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Part 1 Virtual stroke rehabilitation: Introduction and overview

Purpose of this module

The recommendations in this Canadian Stroke Best Practices Recommendations (CSBPR) Virtual Stroke Rehabilitation module complement and build on the CSBPR [Transitions and Community Participation Following Stroke](#) and the CSBPR [Rehabilitation and Recovery following Stroke](#) (Mountain et al., 2019; Teasell et al., 2019; International Journal of Stroke). They are based on a focused review that was undertaken to develop evidence-based recommendations and expert opinion clinical considerations related to delivering stroke rehabilitation through virtual modalities.

Introduction

Stroke is a leading cause of adult disability. There are more than 400,000 people living with its effects in Canada, and this is expected to increase to between 654,000 and 726,000 by 2038 (Krueger et al., 2015).

Stroke rehabilitation is a progressive, dynamic, and goal-oriented process designed to enable a person who has stroke-related impairment achieve their optimal physical, cognitive, emotional, communicative, and social functional level (see [CSBPR Rehabilitation and Recovery following Stroke: Definition and Considerations](#)). It may commence as soon as a person is medically stable. Rehabilitation occurs in a variety of settings including acute or sub-acute care, inpatient rehabilitation units, outpatient and ambulatory care, home-based programs such as early supported discharge, outreach programs, community clinics, and recreation centres.

Developed under the leadership of the Heart and Stroke Foundation of Canada, the CSBPR are intended to provide up-to-date evidence-based guidelines to prevent and manage stroke and promote optimal recovery and reintegration for people who are living with the effects of stroke. This includes not only the person with stroke, but also family members and caregivers (see [CSBPR Transitions and Community Participation Following Stroke: Definition and Considerations](#) for definitions, including caregiver). The dissemination and implementation of these recommendations is meant to optimize evidence-based stroke care across Canada, reduce practice variations in the care of stroke patients, and narrow the gap between current knowledge and clinical practice.

The theme of the 7th edition of the CSBPR is **Building connections to optimize individual outcomes**. People with stroke often present to the healthcare system with multiple comorbid conditions in addition to their stroke, some of which may have contributed to their stroke, some of which may be consequences of it, and some of which may be unrelated. Nelson et al. (2016) found that approximately 80 percent of people who survive a stroke have, on average, five other conditions and a range of psychosocial issues. The interactions among complex comorbid conditions must be considered to ensure stroke rehabilitation programs and ongoing care planning is person-centred and personalized.

As people move through different settings and phases of care after a stroke, they often report feeling anxious and overwhelmed. Challenges and barriers to accessing rehabilitation and follow-up care can include an inability to secure transportation to the site of care and needing to travel long distances. Access to care can also be dependent on other factors, such as financial, physical, or communication issues. Having access to individualized and integrated stroke rehabilitation in their home community can have a significant impact on the person's short- and long-term functional outcomes.

A key consideration throughout the CSBPR is **enabling access to high-quality, evidence-based stroke care** irrespective of geographical location in Canada. It is recognized that healthcare delivery through virtual technology is an effective modality to provide care in regions where local expertise is limited or not available. Prior to the COVID-19 pandemic, virtual healthcare programs (Telestroke) — which involved connecting with a healthcare provider by email, phone, text, or video call — for acute stroke management were well established in many regions. However, the use of these same technologies to deliver stroke rehabilitation and support reintegration was underused and rare. One positive consequence of the pandemic has been the increase in access and use of virtual care and the recognition that virtual care is an efficient and effective method to deliver stroke rehabilitation.

The challenge now is to ensure that virtual stroke rehabilitation becomes integrated as a standard and sustainable delivery option, and that Canadians have the appropriate technology and support for its ongoing use, thereby increasing access for all people with stroke in Canada. Although virtual stroke rehabilitation services can improve equity and access to care, it can also highlight inequities such as access to infrastructure, digital literacy, appropriateness of a virtual approach and safety of environments to participate in the virtual session.

Providing stroke rehabilitation virtually has an added layer of complexity related to communication, as it can be more difficult for those involved to hear and see each other. For example, people with communication impairments such as aphasia may find it more difficult to communicate during a virtual encounter compared to a face-to-face encounter. It is important that appropriate steps are taken to support communication when practicing virtual care. For those with aphasia, this may include the need for additional strategies, adaptations, or communication facilitators during their virtual stroke rehabilitation encounters.

