticity of the shoulder, wrist or hand with reduced arm function to receive 100 or 200 U Dysport in addition to a standardized therapy program provided for 1 hour/day, 2x/week for 4 weeks) or therapy program only. Repeat injections were available to subjects in the intervention group at 3, 6 and 9 months. There was no significant difference in the percentage of patients who had achieved a successful outcome (defined by 3 different levels of improvement on the Action Research Arm Test, depending on baseline arm function) at one month following treatment: 25% of patients in the treatment group compared with 19.5% of patients in the control group ( $p=0.232$ ). However, significant differences in favor of the intervention group were seen in muscle tone at 1 month; upper limb strength at 3 months; basic arm functional tasks (hand hygiene, facilitation of dressing) at 1, 3, and 12 months, and pain at 12 months. McCrory et al. (2009) reported there were no significant between group differences in Assessment of Quality of Life scale change scores, pain, mood, disability or carer burden at 20 weeks in 102 patients with moderate to severe spasticity of the arm, who received 750-1,000 U Dysport or placebo an average of 6 years following stroke.

In cases where spasticity is generalized, and it would be impractical, or contrary to patients' wishes to inject multiple muscle groups with BTX-A, the use of oral agents may be considered as an alternative treatment. Traditional pharmacotherapies for spasticity include centrally acting depressants (baclofen and tizanidine) and muscle relaxants; (dantrolene) however; these treatments are only partially effective in treating spasticity and have the negative side effects of weakness and sedation. Treatment with oral baclofen has not been well studied in the stroke population and is used more frequently in patients recovering from spinal cord injury. Tizanidine has been well-studied in other conditions including multiple sclerosis and acquired brain injury, and has a better side effect profile than other oral agents. There is only a single open-label trial of the use of tizanidine post stroke (Gelber et al. 2001). Following 16 weeks of treatment in which 47 patients received a maximum daily dose of 36 mg (mean 20 mg), there was a decrease in mean combined total modified Ashworth Scale scores (9.3 vs. 6.5,  $p=0.038$ ). There were also significant improvements in pain, quality of life, and physician assessment of disability.

**Range of Motion and Spasticity in the Shoulder, Arm and Hand Evidence Tables and Reference List available at [www.strokebestpractices.ca](http://www.strokebestpractices.ca)**

## Section 5.3: Management of Shoulder Pain & Complex Regional Pain Syndrome (CRPS) following Stroke

### Recommendations

**Definition:** For the purposes of these recommendations ‘early’ refers to strength of evidence for therapies applicable to patients who are less than 6 months post stroke, and ‘late’ refers to strength of evidence for therapies applicable to patients who are more than 6 months from index stroke event.

**Note:** Causes of shoulder pain may be due to the hemiplegia itself, injury or acquired orthopedic conditions due to compromised joint and soft tissue integrity and spasticity.

#### A. Prevention of Hemiplegic Shoulder Pain and Subluxation

- i. Joint protection strategies should be applied during the early or flaccid stage of recovery to prevent or minimize shoulder pain and injury. These include:
  - a. Positioning and supporting the arm during rest [Evidence Level B].
  - b. Protecting and supporting the arm during functional mobility; avoid pulling on the affected arm [Evidence Level C].
  - c. Protecting and supporting the arm during wheelchair use; examples include-using a hemi-tray, arm trough, or pillow [Evidence Level C].
  - d. The use of slings should be discouraged with the exception of the flaccid stage given it may discourage arm use, inhibit arm swing, contribute to contracture formation, and decrease body image [Evidence Level C].
- ii. For patients with a flaccid arm (i.e., Chedoke-McMaster Stroke Assessment Impairment Inventory <3) electrical stimulation should be considered [Evidence Levels: Early- Level B; Late- Level B].
- iii. Overhead pulleys should not be used [Evidence Level A].
- iv. The arm should not be moved passively beyond 90 degrees of shoulder flexion or abduction, unless the scapula is upwardly rotated and the humerus is laterally rotated [Evidence Level B].
- v. Healthcare staff, patients and family should be educated to correctly protect, position, and handle the involved arm [Evidence Level A].
  - a. For example, careful positioning and supporting the arm during assisted moves such as transfers; avoid pulling on the affected arm [Evidence level C].

#### B. Assessment of Hemiplegic Shoulder Pain

- i. The assessment of the painful hemiplegic shoulder could include evaluation of tone, active movement, changes in length of soft tissues, alignment of joints of the shoulder girdle, trunk posture, levels of pain, orthopedic changes in the shoulder, and impact of pain on physical and emotional health [Evidence Level C].

#### C. Management of Hemiplegic Shoulder Pain

- i. Treatments for hemiplegic shoulder pain related to limitations in range of motion may include **gentle** stretching and mobilization techniques, and typically involves increasing external rotation and abduction. [Evidence Level B].

- a. Active range of motion should be increased gradually in conjunction with restoring alignment and strengthening weak muscles in the shoulder girdle [Evidence Level B].
- ii. Taping of the affected shoulder has been shown to reduce pain [Evidence Level A].
- iii. If there are no contraindications, analgesics (such as ibuprofen or narcotics) can be considered for pain relief on an individual case basis [Evidence Level C].
- iv. Injections of botulinum toxin into the subscapularis and pectoralis muscles could be used to treat hemiplegic shoulder pain thought to be related to spasticity [Evidence Level B].
- v. Subacromial corticosteroid injections can be used in patients when pain is thought to be related to injury or inflammation of the subacromial region (rotator cuff or bursa) in the hemiplegic shoulder [Evidence level B].

*Note: For additional information on pain management, refer to [Section 9](#).*

#### D. Hand Edema

- i. For patients with hand edema, the following interventions may be considered:
  - a. Active, active-assisted, or passive range of motion exercises [Evidence Level C].
  - b. When at rest the arm should be elevated if possible [Evidence level C].
  - c. Retrograde massage [Evidence Level C].
  - d. Gentle grade 1-2 mobilizations for accessory movements of the hand and fingers [Evidence Level C].
- ii. There is insufficient evidence for or against compression garments, e.g. compression gloves [Evidence Level C].

#### E. Complex Regional Pain Syndrome (CRPS) (Also known as Shoulder-Hand Syndrome or Reflex Sympathetic Dystrophy)

- i. **Prevention:** Active, active-assisted, or passive range of motion exercises can be used to prevent CRPS [Evidence Level C].
- ii. **Diagnosis** should be based on clinical findings including pain and tenderness of metacarpophalangeal and proximal interphalangeal joints and can be associated with edema over the dorsum of the fingers, trophic skin changes, hyperesthesia, and limited range of motion [Evidence Level C].
- iii. A triple phase bone scan (which demonstrates increased periarticular uptake in distal upper extremity joints) can be used to assist in diagnosis. [Evidence Level C].
- iv. **Management:** An early course of oral corticosteroids, starting at 30 – 50 mg daily for 3 - 5 days, and then tapering doses over 1 – 2 weeks can be used to reduce swelling and pain [Evidence Level B].

#### Rationale

The incidence of shoulder pain following a stroke is high. As many as 72 percent of adult stroke patients report at least one episode of shoulder pain within the first year after stroke. Shoulder pain may inhibit patient participation in rehabilitation activities, contribute to poor functional recovery and can also mask improvement of movement and function. Hemiplegic shoulder pain may contribute to depression and sleeplessness and reduce quality of life.

## System Implications

To achieve timely and appropriate assessment and management of shoulder pain the organization requires:

- Organized stroke care, including stroke rehabilitation units with a critical mass of trained interdisciplinary staff during the rehabilitation period following stroke.
- Equipment for proper limb positioning (e.g. pillows, arm troughs).

To achieve timely and appropriate assessment and management of shoulder pain the organization should provide:

- Initial assessment of active or passive upper extremity range of motion of shoulder, based on Chedoke-McMaster Stroke Assessment score and assessment of external rotation performed by clinicians experienced in stroke rehabilitation.
- Timely access to specialized, interdisciplinary stroke rehabilitation services for the management of shoulder pain.
- Timely access to appropriate rehabilitation therapy intensity/ treatment modalities for management or reduction of shoulder pain in stroke survivors.
- Long-term rehabilitation services in nursing and continuing care facilities, and in outpatient and community programs.
- Physicians trained in stroke care and, where needed, intra-articular shoulder injections and botulinum toxin injections.
- The development and implementation of an equitable and universal pharmacare program, implemented in partnership with the provinces, designed to improve access to cost-effective medicines for all people in Canada regardless of geography, age, or ability to pay. This program should include a robust common formulary for which the public payer is the first payer.

## Performance Measures

1. 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).
2. Length of stay during acute care hospitalization and inpatient rehabilitation for patients experiencing shoulder pain (versus patients not experiencing shoulder pain).
3. Proportion of stroke patients who report shoulder pain at three-month and six-month follow-up.
4. Pain intensity rating change, from baseline to defined measurement periods.
5. Motor score change, from baseline to defined measurement periods.
6. Range of shoulder external rotation before and after treatment for shoulder pain.
7. Proportion of patients with restricted range of motion related to shoulder pain.

### **Measurement Notes:**

- Performance measure 4: Standardized rating scales should be used for assessment of pain levels and motor scores.

- Some data will require survey or chart audit. The quality of documentation related to shoulder pain by healthcare professionals will affect the quality and ability to report some of these performance measures.
- Audit tools at a local level may be helpful in collecting shoulder pain data on patients who experience shoulder pain.

## Implementation Resources and Knowledge Transfer Tools

### Health Care Provider Information

- [Table 1: Stroke Rehabilitation Screening and Assessment Tools \(Appendix Two\)](#)
- Pain scales: <http://pami.emergency.med.jax.ufl.edu/resources/pain-assessment-scales/>
- Chedoke-McMaster Shoulder Pain Subscale: [http://strokengine.ca/assess/module\\_cmmss\\_intro\\_en.html](http://strokengine.ca/assess/module_cmmss_intro_en.html)
- Stroke Engine: <http://www.strokengine.ca/>

### Information for People with Stroke, their Families and Caregivers

- Rehabilitation and Recovery infographic: Guide to taking charge of your stroke recovery: <https://www.heartandstroke.ca/-/media/1-stroke-best-practices/rehabilitation-nov2019/csbp-infographic-rehabilitation.ashx>
- Transitions and community participation infographic: Guide to taking charge of your stroke recovery: <https://www.heartandstroke.ca/-/media/1-stroke-best-practices/transition-of-care-nov2019/csbp-infographic-transitions-and-participation.ashx>
- Aphasia Institute: <http://www.aphasia.ca/people-with-aphasia-and-families/>
- Post Stroke Checklist: <https://www.strokebestpractices.ca/resources/patient-resources>
- Living with Stroke Program: <https://www.heartandstroke.ca/stroke/recovery-and-support/living-with-stroke>
- Stroke Resources Directory: <https://www.heartandstroke.ca/services-and-resources>
- Your Stroke Journey: <https://www.strokebestpractices.ca/-/media/1-stroke-best-practices/resources/patient-resources/en-your-stroke-journey-v21.ashx>
- Stroke Engine: <http://www.strokengine.ca/>

## Summary of the Evidence

The use of supportive slings and supports may reduce the amount of subluxation and hemiplegic shoulder pain, although the evidence is conflicting. Ada et al. (2017) randomized 46 persons who were at risk of developing shoulder subluxation following a recent stroke to use a modified lap-tray while sitting and a triangular sling while standing to support the affected arm for four weeks, while those in a control group used a hemi-sling while sitting and standing. At the end of the treatment period there were no significant difference between groups in terms of shoulder subluxation (MD -3 mm, 95% CI -8 to 3), pain at rest (MD -0.7 out of 10, 95% CI -2.2 to 0.8), shoulder external rotation (MD -1.7 out of 10, 95% CI -3.7 to 0.3) or having less contracture of shoulder external rotation (MD -10 deg, 95% CI -22 to 2). An earlier Cochrane review (Ada et al. 2005) included the results from 4 RCTs evaluating the use of strapping (n=3) and hemisling (n=1). All patients were in the acute phase of stroke (less than 4 weeks) with a flaccid arm with no history of shoulder pain. The number of pain-free days associated with treatment was significantly greater; (mean difference: 13.6 days, 95% CI 9.7 to 17.8, p<0.0001); however, the results from only two studies were included in the pooled result. In another systematic review that specifically evaluated the use of strapping (Appel et al. 2014), the authors concluded the efficacy of shoulder strapping to alleviate upper limb dysfunction and shoulder impairments caused by stroke remains unknown, while acknowledging that shoulder strapping may delay the onset of pain in

those with severe weakness or paralysis. A recent meta-analysis, including the results from five RCTs, reported that shoulder positioning programs were not effective in preventing or reducing the range of motion loss in the shoulders' external rotation (Borisova & Bohannon 2009).

Electrical stimulation can be used for the prevention and management of shoulder subluxation. Vafadar et al (2015) included 10 trials of electrical stimulation evaluating the evidence for the effect of functional electrical stimulation on shoulder subluxation, pain and upper extremity motor function when added to conventional therapy. Pooling data from 6 trials showed that electrical stimulation was more effective than the conventional therapy alone in improving shoulder subluxation, when applied within the first 6 months of stroke ( $SMD = -0.70$ , 95% CI  $-0.98$  to  $-0.42$ ). Only data from two trials were available for the effect of electrical stimulation when applied 6 months after stroke. Lee et al. (2017) included the results of 11 trials evaluating the effectiveness of neuromuscular electrical stimulation (NMES) for the management of shoulder subluxation in both the acute and chronic stages of stroke. NMES was effective in reducing subluxation in the acute stage of stroke ( $SMD = -1.1$ , 95% CI  $-1.53$  to  $-0.68$ ,  $p < 0.001$ ) but not in the chronic stage ( $SMD = -1.25$ , 95% CI  $-1.61$  to  $0.11$ ,  $p = 0.07$ ), but did not significantly reduce pain in either the acute or chronic stages. Ada and Foongchomcheay (2002) included participants with subluxation or shoulder muscle paralysis in both the acute and chronic stages of stroke, from seven RCTs. The results suggested that early treatment, starting with electrical stimulation for 2 hours per day increasing to between 4 and 6 hours per day, in addition to conventional therapy helps to prevent the development of hemiplegic shoulder while later treatment helps to reduce pain. In one of the largest RCTs, Church et al. (2006) randomized 176 patients to receive active or sham surface FES treatments in addition to conventional therapy, for four weeks following acute stroke. There was no significant difference between groups in measures of upper-limb function, or the prevalence of pain post intervention, at 3 months.

Treatment with botulinum toxin type a (BTX-A) may help to improve hemiplegic shoulder pain. A Cochrane review (Singh & Fitzgerald 2010), which included the results of 6 RCTs examined the efficacy of the use of BTX-A toxin in the treatment of shoulder pain. Treatment with BTX-A was associated with reductions in pain at 3 and 6 months, but not at 1 month following injection. De Boer et al (2008) randomized 22 patients, an average of 6 months following stroke with significant shoulder pain to receive a single injection of 100 U Botox or placebo to the subscapularis muscle in addition to some form of physical therapy. While pain scores improved in both groups over time, there was no significant difference at 12 weeks following treatment, nor was there significant improvement between groups in degree of humeral external rotation.

Intra-articular corticosteroids injections may also help to improve symptoms of shoulder pain. Rah et al. (2012) randomized 58 patients with chronic shoulder pain (at least 3/10 on a Visual Analog Scale (VAS) to receive a single subacromial injection of 40 mg triamcinolone acetonide or lidocaine (control condition), in addition to a standardized exercise program. There was significant reduction in the average shoulder pain level at day and night, at 8 weeks associated with steroid injection. In contrast, Snels et al. (2000) reported that in 37 patients with hemiplegic shoulder pain ( $\geq 4$  on a 0 to 10 VAS) randomized to receive three injections (1-2 weeks apart) of 40 mg triamcinolone acetonide or placebo, active treatment was not associated with improvements in pain scores three weeks later. Dogan et al. (2013) found that compared to traditional rehabilitation alone, the addition of intra-articular steroid, and intra-articular steroid plus hydraulic distention significantly improved range of motion immediately after treatment and at 1-month follow-up. Both steroid groups had significant improvements on VAS score at rest and during activity but the group which received steroid plus hydraulic distention were significantly more effective than only the intra-articular steroid injection and therapy.

For patients with hand edema, results from a systematic review (Giang et al. 2016) suggest that mobilization exercises (i.e. range of motion exercises) may be effective in reducing hand edema in patients with acute stroke. Bandaging, intermittent compression, kinesio tape, neutral functional

realignment orthosis, and hand realignment orthosis were not found to be effective treatments.

There is no definitive therapeutic intervention for complex regional pain syndrome (CRPS). Although a wide variety of preventative measures and treatments have been used including exercise, heat, contrast baths, hand desensitization programs, splints, medications, and surgical options, there is little evidence that many of the commonly-used treatments are effective. A Cochrane overview of reviews conducted by O'Connell et al. (2013) evaluated 19 studies that used a variety of interventions to treat pain and/or disability associated with CRPS. The authors found moderate quality evidence that intravenous regional blockade with guanethidine is not effective in CRPS and is associated with adverse events, low quality evidence for biphosphates, calcitonin or daily IV of ketamine for the treatment of pain compared to a placebo. Both motor imagery and mirror therapy may be effective for the treatment of pain compared to a control condition. There is some evidence that local anaesthetic sympathetic blockade, physiotherapy, and occupational therapy are not effective for CRPS. There is very low-quality evidence that compared with placebo, oral corticosteroids reduce pain.

**Management of Shoulder Pain & Complex Regional Pain Syndrome (CRPS) following Stroke**  
**Evidence Tables and Reference List available at [www.strokebestpractices.ca](http://www.strokebestpractices.ca)**

## Section 6.0 Management of the Lower Extremity following Stroke

### Section 6.1: Balance and Mobility

#### Recommendations

**Definition:** For the purposes of these recommendations ‘early’ refers to strength of evidence for therapies applicable to patients who are less than 6 months post stroke, and ‘late’ refers to strength of evidence for therapies applicable to patients who are more than 6 months from index stroke event.

#### A. General Considerations

- i. Patients should participate in training that is meaningful, engaging, progressively adaptive, intensive, task-specific and goal-oriented in an effort to improve transfer skills and mobility [Evidence Level: Early-Level A; Late-Level A].

#### B. Lower-Limb Gait Training

- i. Strength training should be considered for persons with mild to moderate impairment in lower extremity function in both subacute [Evidence Level C] and chronic phases [Evidence Level B] of recovery. Strength training does not affect tone or pain [Evidence Level A].
- ii. Task and goal-oriented training that is repetitive and progressively adapted should be used to improve performance of selected lower-extremity tasks such as sit to stand, walking distance and walking speed [Evidence Level: Early-Level A; Late-Level A].
- iii. Treadmill-based gait training (with or without body weight support) should be used to enhance walking speed, and distance walked as an adjunct to over-ground training or when over-ground training is not available or appropriate. [Evidence Level: Early-Level A; Late-Level A].
- iv. Electromechanical (robotic) assisted gait training devices could be considered for patients who would not otherwise practice walking. They should not be used in place of conventional gait therapy. [Evidence Level: Early-Level A; Late-Level A].
- v. Rhythmic auditory stimulation (RAS) should be considered for improving gait parameters in stroke patients, including gait velocity, cadence, stride length and gait symmetry [Evidence Level A].
- vi. Virtual reality training (such as non-immersive technologies) could be considered as an adjunct to conventional gait training [Evidence Level B].
- vii. Mental Practice should be considered as an adjunct to lower extremity motor retraining [Evidence Level A].
- viii. Functional electrical stimulation (FES) should be used to improve strength and function (gait) in selected patients, but the effects may not be sustained [Evidence Level: Early-Level A; Late-Level A].
- ix. Biofeedback, in the form of visual and/or auditory signals to indicate unequal weight bearing and timing, can be used to enhance gait training and improve functional recovery [Evidence Level B]
- x. The need for gait aids, wheelchairs, and other assistive devices should be evaluated on an individual basis [Evidence Level: Early-Level C; Late-Level C].

- a. Prescription and/or acquisition of an assistive device should be based on anticipation of a long-term need [Evidence Level: Early-Level C; Late-Level C].
- b. Once provided, patients should be reassessed, as appropriate, to determine if changes are required or equipment can be discontinued [Evidence Level: Early-Level C; Late-Level C].
- xi. Ankle-foot orthoses should be used on selected patients with foot drop following proper assessment and with follow-up to verify its effectiveness [Evidence Level: Early-Level A; Late-Level A].

### C. Balance

- i. Therapists should consider both voluntary and reactive balance control within their assessment and treatment [Evidence Level C].
- ii. The following therapies should be considered to improve balance following stroke:
  - a. Trunk training/seated balance training [Evidence Level: Early-Level A; Late-Level A];
  - b. Standing practice (i.e. sit-to-stand practice) [Evidence Level: Early-Level A];
  - c. Force platform biofeedback [Evidence Level: Early-Level A; Late-Level A] and task-oriented training with or without multisensory intervention [Evidence Level: Late-Level A].
  - d. Partial body weight support treadmill training [Evidence Level: Early-Level B].
  - e. Balance training combined with virtual reality in the late phase of stroke [Evidence Level A], but not in the early phase of stroke [Evidence Level A].
  - f. The use of unstable surfaces and balance boards [Evidence Level: Late-Level A].
  - g. Cycling [Evidence Level: Early-Level B; Late-Level B];
  - h. Aquatic balance training [Evidence Level: Late-Level B]
  - i. Tai Chi [Evidence Level B].
  - j. Balance training combined with visual feedback, motor imagery training and whole-body vibration do not improve balance outcomes [Evidence Level: Early-Level A].

### D. Aerobic Training

- i. Once medically stable, patients should be screened for ability to participate in aerobic exercise by appropriately qualified health care professionals with expertise in aerobic training [Evidence Level C].
  - a. A medical history and physical examination should be performed to identify factors that require special consideration or constitute a contraindication to aerobic exercise [Evidence Level: Early -Level B; Late-Level B].
  - b. An exercise stress test with electrocardiogram, and monitoring of blood pressure and subjective symptoms, should be considered particularly for patients with a known history of cardiovascular disease [Evidence Level: Early -Level C; Late-Level C].
  - c. If the target intensity of the planned program is light (i.e., <40-45% of predicted heart rate reserve), a clinical submaximal test (e.g., six-minute walk test) may be adequate to evaluate readiness for aerobic training [Evidence Level: Early -Level C; Late-Level C].

- ii. Individually-tailored aerobic training involving large muscle groups should be incorporated into a comprehensive stroke rehabilitation program to enhance cardiovascular endurance and cognitive function [Evidence Level: Early -Level A; Late-Level A]
  - a. To achieve a training effect, patients should participate in aerobic exercise at least 3 times weekly for a minimum of 8 weeks, progressing as tolerated to 20 minutes or more per session, exclusive of warm-up and cool-down [Evidence Level: Early -Level B; Late-Level B].
  - b. Heart rate and blood pressure should be monitored during training to ensure safety and attainment of target exercise intensity [Evidence Level: Early -Level A; Late-Level A].
- iii. To ensure long-term maintenance of health benefits, a planned transition from structured aerobic exercise to more self-directed physical activity at home or in the community should be implemented. [Evidence Level: Early -Level A; Late-Level A].
  - a. Strategies to address specific barriers to physical activity related to patients, health care providers, family, and/or the environment should be employed [Evidence Level: Early -Level A; Late-Level A].

### Rationale

Stroke frequently affects balance and the use of the legs. Walking is a valued function by patients to facilitate every day interaction. Along with the goal of increasing a patient's safety and ability to walk, basic abilities to stand and transfer safely must also be addressed. To ambulate safely, patients may require assistive devices such as a cane or walker. For walking to be a feasible alternative to wheelchair mobility, critical elements would include having a reasonable walking speed, endurance and balance. Unfortunately, some individuals may not achieve independence in walking and may require a wheelchair.

People with stroke emphasized the importance of the involvement of their family members and caregivers when receiving education and training regarding gait, mobility, and aerobic exercises.

### System Implications

To achieve timely and appropriate assessment and management of basic mobility, postural control, lower extremity function, gait, and transfer skills, the organization/rehabilitation setting requires:

- Organized stroke care, including stroke rehabilitation units with a critical mass of trained staff and an interdisciplinary team during the rehabilitation period following stroke.
- Initial and ongoing standardized assessment performed by clinicians trained and experienced in stroke rehabilitation.
- Timely access to specialized, interdisciplinary stroke rehabilitation services as defined in recommendations.
- Timely access to appropriate intensity of rehabilitation for stroke survivors, including sit to stand training as defined in recommendations.
- Access to required supportive devices and equipment to promote safety and independence. This equipment should be affordable. Processes should be in place to ensure proper assessment of patients to meet equipment needs (e.g., seating assessments).
- Access to ECG monitored exercise stress testing and experienced physician to develop appropriate intensity of aerobic exercise.

Performance Measures
<ol style="list-style-type: none"><li>1. Extent of change (improvement) in functional status on the 6-Minute Walk Test from admission to an inpatient rehabilitation program to discharge. Change (improvement) in functional status scores (e.g., FIM® Instrument sub score locomotion) from admission to an inpatient rehabilitation program to discharge.</li><li>2. Median length of time from stroke admission in an acute care hospital to assessment of rehabilitation potential by a rehabilitation healthcare professional.</li><li>3. Median length of time spent in active rehabilitation on a stroke rehabilitation unit during inpatient rehabilitation.</li><li>4. Median hours per day (minimum of three) of direct task-specific therapy provided by the interdisciplinary stroke team.</li><li>5. Median days per week (minimum of five) of direct task specific therapy provided by the interdisciplinary stroke team.</li><li>6. Extent of change (improvement) in functional status score (e.g., CMSA lower limb sub scale) from admission to an inpatient rehabilitation program to discharge.</li><li>7. Extent of change in functional status scores using a standardized assessment tool (e.g., FIM® Instrument) from admission to an inpatient rehabilitation program to discharge (average and median).</li><li>8. Extent of change in lower limb functional status using a standardized assessment tool (e.g., Chedoke-McMaster Stroke Assessment sub scale) from admission to an inpatient rehabilitation program to discharge.</li><li>9. Extent of change in lower limb spasticity scores using a standardized assessment tool (e.g., Modified Ashworth Scale) from admission to an inpatient rehabilitation program to discharge.</li></ol>
<b>Measurement Notes:</b> <ul style="list-style-type: none"><li>• Therapy time may be extracted from rehabilitation professional workload measurement systems where available.</li><li>• The 5m or 10m gait speed test may be used as the most basic measurement for those not able yet to do 6-minute walk test.</li><li>• Ensure consistency in start time for any time-sensitive</li></ul>
Implementation Resources and Knowledge Transfer Tools
<b>Health Care Provider Information</b> <ul style="list-style-type: none"><li>• <a href="#">Table 1: Stroke Rehabilitation Screening and Assessment Tools (Appendix Two)</a></li><li>• FIM® Instrument: <a href="http://www.strokengine.ca/assess/fim/">http://www.strokengine.ca/assess/fim/</a></li><li>• AlphaFIM® Instrument: <a href="https://www.udsmr.org/">https://www.udsmr.org/</a></li><li>• Chedoke-McMaster Stroke Assessment: <a href="https://www.sralab.org/rehabilitation-measures/chedoke-mcmaster-stroke-assessment-measure">https://www.sralab.org/rehabilitation-measures/chedoke-mcmaster-stroke-assessment-measure</a></li><li>• Modified Ashworth Scale: <a href="http://strokengine.ca/assess/module_mashs_intro-en.html">http://strokengine.ca/assess/module_mashs_intro-en.html</a></li><li>• 6 minute walk test: <a href="http://strokengine.ca/assess/module_6mwt_intro-en.html">http://strokengine.ca/assess/module_6mwt_intro-en.html</a></li><li>• Fugl-Meyer Assessment: <a href="http://strokengine.ca/assess/module_fma_intro-en.html">http://strokengine.ca/assess/module_fma_intro-en.html</a></li><li>• Functional Ambulation Categories: <a href="http://strokengine.ca/assess/module_fac_intro-en.html">http://strokengine.ca/assess/module_fac_intro-en.html</a></li><li>• Timed Up and Go Test: <a href="http://strokengine.ca/assess/module_tug_family-en.html">http://strokengine.ca/assess/module_tug_family-en.html</a></li></ul>

- 6-Minute Walk Test: [http://strokengine.ca/assess/module\\_6mwt\\_family-en.html](http://strokengine.ca/assess/module_6mwt_family-en.html)
- Berg Balance Scale: [http://strokengine.ca/assess/module\\_bbs\\_intro-en.html](http://strokengine.ca/assess/module_bbs_intro-en.html)
- Stroke Engine: <http://www.strokengine.ca/>

### Information for People with Stroke, their Families and Caregivers

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- Transitions and community participation infographic: Guide to taking charge of your stroke recovery: <https://www.heartandstroke.ca/-/media/1-stroke-best-practices/transition-of-care-nov2019/csbp-infographic-transitions-and-participation.ashx>
- Aphasia Institute: <http://www.aphasia.ca/people-with-aphasia-and-families/>
- Post Stroke Checklist: <https://www.strokebestpractices.ca/resources/patient-resources>
- Living with Stroke Program: <https://www.heartandstroke.ca/stroke/recovery-and-support/living-with-stroke>
- Stroke Resources Directory: <https://www.heartandstroke.ca/services-and-resources>
- Your Stroke Journey: <https://www.strokebestpractices.ca/-/media/1-stroke-best-practices/resources/patient-resources/en-your-stroke-journey-v21.ashx>
- Stroke Engine: <http://www.strokengine.ca/>

### Summary of the Evidence

#### Lower-Limb Gait Training

##### *Strength Training*

Many individuals experience muscle weakness as a consequence of stroke. Strength training may help to improve measures of gait and balance. Flansbjer et al. (2008, 2012) randomized 24 persons living in the community a minimum of 6 months post stroke to a training group that participated in supervised progressive resistance training of the knee muscles twice weekly for 10 weeks, or to a control group who continued their usual daily activities. The authors found that on the paretic side, the mean dynamic knee muscle strength extension and flexion in the intervention group had improved significantly more at the end of treatment and was maintained at 4-year follow-up compared to the control group. However, there were no significant differences between groups in mean improvement on the Timed-up-and Go test, gait speed or distance traveled on the 6-Minute Walk Test at 4 years. Cooke et al. (2010), randomized participants with subacute stroke (mean 1 month) to one of three treatment groups for a duration of 6 weeks: 1) conventional physiotherapy (CPT) + Functional Strength training (FST); 2) extra intensity training (CPT + CPT); or 3) CPT alone. Following the intervention both experimental groups showed improvement in walking speeds over the CPT alone group, but this reached significance in the CPT + CPT group. The CPT + CPT group also showed significant improvement in the number of participants with a walking speed over 0.8m/s compared to the CPT group. No significant differences were noted between-groups for torque about the knee, symmetry step length, symmetry step time, the Rivermead score, or on the EuroQoL. At the 12-week follow-up no significant differences were identified between groups.

##### *Task Oriented Training (Task-Specific Training)*

Task oriented training (also called task-specific training) involves active practice of task-specific motor activities. Repeated motor practice has been shown to improve walking speed and functional ambulation.

A Cochrane review by English et al. (2017) pooled findings from 17 RCTs that compared circuit class

training with at least 3 clients, provided for a minimum of once-weekly sessions for a minimum of four weeks, with no therapy, sham therapy, or another therapy modality. Only studies that reported interventions with a focus on repetitive practice of functional tasks arranged in a circuit, with the aim of improving mobility, were included. Pooling the results from 10 trials, the mean distance walked during the 6-minute walk test was 60.86 metres further (95% CI 44.55 to 77.17m), compared with the control condition, which exceeded the minimal clinically important difference of 34.4 metres. The mean gait speed in the intervention groups was 0.15 metres/ second faster (0.10 to 0.19 m/s) compared with the control group. Other outcomes with scores significantly higher in the intervention group included Timed-up-and Go, Stroke Impact Scale, Functional Ambulation Classification and the Rivermead Mobility Index. In another Cochrane review, French et al. (2016) examined task-specific training on upper and lower-limb functions compared with usual care, an alternative intervention, or no care. Lower limb repetitive task-oriented training interventions were tested in 17 trials. Two trials focused on interventions specifically on sit-to-stand practice, 6 trials focused on walking practice, while 4 trials investigated interventions that focused specifically on sitting balance trunk control, and balance. Repetitive task training was associated with significantly greater improvements in walking distance (MD= 34.80 metres, 95% CI 18.19 to 51.41 metres; 9 studies) and functional ambulation (SMD= 0.35, 95% CI 0.04 to 0.66; 8 studies), sit-to-stand post treatment (SMD=0.35, 95% CI 0.13 to 0.56, 7 studies) and standing balance or reach (SMD= 0.24, 95% CI 0.07 to 0.42; 9 studies).

#### *Treadmill Training with and without Body Weight Support*

In a Cochrane review, Mehrholz et al. (2017) included the result of 56 trials (n=3,105) and concluded that patients with stroke who received treadmill training (with or without body weight support) in combination with physiotherapy had significantly improved gait velocity (mean difference=0.06 m/s, 95% CI 0.03 to 0.09) and greater walking endurance (MD=14.19 metres, 95% CI 2.92 to 25.46), when assessed at the end of treatment. Among studies evaluating treadmill training with body weight support, patients were no more likely to achieve independent walking than patients receiving gait training without these devices (risk difference= -0.00, 95% CI -0.02 to 0.02), nor was gait velocity or walking endurance increased significantly at the end of scheduled follow-up (MD=0.03 m/s, 95% CI -0.05 to 0.10 and MD= 21.64 m, 95%CI -4.70 to 47.98). In the MOBILISE trial, (Ada et al. 2010, Dean et al. 2010) 126 patients were randomized to an experimental or a control group within 28 days of stroke and received treatment until they achieved independent walking or for as long as they remained in hospital. Participants in both groups received 30 minutes of walking practice 5 days/week. Additional lower-limb therapy was provided for an additional 30 minutes/day. Participants in the experimental group undertook up to 30 minutes per day of treadmill walking with sufficient body weight support such that initially, the knee was within 15 degrees of extension in mid stance. The control group received up to 30 minutes of over-ground walking training, with the use of aids, if required. Although there were no differences in the proportion of independent ambulators between groups at one, two or 6 months, participants in the experimental group achieved independence in ambulation a median of 14 days sooner.

#### *Electromechanical/Robot-Assisted Gait Training Devices*

In an updated Cochrane review, Mehrholz et al. (2017) included 36 trials studies (n=1,472) that were examined the effectiveness of electromechanical and robot-assisted gait training for improving walking after stroke. Treatments included electromechanical and robot-assisted gait training devices (with or without electrical stimulation) which are designed to assist stepping cycles by supporting body weight and automating the walking therapy process with the addition of physiotherapy compared with physiotherapy or routine care only. Electromechanical-assisted gait training in combination with physiotherapy increased the odds of participants becoming independent in walking at the end of treatment (OR=1.94, 95% CI 1.39 to 2.71; p< 0.001) and at the end of follow-up, but did not significantly increase walking velocity (MD=0.04 m/s, 95% CI 0.00 to 0.09; p=0.08) or walking capacity (MD= 5.84 metres walked in 6 minutes, 95% CI -16.73 to 28.40; p= 0.61). The odds of becoming an independent ambulator were higher for persons treated within the first three months of stroke onset (OR=1.9 vs. OR=1.2). Morone et al. (2011, 2012) included 48 participants, an average of 20 days post stroke,

stratified by motor impairment (high vs. low). All patients underwent standardized rehabilitation for 3 months. After one week of therapy, participants in the robotic group underwent additional robotic-assisted gait training instead of a second therapy session (20 sessions in total) while those in the control group participated in a second therapy session. At the end of treatment participants in the low impairment robot group had improved significantly more than participants in the low impairment control group on the Functional Ambulation Category (FAC) ( $p<0.001$ ), the Rivermead Mobility Index ( $p=0.001$ ) and the 6-Minute Walk test ( $p=0.029$ ). Although participants in the high impairment groups also improved over time, there were no significant between-group differences on any of the outcomes. At 2-year follow-up, patients in the low impairment robot group continued to demonstrate significantly improved scores, while there were no significant differences between groups for highly-impairment patients.

#### *Rhythmic Auditory Stimulation (RAS)*

Rhythmic auditory cueing or stimulation, whereby walking is synchronized to a rhythmic auditory cue, may help to improve motor learning following a stroke. Yoo (2016) included the results of 8 RCTs ( $n=242$ ) comparing intentional synchronization of target movement to externally generated rhythmic auditory cueing with traditional rehabilitative interventions or other controlled interventions in persons with hemiparesis following stroke. RAS was associated with large significant effect sizes for all lower-limb outcomes, including gait velocity (Hedges's  $g=0.98$ , 95% CI 0.69 to 1.28), cadence (Hedges's  $g=0.84$ , 95% CI 0.63 to 1.15) and stride length (Hedges's  $g=0.76$ , 95% CI 0.47 to 1.05).

#### *Virtual Reality*

A Cochrane review (Laver et al. 2017) included the results of 72 trials, which evaluated the effect of virtual reality and interactive video gaming. Most of the trials assessed upper intervention. Based on the results of 3 and 6 trials, virtual reality was not associated with significant improvements in gait speed, balance or Timed Up & Go tests at the end of the intervention. Iruthayarajah et al. (2017) included the results of 22 RCTs specifically examining the use of virtual reality in the chronic stage of stroke to improve balance. Interventions included the Wii Fit balance board, and treadmill training and postural training combined with virtual reality applications. Combining the results of 12 trials, VR interventions were associated with a significantly greater improvement in Berg Balance Scale scores ( $MD=2.94$ , 95%CI 1.82–4.06,  $p<0.001$ ). Gibbons et al. (2016) included the results of 22 trials (552 subjects) evaluating the effects of virtual reality on lower limb outcomes post stroke. Pooled analyses were possible for studies including patients in the chronic stage of stroke. In the VR group, functional balance was improved significantly more following treatment ( $SMD=0.42$ , 95% CI 0.11 to 0.73), but not at follow-up ( $SMD=0.38$ , 95% CI -0.73 to 1.50). Gait velocity, cadence, stride length and step length were also significantly improved immediately following the intervention in the VR group.

#### *Biofeedback*

Stanton et al (2017) included the results of 18 trials evaluating biofeedback. Active interventions included force platforms, EMG biofeedback, audio and visual feedback, provided for an average of 5 weeks. Overall, biofeedback improved lower limb activities compared with usual therapy ( $SMD= 0.50$ , 95% CI 0.30 to 0.70).

#### **Balance Training**

##### *Trunk training*

Trunk training exercises can be added to standard physiotherapy to help improve balance.

Bank et al (2016) included the results of 11 RCTs in a systematic review that investigated various interventions (sitting and standing balance, trunk training and lower-limb training) to improve sitting

balance. Compared with conventional physiotherapy alone, trunk training exercises, there were no significant differences between groups on the Trunk Control test ( $MD=-1.53$ , 95%CI -9.37–6.32,  $p=0.70$ ; 5 studies,  $n=263$ ), while patients that received additional therapy had significantly higher Trunk Impairment Scale scores ( $MD=1.70$ , 0.62–2.78,  $p=0.007$ ; 4 studies,  $n=106$ ). Sorinola et al (2014) included 6 RCTs in a systematic review evaluating trunk exercises (sitting, standing, reaching and weight shifting). Compared with conventional rehabilitation only, additional trunk training was not associated with significant differences between groups on global measures of trunk performance or standing balance and/or functional weight-shifting training, but did improve walking ability ( $SMD=0.81$ , 95% CI 0.30 to 1.33;  $p= 0.002$ ; 3 trials).

### *Sit-to-Stand*

A Cochrane review (Pollock et al. 2014) included the results of 13 RCTs that examined repetitive sit-to-stand training, exercise training programs that included sit-to-stand training, sitting training and augmented feedback. One study, judged to be at high risk of bias, found training increased the odds of independent sit-to-stand ( $OR=4.86$ , 95%CI 1.43–16.50). Active intervention reduced the time needed for sit-to-stand ( $SMD=-0.34$ , 95% CI -0.62 to -0.06,  $n=7$  trials) and improved lateral symmetry ( $SMD=0.85$ , 95%CI 0.38–1.33,  $n=5$  trials).

### *Exercise*

Under the broad umbrella of exercise to improve balance, van Duijnhoven et al. (2016) included the results from 43 RCTs evaluating exercise interventions, including balance training (Tai Chi, virtual reality, sit-to-stand, weight-shifting, circuit training or aquatic therapy), gait training (treadmill training), multisensory training (vibration, rhythmic auditory stimulation), aerobic exercise (water-based, cycling) or and other training (yoga, cognitive tasks). Combining the results from all trials, exercise was associated with significantly higher Berg Balance Scores ( $MD=2.22$ , 95%CI 1.26–3.17,  $p<0.01$ ) and Functional Reach Test scores ( $MD=3.12$ , 95%CI 0.90–5.35,  $p<0.01$ ) at the end of the intervention. Sling exercises have also been shown to improve balance (Chen et al. 2016). Traditional Chinese exercises, delivered for at least 2 weeks (and up to one year), were associated with improvements of 2 and 11 points in Berg Balance scores, compared with conventional therapy in two systematic reviews (Ge et al, 2017, Chen et al. 2015). Aquatic exercises, when combined with a 6-week course of neurodevelopmental treatment were also shown to result in significantly greater mean (gains in Berg Balance scores (2.6 vs. 0.8 points), compared with NDT treatment alone (Kim et al. 2016).

### *Virtual Reality*

de Rooij et al. (2016) included the results of 21 RCTs examining virtual reality balance or treadmill training compared with conventional training. In 5 trials where therapy was dose matched, the mean difference in Berg Balance scores was 2.8 points (95% CI 1.52-2.85,  $p<0.0001$ ) at the end of treatment, which was provided in 2-5 sessions per week for 3-8 weeks. Two other systematic reviews including the results of 22 and 16 RCTs (Iruthayarakam et al. 2017, Li et al. 2016) have also found significant differences in Berg Balance scores in groups that received virtual reality interventions using Wii Fit balance board, IREX or treadmill training with virtual reality ( $MD= 2.94$ , 95% CI 1.82–4.06,  $p < 0.001$  and 1.46, 95% CI 0.09-2.83,  $p=0.04$ ).