Stroke rehabilitation provided using virtual modalities should follow current evidence and best practice, just as when providing in-person care.

Disclaimer: The Canadian Stroke Best Practice Recommendations (CSBPR) are designed to support implementation of best practices in stroke care across Canada. Healthcare systems, health organizations and professional organizations, as well as legislation and standards, may vary provincially. The CSBPR provide guidance on a national level; they do not, on the whole, account for provincial variations in legislation or standards. The CSBPR are not intended to supersede any provincial or local law or organizational or professional standard. In considering and implementing the CSBPR, users are encouraged to consult and follow all appropriate legislation or standard.

Module Overview and definitions

Scope

The recommendations in this Virtual Stroke Rehabilitation module represent one component of the existing modules CSBPR [Transitions and Community Participation Following Stroke](#) and CSBPR [Rehabilitation and Recovery following Stroke](#) (Mountain et al., 2019; Teasell et al., 2019; International Journal of Stroke). They are based on a focused review that was undertaken to develop evidence-based recommendations and expert opinion clinical considerations related to delivering stroke rehabilitation through virtual modalities.

These recommendations are based on the premise that stroke rehabilitation can be provided through virtual technology at any stage along the care continuum, and for a range of intended goals. Virtual stroke rehabilitation has been shown to safely and effectively increase access to rehabilitation therapies and care providers, community reintegration, home monitoring, as well as support mental health and activities of daily living. Virtual healthcare delivery has been shown to

enable timely and cost-efficient access to best-available stroke rehabilitation regardless of where the person with stroke is located. However, it is also important to recognize that virtual stroke rehabilitation does have limitations and is not appropriate for everyone. Healthcare providers should use their clinical judgment and follow discipline-specific and organizational guidelines, policies and/or legislation to guide their decision-making. Heart & Stroke has developed a decision framework that clinicians can consult to support this decision-making process (see [Heart & Stroke virtual care decision framework](#)).

While virtual stroke rehabilitation is a relatively new area of clinical practice, research is emerging at a rapid rate. Prior to mid-2020, there was limited evidence and a paucity of virtual stroke rehabilitation guidance in published clinical practice guidelines. As a result, many of the recommendations in this module are rated as strong recommendations based on low quality of evidence but supported by expert opinion. Additional guidance is provided as Clinical Considerations based on expert opinion where existing evidence does not warrant full recommendation status (see [Clinical Considerations](#)).

Target audience

The recommendations are primarily targeted to healthcare providers throughout the health system who care for those persons affected by stroke. Health system policy makers, planners, funders, community programs, senior managers, and administrators who are responsible for coordinating the delivery of stroke services in a jurisdiction will also find the recommendations to be relevant and applicable to their work. The recommendations will also help people with lived experience of stroke and their caregivers understand stroke care delivery and set expectations for care and recovery.

Definitions and descriptions

- **Virtual care**

Virtual care encompasses all the methods that healthcare providers use to interact with people with stroke remotely, when they are not in the same location or connecting at the same time (i.e., interactions can be synchronous or asynchronous). The goal is to maximize the quality and effectiveness of the care provided to the person with stroke. These interactions, called virtual encounters, are electronic exchanges using teleconferencing, videoconferencing, secure messaging, or audio digital tools, where one or more healthcare providers deliver healthcare services to a patient. Virtual care may include encounters between healthcare providers and people with a health condition and/or family members, and also between providers to discuss the care of the person they are treating.

Related virtual care services may also include telemonitoring and digital self-care tools that collect biometric data that are usually referred to during virtual encounters.

- **Virtual stroke rehabilitation**

Virtual stroke rehabilitation (also known as telerehabilitation), refers to the use of information and communication technologies to deliver rehabilitation services from a distance. Services can include prevention, evaluation, assessment, monitoring, intervention, supervision, education, consultation, and coaching. Virtual stroke rehabilitation can be delivered in many settings and at many stages of care and recovery and can be delivered by health providers from any stroke rehabilitation and recovery-related health discipline. Technologies such as video calls, phone calls, text, or email may be used as part of virtual stroke rehabilitation.

- **Hybrid model**

A hybrid model of care is a combination of in-person and virtual care.

Guideline development methodology

The CSBPR present high-quality, evidence-based stroke care guidelines in a standardized framework. As healthcare providers across all disciplines implement these recommendations, it is expected that practice variations will be reduced and gaps between evidence and practice will start to close leading to improved outcomes for people with stroke.