### **Aerobic Training**

A Cochrane review (Saunders et al. 2016) included the results from 58 trials of patients in both the acute and chronic stages of stroke. Interventions were classified as 1) Cardiorespiratory training versus usual care, 2) Resistance training versus usual care and 3) Mixed training interventions, which included combinations of cardiorespiratory and resistance training methods. At the end of the intervention, cardiorespiratory training was associated with significant increases in maximal and preferred walking speed and walking capacity. Increased gait speed and improved walking capacity were also associated

with mixed training interventions. Both Sandberg et al. (2016) and Hornby et al. (2016) reported significantly greater improvements in the 6-Minute Walk test in RCTs associated with aerobic training, compared with conventional rehabilitation in persons with acute and chronic stroke. Gait speed and fastest possible walking speed were also significantly higher in the aerobic training group (Hornby et al. 2016). Jin et al (2012) and Globas et al. (2012) reported significant improvements in measures of cardiovascular fitness, walking ability and performance in patients more than 6 months post stroke who had received a progressive graded, high-intensity aerobic treadmill exercise or aerobic cycling exercise, with lower extremity weights. Pang et al. (2006) conducted a systematic review of aerobic exercise following stroke, which included the results from 7 RCTs, evaluating patients in all stages of stroke recovery. Exercise intensity in the included studies ranged from 50% to 80% of heart rate reserve, while duration varied from 20-40 min for 3-5 days a week for 3-19 weeks. Regardless of the stage of stroke recovery, there was a significant benefit of therapy. Improvements were noted in the parameters of peak VO<sub>2</sub>, peak workload, walking speed and endurance.

## Gait Aids

### Ankle-Foot Orthoses (AFO)

The use of ankle-foot orthoses is widespread, although there are few controlled trials examining its benefit. A Cochrane review conducted by Tyson & Kent (2013) included the results from 13 RCTs. During a single testing session, participants performed significantly better on measures of balance (weight distribution: SMD=0.32, 95% CI -0.52 to -0.11, p=0.003) and mobility (gait speed: MD=0.06 m/s, 95% CI, 0.03 to 0.08, p<0.0001 and stride length: SMD= 0.28, 95% CI 0.05 to 0.51, p=0.02) while wearing an AFO compared with the control condition where an AFO was not worn. There were no significant treatment effects associated with the outcomes of postural sway and timed mobility tests. When patients who had been wearing an AFO regularly for the previous 6 months were assessed with and without the orthosis, measures of gait speed were significantly better when the AFO was worn (de Wit et al. 2004). Similarly, when 58 patients who had never worn the device previously were assessed with, and without an AFO two hours apart, measures of balance and gait speed were significantly better when the AFO was worn (Wang et al. 2007). In 32 chronic stroke survivors who were randomized to wear or not wear an AFO for a period of three months, gait speed was significantly increased as was and Physiological Cost Index (beats/min) in patients who had worn the device (Erel et al. 2011).

### Functional Electrical Stimulation (FES)

Functional electrical stimulation (FES) can be used to improve gait quality in selected patients who are highly motivated and able to walk independently or with minimal assistance. A systematic review by Howlett et al (2015) included 18 trials of FES for improving upper or lower limb activity compared to placebo, no treatment or training alone. FES was associated with significantly faster gait speed compared with training alone (MD= 0.08 m/s, 95% CI 0.02 to 0.15; results from 8 trials, 203 participants). However, an older Cochrane review (Pomeroy et al. 2006) including the results from 24 RCTs, of which 12 evaluated interventions and outcomes associated with mobility. The results suggested that active FES was not associated with significant increases in gait speed (SMD= -0.02, 95% CI -0.30 to 0.26) or stride length (SMD=0.36, 95% CI -0.93 to 1.63).

**Balance and Mobility Evidence Tables and Reference List available at**  
[www.strokebestpractices.ca](http://www.strokebestpractices.ca)

## Section 6.2: Lower Limb Spasticity following Stroke

### Recommendations

- i. Spasticity and contractures may be managed by antispastic pattern positioning, range-of-motion exercises, and/or stretching [Evidence Level: Early-Level C; Late-Level B].
- ii. Chemo-denervation using botulinum toxin can be used to reduce spasticity, increase range of motion, and improve gait, for patients with focal symptomatically distressing spasticity [Evidence Level: Early – Level C; Late-Level A].
  - a. Note, caution should be taken when delivering botulinum toxin in the early phase while patients are still recovering.
- iii. Oral medications can be considered for the treatment of disabling spasticity, however, side effects of fatigue and drowsiness are common and benefits for treating spasticity tend to be marginal.
  - a. Tizanidine can be used to treat more generalized, disabling spasticity. [Evidence Levels: Early-Level C; Late-Level B].
  - b. Baclofen can be used as a lower cost alternative to treat more generalized disabling spasticity [Evidence Levels: Early-Level C; Late-Level C].
  - c. Benzodiazepines should be avoided due to sedating side effects, which may impair recovery [Evidence Level: Early-Level C; Late-Level C].
- iv. Intrathecal Baclofen should be considered for specific cases of severe intractable and disabling/painful spasticity [Evidence Level: Late-Level B].

### Rationale

Spasticity, defined as a velocity dependent increase of tonic stretch reflexes (muscle tone) with exaggerated tendon jerks can be painful, interfere with functional recovery and hinder rehabilitation efforts. If not managed appropriately, stroke survivors may experience a loss of range of motion at involved joints of the ankle and foot, which can cause difficulties with ambulation.

### System Implications

To achieve timely and appropriate assessment and management of lower limb spasticity the organization requires:

- Organized stroke care, including stroke rehabilitation units with a critical mass of trained staff and an interdisciplinary team during the rehabilitation period following stroke.
- Initial and ongoing assessments performed by clinicians experienced in stroke rehabilitation both in hospital and in the community.
- Assessment for an orthotic/splint/brace should be considered to ensure safety.
- Timely access to specialized, interdisciplinary stroke rehabilitation services as defined within the best practice recommendations.
- Timely access to appropriate intensity of rehabilitation for stroke survivors as defined within the best practice recommendations.

- Funding for chemodenervation and associated post injection rehabilitation services where necessary. May require access to electromyography or ultrasound to facilitate localization of the motor points for injections.
- The development and implementation of an equitable and universal pharmacare program, implemented in partnership with the provinces, designed to improve access to cost-effective medicines for all people in Canada regardless of geography, age, or ability to pay. This program should include a robust common formulary for which the public payer is the first payer.

## Performance Measures

1. Extent of change in functional status scores using a standardized assessment tool (e.g., FIM® Instrument) from admission to an inpatient rehabilitation program to discharge (average and median).
2. Extent of change in lower limb functional status using a standardized assessment tool (e.g., Chedoke-McMaster Stroke Assessment sub scale) from admission to an inpatient rehabilitation program to discharge.
3. Extent of change in lower limb spasticity scores using a standardized assessment tool (e.g., Modified Ashworth Scale) from admission to an inpatient rehabilitation program to discharge.
4. Median length of time from stroke admission in an acute care hospital to assessment of rehabilitation potential by a rehabilitation healthcare professional.
5. Median length of time spent in active rehabilitation on a stroke rehabilitation unit during inpatient rehabilitation.
6. Median total length of time spent on a stroke rehabilitation unit during inpatient rehabilitation.

## Measurement Notes:

- Ensure consistency in start time for all time-based measures, and document the definition of start and stop times for transparency and replication.

## Implementation Resources and Knowledge Transfer Tools

### Health Care Provider Information

- [Table 1: Stroke Rehabilitation Screening and Assessment Tools \(Appendix Two\)](#)
- FIM® Instrument: <http://www.strokengine.ca/assess/fim/>
- AlphaFIM® Instrument: <https://www.udsmr.org/>
- Chedoke-McMaster Stroke Assessment: <https://www.sralab.org/rehabilitation-measures/chedoke-mcmaster-stroke-assessment-measure>
- Modified Ashworth Scale: [http://strokengine.ca/assess/module\\_mashs\\_intro-en.html](http://strokengine.ca/assess/module_mashs_intro-en.html)
- Stroke Engine: <http://www.strokengine.ca/>

### Information for People with Stroke, their Families and Caregivers

- Rehabilitation and Recovery infographic: Guide to taking charge of your stroke recovery: <https://www.heartandstroke.ca/-/media/1-stroke-best-practices/rehabilitation-nov2019/csbp-infographic-rehabilitation.ashx>
- Transitions and community participation infographic: Guide to taking charge of your stroke recovery: <https://www.heartandstroke.ca/-/media/1-stroke-best-practices/transition-of-care-nov2019/csbp-infographic-transitions-and-participation.ashx>

- Aphasia Institute: <http://www.aphasia.ca/people-with-aphasia-and-families/>
- Post Stroke Checklist: <https://www.strokebestpractices.ca/resources/patient-resources>
- Living with Stroke Program: <https://www.heartandstroke.ca/stroke/recovery-and-support/living-with-stroke>
- Stroke Resources Directory: <https://www.heartandstroke.ca/services-and-resources>
- Your Stroke Journey: <https://www.strokebestpractices.ca/-/media/1-stroke-best-practices/resources/patient-resources/en-your-stroke-journey-v21.ashx>
- Stroke Engine: <http://www.strokengine.ca/>

## Summary of the Evidence

Few studies have been published examining the prevention or treatment of spasticity or contracture using antispastic pattern positioning, range of motion exercises, stretching and/or splinting in the lower extremity. Kluding et al. (2008) reported that eight sessions of functional task practice combined with ankle joint mobilizations, provided over four weeks, resulted in increased ankle range of motion, compared with a group that received therapy only, in the chronic stage of stroke. The participants in the intervention group gained 5.7 degrees in passive ankle range of motion compared with 0.2 degrees in the control group ( $p<0.01$ ).

The use of Botulinum toxin-type A (BTX-A) for treatment of lower-limb spasticity is not as well-studied compared with the upper extremity. A meta-analysis (Foley et al. 2010), which included the results from 8 studies reported a moderate increase in gait speed associated with BTX-A ( $SMD= 0.193\pm 0.081$ , 95% CI 0.033 to 0.353,  $p<0.018$ ). Kaji et al. (2010) randomized 120 patients with lower limb spasticity following a stroke of greater than six months post onset to receive a single treatment of 300 U Botox® or placebo. There was a significantly greater reduction in mean modified Ashworth Scale scores at weeks four, 6 and 8 in the treatment group compared with the control group; however, there were no significant differences between groups at week 10 or 12. Pittock et al. (2003) compared escalating doses of BTX-A with placebo and found that the highest dose (1,500 U Dysport ®) was associated with the greatest relief of calf spasticity compared with placebo at four, eight and 12 weeks following treatment. Lower doses (500 and 1,000 U) resulted in significant reductions in spasticity at week four only.

Intrathecal baclofen is popular treatment for spasticity in many populations including stroke, spinal cord injury, and cerebral palsy. Meythalar et al. (2002) performed a cross-over randomized controlled trial among individuals with chronic stroke. At one year the authors noted that spasticity had improved, as evidenced by a decline in Ashworth scores and reflex scores ( $p<0.01$  for both); spasm frequency scores did not improve ( $p>0.05$ ).

**Lower Limb Spasticity following Stroke Evidence Tables and Reference List available at [www.strokebestpractices.ca](https://www.strokebestpractices.ca)**

## Section 6.3: Falls Prevention and Management

### Recommendations

- i. Following stroke, all patients should be screened for fall risk by an experienced clinician at admission, at all transition points, after a fall, and/or whenever there is a change in health status [Evidence Level C]. [Refer to Appendix 2 Table 2: Suggested Screening/Assessment Tools for Risk of Falling Post Stroke](#). Refer to [Section 6.1C](#) for recommendations regarding balance.
- ii. Screening should include identification of medical, functional, cognitive, and environmental factors associated with risk of falling and fall injuries (e.g., orthostatic hypotension, dehydration, muscle weakness, and osteoporosis) [Evidence Level B].
- iii. Those identified as being at risk for falls should undergo a comprehensive interdisciplinary assessment that includes medical and functional history and evaluation of mobility, vision, perception, cognition, cardiovascular status, and environment [Evidence Level C].
- iv. Based on risk assessment findings, an individualized falls prevention plan should be implemented for each patient [Evidence Level B].
  - a. The patient, family, and caregiver should be made aware of the patient's increased risk for falls and given a list of precautions to reduce their risk of falling [Evidence Level B].
  - b. The patient, family, and caregiver should receive skills training to enable them to safely transfer and mobilize the patient [Evidence Level B]. This should include what to do if a fall occurs and how to get up from a fall [Evidence Level C].
  - c. The patient, family, and caregiver should receive education regarding suitable gait aids, footwear, transfers, and wheelchair use, considering the healthcare and community environment [Evidence Level B].
  - d. Bed and chair alarms should be provided for patients at high risk for falls according to local fall prevention protocols [Evidence Level C].
- v. If a patient experiences a fall, they should be assessed for possible injury prior to an assessment of the circumstances surrounding the fall should be conducted to identify precipitating factors. Pre-existing falls prevention plans should be modified to reduce the risk of further falls [Evidence Level C].

*Note: For treatment strategies for risks of falling (e.g. leg weakness, impaired balance, visual disturbances, cognitive impairment, sensory loss), refer to appropriate topics within this module.*

### Rationale

Patients with stroke are at higher risk for falls than many other hospitalized patients. The reported incidence ranges from 14 to 65 percent. Falls occur often within the first week following stroke during the acute phase, and then again as patient mobility increases. The interdisciplinary care team must be cognizant of the risk for falls and ensure appropriate assessments and interventions take place.

People with stroke emphasize the importance of individualizing the education and strategies used for fall prevention and management as they are unique to each person's abilities. In addition, people with stroke expressed the importance of neck/wrist fall alarms/emergency button systems, especially for people experiencing aphasia and/or apraxia. Balance is a concerning issue discussed by people with stroke and should be evaluated on each person, even if the person is not presenting with any obvious balance difficulties.

### System Implications

Organizations should provide a falls prevention and management strategy that includes:

- regular and ongoing education for staff in all hospital settings about risk assessment and prevention strategies related to falls, including transfer and mobilization training;
- use of a falls screening tool in all organizations for early recognition of fall risk;
- patient transferring and mobilization instructions provided to all staff by physiotherapists and occupational therapists, and provided to patients and families by trained staff members;
- delivery of all therapies by trained professionals capable of interacting with people with communication limitations such as aphasia, by using supported conversation techniques;
- standardized falls risk assessment process within each organization that addresses timing of fall assessments, components, and the need for documentation;
- Universal falls precautions in all environments where stroke patients receive care.

### Performance Measures

1. Fall incidence rate for stroke patients admitted to hospital (acute care or rehabilitation)
2. Percentage of patients with falls who experience injuries during the fall.
3. Percentage of patients with falls who experience a prolonged length of stay as a result of the fall.

### Measurement Notes:

- Falls assessments are included as separate documentation in some organizations, and included in interdisciplinary clinical notes in others.
- The absence of documentation may not reflect whether or not assessments were done.

### Implementation Resources and Knowledge Transfer Tools

#### Health Care Provider Information

- [Table 1: Stroke Rehabilitation Screening and Assessment Tools \(Appendix Two\)](#)
- [Table 2: Suggested Screening/Assessment Tools for Risk of Falling Post Stroke \(Appendix Two\)](#)
- RNAO Preventing Falls and Reducing Injury from Falls Best Practice Guideline:  
<https://rnao.ca/bpg/guidelines/prevention-falls-and-fall-injuries>
- Berg Balance Scale: [http://strokengine.ca/assess/module\\_bbs\\_intro-en.html](http://strokengine.ca/assess/module_bbs_intro-en.html)
- Function in Sitting Test: <http://www.samuelmerritt.edu/fist>
- Stroke Engine: <http://www.strokengine.ca/>

#### Information for People with Stroke, their Families and Caregivers

- Rehabilitation and Recovery infographic: Guide to taking charge of your stroke recovery:  
<https://www.heartandstroke.ca/-/media/1-stroke-best-practices/rehabilitation-nov2019/csbp-infographic-rehabilitation.ashx>
- Transitions and community participation infographic: Guide to taking charge of your stroke recovery: <https://www.heartandstroke.ca/-/media/1-stroke-best-practices/transition-of-care-nov2019/csbp-infographic-transitions-and-participation.ashx>
- Aphasia Institute: <http://www.aphasia.ca/people-with-aphasia-and-families/>
- Post Stroke Checklist: <https://www.strokebestpractices.ca/resources/patient-resources>

- Living with Stroke Program: <https://www.heartandstroke.ca/stroke/recovery-and-support/living-with-stroke>
- Stroke Resources Directory: <https://www.heartandstroke.ca/services-and-resources>
- Your Stroke Journey: <https://www.strokebestpractices.ca/-/media/1-stroke-best-practices/resources/patient-resources/en-your-stroke-journey-v21.ashx>
- Reduce Your Risk for Falls: [http://rnoa.ca/sites/rnoa-ca/files/Reduce\\_Your\\_Risk\\_for\\_Falls.pdf](http://rnoa.ca/sites/rnoa-ca/files/Reduce_Your_Risk_for_Falls.pdf)
- Stroke Engine: <http://www.strokengine.ca/>

## Summary of the Evidence

The risk of falling is increased following stroke due to leg weakness, impaired balance, visual disturbances, functional dependence, cognitive impairment and sensory loss. During hospitalization for stroke rehabilitation, Teasell et al. (2002) reported that one third of patients of 238 patients admitted to a stroke rehabilitation unit sustained at least one fall during their stay and almost half of the fallers experienced at least 2 falls. Czernuszenko & Czlonkowska (2009) reported that during stroke rehabilitation, there were 252 falls that occurred in 189 (16.3%) patients. The incidence rate for any fall was 7.6 per 1,000 patient-days (95% CI 6.6–8.5). Almost two-thirds of falls occurred during the first two weeks after admission. Patients fell most often during transfers (34%), while sitting (21%) and during position changes such as going from a sitting to standing (13%). Most falls did not result in injury (72%), while minor injuries occurred in 27% of cases, with 1.2% resulting in serious injury (fracture).

Patients at highest risk of falling need to be identified as soon as possible so that appropriate preventative measures can be taken. However, there are few valid screening tools that exist. Breisinger et al. (2014) developed the Stroke Assessment of Fall Risk (SAFR) to identify patients at risk of falling during inpatient rehabilitation. SAFR is composed of 4 impairment items (impulsivity, hemi-neglect, static, and dynamic sitting balance) and 3 functional limitations items (lowest score on three FIM: transfers, problem solving, and memory), with possible scores ranging from 0 (low risk) to 49 (high risk). The area under the curve of the receiver operator curve was 0.73, which was significantly more accurate compared with a locally-developed, 3-item, non-stroke specific tool, which could identify the risk of fallers no better than chance. Nystrom & Hellstrom (2013) reported that higher scores on the Prediction of Falls in Rehabilitation Settings Tool (Predict FIRST), assessed during the first and forth day of admission to an acute stroke unit helped to predict falls that occurred during the next 6 weeks (OR=5.21, 95% CI 1.10 to 24.78, p=0.038). Predict FIRST is composed of 5 fall risk factors, each giving one point: male, central nervous system medications, a fall in the past year, frequent toileting, and inability to do tandem stance. The scale is cumulative (i.e. more risk factors give a higher risk of falling). Patients with a score of zero have a 2% chance of falling, while those with all 5 points have a 52% risk of falling during the inpatient rehabilitation period. Pinto et al. (2014) reported that longer time to complete The Timed Up and Go (TUG) test was predictive of falls among persons living in the community following a median of 13 months post stroke (OR=1.035, 95% CI 1.196 to 5.740, p=0.016). Fallers (n=56) took a median time of 18 seconds to complete the test compared with non fallers (n=94) at 14 seconds.

There have been very few RCTs conducted evaluating therapies to specifically designed to reduce the occurrence of falls following stroke, and of those, the evidence suggests that such interventions are not effective. Dean et al. (2012) randomized 151 community-based stroke patients to an intervention group that received exercise and task related training or control group that performed an upper-extremity strength training program and cognitive tasks. At 12-month follow up, although patients in the experimental group showed significantly improvement in gait speed, there was no significant difference between groups in the number of patients who fell. Batchelor et al. (2012) randomized 156 patients at high risk of falls into a tailored multifaceted falls prevention group or the control group which consisted of usual care. The falls prevention program consisted of an individualized home-based exercise program, falls risk strategies, education, and injury risk minimization strategies. There was no difference in the frequency of falls between groups. The intervention group had 1.89 falls/person-year, and the control group had 1.76 falls/person-year, incidence rate ratio=1.10, P=0.74). The proportion of fallers did not differ significantly between groups (risk ratio=0.83, 95% CI, 0.6-1.14), nor was the risk of injury

between groups (incidence rate ratio=1.57, p=0.25). A Cochrane review (Verheyden et al. 2013) included 10 RCTs examining the effectiveness of interventions for preventing falls post stroke. There was no significant reduction in number of falls associated with exercise interventions in either the acute/subacute or chronic stages of stroke, or the number of fallers between the intervention and control groups in the chronic stage of stroke. Vitamin D was associated with declines in the number of falls in 2 trials (same group of authors).

**Falls Prevention and Management Evidence Tables and Reference List available at**  
**[www.strokebestpractices.ca](http://www.strokebestpractices.ca)**

## Section 7: Assessment and Management of Dysphagia and Malnutrition following Stroke

### Recommendations

#### 7.1 Dysphagia

- i. Patients should be screened for swallowing impairment before any oral intake (e.g. medications, food, liquid) by an appropriately trained professional using a valid screening tool [Evidence Level B]. [Refer to Appendix Two Table 3:Suggested Swallow Screening and Assessment Tools for more information.](#)
- ii. Abnormal results from the initial or ongoing swallowing screens should prompt referrals to a speech-language pathologist, occupational therapist, dietitian or other trained dysphagia clinicians as appropriate for more detailed bedside swallowing assessment and management of swallowing, feeding, nutritional and hydration status [Evidence Level C].
  - a. An individualized management plan should be developed to address therapy for dysphagia, dietary needs, and specialized nutrition plans [Evidence Level C].
- iii. Videofluoroscopic swallow study (VSS, VFSS) or fiberoptic endoscopic examination of swallowing (FEES), should be performed on all patients considered at high risk for oropharyngeal dysphagia or poor airway protection, based on results from the bedside swallowing assessment, to guide dysphagia management (e.g. therapeutic intervention) [Evidence Level B].
- iv. Based on the videofluoroscopic swallow study (VSS, VFSS, MBS) or fiberoptic endoscopic examination of swallowing (FEES), restorative swallowing therapy and/or compensatory techniques to optimize the efficiency and safety of the oropharyngeal swallow mechanism, should be implemented with monitoring and reassessment as required. [Evidence Level B].
  - a. Restorative therapy may include lingual resistance, breath holds and effortful swallows [Evidence Level B].
  - b. Compensatory techniques may address posture, sensory input with bolus, volitional control, and texture modification [Evidence Level B].
- v. Patients, families and caregivers should receive education on swallowing, prevention of aspiration, and feeding recommendations [Evidence Level C].
- vi. To reduce the risk of aspiration pneumonia, patients should be permitted and encouraged to feed themselves whenever possible [Evidence Level C].
- vii. Patients should be given meticulous mouth and dental care and educated in the need for good oral hygiene to further reduce the risk of pneumonia [Evidence Level B].

#### 7.2 Nutrition and Hydration

- i. Patients should be screened for malnutrition, ideally within 48 hours of inpatient rehabilitation admission using a valid screening tool [Evidence Level C]. [Refer to Appendix Two Table 3: Suggested Swallow Screening and Assessment Tools for more information](#)
  - a. Patients can be rescreened for changes in nutritional status regularly throughout inpatient admission and prior to discharge, as well as periodically in outpatient and community settings [Evidence Level C].
  - b. Results from the screening process can be used to guide appropriate referral to a dietitian for further assessment and ongoing management of nutritional and hydration status [Evidence Level C].

- ii. Stroke patients with suspected nutritional concerns, hydration deficits, dysphagia, or other comorbidities who may require nutritional intervention should be referred to a dietitian [Evidence Level B]. Dietitians provide recommendations on:
  - a. Meeting nutritional and fluid needs orally while supporting alterations in food texture and fluid consistency recommended by a dietitian, speech-language pathologist or other trained professional, as appropriate [Evidence Level B];
  - b. Enteral nutrition support in patients who cannot safely swallow or meet their nutrient and fluid needs orally [Evidence Level B].
  - c. Nasogastric feeding tubes should be replaced by gastric-jejunum tube (GJ-tube) if the patient requires a prolonged period of enteral feeding [Evidence Level B].
- iii. The decision to proceed with enteral nutrition support, i.e. tube feeding, should be made as early as possible after admission, usually within the first three days of admission in collaboration with the patient, family (or substitute decision maker), and the interdisciplinary team [Evidence Level B].

### Rationale

The published estimates of the incidence of stroke-related dysphagia vary widely from 19% to 65% in the acute stage of stroke, depending on the lesion location, timing and selection of assessment methods. The presence of dysphagia is important clinically because it has been associated with increased mortality and medical complications, including pneumonia. The risk of pneumonia has been shown to be 3 times higher when patients are dysphagic. Stroke-related pneumonia is fairly common with estimates that range from 5% to 26%, depending on diagnostic criteria. Patients with dysphagia often do not receive sufficient caloric intake, which may result in poorer outcomes as a result of malnutrition.

People with stroke emphasize the importance of caregiver education and training relating to the potential risks of dysphasia, such as aspiration.

### System Implications

In order to manage dysphagia and malnutrition post stroke organizations should:

- develop and deliver educational programs to train appropriate staff to perform an initial swallowing screen for stroke patients. This may include staff across the continuum, such as in emergency departments, acute inpatient units, rehabilitation facilities, and community and long-term care settings;
- ensure access to appropriately trained healthcare professionals such as speech–language pathologists, occupational therapists, and/or dietitians who can conduct in-depth assessments and recommend appropriate management to prevent malnutrition and aspiration.

### Performance Measures

1. Proportion of stroke patients with documentation that an initial dysphagia screening assessment was performed in the emergency department or during hospital admission (core).
2. Proportion of stroke patients who fail an initial dysphagia screening who then receive a comprehensive assessment by a speech–language pathologist, occupational therapist, dietitian, or other appropriately trained healthcare professional.
3. Median time in minutes from patient arrival in the emergency department to initial swallowing screening by a trained clinician.
4. Incidence of malnutrition among patients admitted to inpatient care for stroke which leads to delays in discharge.

### **Measurement Notes:**

- In chart audits, dysphagia screening has been poorly documented. Clinical providers should be educated and made aware of the importance of documenting dysphagia screening for valid and reliable measurement and monitoring.
- Measure 1 is a mandatory reporting indicator for the Accreditation Canada Stroke Distinction Program

## **Implementation Resources and Knowledge Transfer Tools**

### **Health Care Provider Information**

- [Table 1: Stroke Rehabilitation Screening and Assessment Tools \(Appendix Two\)](#)
- [Table 3: Suggested Swallow Screening and Assessment Tools \(Appendix Two\)](#)
- Mini Nutritional Assessment: [https://www.mna-elderly.com/forms/mini/mna\\_mini\\_english.pdf](https://www.mna-elderly.com/forms/mini/mna_mini_english.pdf)
- Malnutrition Universal Screening Tool (MUST): <http://www.bapen.org.uk/screening-for-malnutrition/must/introducing-must>
- Canadian Nutrition Screening Tool: <http://nutritioncareincanada.ca/tools/screening>
- Stroke Engine: <http://www.strokengine.ca/>

### **Information for People with Stroke, their Families and Caregivers**

- Rehabilitation and Recovery infographic: Guide to taking charge of your stroke recovery: <https://www.heartandstroke.ca/-/media/1-stroke-best-practices/rehabilitation-nov2019/csbp-infographic-rehabilitation.ashx>
- Transitions and community participation infographic: Guide to taking charge of your stroke recovery: <https://www.heartandstroke.ca/-/media/1-stroke-best-practices/transition-of-care-nov2019/csbp-infographic-transitions-and-participation.ashx>
- Aphasia Institute: <http://www.aphasia.ca/people-with-aphasia-and-families/>
- Post Stroke Checklist: <https://www.strokebestpractices.ca/resources/patient-resources>
- Living with Stroke Program: <https://www.heartandstroke.ca/stroke/recovery-and-support/living-with-stroke>
- Stroke Resources Directory: <https://www.heartandstroke.ca/services-and-resources>
- Your Stroke Journey: <https://www.strokebestpractices.ca/-/media/1-stroke-best-practices/resources/patient-resources/en-your-stroke-journey-v21.ashx>  
Eating and Swallowing: <https://www.heartandstroke.ca/stroke/recovery-and-support/physical-changes/swallowing>
- Stroke Engine: <http://www.strokengine.ca/>

## **Summary of the Evidence**

The use of a standardized program for bedside screening is now included in most clinical guidelines. Its implementation has long been thought to decrease the incidence of dysphagia-related pneumonia. Bedside screening may include components related to a patient's level of consciousness, an evaluation of the patient's oral motor function and oral sensation, as well as the presence of a cough. It may also include trials of small sips of water, whereby a "wet" or hoarse voice are suggestive of an abnormal swallow. A recent systematic review (Smith et al. 2018) included the results from 3 RCTs comparing dysphagia screening protocols or quality improvement interventions designed to improve screening rates versus no screening, alternative screening, usual care. The percentage of patients who received

dysphagia screening and developed pneumonia was not significantly lower, compared with patients in a control group, in any of the trials. The authors highlight the lack of evidence from RCTs and state that “*no conclusions can be drawn about the clinical effectiveness of dysphagia screening protocols.*”

While texture-modified diets, the use of restorative swallowing therapy, and compensatory techniques, are the most commonly used treatments for the management of dysphagia in patients who are still safe to continue oral intake, there is little direct evidence of their benefit. The effectiveness of a variety of treatments for dysphagia and nutritional management was evaluated in a Cochrane review (Bath et al. 2018). Dysphagia treatments examined included acupuncture, behavioural interventions, drug therapy, neuromuscular electrical stimulation, pharyngeal electrical stimulation, physical stimulation (thermal, tactile), transcranial direct current stimulation, and transcranial magnetic stimulation. Overall, there was no reduction in the odds of death or disability or case fatality at the end of the trial associated with dysphagia therapies. While swallowing therapy significantly reduced the proportion of participants with dysphagia at the end of the trial, reduced the risk of chest infections or pneumonia, and was associated with a mean reduction in hospital length of stay of almost 3 days, the authors cautioned that *further high-quality trials are required before clinical decisions can be made about what treatments are effective*. Neuromuscular electrical stimulation using devices such as VitalStim have been shown to be an effective intervention for restoring swallowing function in trials including persons with stroke-associated dysphagia (Park et al. 2016, Terre & Mearin 2015). While this treatment is popular in the United States and other countries, it is not widely used in Canada. Carnaby-Mann & Crary et al. (2007) conducted a systematic review, which included the results from 7 studies of patients with oropharyngeal dysphagia secondary to stroke, cancer or other disease. A medium-sized treatment effect was reported for the outcome of change in swallowing score ( $SMD=0.66$ , 95% CI 0.47 to 0.85,  $p<0.001$ ). Pharyngeal electrical stimulation is a novel new treatment that is not used routinely in clinical practice. While demonstrated to be safe, its effectiveness remains unproven (Bath et al. 2016).

For patients who cannot obtain nutrient and fluid needs orally, enteral nutrition may be required. Results from the largest trial of its kind indicates that there is little difference between routes of feeding when choosing between enteral feeding approaches. The FOOD trial (Dennis et al. 2005) also addressed the issues of timing of initiation of enteral feeding. The FOOD trial included 1,210 patients admitted within 7 days of stroke from 47 hospitals in 11 countries. In one arm of the trial, patients were randomized to receive either a percutaneous endoscopic gastrostomy (PEG) or nasogastric (NG) feeding tube within 3 days of enrolment into the study. PEG feeding was associated with a non-significant absolute increase in risk of death of 1.0% (-10.0 to 11.9,  $p=0.9$ ) and a borderline increased risk of death or poor outcome of 7.8% (0.0 to 15.5,  $p=0.05$ ) at 6 months. In the second part of the trial patients were randomized to receive feeds as early as possible or to avoid feeding for 7 days. Early tube feeding was associated with non-significant absolute reductions in the risk of death or poor outcome (1.2%, 95% CI -4.2 to 6.6,  $p=0.7$ ) and death (15.8%, 95% CI -0.8 to 12.5,  $p=0.09$ ) at 6 months. A Cochrane review (Gomes et al. 2015) comparing NG and PED feeding tubes also reported few differences between feeding tube types. PEG tubes were associated with significantly reduced odds of treatment failures (blocked tubes or disruptions in feeding schedule), but there was no significant difference between groups in in mortality, aspiration-related pneumonia or adverse events.

Oral supplementation can be used for patients who are not able to consume sufficient energy and protein to maintain body weight, or for those with premorbid malnutrition. The results from the FOOD trial (Dennis et al. 2005) indicate that while routine supplementation with an additional 540 Kcal/day for all patients, regardless of premorbid nutritional status, does not help to improve global outcomes. In this trial, 4,023 patients were randomized to receive or not receive an oral nutritional supplement in addition to a regular hospital diet, provided for the duration of their entire hospital stay. At 6-month follow-up, there was no significant difference between groups on the primary outcome, death or poor outcome ( $OR=1.03$ , 95% CI 0.91 to 1.17,  $p>0.05$ ). The FOOD trial results would be compatible with a 1% to 2% absolute benefit or harm from oral supplements. Oral supplementation was not associated with a reduction in the odds of case fatality, death or dependency, the need for institutionalization, or mean LOS in a Cochrane review (Geeganage et al. 2012). However, oral supplementation was associated with a reduction in the odds of pressure sores ( $OR=0.56$ , 95% CI 0.32 to 0.96,  $p=0.034$ ) and

an increase in daily mean energy and protein intake.

**Assessment and Management of Dysphagia and Malnutrition following Stroke Evidence Tables and Reference List available at [www.strokebestpractices.ca](http://www.strokebestpractices.ca)**

## Section 8: Rehabilitation of Visual and Perceptual Deficits

### Recommendations

- i. All patients with stroke should be screened for visual, visual motor and visual perceptual deficits as a routine part of the broader rehabilitation assessment process [Evidence Level C].
- ii. Patients with suspected perceptual impairments (visuo-spatial impairment, agnosias, body schema disorders and apraxias) should be assessed using validated tools [Evidence Level C].
- iii. Patients, families and caregivers should receive education on visual-spatial neglect and treatment recommendations [Evidence Level C].
- iv. Visual scanning techniques should be used to improve perceptual impairments caused by neglect [Evidence Level B]
- v. Virtual reality or computer-based interventions for neglect should be used to improve visual perception and alleviate right-hemisphere bias [Evidence Level B].
- vi. There is insufficient evidence to recommend for or against limb activation to improve neglect [Evidence Level B]
- vii. There is conflicting evidence on the effectiveness of prism glasses and eye-patches for improving neglect [Evidence Level B].
- viii. Patients with suspected limb apraxia should be treated using errorless learning, gesture training and graded strategy training [Evidence Level B].
- ix. Mirror therapy: Mirror therapy appears to improve neglect [Evidence Level B] and may be considered as an intervention for unilateral inattention [Evidence Level B].
- x. Mirror therapy combined with limb activation: Combining mirror therapy with limb activation appears to be more effective than limb activation alone at improving neglect [Evidence Level B].

*Refer to CSBPR Transitions and Community Participation Section 4 for information on return to driving.*

### Rationale

Visual perceptual disorders are a common clinical consequence of stroke. They include unilateral neglect, which has a major impact on rehabilitation outcome. Visual perceptual disorders result in processing changes in the integration of visual information with other systems. These changes decrease a patient's ability to adapt to the basic requirements of daily life. The incidence of unilateral spatial neglect is estimated to be approximately 23%. The presence of neglect has been associated with both severity of stroke and age of the individual.

Limb apraxias are more common in those with left hemisphere involvement (28 – 57%) but can also be seen in right hemisphere damage (0 – 34%) (Donkervoort et al., 2000). While apraxia improves with early recovery, up to 20 percent of those initially identified will continue to demonstrate persistent problems. Severity of apraxia is associated with changes in functional performance.

People with stroke emphasized the importance of screening for visual perceptual deficits following stroke and the impact of this on recovery. For example, experiencing diplopia creates challenges in trying to fully participate in rehabilitation.

### System Implications

To achieve timely and appropriate assessment and management of perceptual deficits, the organization should provide:

- Initial standardized assessment of visual perceptual deficits (including inattention and apraxia) performed by clinicians experienced in the field of stroke.
- Timely access to specialized, interdisciplinary stroke rehabilitation services where therapies of appropriate type and intensity are provided.
- Access to appropriate equipment to aid in recovery when necessary without financial barriers.
- Long-term rehabilitation services widely available in nursing and continuing care facilities, and in outpatient and community programs.

## Performance Measures

- Proportion of stroke patients with documentation that an initial screening for visual perceptual deficits was performed as part of a comprehensive rehabilitation assessment.
- Proportion of stroke patients with poor results on initial screening who then receive a comprehensive assessment by appropriately trained healthcare professionals.

## Implementation Resources and Knowledge Transfer Tools

### Health Care Provider Information

- [Table 1: Stroke Rehabilitation Screening and Assessment Tools \(Appendix Two\)](#)
- Comb and Razor Test: [http://strokengine.ca/assess/module\\_crt\\_intro-en.html](http://strokengine.ca/assess/module_crt_intro-en.html)
- Behavioral Inattention Test: [http://strokengine.ca/assess/module\\_bit\\_intro-en.html](http://strokengine.ca/assess/module_bit_intro-en.html)
- Line Bisection Test: [http://strokengine.ca/assess/module\\_lbt\\_intro-en.html](http://strokengine.ca/assess/module_lbt_intro-en.html)
- Rivermead Perceptual Assessment Battery: <http://www.gl-assessment.co.uk/products/rivermead-perceptual-assessment-battery>
- Ontario Society of Occupational Therapy Perceptual Evaluation: [http://strokengine.ca/assess/module\\_osot\\_intro-en.html](http://strokengine.ca/assess/module_osot_intro-en.html)
- Motor-Free Visual Perceptual Test: [http://strokengine.ca/assess/module\\_mvpt\\_intro-en.html](http://strokengine.ca/assess/module_mvpt_intro-en.html)
- Apraxia Screen of TULIA (AST): <https://www.sralab.org/rehabilitation-measures/apraxia-screen-tulia>
- Stroke Engine: <http://www.strokengine.ca/>

### Information for People with Stroke, their Families and Caregivers

- Rehabilitation and Recovery infographic: Guide to taking charge of your stroke recovery: <https://www.heartandstroke.ca/-/media/1-stroke-best-practices/rehabilitation-nov2019/csbp-infographic-rehabilitation.ashx>
- Transitions and community participation infographic: Guide to taking charge of your stroke recovery: <https://www.heartandstroke.ca/-/media/1-stroke-best-practices/transition-of-care-nov2019/csbp-infographic-transitions-and-participation.ashx>
- Aphasia Institute: <http://www.aphasia.ca/people-with-aphasia-and-families/>
- Post Stroke Checklist: <https://www.strokebestpractices.ca/resources/patient-resources>
- Living with Stroke Program: <https://www.heartandstroke.ca/stroke/recovery-and-support/living-with-stroke>
- Stroke Resources Directory: <https://www.heartandstroke.ca/services-and-resources>

- Your Stroke Journey: <https://www.strokebestpractices.ca/-/media/1-stroke-best-practices/resources/patient-resources/en-your-stroke-journey-v21.ashx>
- Stroke Engine: <http://www.strokengine.ca/>
- Heart and Stroke Foundation Canadian Partnership for Stroke Recovery: <https://www.canadianstroke.ca/>
- Senses and Perception: <https://www.heartandstroke.ca/stroke/recovery-and-support/emotions/changes-in-perception>

## Summary of the Evidence

The most common type of visual perception disorder following stroke is visual neglect or inattention. Estimates obtained from a systematic review indicated that visual neglect was reported on average in 32% of patients following stroke. The range was wide with the lowest number coming from a prospective study, where assessments were conducted within 3 weeks following stroke in patients with suspected visual deficits, to 82%, when assessed within 3 days of stroke in an unselected sample of general stroke patients (Hepworth et al. 2015). Unilateral spatial neglect (USN) is being more commonly associated with lesions in the right hemisphere (affecting the left side of the body) compared to a left-sided lesion. The presence of neglect has been associated with longer lengths of hospital stay and slower recovery during inpatient rehabilitation (Gillen et al. 2005).

Therapeutic approaches to treat neglect include *remedial* approaches (e.g., visual scanning, feedback or cueing, virtual reality and mental practice), and *compensatory* approaches (e.g. prisms, half-field, eye-patching, limb activation). Azouvi et al. (2017) included the results of 37 RCTs in a narrative review assessing rehabilitation techniques for post-stroke spatial neglect, including both top down and bottom up approaches. The authors concluded that one rehabilitation approach cannot be recommended over another, and a combination of several methods may be most effective than a single method. They further concluded that the evidence levels associated with these interventions remain low due to small sample sizes, methodological bias, and contradictory results. Bowen et al. (2013) included the results of 23 RCTs evaluating a variety of cognitive rehabilitation programs compared with an active or inactive control in persons with neglect following stroke. While cognitive rehabilitation approaches were associated with significant improvements in measures of neglect, when measured immediately after the intervention ( $SMD=0.35$ , 95% CI 0.09 to 0.62,  $p=0.0092$ ), they were no longer when measured at follow-up ( $SMD=0.28$ , 95% CI -0.03 to 0.59,  $p=0.079$ ). These techniques were not associated with significant improvements in ADL performance, when measured immediately after the intervention ( $SMD=0.23$ , 95% CI -0.02 to 0.48,  $p=0.068$ ), or at follow-up ( $SMD=0.31$ , 95% CI -0.10 to 0.72,  $p=0.14$ ). In another systematic review, Lisa et al. (2013) reported that among almost all of the 15 included RCTs, there were improvements reported in both the experimental and control groups, but in only 7 trials were there statistically significant between group differences, in favor of the experimental group. Large effect sizes ( $d > 0.80$ ) were found in only four studies of virtual reality vs. visual scanning training (VST) ( $d=0.90$ ), somatosensory electrical stimulation + VST vs. sham +VST ( $d=1.63$ ), TENS vs. control ( $d=0.87$ ) and optokinetic stimulation vs. control ( $d=1.59$ ), and individual and group mirror therapy vs. sham ( $d=2.84$  and  $d= 1.25$ ).

Other forms of treatment for spatial neglect and visual field deficits include the use of noninvasive brain stimulation. Kem et al. (2013) randomized 27 patients admitted for inpatient rehabilitation, with visuospatial neglect to receive repetitive transcranial magnetic stimulation (rTMS). Patients were randomized to receive 10, 20-minute sessions over 2 weeks of 1) low-frequency (1Hz) rTMS over the non-lesioned posterior parietal cortex (PPC), 2) high-frequency (10Hz) rTMS over the lesioned PPC, or 3) sham stimulation. Although there were no significant differences between groups in mean changes in Motor-Free Visual Perception Test, Star Cancellation Test or Catherine Bergego Scale, there was a significant difference among groups in Line Bisection Test change scores ( $p=0.049$ ). Post-hoc analysis indicated the improvement was significantly greater in the high-frequency rTMS group compared to sham-stimulation group (-36.9 vs. 8.3,  $p=0.03$ ). Additionally, improvements in mean Korean-Modified Barthel Index scores in both the high and low frequency groups were significantly greater compared to those in the sham stimulation group ( $p<0.01$  and  $p=0.02$ , respectively). Yang et al. (2017) reported

improvements in mean Behavioural Inattention Test (BIT)-Conventional, following treatment with rTMS, when treatment was combined with a sensory cueing device worn on the left wrist.