The methodology used to develop this module followed a thorough and rigorous process. Refer to [CSBPR Overview of Methodology](#) for additional detail.

1. Establish an expert interprofessional writing group representing relevant disciplines across the continuum of care and a range of settings, and striving for balance regarding gender and diversity. Refer to [Appendix 1](#) for a list of writing group members and affiliations.
2. Consult with the acute stroke management, virtual care, and stroke rehabilitation Community Consultation and Review Panels, comprising people with stroke, caregivers, and family members.
3. Select clinical questions to address in the module using the population/problem, intervention or exposure, comparison, and outcome (PICO) format, where appropriate and applicable.
4. Conduct a systematic search and appraisal of research literature to January 2022, and update evidence summary. Refer to the [assigning evidence levels](#) section of this module for more information on the GRADE approach.
5. Conduct a systematic search and appraisal of external reference guideline recommendations.
6. Writing group and community consultation panels review and revise existing recommendations, develop new recommendations, address clinical questions, and adhere to the elements of the Agree 2 criteria where appropriate (Agree Trust). This includes rating the quality of evidence and the strength of the recommendations.
7. Review of the proposed module by the Canadian Stroke Best Practices Advisory Committee, and incorporation of edits as required.
8. Review of the proposed module by external leading experts in Canada and internationally, and incorporation of edits as required.
9. Update educational materials and implementation resources.
10. Obtain final approval and endorsement and undertake French translation.
11. Disseminate through publication and public release knowledge translation activities.
12. Continue with ongoing review and update process.

More detail for each of these steps is available in the [CSBPR Overview, Methods and Knowledge Translation](#) manual on the Canadian stroke best practices website.

Assigning evidence levels

The [Grading of Recommendations, Assessment, Development and Evaluation](#) (GRADE) methodology assesses:

- The strength of each recommendation, based on the balance of desirable and undesirable consequences, quality of evidence, values and preferences of those affected, and resource use
- The quality of the evidence upon which the recommendations are formulated: risk of bias, directness of evidence, consistency and precision of results, risk of publication bias, magnitude of the effect, dose-response gradient, and influence of residual plausible confounding (Schünemann et al., 2013)

The writing group was provided with comprehensive evidence tables that included summaries of high-quality evidence identified through the structured literature searches. The group discussed and debated the quality of the evidence and through consensus developed a final set of proposed recommendations. Each recommendation was assigned a rating as to the strength of the recommendation and the quality of the evidence, as follows:

- Strength of the recommendation: Strong or conditional
 - A strong recommendation is one for which the guideline panel is confident that the desirable effects of an intervention outweigh its undesirable effects.
 - A conditional recommendation is one for which the guideline panel finds that the desirable effects probably outweigh the undesirable effects but appreciable uncertainty exists.
- Quality of the evidence: High, moderate, low, or very low

Clinical considerations

The CSBPR uses the additional category of clinical considerations, consisting of expert opinion statements. These are included when it is determined that guidance related to common clinical issues would be helpful, but the topic lacked sufficient evidence to form an actual recommendation. Virtual stroke rehabilitation is an emerging field and as such, evidence is evolving and is not as mature as other topic areas. As a result, some sections in this document only contain clinical considerations at this time and the emerging evidence continues to be monitored.

Conflicts of interest

All potential participants in the recommendation development and review process are required to complete confidentiality agreements and declare all actual and potential conflicts of interest prior to participation. Declared conflicts of interest are reviewed by the co-chairs of the CSBPR Advisory Committee and Heart & Stroke staff to assess the potential impact. Those with significant conflicts with respect to the module topic are not selected for writing group or reviewer roles.

Participants who have conflicts for a particular topic area are identified at the beginning of discussions for that topic and are recused from voting. If a co-chair is in conflict, they are

recused from their responsibilities for that discussion and another non-conflicted participant assumes the role for that discussion and vote. Heart & Stroke senior staff members participate in all writing group discussions and intervene if they perceive an untoward bias by a writing group member.

Conflict of interest declarations for the Virtual Stroke Rehabilitation module writing group members can be found in [Appendix 1](#).

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Community Consultation and Review Panel

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Comments

The Heart and Stroke Foundation of Canada's stroke team invites your comments, suggestions, and inquiries about the development and application of the CSBPR at strokebestpractices@heartandstroke.ca.

Part 2 Virtual stroke rehabilitation: Recommendations and supporting information

Based on the literature review and writing group discussion, the following recommendations and clinical considerations have been developed.

Section 1 Access, eligibility, consent and privacy

1.1 Access to stroke rehabilitation through virtual care modalities

1.1 Recommendations

- i. Virtual stroke rehabilitation should be available as an alternative or adjunct to in-person therapy for people with stroke [Strong recommendation; Moderate quality of evidence].
- ii. Virtual care modalities should be integrated into stroke care planning and service delivery across the continuum (i.e., from acute stroke care to stroke prevention, stroke rehabilitation, home-based therapy, and ambulatory care) to support optimal recovery of people with stroke, provide support for families, and ensure equitable access to care throughout Canada [Strong recommendation; Moderate quality of evidence].
- iii. All rehabilitation disciplines should consider the use of virtual care technology for assessment of people with stroke and for delivery of clinical therapies where appropriate (e.g., exercise monitoring and intensity adjustments, speech and language therapies for aphasia) [Strong recommendation; Low quality of evidence].
- iv. Home-based monitoring for outpatient stroke rehabilitation through web-based applications may be considered as an alternative or adjunct to in-person rehabilitation therapy sessions when frequent monitoring is necessary and access to in-person services is limited [Strong recommendation; Moderate quality of evidence].
Refer to [technology and planning for additional information](#).

1.2 Eligibility

1.2 Recommendations

- i. All people with acute stroke admitted to hospital should be assessed to determine the severity of their stroke, their early rehabilitation needs, and the most appropriate mechanism to deliver timely and effective stroke rehabilitation, whether in-person, virtual, or a hybrid (a combination of in-person and virtual modalities) model [Strong recommendation; Moderate quality of evidence]. *Refer to [CSBPR Rehabilitation and Recovery following Stroke](#) for additional information.*
- ii. All people who present with acute stroke who are not admitted to hospital should be screened in-person or through virtual care modalities for the need to undergo a comprehensive rehabilitation assessment to determine the scope of deficits from the index stroke event and any potential rehabilitation requirements [Strong recommendation; Low quality of evidence].
- iii. Clearly defined criteria and protocols or algorithms should be available to help referring sites determine when and how people with stroke can access virtual stroke rehabilitation, secondary prevention, and ambulatory services [Strong

recommendation; Low quality of evidence]. [Refer to *Heart & Stroke virtual care decision framework* for additional information.](#)

- iv. Virtual stroke rehabilitation should be offered to eligible people and when an in-person therapy session is not feasible or not available, and the goals of the session can be achieved virtually [Strong recommendation; Moderate quality of evidence].

Section 1.2 Clinical considerations

- i. Clinicians should consider the safety and appropriateness of virtual stroke rehabilitation for each person with stroke, taking into consideration the person's abilities, impairments, and current health status (e.g., cognitive, behavioural, communication, physical, and sensory factors) and available resources. [Refer to *Heart & Stroke virtual care decision framework* for additional information.](#)
- ii. Individual preferences should be considered when a person with stroke is eligible for both virtual and in-person stroke rehabilitation, and the clinician is able to offer either one or a combination of both options.
- iii. The clinician should develop a safety or adverse events plan with the person with stroke prior to starting virtual stroke rehabilitation. This includes having the person's phone number, address, and emergency contact information, and asking them to have a family member or caregiver nearby and/or a phone at hand. [Refer to *CSBPR virtual stroke care toolkit* for additional information.](#)

1.3 Consent and privacy

Note, no evidence-based recommendations included for this section.

Section 1.3 Clinical considerations

- i. Protocols to share personal health information should be developed, in accordance with applicable legislation and organizational requirements, to allow clinicians to share personal health information about the person with stroke. These should include electronic health records or other electronic forms of information sharing, if available.
- ii. Informed consent for virtual care must be obtained from the person with stroke or substitute decision-maker and documented before virtual stroke rehabilitation commences, to ensure an understanding of the nature of virtual rehabilitation, including awareness of the limitations and the risks of virtual care and electronic communication.
- iii. Established privacy procedures should be followed when providing virtual stroke rehabilitation, such as confirming the person's identity at the beginning of the virtual encounter and ensuring that all participants are in an appropriate setting, where privacy can be optimized.
- iv. When providing virtual stroke rehabilitation, clinicians should follow discipline-specific and organizational virtual care guidelines, policies and other mandates, as well as those established by their professional regulatory organizations. This includes requirements related to consent and privacy when delivering virtual stroke care within clinicians' jurisdictions and the jurisdiction where the person with stroke is receiving virtual care.