**Rehabilitation of Visual and Perceptual Deficits Evidence Tables and Reference List available at  
[www.strokebestpractices.ca](http://www.strokebestpractices.ca)**

## Section 9: Management of Central Pain

### Recommendations

- i. Patients with persistent Central Post Stroke Pain (CPSP) should receive a trial of low-dose, centrally acting analgesics [Evidence Level C]:
  - a. Patients should receive an anticonvulsant (such as gabapentin or pregabalin) as a first-line treatment for central nervous system pain [Evidence Level C].
  - b. Patients should receive a tricyclic antidepressant (e.g., amitriptyline) or an SNRI (particularly duloxetine) as second-line treatment [Evidence Level C].
  - c. Treatment for patients resistant to first- and second-line treatment can include opioids or tramadol [Evidence Level C]. Caution is advised for the use of opioids as there is a significant risk of physical dependency.
- ii. An individualized patient-centred approach for management of central pain syndromes should be implemented by an interdisciplinary team that includes healthcare professionals with expertise in mental health and central pain management [Evidence Level C].

### Rationale

Central post-stroke pain (CPSP) is a rare neurological disorder in which the body becomes hypersensitive to pain as a result of damage to the spinothalamic tract (STT), although not all damage to the STT produces CPSP. It reportedly affects 2% to 5% of stroke patients. With involvement of the STT, patients have loss of temperature and pain sensation in the involved area. It is most commonly associated with lesions to the ventrocaudal nucleus of the thalamus but has been reported in brainstem lesions where there is damage to the STT. The primary symptoms are pain and loss of sensation, usually in the face, arms, and/or legs. Pain or discomfort may be felt after being mildly touched or even in the absence of a stimulus. The pain may worsen by exposure to heat or cold and by emotional distress. CPSP can dramatically hinder a patient's ability to perform ADLs, interfere with sleep and reduce quality of life.

People with stroke provided feedback stressing the importance of family and caregiver education on CPSP. Depending on the abilities of the person with stroke, family members and caregivers need training on the treatment of CPSP, including the dosing, timing, and contraindications of analgesics. In addition, people with stroke require education on CPSP so they can self-monitor and recognize potential symptoms. People with stroke value their choices and autonomy and appreciate when medications are offered and explained to them.

### System Implications

- Inclusion of central pain assessments as part of standard screening and assessment protocols for stroke rehabilitation
- Access to specialized services for management of central pain
- The development and implementation of an equitable and universal pharmacare program, implemented in partnership with the provinces, designed to improve access to cost-effective medicines for all people in Canada regardless of geography, age, or ability to pay. This program should include a robust common formulary for which the public payer is the first payer.

### Performance Measures

1. Changes in pain ratings from initiation of treatment, measured weekly, using standardized pain scales.

2. Changes in quality of life of stroke patients who experience central pain syndrome, measured using a standardized scale and at regular follow-up intervals.

## Implementation Resources and Knowledge Transfer Tools

### Health Care Provider Information

- [Table 1: Stroke Rehabilitation Screening and Assessment Tools \(Appendix Two\)](#)
- Pharmacological management of chronic neuropathic pain: revised consensus statement from the Canadian Pain Society: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4273712/>
- Visual Analogue Scale (VAS): [http://www.blackwellpublishing.com/specialarticles/jcn\\_10\\_706.pdf](http://www.blackwellpublishing.com/specialarticles/jcn_10_706.pdf)
- McGill Pain Questionnaire: [https://www.physio-pedia.com/McGill\\_Pain\\_Questionnaire](https://www.physio-pedia.com/McGill_Pain_Questionnaire)
- Pain rating scales: <http://pami.emergency.med.jax.ufl.edu/resources/pain-assessment-scales/>
- Beck Depression Inventory (BDI), PHQ-9 Depression Scale: [http://strokengine.ca/assess/module\\_bdi\\_intro-en.html](http://strokengine.ca/assess/module_bdi_intro-en.html)
- Stroke Engine: <http://www.strokengine.ca/>

### Information for People with Stroke, their Families and Caregivers

- Rehabilitation and Recovery infographic: Guide to taking charge of your stroke recovery: <https://www.heartandstroke.ca/-/media/1-stroke-best-practices/rehabilitation-nov2019/csbp-infographic-rehabilitation.ashx>
- Transitions and community participation infographic: Guide to taking charge of your stroke recovery: <https://www.heartandstroke.ca/-/media/1-stroke-best-practices/transition-of-care-nov2019/csbp-infographic-transitions-and-participation.ashx>
- Aphasia Institute: <http://www.aphasia.ca/people-with-aphasia-and-families/>
- Post Stroke Checklist: <https://www.strokebestpractices.ca/resources/patient-resources>
- Living with Stroke Program: <https://www.heartandstroke.ca/stroke/recovery-and-support/living-with-stroke>
- Stroke Resources Directory: <https://www.heartandstroke.ca/services-and-resources>
- Your Stroke Journey: <https://www.strokebestpractices.ca/-/media/1-stroke-best-practices/resources/patient-resources/en-your-stroke-journey-v21.ashx>
- Physical Changes (Pain): <https://www.heartandstroke.ca/stroke/recovery-and-support/physical-changes>
- Stroke Engine: <http://www.strokengine.ca/>

## Summary of the Evidence

Central post-stroke pain (CPSP) is a rare neurological disorder, in which the body becomes hypersensitive to pain, resulting from damage to the thalamus, the part of the brain that affects sensation. The condition is rare, occurring in an estimated 2% to 5% of all stroke cases. Antidepressants including tricyclic antidepressants, serotonin–norepinephrine reuptake inhibitors and selective serotonin reuptake inhibitors are used most frequently for the treatment of neuropathic pain, although there is little published evidence of their effectiveness in CPSP. Vranken et al. (2011) randomized 48 patients with severe neuropathic pain resulting from cerebrovascular lesions or spinal cord lesions to receive escalating doses of either duloxetine (60 and 120mg/day) or placebo for 8 weeks. At the end of treatment, the mean pain scores, assessed using a 10-point visual analogue scale were reduced from 7.1 to 5.0 (duloxetine) vs. 7.2 to 6.1 (placebo), p=0.06. There were no differences

between groups in Patient Disability Index or EQ-5D scores but patients in the duloxetine group reported better pain scores on the bodily pain sub section of the SF-36 ( $p=0.035$ ).

Several RCTs have been published evaluating the effectiveness of the anticonvulsant drugs, pregabalin and gabapentin, most of which included patients with neuropathic pain of varying etiology. A single RCT included patients who were suffering exclusively from CPSP. In this study (Kim et al. 2011) randomized 220 patients to receive either 150-600 mg of pregabalin or placebo over 13 weeks. At the end of treatment, the mean pain scores were reduced from 6.5 to 4.9 in the pregabalin group and from 6.3 to 5.0 in the placebo group, although the difference was not statistically significant. ( $p=0.578$ ). Treatment with pregabalin resulted in significant improvements, on secondary endpoints including some aspects of sleep, anxiety and clinician global impression of change. Adverse events were more frequent with pregabalin causing the discontinuation of treatment in 8.2% of patients compared with 3.7% of placebo patients. Vranken et al. (2008) randomized 40 patients (19 with stroke) suffering from severe neuropathic pain, to receive a 4-week course of treatment with escalating doses of pregabalin (max 600 mg/day) or placebo. At the end of treatment, patients in the pregabalin group experienced significantly greater pain relief on a 10-point visual analogue scale (mean=7.6 to 5.1 vs. 7.4 to 7.3,  $p=0.01$ ) and had significant improvement in EQ-5D scores and in the bodily pain domain of the SF-36. There was no significant difference in Pain Disability Index scores between groups. Serpell et al. (2002) randomized 307 patients with a wide range of neuropathic pain syndromes (9 with post stroke pain) to receive either gabapentin or placebo for 8-weeks. Gabapentin was given in three divided doses to a maximum of 2400 mg/day. Patients in the treatment group experienced a significantly greater reduction in pain over the study period (mean reduction of 21% vs. 14%,  $p=0.048$ ). Significant differences were shown in favour of gabapentin for the clinician and patient Global Impression of Change Scale, and some domains of the Short Form-McGill Pain Questionnaire.

One RCT has evaluating the potential benefit of the anti-epileptic agent, levetiracetam in patients with CPSP. Jungehulsing et al. (2013) included 42 patients with CPSP resulting from stroke, of duration greater than 3 months and a score of 4 or greater on 10-point pain intensity scale. Participants were randomized to receive levetiracetam at a maximum dose of 3000 mg or a placebo over a 24-week study period which included two, 8-week treatment periods. Treatment with levetiracetam was not associated with significantly greater improvement in spontaneous or evoked pain, or any of the secondary measures including the McGill Pain Questionnaire, revised Beck Depression Inventory, or the Short Form-12 Health Survey, with increased frequency of reported side-effects.

**Management of Central Pain Evidence Tables and Reference List available at**  
[www.strokebestpractices.ca](http://www.strokebestpractices.ca)

## Section 10: Rehabilitation to Improve Language and Communication

### Recommendations

- i. All health care providers working with persons with stroke across the continuum of care should undergo training about aphasia and other communication disorders, including the recognition of the impact of aphasia and methods to support communication such as Supported Conversation for Adults with Aphasia (SCA™) [Evidence Level C].

*Note: Other communication disorders may include: dysarthria, apraxia of speech and cognitive communication deficits.*
- ii. All stroke patients should be screened for communication disorders, ideally by a Speech Language Pathologist, and using a valid screening tool [Evidence Level C].
  - a. If a Speech Language Pathologist is not available this should be done by another appropriately trained professional. [Evidence Level C]. *Refer to Appendix 2 Table 4: Suggested Screening and Assessment Tools for Aphasia.*
- iii. Patients with any suspected communication deficits should be referred to a Speech-Language Pathologist (SLP) for assessment in the following areas using valid and reliable methods: comprehension, verbal production, reading, writing, speech/voice, and cognitive-communication. [Evidence Level C]. *Refer to Appendix 2 Table 4: Suggested Screening and Assessment Tools for Aphasia.*
- iv. Persons with aphasia should have early access to a combination of intensive speech and language therapy and communication therapy according to their needs, goals and impairment severity [Evidence Level B].
- v. Treatment to improve functional communication can include language therapy focusing on:
  - a. Production and/or comprehension of words, sentences and discourse, (including reading and writing) [Evidence Level C];
  - b. Conversational treatment [Evidence Level C];
  - c. Constraint induced language therapy [Evidence Level B];
  - d. Use of non-verbal strategies, assistive devices and technology (e.g., I-Pads, Tablets, other computer-guided therapies) which can be incorporated to improve communication [Evidence Level C].
  - e. Use of computerized language therapy to enhance benefits of other therapies [Evidence Level C].
- vi. Appropriate patients should be assessed for their potential to benefit from using augmentative alternative communication (e.g. iPad, tablet, electronic devices, alphabet board) or other communication support tools [Evidence Level C].
- vii. Treatment to improve functional communication should include supported conversation techniques for potential communication partners of the person with aphasia [Evidence Level A].
- viii. Treatment for aphasia may include group therapy and conversation groups. Groups can be used to supplement the intensity of therapy during hospitalization and/or as continuing therapy following discharge [Evidence Level B].
- ix. All information intended for patient use should be available in aphasia-friendly formats [Evidence Level C].
- x. Families of persons with aphasia should be engaged in the entire process from screening through intervention, including family education and training in supported communication

<p>[Evidence Level C]. Refer to <a href="#">CSBPR Mood, Cognition and Fatigue following Stroke module, Section 1</a> for additional information on aphasia and depression.</p> <p>xi. The impact of aphasia on functional activities, participation and QoL, including the impact on relationships, vocation and leisure, should be assessed and addressed across the continuum of care [Evidence Level C]. Refer to <a href="#">CSBPR Transitions and Community Participation following Stroke module, Section 4</a> for additional information.</p>
<h3>Rationale</h3> <p>Aphasia is defined as the loss of ability to communicate orally, through signs, or in writing, or the inability to understand such communications. Aphasia is one of the most common consequences of stroke in both the acute and chronic phases. Acutely, it is estimated that between 21 – 38% of stroke patients are aphasic. The presence of aphasia has been associated with general decreased response to stroke rehabilitation interventions and an increased risk for mortality. Aggressive management of aphasia helps to improve both language and broader recovery.</p> <p>People with stroke provided feedback on the value and necessity of rehabilitation to improve communication and language. Aphasia and apraxia challenges are significant for both the person with stroke and the caregiver. People with stroke express that difficulties in these areas can have a profound impact on their self-esteem and relationships. Availability of individualized therapy, specialists and mobile applications that are accessible, regardless of financial limitations and geography, that help with communication and language were recognized as an important element of recovery. Additionally, people with stroke emphasize the need to address communication and language early in the post-stroke stage to improve their ability to communicate with other health care team members and further optimize their recovery.</p>
<h3>System Implications</h3> <p>Patients with communication deficits, and their family members and caregivers, require access to specialized inpatient and community-based communication services following their stroke:</p> <ul style="list-style-type: none"><li>Programs and services should be in place in all organizations and communities with easy access and appropriate support for stroke patients with communication impairments, including access to speech-language pathologists</li><li>Telemedicine technology should be strongly considered and actively utilized, particularly in areas with limited in-person access to speech-language pathologists, to ensure equity in rehabilitation opportunities for people with post-stroke aphasia</li><li>Community support programs and peer-support groups should be established and information should be readily available in acute care and the rehabilitation settings for patients to access these groups</li></ul>
<h3>Performance Measures</h3> <ol style="list-style-type: none"><li>Percentage of patients screened for aphasia during acute inpatient admission; and during initial assessment in a rehabilitation setting.</li><li>Percentage of patients with aphasia who receive a detailed assessment by a speech-language pathologist prior to leaving acute care.</li><li>Median time from hospital discharge to initiation of aphasia therapy in the community.</li><li>Number of staff members in each rehabilitation setting trained on supportive communication techniques.</li></ol>

5. Percentage of time each patient with stroke and communication issues spends in therapy with communication specialist (speech language pathologist or other trainer professional when SLP not available).

## Implementation Resources and Knowledge Transfer Tools

### Health Care Provider Information

- [Table 1: Stroke Rehabilitation Screening and Assessment Tools \(Appendix Two\)](#)
- [Table 4: Suggested Screening and Assessment Tools for Aphasia \(Appendix Two\)](#)
- Aphasia Institute: <http://www.aphasia.ca/health-care-professionals>
- Frenchay Aphasia Screening Tools: [http://strokengine.ca/assess/module\\_fast\\_intro-en.html](http://strokengine.ca/assess/module_fast_intro-en.html)
- American Speech-Language-Hearing Association Functional Assessment of Communication Skills in Adults (ASHA-FACS): [http://strokengine.ca/assess/module\\_asha\\_2d\\_facs\\_intro-en.html](http://strokengine.ca/assess/module_asha_2d_facs_intro-en.html)
- Mississippi Aphasia Screening Test: <http://www.tbims.org/mast/index.html>
- Aphasia Access: <http://www.aphasiaaccess.org/>
- Aphasia United Best Practice Recommendations: <http://www.aphasiaunited.org/best-practice-recommendations>
- Australian Aphasia Rehabilitation Pathway: <http://www.aphasiapathway.com.au/?name=About-the-statements>
- Stroke Engine: <http://www.strokengine.ca/>

### Information for People with Stroke, their Families and Caregivers

- Rehabilitation and Recovery infographic: Guide to taking charge of your stroke recovery: <https://www.heartandstroke.ca/-/media/1-stroke-best-practices/rehabilitation-nov2019/csbp-infographic-rehabilitation.ashx>
- Transitions and community participation infographic: Guide to taking charge of your stroke recovery: <https://www.heartandstroke.ca/-/media/1-stroke-best-practices/transition-of-care-nov2019/csbp-infographic-transitions-and-participation.ashx>
- Aphasia Institute: <http://www.aphasia.ca/people-with-aphasia-and-families/>
- Post Stroke Checklist: <https://www.strokebestpractices.ca/resources/patient-resources>
- Living with Stroke Program: <https://www.heartandstroke.ca/stroke/recovery-and-support/living-with-stroke>
- Stroke Resources Directory: <https://www.heartandstroke.ca/services-and-resources>
- Your Stroke Journey: <https://www.strokebestpractices.ca/-/media/1-stroke-best-practices/resources/patient-resources/en-your-stroke-journey-v21.ashx>
- Communication: <https://www.heartandstroke.ca/stroke/recovery-and-support/physical-changes/communication>
- Stroke Engine: <http://www.strokengine.ca/>

## Summary of the Evidence

Aphasia, an acquired communication disorder that impairs the ability to process language, speak and understand others, affects 21% to 38% of stroke survivors (Lazar et al. 2017). Aphasia is associated with increased length of hospital stay, inpatient complications, overall neurological disability, mortality and discharge disposition (Lazar et al. 2017). Due to its impact on communication skills, recovery and reintegration to the community, aphasia therapy is an important component of both acute and post-acute rehabilitation. A Cochrane review (Brady et al. 2016) included 57 randomized controlled trials (RCTs) comparing speech-language therapy (SLT) for aphasia after stroke with no SLT, social support

or stimulation, or another SLT. In total, 74 randomized comparisons, consisting of over 3,000 participants were included in the review. Speech language therapy was associated with a significant improvement in functional communication (standardized mean difference (SMD) 0.28; 95% confidence internal (CI) 0.06 to 0.49,  $p = 0.01$ ), compared with no SLT, along with significant improvements in reading comprehension (SMD: 0.29; 95% CI: 0.03 to 0.55), general expressive language (SMD: 1.28; 95% CI: 0.38 to 2.19) and written expressive language (SMD: 0.41; 95% CI: 0.14 to 0.67) after SLT. The positive effects were no longer evident at 6 months. No significant differences in outcomes were found between SLT and group therapy, computer-assisted therapy, and cognitive-linguistic and communicative treatments; (Brady et al. 2016) while results were inconsistent for constraint-induced therapy (Brady et al. 2016, Zhang et al. 2017). A recent systematic review examining the use of training communication partners or significant others found that while there was an increase in communication activities and participation between the participant and communication partner, there was insufficient evidence of its effect on language impairment, psychological adjustment and quality of life. (Simmons-Mackie et al. 2016). The impact SLT has on communication outcome appears to be mediated by the intensity and duration of the therapy. A systematic review authored by Bhogal et al. (2003) found that studies that demonstrated significantly improved outcomes following SLT provided on average 8.8 hours of therapy per week for 11.2 weeks; totalling an average of 98.4 hours of therapy. In contrast, there was no effect of SLT treatment in studies that provided only an average of 2 hours of therapy over 22.9 week; totalling an average of 43.6 hours of therapy. Similarly, Brady et al. (2016) noted that functional communication, and severity of impairment, significantly improved after high-intensity, long duration therapy compared to low-intensity, short duration therapy.