Section 2 Technology and planning

2.1 Technology

2.1 Recommendations

- i. Virtual stroke rehabilitation—enabling technologies, including Internet, video-conferencing tools, and remote monitoring devices, can be used to enable consultations and/or service delivery [Strong recommendation; Low quality of evidence].
- ii. Asynchronous modalities, such as email and text, may be considered where appropriate for communication related to sharing educational resources, scheduling, and planning of care [Conditional recommendation; Low quality of evidence].
- iii. Technologies and processes should be in place to ensure timely documentation and transfer of relevant health record information to and from the virtual stroke rehabilitation provider and the referring source and/or other members of the stroke care team for virtual care encounters in accordance with clinical care processes, organizational requirements, jurisdictional legislation, and regulatory bodies [Strong recommendation; Moderate quality of evidence].

Section 2.1 Clinical considerations

- i. Recommendations for specific virtual stroke rehabilitation platforms or technologies are beyond the scope of this document; however, efforts should be made to ensure the platforms and/or equipment used for virtual rehabilitation support ease of use, efficacy, privacy, and reliability, and follow local and provincial regulations.

2.2 Planning delivery of virtual stroke rehabilitation

2.2 Recommendations

- i. Preparations for implementing virtual stroke rehabilitation should involve a clear identification of program goals, a needs assessment to identify local barriers and enablers, an implementation plan to address barriers and incorporate enablers, and a process for continuous quality improvement [Strong recommendation; Low quality of evidence].

Section 2.2 Clinical considerations

- i. Virtual stroke rehabilitation services should be overseen and directed through a governance structure that may include establishing an executive steering committee, a project team, and a change management team to engage clinicians, people with stroke, families, and caregivers to continually evaluate and update the approach.
- ii. As part of transition planning, the inpatient interdisciplinary rehabilitation team should discuss the option of using virtual stroke rehabilitation early during the inpatient stay, in consultation with the outpatient team, the person with stroke, and their family and caregivers. [Refer to *Heart & Stroke virtual care decision framework* for additional information.](#)
- iii. Approaches to delivering virtual stroke rehabilitation, including location, assessment, treatment, and communication technology, should be tailored to the needs and

expertise of the local clinician and the person with stroke and their family and caregivers, and meet applicable privacy and security policies and legislation. For example, people with stroke may be able to participate in videoconferencing at a local clinic or hospital if they do not have access to virtual compatible devices, broadband Wi-Fi, high speed Internet, or other technology for virtual rehabilitation encounters at home.

- iv. An evaluation plan for virtual stroke rehabilitation encounters, including mechanisms for data collection, analysis, and reporting, should be developed to monitor key performance indicators to inform ongoing quality improvement and the sustainability of virtual rehabilitation services.

Refer to [Performance measures](#): Key quality indicators for additional information.

Section 3 Training and competency

3.1 Training for healthcare providers

3.1 Recommendations

- i. Team members who are providing virtual stroke rehabilitation therapy should have expertise and experience in stroke rehabilitation [Strong recommendation; Low quality of evidence].
- ii. Rehabilitation team members should receive training to attain and maintain the necessary competencies to provide safe and appropriate virtual stroke rehabilitation using designated virtual care platforms [Strong recommendation; Low quality of evidence].

Section 3.1 Clinical considerations

- i. Non-clinical team members should receive relevant training (e.g., on use of designated digital platforms or communication with people with aphasia) to effectively arrange and support a virtual stroke rehabilitation encounter.

3.2 Training for people with stroke, families, and caregivers

Note, no evidence-based recommendations included for this section.

3.2 Clinical considerations

- i. People with stroke and their families and caregivers should be provided with clear and appropriately adapted instructions on how to access, test, and use the designated virtual stroke rehabilitation platform on their own digital devices.
- ii. People with stroke and their families and caregivers should be taught how to access and use the virtual rehabilitation platforms that will be used in their outpatient sessions and/or community programs, ideally prior to discharge from hospital or during an in-person session where appropriate.
- iii. People with stroke and their families and caregivers should be provided with clear and appropriately adapted instructions on how to prepare for the virtual stroke rehabilitation session, including appropriate clothing, lighting, and equipment that are needed to facilitate the encounter. They should also provide an alternate means of contact should the system be interrupted or a safety issue arise.