**Rehabilitation to Improve Language and Communication Evidence Tables and Reference List available at [www.strokebestpractices.ca](http://www.strokebestpractices.ca)**

## APPENDIX ONE

### Canadian Stroke Best Practice Recommendations

#### Rehabilitation and Recovery following Stroke Writing Group 2019

NAME	PROFESSIONAL ROLE	LOCATION	CONFLICT OF INTEREST
Teasell, Robert	Co-chair, Professor, University of Western Ontario; Medical Director, Stroke Rehabilitation Program, Parkwood Hospital, London	Ontario	<p><b>Potential conflict:</b> Grant/honorarium -Allergan make BoTox to treat spasticity. They provide grant funding to look at the Evidence for Long-Term Stroke Management and treatment of spasticity.</p> <p><b>Potential conflict:</b> Clinical trial - Canadian Partnership for Stroke Recovery and Heart and Stroke Foundation (Study of impact of Prozac on stroke recovery and impact of exoskeleton in early treatment of severe stroke patients.)</p>
Salbach, Nancy M.	Co-chair,, Associate Professor, Department of Physical Therapy, University of Toronto, Adjunct Scientist, Toronto Rehabilitation Institute, University Health Network Heart and Stroke Foundation Mid-Career Investigator	Ontario	<p><b>Potential conflict:</b> Mid career award, and funding of ongoing study - Heart and Stroke Foundation of Canada</p> <p><b>Potential conflict:</b> funding of ongoing study - Canadian Institutes for Health Research</p>
Acerra, Nicole	Clinical Specialist, Neurosciences, Physical Therapist, Regional Clinical Resource Therapist, Neurology, Vancouver Coastal Health	British Columbia	No conflicts to declare
Bastasi, Diana	Faculty Lecturer, McGill University, School of Physical and Occupational Therapy	Quebec	No conflicts to declare
Carter, Sherri L.	Psychologist, Stroke Acquired Brain Injury Program, QEII Health Sciences Centre; Adjunct (Clinical Associate), Dalhousie University, Department of Psychology and Neuroscience	Nova Scotia	No conflicts to declare
Fung, Joyce	Associate Professor, School of Physical and Occupational Therapy, McGill University; Director of	Quebec	No conflicts to declare

NAME	PROFESSIONAL ROLE	LOCATION	CONFLICT OF INTEREST
	Research, Jewish Rehabilitation Hospital (CISSS-Laval) research site of CRIR		
<b>Halabi, Mary-Lou</b>	Stroke Services Coordinator, Stroke Program, Edmonton Zone, Alberta Health Services	Alberta	No conflicts to declare
<b>Harris, Jocelyn</b>	Associate Professor, School of Rehabilitation Sciences, McMaster University	Ontario	No conflicts to declare
<b>Kim, Esther</b>	Associate Professor, Department of Communication Sciences and Disorders, Faculty of Rehabilitation Medicine, University of Alberta	Alberta	No conflicts to declare
<b>Noland, Andrea</b>	Clinical Educator, School of Audiology and Speech Sciences, University of British Columbia	British Columbia	No conflicts to declare
<b>Pooyania, Sepideh</b>	Assistant Professor, Section of Physical Medicine and Rehabilitation, University of Manitoba	Manitoba	No conflicts to declare
<b>Rochette, Annie</b>	Professor, School of Rehabilitation, University of Montreal and Investigator at Centre for Interdisciplinary Research in Rehabilitation of Greater Montreal	Quebec	<p><b>Potential conflict:</b> Advisory board or equivalent with a commercial organization: Heart &amp; Stroke (Stroke Council), Canadian Partnership for Stroke Recovery (Priority and Planning Committee)</p> <p><b>Potential conflict:</b> Canadian Partnership for Stroke Recovery – receives funding for <a href="http://www.strokengine.ca">www.strokengine.ca</a></p>
<b>Stack, Bridget D.</b>	Administrative Director, Internal Medicine, Family Medicine, Palliative Care Medicine, Neurosciences & Rehabilitation	New Brunswick	No conflicts to declare
<b>Symcox, Erin</b>	Nurse Clinician, Stroke Team  Tertiary Neuro Rehabilitation  PCU 58, Foothills Medical Centre	Alberta	No conflicts to declare

NAME	PROFESSIONAL ROLE	LOCATION	CONFLICT OF INTEREST
<b>Timpson, Debbie</b>	Physical Medicine Rehabilitation  Chief of Rehabilitation, Pembroke Regional Hospital	Ontario	No Conflicts of Interest Declared
<b>Varghese, Suja</b>	Clinical Lead Dietitian, Rehabilitation and Palliative Care Program, Eastern Health, Newfoundland and Labrador, Clinical Lecturer, Division of Community Health and Humanities, Memorial University of Newfoundland	Newfoundland	No conflicts to declare
<b>Verrilli, Sue</b>	Regional Education Coordinator, Northeastern Ontario Stroke Network	Ontario	No Conflicts of Interest Declared

## Canadian Stroke Best Practice Recommendations Rehabilitation and Recovery following Stroke External Reviewers 2019

EXTERNAL REVIEWER	PROFESSIONAL ROLE	LOCATION	CONFLICT OF INTEREST
Bailey, Kristen	M.H.Sc., RSLP, SLP (C)  Speech Language Pathologist, Fraser Health Authority  Service Provider for Community Brain Injury Program for Children and Youth, BC Centre for Ability	British Columbia	No conflicts to declare
Barclay, Ruth	PhD, PT  Associate Professor, Department of Physical Therapy, College of Rehabilitation Sciences, Rady Faculty of Health Sciences, University of Manitoba	Manitoba	No conflicts to declare
Barry, Amelia	MD, FRCP, CSCN (EMG)  Assistant Professor, Division of Physical Medicine Dalhousie University	New Brunswick	<b>Potential conflict:</b> Board Member NB Heart and Stroke (no financial renumeration)
Boe, Shaun G.	MPT, PhD  Associate Dean Research, Faculty of Health  Associate Professor, School of Physiotherapy, Dept. of Psychology & Neuroscience,  School of Health & Human Performance, Dept. of Physical Medicine & Rehabilitation,  Dalhousie University  Affiliate Scientist, Nova Scotia Health Authority	Nova Scotia	<b>Potential conflict:</b> Advisory board: Canadian Stroke Congress Scientific Planning Committee  <b>Potential conflict:</b> Advisory board: Canadian Stroke Congress Working Group  <b>Potential conflict:</b> Advisory board: Stroke Best Practice Advisory Group
Cole-Haskayne, Andrea	BA, RN, BN  Clinical Nurse Educator  Safe Clinical Practice Program  Alberta Health Services	Alberta	No conflicts to declare

<b>Deutsch, Judith</b>	PT PHD FAPTA  Professor and Director Rivers Lab, Department of Rehabilitation and Movement Sciences, Rutgers School of Health Professions	United States	<b>Potential conflict:</b> Advisory board: VRehab LLC  <b>Potential conflict:</b> Patent: Rutgers – Inventor on several patents for virtual reality rehab systems  <b>Potential conflict:</b> Investments: VRehab LLC – Co-owner of company established to get funding for development and research of virtual reality systems for rehabilitation
<b>Egan, Mary</b>	PhD, OT Reg (Ont)  Professor, School of Rehabilitation Sciences, University of Ottawa  Scientist, Bruyere Research Institute	Ontario	No conflicts to declare
<b>Kagan, Aura</b>	Ph.D. Reg. CASLPO  Executive Director, Director of Applied Research and Education  Aphasia Institute, Toronto	Ontario	<b>Potential conflict:</b> Aphasia Institute is a registered charity that does sell training and resources on a cost-recovery bases
<b>Kwong, Evan H.</b>	BSC (Pharm), MD, MSc, FRCPC  Clinical Assistant Professor, UBC Division of Physical Medicine and Rehabilitation  Division Head, Providence Healthcare Division of Physical Medicine and Rehabilitation  Physician Lead, Holy Family Hospital Rehabilitation	British Columbia	No conflicts to declare
<b>Lasiuk, Katherine (Kat)</b>	MSc-SLP, R.SLP  Speech Language Pathologist	Alberta	No conflicts to declare
<b>Lazorek, Carmen</b>	BScOT, MRSc  Provincial Senior Practice Lead, Occupational Therapy, Alberta Health Services	Alberta	No conflicts to declare

<b>Lo, Alto</b>	MD, FRCPC, CSCN (EMG)  Physical Medicine and Rehabilitation  Glenrose Rehabilitation Hospital, University of Alberta Clinical Academic Lecturer	Alberta	<b>Potential conflict:</b>  Grant/honorarium: Allergan Canada – Travel grants for conferences  <b>Potential conflict:</b>  Merz Canada – Travel grants for conferences
<b>Nelson, Michelle LA</b>	MA, PhD  Scientist, Lunenfeld-Tanenbaum Research Institute, Assistant Professor, IHPME, University of Toronto	Ontario	No conflicts to declare
<b>Paterson, Phyllis G.</b>	Ph.D  Professor of Nutrition, College of Pharmacy and Nutrition, University of Saskatchewan	Saskatchewan	<b>Potential conflict:</b>  Grant/honorarium: CIHR – Grant holder
<b>Patterson, Kara K.</b>	PT, PhD  Assistant Professor, Physical Therapy, University of Toronto  Scientist, Toronto Rehabilitation Institute, UHN	Ontario	No conflicts to declare
<b>Simmons-Mackie, Nina</b>	Ph.D. BC-ANCDS  Professor Emeritus, Southeastern Louisiana University, Hammond, LA, USA	United States	No conflicts to declare
<b>Stinear, Cathy M.</b>	PhD  Professor, Clinical Neuroscience  Department of Medicine, University of Auckland, New Zealand	New Zealand	<b>Potential conflict:</b>  Advisory board: Neurological Foundation of New Zealand – Member of the National Council  <b>Potential conflict:</b>  Payment: Health Research Council of New Zealand – Committee chair fees  <b>Potential conflict:</b>  Grant/honorarium: Neurological Foundation of New Zealand – Grant holder
<b>Thomas, Aliki</b>	PhD., OT(c), erg.  Associate Professor, School of Physical and Occupational Therapy, McGill University  Research Scientist, Centre for Medical Education, McGill University, Site Director of	Quebec	<b>Potential conflict:</b>  Stroke Best Practice Advisory Group

	Research, Centre for Interdisciplinary Research in Rehabilitation (CRIR), Jewish Rehabilitation Hospital, CISSS de Laval		
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## APPENDIX TWO

**Table 1: Suggested Stroke Rehabilitation Screening and Assessment Tools**

**a. Tools to Assess Functional Capacity and Activities of Daily Living**

Assessment Tool	Purpose	Items and Administration	Additional Considerations	Availability
<b>Functional Independence Measure (FIM®)</b>  <b>Keith et al. 1987</b>	The FIM® is an <b>assessment</b> tool for physical and cognitive disability and is intended to measure burden of care.	18 items evaluating 6 areas of function: self-care, sphincter control, mobility, locomotion, communication and social cognition.  Score Interpretation: Maximum score is 126, with higher scores indicating greater levels of functional independence.  Scores can also be calculated for motor and cognitive subscales.  Administration: Observation; approx. 30 minutes to complete.	The FIM® has been well-studied for its validity and reliability within stroke populations; however, it has been suggested that reliability is dependent on the individual administering the assessment (Salter et al. 2012).  Specialized Training: Required.	Available for purchase. <a href="http://www.udsmr.org/WebModules/FIM/Fim_About.aspx">www.udsmr.org/WebModules/FIM/Fim_About.aspx</a>
<b>AlphaFIM® Instrument</b>  <b>Stillman et al. 2009</b>	The AlphaFIM® Instrument is an assessment tool designed for use during acute care.	6 items assessing of motor (eating, grooming, bowel management and toilet transfers) and cognitive (expression and memory) function, which can be reliably collected in acute care. For patients who are able to walk 150 feet or more, eating and grooming items are replaced by items evaluating walking and bed transfer.  Score Interpretation: Alpha-FIM® scores are transformed to a projected FIM® scores and an estimate of patient burden of care hours using an online proprietary algorithm (Lo et al. 2012).  Administration: Approx. 5 minutes to complete.	Requires less time to complete than the original FIM®.  Specialized Training: Required	Available for purchase. <a href="http://www.udsmr.org/WebModules/Alpha/Alp_About.aspx">www.udsmr.org/WebModules/Alpha/Alp_About.aspx</a>

Assessment Tool	Purpose	Items and Administration	Additional Considerations	Availability
<b>Modified Rankin Scale (mRS)</b>  <b>Rankin 1957, Bonita et al. 1988, van Swieten et al. 1988</b>	The mRS is an <b>assessment</b> tool for rating global outcome.	Individuals are assigned a subjective grade or rank ranging from 0 (no symptoms) to 5 (severe disability) based on level of independence with reference to pre-stroke activities rather than observation of task-based performance.  Administration: Interview; 15 minutes to complete.	The scale's categorical options have been criticized as being broad and poorly defined (Wilson et al. 2002).  Specialized Training: Not required.	Free  <a href="http://www.rankinscale.org/">www.rankinscale.org/</a>
<b>Barthel Index of Activities of Daily Living (BI)</b>  <b>Mahoney et al. 1965</b>	The BI is an <b>assessment</b> tool for evaluating independence in self-care activities.	The BI consists of 10 common ADLs, 8 related to personal care and 2 related to mobility.  Score Interpretation: The index yields a total score out of 100 with higher scores indicating greater functional independence.  Administration: Self-Report (less than 5 minutes) or direct observation (up to 20 minutes).	Widespread familiarity of the BI contributes to its interpretability.  The BI is relatively insensitive and a lack of comprehensiveness may result in problems with ceiling and floor effects (Duncan et al. 1997).  Specialized Training: Not required.	Free  <a href="http://www.strokecenter.org/wp-content/uploads/2011/08/barthel.pdf">http://www.strokecenter.org/wp-content/uploads/2011/08/barthel.pdf</a>
<b>Modified Barthel Index of Activities of Daily Living (MBI)</b>  <b>Collin et al. 1988</b>	The MBI is a modified version of the BI.	The content of the BI and MBI are the same. It is only the scoring values that were changed in the MBI.  Scoring: Functional categories may be scored from 0 to 1, 0 to 2 or 0 to 3, depending on the item. Total scores range from 0 to 20	The MBI has been reported to have excellent internal consistency, test-retest reliability and inter-rater reliability.  Specialized training: Training required if administered by direct observation	<a href="http://www.strokecenter.org/trials/scales/barthel.pdf">http://www.strokecenter.org/trials/scales/barthel.pdf</a>
<b>Frenchay Activities Index (FAI)</b>  <b>Holbrook et al. 1983</b>	The FAI is an <b>assessment</b> tool for instrumental activities of daily living.	15 items representing activities in 3 domains: domestic chores, leisure and work, and outdoor activities.  Score Interpretation: Summed scores range from 15-60, with lower scores indicating less frequent activity.  Administration: Interview; approx. 5 minutes to	The FAI provides complementary information to that obtained from the Barthel Index, with the FAI representing higher level ADLs (Pederson et al. 1997)  Age and Gender may influence scores (Holbrook & Skilbeck 1983; Appelros 2007).	Free  <a href="http://www.rehabmeasures.org/PDF%20Library/Frenchay%20Activities%20Index.pdf">www.rehabmeasures.org/PDF%20Library/Frenchay%20Activities%20Index.pdf</a>

Assessment Tool	Purpose	Items and Administration	Additional Considerations	Availability
		complete.	Specialized Training: Not required.	
<b>6 Minute Walk Test (6MWT)</b>  <b>Butland et al. 1982</b>	The 6MWT is an <b>assessment</b> tool for walking capacity and endurance.	<p>The total distance in metres walked during the trial period is measured and recorded. The number and duration of rests can also be measured.</p> <p>Administration: Observation; 6 minutes to complete.</p>	<p>Age, height, weight, and sex should each be considered when interpreting results. Encouragement may also impact test results: the published standardized protocol should be used (ATS, 2002; updated protocol Holland et al. 2014).</p> <p>Reference equation developed for Canadians, which was based from the ATS protocol, uses only sex and age to determine the normative value for the 6-minute walk (Hill et al. 2011).</p> <p>As a test of submaximal walking capacity, this test may be best suited to those with moderate-severe impairment (Salter et al. 2012). Variations of this test include the 2 minute and 12-minute walk tests.</p> <p>Specialized Training: Required reading.</p>	<p>Free</p> <p>The iWalk Toolkit has stroke-specific protocols, educational videos, and the iWalkAssess app.</p> <p>To find the toolkit, visit: <a href="http://www.iwalkassess.com">www.iwalkassess.com</a></p>
<b>10 Meter Walk Test (10MWT)</b>  <b>Sullivan et al. 2013</b>	The 10MWT is an <b>assessment</b> tool for walking speed.	<p>The total time required to walk 10 meters is measured and recorded.</p> <p>Administration: Time is measured while individual walks 10-meters, after given space to accelerate to their preferred walking speed (this distance is not included when determining speed).</p>	<p>Requires a 14-meter path that includes 2 meter for acceleration and deceleration.</p> <p>Meta-analysis of age- and sex-specific normative speed found that the grand mean speed ranged from 94.3 cm/second (women aged 80 to 99 years) to 143.4 cm/second (men aged 40 to 49 years). The grand mean gait speed was relatively consistent for the decades 20 to 29 years to 60 to 69 years for men (133.9 to 143.3 cm/second) and women (124.1 to 139.0 cm/second). By the time subjects were aged 80 years or more, their mean gait speed declined to less</p>	<p>Free</p> <p><a href="http://www.rehabmeasures.org/PDF%20Library/10%20Meter%20Walk%20Test%20Instructions.pdf">http://www.rehabmeasures.org/PDF%20Library/10%20Meter%20Walk%20Test%20Instructions.pdf</a></p> <p>The iWalk Toolkit has stroke-specific protocols, educational videos, and the iWalkAssess app.</p>

Assessment Tool	Purpose	Items and Administration	Additional Considerations	Availability
			<p>than 100 cm/second. (Bohannon et al. 2011).</p> <p>Specialized Training: Required reading.</p>	<p>To find the toolkit, visit: <a href="http://www.iwalkassess.com">www.iwalkassess.com</a></p>
<b>Life Habits (LIFE-H)</b>  <b>Fougeyrollas et al. 1998</b>	The LIFE-H is an assessment tool for quality of social participation based on the ability to accomplish activities of daily living and social roles.	<p>LIFE-H assesses 12 domains of life habits. The first 6 domains are related to activities of daily living including: nutrition, fitness, personal care, communication, housing, mobility. The remaining are domains are related of social roles: responsibilities, interpersonal relationships, community life, education, employment and leisure.</p> <p>Score interpretation: LIFE-H is based on a continuous score ranging from 0 to 9, with 0 implying an optimal level of participation and 9 indicating total handicap. In the shortened version, the scale is reversed with 9 implying optimal level of participation and 0 indicating total handicap. The total LIFE-H score is obtained by summing the score of each item and then dividing by the number of items.</p> <p>Administration: The life-H is a self-administered questionnaire. Proxy respondents may be used for clients with low cognitive levels. (Poulin &amp; Desrosiers 2008).</p>	<p>The LIFE-H includes 240 items. The LIFE-H is also available to three shortened version: 1. LIFE-H 2.1 (58 items); 2. LIFE-H 3.0 (69 items); and 3. LIFE-H 3.1 (77 items). The International Network of Disability Creation Process encourages use of version 3.0. (Fougeyrollas et al. 1997; Fougeyrollas et al. 2001)</p> <p>The LIFE-H 3.0 (short form) may take 20 to 40 minutes to complete. The administration time for the long form can vary from 20 to 120 minutes.</p> <p>The LIFE-H is able to discriminate healthy individuals from clients with stroke.</p> <p>Training: None</p>	A copy of the LIFE-H can be ordered from the International Network on the Disability Creation Process (INDCP) by emailing the coordinator at francis.charrier@idrpq.qc.ca.
<b>Canadian Occupational Performance Measure (COPM)</b>  <b>Law et al. 1990</b>	The COPM is an <b>assessment</b> tool that measures a client's everyday functioning in self-care, productivity and leisure.	The measure consists of 25 functional items/tasks (i.e. bathing, ability to work at least part-time, activities involved in). Each task is then scored on a single 10-point rating scale primarily measuring proficiency in each of the 3 sub-categories (self-care, productivity and leisure).	<p>The measure has been shown to have good reliability and adequate validity (Yang et al. 2017).</p> <p>Specialized training: Required.</p>	<p>Available for purchase.</p> <p><a href="http://www.thecopm.ca/buy/">http://www.thecopm.ca/buy/</a></p>

Assessment Tool	Purpose	Items and Administration	Additional Considerations	Availability
		Administration: The COPM is administered using a semi-structured interview in a five-step process with the client or their caregiver. The five steps are: problem definition, problem weighting, scoring, re-assessment, and follow-up (Law et al. 1990).		
<b>ABILHAND</b>  <b>Penta et al. 1998</b>	The ABILHAND is an <b>assessment</b> tool for performing bimanual activities of daily living.	<p>The measure consists of 23 items assessing common bimanual activities of daily living. Each item is scored from: 0=impossible, 1=difficult, 2=easy.</p> <p>Administration: Typically administered by a clinician in an interview. Estimated to take between 10 to 30 minutes to complete (Ashford et al., 2008).</p>	<p>The measure has been shown to have good psychometric properties (Murphy et al. 2015).</p> <p>Specialized training: None required</p>	<p>The measure and its corresponding analysis can be viewed for free at:</p> <p><a href="http://rssandbox.iescagilly.be/abilhand-rasch-analysis-chronic-stroke.html">http://rssandbox.iescagilly.be/abilhand-rasch-analysis-chronic-stroke.html</a></p>
<b>Functional autonomy measurement system (SMAF)</b>  <b>Hébert 1988</b>	The SMAF is an <b>assessment</b> tool of functional independence.	<p>The measure consists of 29 items relating to: Instrumental activities of daily living (7 items), mobility (6 items), communication (3 items), cognitive function (5 items), and home living activities (8 items).</p> <p>Administration: Observation, approx. 42 minutes to complete.</p>	<p>The measure has been shown to have a strong correlation with the FIM (Desrosiers, 2003).</p> <p>Specialized training: Required.</p>	<p>Available for purchase</p> <p><a href="http://www.demarchesmaf.com/en/">http://www.demarchesmaf.com/en/</a></p>

## b. Tools to Assess Stroke Severity

Assessment Tool	Purpose	Items and Administration	Additional Considerations	Availability
<b>Canadian Neurological Scale (CNS)</b>  <b>Côté et al. 1986</b>	The CNS is an <b>assessment</b> tool for neurological impairment.	Items include an assessment of mental activity (level of consciousness, orientation and speech) and motor activity (face, arms and legs) for patients with or without comprehension deficits in the acute stage.  Score Interpretation: Maximum score is 11.5; lower scores indicate higher severity.  Administration: Approximately 5-10 minutes or less to complete by an administrator.	Quick and simple tool completed by a trained health care practitioner. Used in the acute phase of stroke.  Specialized Training: Not Required.	Free <a href="http://www.strokecenter.org/wp-content/uploads/2011/08/canadian.pdf">www.strokecenter.org/wp-content/uploads/2011/08/canadian.pdf</a>
<b>National Institutes of Health Stroke Scale (NIHSS)</b>  <b>Brott et al. 1989</b>	The NIHSS is an <b>assessment</b> tool for neurological status following a stroke.	11 items which include an assessment of level of consciousness, facial palsy and the presence of neglect or visual, sensory, motor, language or speech deficits. Items are answered according to a 3 or 4 point ordinal scale.  Score Interpretation: Maximum score is 42; higher scores indicate a greater level of severity. (1-4=mild; 5-14=mild to moderate; 15-24=severe; >25=very severe)  Administration: Approximately 5-10 minutes to complete by an administrator.	Can be completed by non-neurologists. Shortened versions are available.  The suitability of the item assessing limb ataxia has been questioned, and several items cannot be assessed in patients with severe stroke.  Specialized Training: Required.	Free <a href="http://www.strokecenter.org/wp-content/uploads/2011/08/NIH_Stroke_Scale.pdf">www.strokecenter.org/wp-content/uploads/2011/08/NIH_Stroke_Scale.pdf</a>
<b>Orpington Prognostic Scale (OPS)</b>  <b>Kalra &amp; Crome 1993</b>	The OPS is an <b>assessment</b> tool for stroke severity and has been found to be beneficial in identifying a patient's suitability for	4 items which include an assessment of motor functioning in the arm, proprioception, balance and cognition.  Score Interpretation: Maximum score is 6.8; higher scores indicate a greater level of severity. (<3.2=mild to moderate; 3.2 - 5.2 = moderate to moderately severe; >5.2 =	Quick and simple tool that does not require additional equipment for administration.  Should not be used until the patient's medical condition has stabilized.	Free <a href="http://www.uwhealth.org/files/uwhealth/docs/pdf/spep_orpington_scale.pdf">www.uwhealth.org/files/uwhealth/docs/pdf/spep_orpington_scale.pdf</a>

Assessment Tool	Purpose	Items and Administration	Additional Considerations	Availability
	rehabilitation.	severe or major).  Administration: Approximately 5 minutes or less to complete by an administrator.	Specialized Training: Not Required.	