Section 4 Assessment and service delivery

4.1 Assessment

4.1 Recommendations

- i. Where available, tools selected for assessment of impairments, activity limitations, participation restrictions, and environmental factors relevant to stroke rehabilitation should have evidence of validity for the method of virtual administration and be administered by trained personnel using a structured process.
 - a. Assessment tools selected for use via videoconferencing should have evidence of validity for this administration method [Conditional recommendation; Low quality of evidence]
 - b. Assessment tools selected for use via telephone should have evidence of validity for this administration method [Conditional recommendation; Moderate quality of evidence].
- ii. Screening for pre-stroke mental health and cognitive status and for changes in mood or cognition following stroke should be included as a routine component of virtual stroke rehabilitation [Strong recommendation; Moderate quality of evidence].
- iii. For people with stroke who have communication differences or limitations, such as aphasia, assessment tools should be adapted for use through virtual modalities, as required [Strong recommendation; Low quality of evidence].

Section 4.1 Clinical considerations

- i. There is limited published evidence on the safety, feasibility, reliability, and validity of approaches to administering standardized assessment tools post-stroke using virtual rehabilitation platforms or technologies. Safety precautions should be taken during virtual performance-based health assessments.
 - a. Assessment considerations may include ensuring the person with stroke has sufficient capacity to follow instructions, access to handholds to maintain balance, and a support person present to assist.
- ii. When assessments cannot be fully administered virtually, a hybrid model that combines in-person and virtual assessment should be considered.
- iii. Self-reported measures of rehabilitation outcomes, which are typically evaluated using performance-based assessment, may be feasible and useful to integrate when in-person assessment is not available.

4.2 Service delivery

4.2 Recommendations

- i. Virtual outpatient stroke rehabilitation services, whether delivered using virtual modalities alone or a hybrid model, should offer the same elements as coordinated, in-person rehabilitation services [Strong recommendation; Moderate quality of evidence]. These elements ideally include:

- a. An interdisciplinary stroke rehabilitation team [Strong recommendation; High quality of evidence].
- b. A case coordination approach that includes regular team communication to discuss assessment of new referrals and review management, goals, and plans for discharge or transition [Strong recommendation; Moderate quality of evidence].
- c. Outpatient therapy provided for a minimum of 45 minutes per day [Strong recommendation; Moderate quality of evidence] per required discipline, two to five days per week, based on individual needs and goals of the person with stroke [Strong recommendation; High quality of evidence]; ideally for at least eight weeks [Strong recommendation; Low quality of evidence].
- d. Ongoing assessment at appropriate intervals, to monitor for changes in function or health status in the person with stroke that may signal an in-person visit, is required [Strong recommendation; Low quality of evidence].
[Refer to *Heart & Stroke virtual care decision framework* for additional information.](#)

Rationale for virtual stroke rehabilitation recommendations

The COVID-19 global pandemic created the necessity for large-scale, rapid conversion to virtual healthcare delivery. Many health providers have quickly acquired new knowledge and skills in order to deliver virtual rehabilitation and they are willing to integrate this new skillset into their future practices. The challenge now is to maintain this momentum and build sustainable models for virtual healthcare to meet the ongoing healthcare needs of people in Canada. Virtual stroke care supports equitable and timely access to optimal stroke services across the continuum of care and geographic boundaries. It improves communication and networking and enables better access to stroke expertise, regardless of the location of the patient or the treating hospital, facility or healthcare provider. Many communities do not have access to physicians with stroke expertise, neurologists, physiatrists or other experts in stroke rehabilitation and recovery. Virtual stroke care can be a cost-effective tool to help health systems close the urban/rural and tertiary/primary care gap.

Evidence related to the benefits and effectiveness of virtual stroke rehabilitation in facilitating optimal recovery after the acute phase is emerging. Virtual stroke rehabilitation can facilitate more timely access to rehabilitation specialists and therapeutic programs through remote connections in care facilities and patients' homes.

A Heart & Stroke online survey of more than 3,000 people living with stroke, heart conditions, and vascular cognitive impairment, as well as caregivers, found that more than half wanted the option of virtual appointments. Similarly, the Heart & Stroke Virtual Care Community Consultation and Review Panel (CCRP) also supported virtual encounters, citing increased access to care and resources, as well as access to more specialized care and multiple healthcare providers at one virtual encounter for a coordinated visit. They discussed the financial and time savings, and the benefit of avoiding travel which is especially important for those living far from large urban stroke centres or those unable to travel due to other factors.