### c. Tools to Assess Motor Function

Assessment Tool	Purpose	Items and Administration	Additional Considerations	Availability
<b>Chedoke-McMaster Stroke Assessment Scale (CMSA)</b>  <b>Gowland et al. 1993</b>	The CMSA is a <b>screening and assessment</b> tool for physical impairment and disability.	The CMSA consists of two inventories. The physical impairment inventory assesses 6 domains (should pain, postural control and arm, hand, leg, and foot movement), whereas the disability inventory assesses gross motor and walking function.  Score Interpretation: The impairment and disability inventories yield total scores out of 42 and 100, respectively, with lower scores indicating greater impairment.  Administration: Observation; up to 60 minutes to complete.	The CMSA is relatively comprehensive and has been well studied for reliability and validity (Poole and Whitney 2001).  Taking approximately 1 hour to complete, the length and complexity of the CMSA may decrease the scales utility in clinical practice (Poole and Whitney 2001).  Specialized Training: Required reading.	Free <a href="http://www.rehabmeasures.org/PDF%20Library/CMSA%20Manual%20and%20Score%20Form.pdf">http://www.rehabmeasures.org/PDF%20Library/CMSA%20Manual%20and%20Score%20Form.pdf</a>
<b>Fugl-Meyer Assessment of Motor Recovery after Stroke (FMA)</b>  <b>Fugl-Meyer et al. 1975</b>	The FMA is an <b>assessment</b> tool for motor functioning following a stroke.	155 items assessing motor function in the upper and lower extremity, balance, sensation, range of motion and pain.  Score Interpretation: Maximum score is 226 (66 for upper extremity, 34 for lower extremity, 14 for balance, 24 for sensation, 44 for range of motion and 44 for pain); higher scores indicate greater functional performance.  Administration: Approximately 30 minutes or more to complete by direct observation.	Widely used and validated. Shortened versions are available and the motor scale of the tool can be administered on its own.  Requires additional equipment (e.g. tennis ball) and should be administered by a trained therapist (Occupational Therapist or Physiotherapist).  Specialized Training: Required.	Free <a href="http://www.rehabmeasures.org/lists/rehabmeasures/disform.aspx?ID=908">http://www.rehabmeasures.org/lists/rehabmeasures/disform.aspx?ID=908</a>

Assessment Tool	Purpose	Items and Administration	Additional Considerations	Availability
Rivermead Motor Assessment (RMA)  Lincoln & Leaditter 1979	The RMA is an <b>assessment</b> tool for motor performance.	38-items of increasing difficulty representing 3 domains: gross function, leg and trunk movement, and arm movement.  Score Interpretation: Scores range from 0-38, with higher scores indicating better motor ability.  Administration: Observation; up to 45 minutes to complete.	Although the RMA can be time consuming, administration is faster with high functioning individuals because of the progressing difficulty of the measure.  Some concern has been reported regarding the validity of the RMA (Adams et al. 1997; Kurtais et al. 2009).  The RMA should be administered by a physiotherapist.  Specialized Training: Not required.	Free <a href="http://www.strokengine.ca/assets/rma/">www.strokengine.ca/assets/rma/</a>
Stroke Rehabilitation Assessment of Movement (STREAM)  Daley et al. 1999	The STREAM is an <b>assessment</b> tool for motor functioning following a stroke.	30 items assessing voluntary movement of the upper and lower limbs and basic mobility. Items are answered based on a 3 or 4 point ordinal scale.  Score Interpretation: Maximum score is 70 (20 each for upper and lower limb and 30 for basic mobility); higher scores indicate greater mobility.  Administration: Approximately 15 minutes to complete by an administrator.	Quick and simple tool that does not require additional equipment for administration. A shortened version is available.  Floor and ceiling effects have been noted for the STREAM raising concerns about the ability to capture change in patients who are functioning at the higher or lower end of the scale.  Specialized Training: Not required.	Free <a href="http://ptjournal.apta.org/content/79/1/8.full.pdf+html">http://ptjournal.apta.org/content/79/1/8.full.pdf+html</a>

## d. Tools to Assess Mobility

Assessment Tool	Purpose	Items and Administration	Additional Considerations	Availability
<b>Berg Balance Scale (BBS)</b>  <b>Berg et al. 1989</b>	The BBS is an <b>assessment</b> tool for balance in older adults.	<p>14-items in which patients are asked to maintain positions or complete movement tasks of varying levels of difficulty. All items are common to everyday life.</p> <p>Score Interpretation: Total scores range from 0-56, with scores of less than 45 generally accepted as being indicative of balance impairment.</p> <p>Administration: Observation; approx. 10 -15 minutes to complete.</p>	<p>The BBS requires little equipment or space to complete and has demonstrated high levels of reliability even when administered by an untrained assessor (Berg et al. 1995).</p> <p>Sensitivity may be reduced among severely affected patients as the BBS includes only one item relating to balance in a seated position (Mao et al. 2002).</p> <p><b>Specialized Training:</b> Not required.</p>	Free <a href="http://www.strokengine.ca/assess/bbs/">http://www.strokengine.ca/assess/bbs/</a>
<b>Clinical Outcome Variables (COVS)</b>  <b>Seaby &amp; Torrance 1989</b>	The COVS is an <b>assessment</b> tool for functional mobility.	<p>13 items assessing mobility with respect to transfers, rolling, lying to sitting, sitting balance, ambulation, wheelchair mobility and arm function.</p> <p>Score Interpretation: Total scores range from 13 - 91, with lower scores indicating less functional mobility.</p> <p>Administration: Observation; 15 - 45 minutes to complete.</p>	<p>Provides detail in areas of mobility not assessed by global functional assessments such as the FIM® (Barclay-Goddard 2000).</p> <p>Although reliability of the COVS has been demonstrated, further evaluation of validity is required (Salter et al. 2012).</p> <p>Administration of the COVS requires a fairly lengthy list of equipment.</p> <p><b>Specialized Training:</b> Required reading.</p>	Available for purchase <a href="http://www.irrd.ca/covs/">http://www.irrd.ca/covs/</a>
<b>Functional Ambulation Categories (FAC)</b>  <b>Holden et al. 1984</b>	The FAC is an <b>assessment</b> tool for rating ambulation status.	<p>Individuals are assigned a subjective grade based on 5 broad categories of walking ability, with scores ranging from 0 (cannot walk or needs help from more than 1 person) to 5 (can walk independently anywhere).</p> <p>Administration: Observation; approx. 5 minutes to complete.</p>	<p>The FAC may be subject to ceiling effects. Further research is needed to evaluate responsiveness in higher functioning populations (Salter et al. 2012).</p> <p><b>Specialized Training:</b> Not required.</p>	Free <a href="http://www.strokengine.ca/?s=functional+ambulation+categories">http://www.strokengine.ca/?s=functional+ambulation+categories</a>

Assessment Tool	Purpose	Items and Administration	Additional Considerations	Availability
<b>Mini BESTest</b>  <b>Franchignoni et al. 2010.</b>	The MiniBEST is an assessment tool for balance control	<p>The MiniBEST assesses balance control and dynamic balance through 14 items through the following domains: anticipatory postural adjustment, reactive postural control, sensory orientation, dynamic gait.</p> <p>Scoring: Each item is scored on a 3 level ordinal scale (0-2) for a total of 28 points. Two items have right and left assessment, where the lower score is used within the total score.</p> <p>Administration: 10 to 15 minutes to administer</p>	<p>Requires the following equipment:</p> <ul style="list-style-type: none"> <li>• 60 cm x 60 cm block of 4" medium density Tempur foam (T41)</li> <li>• Incline ramp of 10-degree slope (2 x 2 foot recommended)</li> <li>• Standard chair without arm rests or wheels</li> <li>• Firm chair with arms</li> <li>• Box that is 9 inches (23 cm) in height (~2 stacked shoeboxes)</li> <li>• Stopwatch</li> <li>• Masking tape marked on floor at 3 meters from front of chair</li> </ul> <p>Training: Specialized training is required: reading article/manual; training course/training DVD.</p>	For free: <a href="http://www.bestest.us/">http://www.bestest.us/</a>
<b>Rivermead Mobility Index (RMI)</b>  <b>Collen et al. 1991</b>	The RMI is an assessment tool for functional mobility.	<p>15 items, 14 of which involve yes/no questions regarding performance of functional activities and 1 that involves unassisted standing for 10 seconds.</p> <p>Score Interpretation: Scores range from 0 - 15, with higher scores indicating better functional mobility.</p> <p>Administration: Self-report and observation; less than 5 minutes to complete.</p>	<p>Caution in the interpretation of the tests' hierarchical scaling has been advised as modifications (e.g., use of assistive devices) are not considered (Collen et al. 1991).</p> <p>Specialized Training: Not required.</p>	Free <a href="http://www.strokengine.ca/?s=rivermead">http://www.strokengine.ca/?s=rivermead</a>
<b>Timed "Up and Go" Test (TUG)</b>  <b>Podsiadol &amp; Richardson</b>	The TUG is a screening tool for basic mobility and balance.	Individuals are asked to stand from a seated position, walk 3 metres (using an aid if required), turn, walk back to the chair, and reseat themselves.	The TUG addresses relatively few aspects of balance and yields a narrower assessment than more comprehensive balance measures, such as the Berg Balance Scale (Whitney et al. 1998).	Free <a href="http://www.strokengine.ca/?s=timed+up+and+go">http://www.strokengine.ca/?s=timed+up+and+go</a>

Assessment Tool	Purpose	Items and Administration	Additional Considerations	Availability
<b>1991</b>		<p>Score Interpretation: The total time to complete the test is recoded with shorter intervals indicating better mobility and balance.</p> <p>Administration: Observation; approx. 3 minutes to complete.</p>	Specialized Training: Not required.	
<b>Functional Reach Test (FRT)</b>  <b>Duncan et al. 1990</b>	The FRT is an <b>assessment</b> tool for static balance assessing the maximum distance a participant can reach forward while standing in a fixed position.	<p>The participant stands along a wall, position the arm at 90 degrees of shoulder flexion with a closed fist. Measurements are taken at the 3<sup>rd</sup> metacarpal head in the starting position, and then again at the 3<sup>rd</sup> metacarpal head after reaching as far as they can. Reach distance is measured in inches. This is done three times, with the final score being the average of the last two trials.</p> <p>The modified version of the FRT is assessed similarly, except it is used for participant who are unable to stand. Trials are done either: sitting with the unaffected side near the wall and leaning forward; sitting with the back to wall and leaning right; and sitting with back to the wall leaning left.</p>	<p>Requires a yardstick and duct tape.</p> <p>Specialized Training: Not required.</p>	<p>Free</p> <p><a href="https://www.sralab.org/sites/default/files/2017-06/5Hgjkv-Functional%20Reach%20Test.pdf">https://www.sralab.org/sites/default/files/2017-06/5Hgjkv-Functional%20Reach%20Test.pdf</a></p>

### e. Tools to Assess the Upper Extremity

Assessment Tool	Purpose	Items and Administration	Additional Considerations	Availability
Action Research Arm Test (ARAT)  Lyle 1981	The ARAT is an <b>assessment</b> tool for upper extremity function and dexterity.	19 items assessing four areas of function: grasp, rip, pinch, and gross movement.  Score Interpretation: Scores range from 0 - 57, with lower scores indicating greater impairment.  Administration: Observation; approx. 10 minutes to complete.	Significant floor and ceiling effects have been identified (Van der Lee et al.2002).  Specialized Training: Not required.	Free <a href="http://www.strokengine.ca/?s=action+research+arm+test">http://www.strokengine.ca/?s=action+research+arm+test</a>
Box & Block Test (BBT)  Mathiowetz et al. 1985	The BBT is an <b>assessment</b> tool for unilateral gross manual dexterity.	Individuals are asked to move small blocks, one at time, from one compartment to another within 60 seconds.  Score Interpretation: Scores are calculated by summing the number of blocks transported within the trial period.  Administration: Observation; approx. 5 minutes to complete.	Established norms increase the interpretability of BBT results. Seated administration may increase the accessibility of the test.  Because the BBS requires adequate strength and grip to transport blocks, it may be best suited for those with mild-moderate hemiparesis/weakness (Chanubol et al. 2012).  Specialized Training: Not required.	Standardized equipment available for purchase  <a href="http://www.pattersonmedical.com/app.aspx?cmd=getProductDetail&amp;key=070_921018701">http://www.pattersonmedical.com/app.aspx?cmd=getProductDetail&amp;key=070_921018701</a>
Chedoke Arm and Hand Activity Inventory (CAHAI)  Barreca et al. 2004	The CAHAI is an <b>assessment</b> tool for arm and hand function.	13 bilateral functional tasks (e.g. do up five buttons, carry a bag up stairs, pour a glass of water).  Score Interpretation: Total scores range from 13 to 91, with lower scores indicating greater impairment.  Administration: Observation; approx. 25 minutes to complete.	The CAHAI has demonstrated good validity and reliability in stroke populations and evaluates a wide range of functions that are not considered in other measures of arm and hand function (Barreca et al. 2005).  Specialized Training: Required.	Free <a href="http://www.cahai.ca/">http://www.cahai.ca/</a>
Nine Hole Peg Test (NHPT)  Mathiowetz et al. 1985	The NHPT is an <b>assessment</b> tool for fine manual dexterity.	Individuals are asked to, one at a time, insert 9 pegs from a container into a board with 9 empty holes and then to move the pegs back into the container while being timed.  Score Interpretation: Two-trials are performed with each hand, with the final time being an average of the two trials. Lower scores indicate better dexterity.	The NHPT has demonstrated good reliability and validity (Salter et al. 2012).  Norms for age, gender, and hand dominance have been established; however, norms produced from the original study may not transfer well to commercial versions of the test (Davis et al. 1999).	Standardized equipment available for purchase  <a href="http://www.pattersonmedical.com/app.aspx?cmd=getProduct&amp;key=IF_921029571">http://www.pattersonmedical.com/app.aspx?cmd=getProduct&amp;key=IF_921029571</a>

Assessment Tool	Purpose	Items and Administration	Additional Considerations	Availability
		Administration: Observation; approx. 5 minutes to complete	The NHPT is susceptible to practice effects.  Specialized Training: Not required.	
<b>Wolf Motor Function Test (WMFT)</b>  <b>Wolf et al. 2001</b>	The WMFT is an <b>assessment</b> tool for upper extremity motor ability.	17 items of increasing complexity and progressing from proximal to distal joint involvement. Tasks are performed as quickly as possible and are assessed in terms of time, strength, and movement quality.  Score Interpretation: Scores range from 0 - 75 with higher scores indicating greater motor ability.  Administration: Observation; approx. 30 - 45 minutes to complete.	Provides assessment of both performance time and quality of movement.  Floor effects have been reported for individuals with severe impairment (Salter et al. 2012).  Further evidence regarding reliability and validity when used in clinical practice (i.e., real-time observation) is required.  Specialized Training: Required.	Free <a href="http://www.strokengine.ca/?s=wolf+motor+function+test">http://www.strokengine.ca/?s=wolf+motor+function+test</a>

## f. Tools to Assess Mood and Cognition

Assessment Tool	Purpose	Items and Administration	Additional Considerations	Availability
<b>Beck Depression Inventory (BDI)</b>  <b>Beck et al. 1961</b>	The BDI is a <b>screening</b> tool for depression and, if present, provides cut points for severity.	21 items relating to symptoms that have been found to be associated with the presence of depression. Items are presented in a multiple choice format ranging from 0 (no symptoms) to 3 (severe symptoms).  Score Interpretation: Maximum score is 63; higher scores indicate greater severity. Graded levels of severity; a score of 10 is considered the cut point for depression.  Administration: 5 - 10 minutes for self-report; 15 minutes with support.	Quick screening tool that does not require extra tools for completion.  Level of depression may be overestimated in women and when completed by a proxy. Rate of misdiagnosis was up to 34% in patients with stroke (Aben et al. 2002).  Specialized Training: Not required.	Free <a href="http://www.strokengine.ca/?s=beck+depression+inventory">http://www.strokengine.ca/?s=beck+depression+inventory</a>
<b>Patient Health Questionnaire-9 (PHQ-9)</b>	The PHQ-9 is the 9-item depression module from the	9 items relating to the 9 criteria used by the DSM-V for the diagnosis of depressive disorders. Items ask about behaviour in the past two weeks, and each item is scored from:	Quick screening tool. Clinicians before making a final diagnosis should rule out physical causes of depression, normal bereavement, and history of a manic	Free <a href="https://www.phqscreen.com">https://www.phqscreen.com</a>

Assessment Tool	Purpose	Items and Administration	Additional Considerations	Availability
Kroenke et al. 2001	full PHQ. It is a <b>screening</b> tool for depression and provides an assessment of symptom severity as well.	0 ("Not at all"), 1 ("Several days"), 2 ("More than half the days"), 3 ("Nearly everyday"). Consists of a total score from 0 to 27. Item 9 measures suicidal ideation.  Major depression is diagnosed if a score greater than 10 is attained. Other depression is diagnosed if a score between 4 to 8 is attained.  Administration: Is a 3-page questionnaire that can be self-administered by the patient.	episode.  Specialized Training: Not required.	<a href="#">ers.com/</a>
Geriatric Depression Scale (GDS)  Yesavage et al. 1982	The GDS is a <b>screening</b> tool for depression and, if present, provides cut points for severity.	30 items relating to symptoms that have been found to be associated with the presence of depression. Items are presented in a yes/no response format.  Score Interpretation: Maximum score is 30 and indicates the highest level of depression. Graded levels of severity; a score of 10 is considered the cut point for depression.  Administration: 5 - 10 minutes for self-report.	Developed for use in the geriatric population. Short forms of the GDS are available.  The tool has been cited as being more accurate for diagnosing women compared to men, and there are concerns with its use for cognitively impaired individuals.  Specialized Training: Not required.	Free <a href="http://www.strokeengine.ca/?s=geriatric+depression+scale">http://www.strokeengine.ca/?s=geriatric+depression+scale</a>
Hospital Anxiety and Depression Scale (HADS)  Zigmond & Snaith, 1983	The HADS is a <b>screening</b> tool for anxiety and depression and, if present, provides cut points for severity.	14 items (7 anxiety items and 7 depression items). Items are presented in a multiple choice format ranging from 0 to 3.  Score Interpretation: Maximum score is 21 for both anxiety and depression; higher scores indicate greater severity. (0-7=normal; 8-10=borderline abnormal; 11-21=abnormal)	Simple screening tool that does not require extra tools for completion.  Does not contain questions related to the presence of somatic symptoms.  Specialized Training: Not required.	Available for purchase. <a href="http://www.glassessment.co.uk/products/hospital-anxiety-and-depression-scale-0">http://www.glassessment.co.uk/products/hospital-anxiety-and-depression-scale-0</a>

Assessment Tool	Purpose	Items and Administration	Additional Considerations	Availability
<b>General Health Questionnaire (GHQ)</b> <b>Goldberg &amp; Hillier, 1979</b>	The GHQ is a <b>screening</b> tool for psychiatric disorders.	<p>Administration: 2-6 minutes for self-report.</p> <p>28 items each addressing a particular symptom related to 4 domains of distress (depression, anxiety, worrying, and social distress). Items are in the form questions with yes/no responses.</p> <p>Score Interpretation: Multiple scoring methods exist. Conventional method is to score based on presence or absence of a symptom.</p> <p>Administration: Approximately 5 minutes to complete by self-report.</p>	<p>Quick and simple tool that does not require additional materials for completion.</p> <p>Cut-off scores have not been properly validated for diagnosis of psychiatric disorders.</p> <p>Specialized Training: Required reading.</p>	<p>Available for purchase.  <a href="https://shop.psych.acer.edu.au/acer-shop/group/SD">https://shop.psych.acer.edu.au/acer-shop/group/SD</a></p>
<b>Mini-Mental State Examination (MMSE)</b> <b>Folstein et al. 1975</b>	The MMSE is a <b>screening</b> tool for cognitive impairment.	<p>11 items relating to 6 cognitive domains (orientation – in time and space, registration, attention and calculation, recall, language and read and obey). Items are in the form of questions or tasks.</p> <p>Score Interpretation: Maximum score is 30; higher scores indicate greater cognitive functioning.</p> <p>Administration: Approximately 10 minutes to administer.</p>	<p>Relatively quick and simple tool that requires no additional equipment.</p> <p>Has been reported to have a low sensitivity, noted especially for those individuals with mild cognitive impairment as well and patients with stroke.</p> <p>Specialized Training: Not required.</p>	<p>Available for purchase.  <a href="http://www4.parinc.com/Products/Product.aspx?ProductID=MMSE">http://www4.parinc.com/Products/Product.aspx?ProductID=MMSE</a></p>
<b>Montreal Cognitive Assessment (MoCA)</b> <b>Nasreddine et al. 2005</b>	The MoCA is a <b>screening</b> tool for cognitive impairment.	<p>11 items relating to 8 cognitive domains (visuospatial, executive, naming, memory, language, abstraction, delayed recall and orientation). Items are in the form of questions or tasks.</p> <p>Score Interpretation: Maximum score is 30; higher scores indicate greater cognitive functioning. Total score <math>\geq 26</math> is considered</p>	<p>Relatively quick tool and is suitable for patients with mild cognitive impairment.</p> <p>Requires extra equipment (stopwatch and score sheet) and some training.</p> <p>Specialized Training: Required reading.</p>	<p>Free  <a href="http://www.mocatest.org/">http://www.mocatest.org/</a></p>