The panel emphasized the importance of equitable access to necessary infrastructure, such as Internet connections and technology. They talked about potential challenges for those engaging in virtual stroke rehabilitation, such as discomfort with use of technology and low digital literacy,

and being unfamiliar with what virtual care is and how it can be used. They outlined the need for education about virtual care and training on the use of technology. They also discussed the value in having a support person with them when participating in virtual rehabilitation to help with technology, remember information, support and enhance safety, aid movements, and provide encouragement. They acknowledged that having a support person may not be possible for everyone, and they encourage healthcare providers and those receiving care to consider the impact this may have on those participating in a virtual visit.

During discussions about advancing virtual stroke rehabilitation and expanding information available online, the CCRP stressed the value of being connected to a stroke rehabilitation team to help determine credible information and ensure they are receiving the best care possible. With many resources available online, the CCRP shared that at times it can be difficult to discern what information is appropriate and what is not; access to a stroke rehabilitation team provides a credible source of information to support their recovery journey.

Finally, the CCRP identified that, for a variety of reasons, virtual care may not be appropriate for some people, and so there is a need for joint decision-making between the person with stroke and the healthcare provider to determine the most appropriate way forward, whether that be virtual, in-person, or a hybrid model.

System implications

To ensure that as many of these virtual stroke rehabilitation recommendations as possible are implemented across Canada, health system leaders, funders, and administrators at all levels of government and in all regions need to be actively engaged in and committed to building sustainable models for virtual care across the continuum. Many of the enablers listed below are beyond the scope of direct clinical care providers and many health professional groups.

Health system leaders, funders and administrators should ensure that all healthcare providers have the necessary tools, resources, and processes to provide high-quality, evidence-based stroke care across the full continuum of care.

For virtual stroke rehabilitation, the following actions, structures, resources, and processes need to be considered:

- The need for appropriate technology and access to stable Internet and phone services to support virtual stroke rehabilitation for clinicians and people with stroke.
- The need to train and support healthcare providers and people with stroke on how to use virtual stroke rehabilitation technologies.
- Virtual stroke rehabilitation should be integrated and seen as part of larger regional or provincial stroke delivery plans that decentralize expertise to support clinical care in less well-resourced areas. Inherent in such a system are clear criteria, protocols, algorithms, and service agreements for the transfer and repatriation of people with stroke when clinically indicated.
- A governance structure with a clear framework of accountabilities for virtual healthcare services is required. This includes facility, regional and/or provincial levels of governance.
- The considerable human resource implications include establishing the appropriate number of healthcare providers to participate in virtual encounters, and right-sizing the work force to take into account the time taken away from the in-person clinical duties of consulting clinicians at their places of work.

- Clear guidelines and processes for healthcare provider reimbursement need to be established as part of the development of a virtual stroke rehabilitation program.
- The need for service agreements that address the availability of maintenance and technical support to ensure the clinical requirements of virtual care are met.
- The need for all users of a virtual stroke rehabilitation system to be aware of their roles and responsibilities and know how to use the technology. This includes regular updates to maintain competence.
- The need for agreements and protocols for interprovincial and territorial consultations where appropriate and time efficient, and where service gaps exist.
- Processes need to be established to monitor and evaluate virtual stroke rehabilitation services, including the use of validated data collection mechanisms and the establishment of standardized key quality indicators.
- Provincial healthcare administrators need to work together to build sustainable models for cross-border care delivery. Licensing requirements for virtual healthcare vary among provinces and territories. Healthcare professionals may have to be licensed in multiple jurisdictions, possibly both in their location and in the location of the person with stroke receiving care. In addition, special requirements and/or conditions on the provision of services may be required in some jurisdictions. Privacy legislation should also be followed in each applicable jurisdiction.
- Virtual stroke rehabilitation may present challenges with consent. In addition to obtaining informed consent for the proposed treatment, healthcare professionals may want to ask people with stroke to read and accept standard terms and conditions for virtual stroke rehabilitation care and services and document the consent and any discussion.

Performance measures: Key quality indicators

Virtual stroke rehabilitation is an emerging field. It is critically important that mechanisms be established to collect consistent high-quality data to inform planning and improvement and provide evidence for quality and sustainability. Virtual care should be considered as one modality in the delivery of stroke care. This interim module is specific to virtual stroke rehabilitation and should be considered in addition to the CSBPR [Rehabilitation and Recovery following Stroke](#) and CSBPR [Transitions and Community Participation Following Stroke](#) modules, including the performance measures in that document.