Assessment Tool	Purpose	Items and Administration	Additional Considerations	Availability
		normal.  Administration: Approximately 10 minutes to administer.		
<b>Clock Drawing Test (CDT)</b>  <b>Sunderland et al. 1989</b>	The CDT is a <b>screening</b> tool for cognitive impairment.	Involves a command to draw a clock or to copy a clock.  Score Interpretation: No universal system for scoring exists. Individual scoring systems are based on the number of deviations from what is expected from the drawing.  Administration: Approximately 1-2 minutes to complete by the patient.	Quick and simple tool that does not require additional equipment for administration.  Often used as a supplement to other cognitive assessment tools. The CDT is one component of the MoCA.  Specialized Training: Not required.	Free  <a href="http://www.strokeengine.ca/?s=clock+drawing">http://www.strokeengine.ca/?s=clock+drawing</a>

### g. Tools to Assess Visual Perception and Neglect

Assessment Tool	Purpose	Items and Administration	Additional Considerations	Availability
<b>Behavioral Inattention Test (BIT)</b>  <b>Wilson et al. 1987</b>	The BIT is a <b>screening</b> and <b>assessment</b> tool for visual neglect.	Comprised of two sections: the BIT Conventional subtest (BITC) (6 tests) and the BIT Behavioral subtest (BITB) (9 tests). The BITC consists of tests such as Line Crossing, Letter Cancellation etc. and the BITB consists of tests such as Picture Scanning and Telephone Dialing.  Score Interpretation: Maximum score and cut point for diagnosis of visual neglect are: (cut point/maximum score)  1. BITC: 129/146 2. BITB: 67/81	A shortened version of the BIT is available consisting of 3 tests from the BITC and 5 tests from the BITB.  Lengthy test that requires additional equipment (e.g. photographs, clock, coins, cards etc.).  Specialized Training: Not required.	Available for purchase.  <a href="http://www.pearsonassessment.ca/en/programs/00/51/95/p005195.html?CS_Category=%26CS_Catalog=TPC-CACatalog%26CS_ProductID=749129972">http://www.pearsonassessment.ca/en/programs/00/51/95/p005195.html?CS_Category=%26CS_Catalog=TPC-CACatalog%26CS_ProductID=749129972</a>

Assessment Tool	Purpose	Items and Administration	Additional Considerations	Availability
		<p>3. BIT: 196/227</p> <p>Administration: Approximately 40 minutes to administer.</p>		
<b>Line Bisection Test (LBT)</b>  <b>Schenkenberg et al. 1980</b>	The LBT is a <b>screening</b> tool for unilateral spatial neglect.	<p>Consists of a series of 18 lines for which patients are asked to mark the midpoint on each line. It is part of the BIT but can also be used as a stand-alone tool.</p> <p>Score Interpretation: Scoring is completed by measuring the distance between the true midpoint of the line and the mark made by the patient. No cut point for the diagnosis of unilateral spatial neglect has been established for this test.</p> <p>Administration: Approximately 5 minutes to complete by the patient.</p>	<p>Does not require extra tools for completion.</p> <p>The test is unable to differentiate between visual neglect and visual field deficits.</p> <p>Specialized Training: Not required.</p>	<p>Available for purchase.</p> <p><a href="http://www.pearsonassess.ca/en/programs/00/51/95/p005195.html?CS_Category=%26CS_Catalog=TPC-CACatalog%26CS_ProductID=749129972">http://www.pearsonassess.ca/en/programs/00/51/95/p005195.html?CS_Category=%26CS_Catalog=TPC-CACatalog%26CS_ProductID=749129972</a></p>
<b>Motor-free Visual Perception Test (MVPT)</b>  <b>Colarusso &amp; Hammill 1972</b>	The MVPT is an <b>assessment</b> tool for visual perception.	<p>36 items assessing 5 domains of visual perception (spatial relations, discrimination – visual and figure-ground, visual closure and visual memory). Items are in the form of multiple choice questions with 4 possible answers.</p> <p>Score Interpretation: Maximum score is 36; higher scores indicate greater visual perception.</p>	<p>Quick and simple tool and widely used.</p> <p>Administration requires extra equipment (test plates).</p> <p>Specialized Training: Required.</p>	<p>Available for purchase.</p> <p><a href="http://www.academichtherapy.com/detailATP.tpl?action=search&amp;cart=14301685755462655&amp;eqskudatarg=8962-9&amp;eqTitledatarg=Motor-Free%20Visual%20Perception%20Test-4%20%28MVPT-4%29&amp;eqvendordatarg=ATP&amp;bobby=%5Bbobby%5D&amp;bob=%5Bbob%5D&amp;TBL=[tbl]">http://www.academichtherapy.com/detailATP.tpl?action=search&amp;cart=14301685755462655&amp;eqskudatarg=8962-9&amp;eqTitledatarg=Motor-Free%20Visual%20Perception%20Test-4%20%28MVPT-4%29&amp;eqvendordatarg=ATP&amp;bobby=%5Bbobby%5D&amp;bob=%5Bbob%5D&amp;TBL=[tbl]</a></p>

## **h. Tools to Assess Spasticity**

Assessment Tool	Purpose	Items and Administration	Additional Considerations	Availability
<b>Modified Ashworth Scale (MAS)</b>  <b>Bohannon &amp; Smith 1987</b>	The MAS is an <b>assessment</b> tool for spasticity.	<p>Number of items is dependent on the number of joints that are being assessed. Joint assessment involves the movement of a joint from either maximal extension or flexion to the opposite position over a one second count.</p> <p>Score Interpretation: A score is reported for each joint assessed. Scores can range from 0-4 (0, 1, 1+, 2, 3, and 4); higher scores indicate greater rigidity or tone.</p> <p>Administration: Variable depending on the number of joints being assessed; a single joint is assessed over a one second count.</p>	<p>Quick assessment with no extra equipment required.</p> <p>The joint movement may cause some patient discomfort.</p> <p>Specialized Training: Required.</p>	<p>Free</p> <p><a href="http://www.strokeengine.ca/?s=modified+ashworth">http://www.strokeengine.ca/?s=modified+ashworth</a></p>
<b>Disability Assessment Scale (DAS)</b>  <b>Brashears et al. 2002</b>	The DAS is an <b>assessment</b> tool for upper limb spasticity.	<p>The items of the DAS assess spasticity in four functional domains: hand hygiene, dressing, limb position and pain.</p> <p>Items are scored from: 0 (no disability), 1 (mild disability), 2 (moderate disability), and 3 (severe disability).</p> <p>Administration: A face to face interview with the client.</p>	<p>Measure is specific to clients with spasticity. DAS has been shown to have comparable intra- and interrater reliability to the MAS (Brashears et al., 2002).</p> <p>Specialized Training: Not required.</p>	<p>Information about the scale can be seen in the following publication by Brashears et al. 2002.</p> <p><a href="https://www.ncbi.nlm.nih.gov/pubmed/12370866">https://www.ncbi.nlm.nih.gov/pubmed/12370866</a></p>
<b>Modified Tardieu Scale (MTS)</b>  <b>Tardieu et al. 1957</b>	The MTS is an <b>assessment</b> scale for spasticity in various neurological conditions.	<p>The MTS assesses spasticity by quantifying a spastic muscle's response to stretch applied at given velocities.</p> <p>The velocities of joint movement are as slow as possible (V1), speed of the limb falling from gravity (V2), and when the joint is moved as fast as possible (V3). The quality and angle of muscle reactions are recorded during these</p>	<p>The MTS has been believed to be an appropriate alternative to the MAS, as it compares the muscle reaction to passive stretch at both slow and fast velocities (Li et al., 2014). But the MAS is more commonly used.</p> <p>Specialized Training: An experienced therapist with repositioning spastic</p>	<p>Information about the scale can be seen in the following publication by Ansari et al., 2008.</p> <p><a href="https://www.ncbi.nlm.nih.gov/pubmed/19117179">https://www.ncbi.nlm.nih.gov/pubmed/19117179</a></p>

Assessment Tool	Purpose	Items and Administration	Additional Considerations	Availability
		<p>velocities.</p> <p>The quality of muscle reactions are scored as: 0 (no resistance throughout the duration of the stretch), 1 (slight resistance), 2 (clear catch occurring at a precise angle, followed by a release), 3 (fatigable clonus), 4 (inflexible clonus), 5 (joint is immovable).</p> <p>Administration: Performed and assessed by a trained therapist.</p>	<p>muscles.</p>	

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**Table 2: Suggested Screening/Assessment Tools for Risk of Falling Post Stroke**

Assessment Tool	Time to Complete	Items and Scores	Required Equipment
<b>Stroke Assessment of Fall Risk (SAFR)</b>  <b>Breisinger et al. 2014</b>	Unknown	<p>7 fall risk-factors comprised of 4 impairment-based measures (impulsivity, hemi-neglect, static, and dynamic sitting balance) and 3 Functional Independence Measures (transfers, problem-solving, and memory) are measured.</p> <p>Total scores range from 0-49 with a higher score indicating a higher risk of falling.</p>	Several commonly available objects.
<b>Predict-FIRST</b>  <b>Sherrington et al. 2010</b>	30 minutes for physical component.	<p>Respondents are measured on 5 risk factors including frequent toileting, central nervous system medications, experiencing a fall in the past year, being male, and inability to perform a tandem stance.</p> <p>Respondents are cumulatively scored across the five risk factors to assess the probability of falling. A score of 0=2% chance of falling, 1=4%, 2=9%, 3=18%, 4=33% and 5=52%.</p>	Several commonly available objects.
<b>STRATIFY</b>  <b>Oliver et al. 1997</b>	Unknown	<p>Patients are given five questions about the absence (score of 0) or presence (score of 1) of falls risk factors including previous falls, visual impairments, frequent toileting, agitation, and a mobility score of three or four. Mobility scores are obtained by combining the mobility and transfer scores on the Barthel Index.</p> <p>STRATIFY scores are ranged from 0 (low risk) to 5 (high risk).</p>	Several commonly available objects.
<b>Timed Up &amp; Go Test (TUG)</b>  <b>Podsiadlo &amp; Richardson 1991</b>	1-2 minutes	<p>The patient begins in a seated position, is asked to stand and walk 3 metres, turn, walk back to their chair sit back down.</p> <p>Patient is timed with difficulties in mobility monitored by instructor. A time of <math>\geq</math> 15 seconds indicates an increased risk of falling.</p>	Several commonly available objects.
<b>Modified Motor Assessment Scale (M-MAS)</b>  <b>Carr et al. 1985</b>	15-35 minutes	<p>8 items pertaining to balance, mobility and motor function, the latter of which measuring upper arm function, walking, sitting to standing, supine to side-lying, supine to sitting, and hand movements.</p> <p>Each item is scored 0 to 6 with a higher score indicating greater difficulty</p>	Several commonly available objects along with a low plinth.

Assessment Tool	Time to Complete	Items and Scores	Required Equipment
		performing the equivalent item task.	

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**Table 3: Suggested Swallow Screening and Assessment Tools**

Author/ Name of test	Components of test Details of validation study	Results of original validation study
<b>Daniels et al. 1997</b>  <b>"Any Two"</b>	<p>Items included: 6 clinical features-dysphonia, dysarthria, abnormal volitional cough (includes water-swallowing test), abnormal gag reflex, cough after swallow and voice change after swallow were assessed.</p> <p>Scoring: Presence of any 2 of the items distinguished patients with/without dysphagia</p> <p>Sample: 59 acute stroke survivors were studied within 5 days of hospital admission.</p>	<p>Diagnostic standard: VMBS exam</p> <p>Prevalence of dysphagia: 74.6%</p> <p>The sensitivities and specificities of individual items ranged from 31%-76.9% and 61%-88%, respectively.</p> <p>Overall:</p> <p>Sensitivity: 92%</p> <p>Specificity: 67%</p>
<b>Trapl et al. 2007</b>  <b>The Gugging Swallowing Screen (GUSS)</b>	<p>Preliminary Assessment (vigilance, throat clearing, saliva swallow)</p> <p>Direct swallow (semisolid, liquid, solid swallow trials)</p> <p>Scoring: Total scores ranged from 0 (worst) - 20 (no dysphagia). A cut-off score of 14 was selected</p> <p>Sample: 50 first-ever acute stroke patients with suspected dysphagia</p>	<p>Diagnostic standard: fiberoptic endoscopic evaluation using the Penetration Aspiration Scale to interpret the results.</p> <p>Prevalence of dysphagia: 73%</p> <p>First group of 19 patients using the GUSS to identify participants at risk of aspiration:</p> <p>Sensitivity: 100%, Specificity: 50%</p> <p>Second group of 30 patients Sensitivity: 100%, Specificity: 69%</p> <p>Interrater reliability: Kappa=0.835</p>
<b>Martino et al. 2009</b>  <b>The Toronto Bedside Swallowing Screening Test (TOR-BSST)</b>	<p>Items included: presence of dysphonia before/after water swallowing test, impaired pharyngeal sensation and abnormal tongue movement.</p> <p>Scoring: pass=4/4 items; fail ≥1/4 items</p> <p>Sample: 311 stroke patients (103 acute, 208 rehabilitation)</p>	<p>Diagnostic standard: VMBS exam.</p> <p>Prevalence of dysphagia: 39%</p> <p>Sensitivity: 96%</p> <p>Specificity: 64%</p> <p>Interrater reliability (based on observations from 50 participants) ICC =0.92 (95% CI: 0.85-0.96)</p>

Author/ Name of test	Components of test Details of validation study	Results of original validation study
<b>Edmiston et al. 2009</b> <b>USA</b>	Items included: Glasgow Coma Scale score <13, presence of facial, tongue or palatal asymmetry/weakness. If no to all 3 items, then proceed to 3 oz. water swallowing test.	Diagnostic standard: Mann Assessment of Swallowing Ability (MASA), performed by a SPL.
<b>Acute Stroke Dysphagia Screen</b>	Scoring: If there is evidence of change in voice quality, cough or change in vocal quality 1 minute after water swallowing test = fail.  Sample: 300 acute stroke patients screened by nurses within 8 to 32 hours following admission.	Prevalence of dysphagia: 29% Sensitivity (Dysphagia): 91% Specificity: 74% Sensitivity (aspiration risk): 95% Specificity: 68%  Interrater reliability: Kappa=94%
<b>Turner-Lawrence et al. 2009</b>	The two-tiered bedside tool was developed by SLPs.  Tier 1 items included: voice quality, swallowing complaints, facial asymmetry, and aphasia.	Diagnostic standard: formal assessment conducted by an SLP  Prevalence of dysphagia: 57%
<b>Emergency Physician Dysphagia Screen</b>	Tier 2 items included a water swallow test, with evaluation for swallowing difficulty, voice quality compromise, and pulse oximetry desaturation ( $\geq 2\%$ ).  Patients failing tier 1 did not move forward to tier 2.  Scoring: Patients who passed both tiers were considered to be low-risk.  Sample: a convenience sample of 84 stroke patients (ischemic/hemorrhagic) screened by 45 ER MDs.	Sensitivity: 96% Specificity: 56%  Interrater reliability: Kappa=0.90
<b>Antonios et al. 2010</b>  <b>Modified Mann Assessment of Swallowing Ability (MMASA)</b>	12 of the 24 MASA items were retained including: alertness, co-operation, respiration, expressive dysphasia, auditory comprehension, dysarthria, saliva, tongue movement, tongue strength, gag, volitional cough and palate movement.  Scoring: Maximum score is 100 (no dysphagia). A cut-off score of 94 was used to identify patients at risk of dysphagia  Sample: 150 consecutive patients with acute ischemic stroke were assessed by 2 neurologists shortly after admission to hospital.	Diagnostic standard: MASA conducted by SLP  Prevalence of dysphagia: 36.2% Sensitivity: 87% & 93% Specificity: 86% & 84%  Interrater reliability: Kappa=0.76
<b>Schrock et al. 2011</b>  <b>MetroHealth Dysphagia Screen</b>	5 Items included: Alert and able to sit upright for 10 minutes, weak, wet or abnormal voice, drooling, slurred speech and weak, or inaudible cough.  Scoring: $\geq 1$ items answered yes=failed screen	Diagnostic standard: VMBS Prevalence of dysphagia at 30 days: 32%  Sensitivity: 95% Specificity: 55%  Interrater reliability: Kappa=0.69

Author/ Name of test	Components of test Details of validation study	Results of original validation study
	Sample: 283 patients admitted to the Emergency department with acute stroke and screened for the presence of dysphagia by nurses	

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**Table 4: Suggested Screening and Assessment Tools for Aphasia**

Assessment Tool	Time to Complete	Items and Scores	Required Equipment
<b>Acute Aphasia Screening Protocol (AASP)</b>  <b>Crary et al. 1989</b>	10 minutes	44 items representing 4 domains: Attention/orientation to communication, auditory comprehension, expressive ability, and conversational style.  Total scores range from 0-50 and are expressed as a percentage.	Several commonly available objects.
<b>Communicative Effectiveness Index (CETI)</b>  <b>Lomas et al. 1989</b>	Unknown	16 items consisting of statements regarding communication abilities with each statement rated out of 10.  Scores are summed to yield a total score out of 160 with higher scores indicative of good communication ability.	No equipment is required.
<b>Frenchay Aphasia Screening Test (FAST)</b>  <b>Enderby et al. 1987</b>	3-10 minutes	Respondents are presented with tasks representing 4 language domains: comprehension, speech, reading, and writing.  Respondents are scored on the basis of completeness/correctness of responses, with total scores ranging from 0-30. Lower scores indicate greater language impairment.	A stimulus card and written instructions.
<b>Frenchay Dysarthria Assessment</b>  <b>Enderby et al. 1980</b>	20 minutes	Respondents are presented with task representing 9 domains of speech: Reflexes (cough, swallow, dribble/drool); Respiration (at rest, in speech); Lips (at rest, spread, seal, alternate, in speech); Palate (fluids, maintenance, in speech); Laryngeal (time, pitch, volume, in speech); Tongue (at rest, protrusion, elevation, lateral, alternate, in speech); and Intelligibility (word, sentences, conversation).  Respondents are rated on their ability to perform each parameter using a 9-point scale that includes 5 descriptors and ½ marks.	Required
<b>Mississippi Aphasia Screening Test (MAST)</b>  <b>Nakase-Thompson et al. 2005</b>	5-10 minutes	46 items representing 9 subscales: Naming, automatic speech, repetition, yes and no accuracy, object recognition, verbal instructions, reading instructions, verbal fluency, and writing/spelling diction.  Scores can be summed for each individual subscale, combined to form two index scores representing expressive and receptive language, or summed to provide a global score out of 100. Lower scores indicate greater language impairment.	A photo, several commonly available objects, and written instructions.
<b>Porch Index of Communicative Ability (PICA)</b>	60 minutes	10 items over 8 subtests including verbal, auditory, copying, reading, pantomime, writing, visual and completion time.  Scores range from 1-16 with a higher score indicative of a high communicative	Several commonly available objects.

Assessment Tool	Time to Complete	Items and Scores	Required Equipment
Porch 1967		ability and a low score indicative of communication impairment.	
Reitan-Indiana Aphasia Screening Examination (ASE)	N/A	32 items assessing language reception, expression, and comprehension. Scores are summed to yield a total score out of 77, with higher scores indicating greater language impairment.	A single commonly available object and written instructions.
Reitan & Wolfson 1985			
ScreeLing	15 minutes	72 items representing 3 subscales: Semantics, Phonology, and Syntax. Scores can be calculated for each subscale, yielding a score from 0-24, or can be summed to provide a global score ranging from 0-72. Lower scores indicate greater language impairment.	No equipment is required.
Doesborgh et al. 2003			
Ullevall Aphasia Screening Test (UAS)	5-10 minutes	Respondents are shown a picture and asked to follow a set of standardized instructions.	The stimulus painting, reading cards, and several commonly available objects.
Thommessen et al. 1999		Seven aspects of language are used to assess responses and individuals are rated based on overall performance as having normal language ability or mild, moderate, or severe language disorder.	
Western Aphasia Battery (WAB)	1-2 hours	10 subtests assessing spontaneous speech, auditory comprehension, naming and repetition. Total scores are added up and expressed as a percentage. A score less than 93.8% is considered to be indicative of aphasia.	Several commonly available objects and written instructions.
Shewan & Kertesz 1980			

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