Jurisdictions may consider using one or more of the following indicators to monitor virtual care services:

Health system and clinical indicators (please refer to [Quality of Stroke Care in Canada Key Quality Indicators and Stroke Case Definitions](#) for more details)

1. Proportion of people with stroke who receive access to stroke rehabilitation through virtual healthcare modalities for assessment and/or management.
2. Number of scheduled rehabilitation appointments for people with stroke accessing rehabilitation services through virtual healthcare modalities, with values reported separately for each service accessed (e.g., physiotherapy, speech therapy).
3. Median time from stroke onset to rehabilitation referral for:
 - a. Inpatient stroke rehabilitation

- b. Ambulatory stroke rehabilitation
 - c. Virtual stroke rehabilitation
4. Proportion of people with stroke who underwent a virtual care session indicated by the presence of the virtual care consultant's note in the person's health record.
 5. Median duration of scheduled virtual stroke rehabilitation encounters, with values reported separately for each service (e.g., physiotherapy, speech therapy).
 6. Cost effectiveness of virtual stroke rehabilitation compared to in-person stroke rehabilitation.
 7. Proportion of virtual stroke rehabilitation encounters requiring urgent transfer of person with stroke to an in-person healthcare visit.
 8. Proportion of virtual stroke rehabilitation encounters disrupted by technical difficulties by the healthcare provider.
 9. Proportion of virtual stroke rehabilitation appointments provided using synchronous two-way video conferencing compared to by telephone only.

Persons with lived experience–oriented indicators

1. Patient-reported experience with virtual stroke rehabilitation related to attributes such as feasibility, satisfaction, quality, sound, visual clarity, reliability of technology, and ease of use.
2. Proportion of virtual stroke rehabilitation encounters disrupted by technical difficulties by healthcare provider.
3. Median time from referral for virtual stroke rehabilitation to first virtual stroke rehabilitation encounter.
4. Patient-reported experience of their safety during virtual stroke rehabilitation encounters, including prevention of risks associated with virtual stroke rehabilitation.
5. Proportion of virtual stroke rehabilitation encounters that included family members and/or caregivers who were in a different location from the person with stroke.

Measurement notes

Refer to the Canadian Stroke Best Practices to [Quality of Stroke Care in Canada Key Quality Indicators and Stroke Case Definitions](#) for detailed indicator definitions, numerators and denominators, and additional analysis considerations.

Documentation for virtual healthcare encounters is often not standardized, making it harder to gather performance measure information.

Refer to the appropriate sections in the CSBPR [Rehabilitation and Recovery following Stroke](#) and CSBPR [Transitions and Community Participation Following Stroke](#) modules for information on indicators related to actual therapies.

The National Rehabilitation Reporting System does not currently collect data on virtual healthcare encounters.

Implementation resources and knowledge transfer tools

Tools external to Heart & Stroke and Canadian Stroke Best Practices may be useful implementation resources for stroke care; however, their inclusion in this list does not imply actual or implied endorsement by Canadian Stroke Best Practices. The reader is encouraged to review these tools critically and implement them into practice based at their discretion.

Healthcare provider information

- CSBPR Virtual Stroke Care Implementation Toolkit:
<https://heartstrokeprod.azureedge.net/-/media/1-stroke-best-practices/csbpr-virtual-stroke-toolkit-final>
- Heart & Stroke: Virtual Care Decision Framework: <https://www.heartandstroke.ca/-/media/1-stroke-best-practices/csbpr-f20-virtualcareddecisionframework-en>
- Heart & Stroke: Post-Stroke Checklist: https://www.heartandstroke.ca/-/media/1-stroke-best-practices/resources/patient-resources/002-17_csbpr_post_stroke_checklist_85x11_en_v1
- Heart & Stroke: FAST Signs of Stroke: <https://www.heartandstroke.ca/stroke/signs-of-stroke/fast-signs-of-stroke-are-there-other-signs>
- Heart & Stroke: 2020 CPR & EEC Guidelines: https://cpr.heartandstroke.ca/s/article/Guidelines?language=en_US
- Stroke Engine: <http://strokengine.ca/>
- Aphasia Institute: ParticiPics: <https://www.participics.ca/>
- UHN TR-Telerehab Toolkit: <https://kite-uhn.com/tools/tr-telerehab-toolkit>

Information for people with lived experience of stroke, including family and caregivers

- Heart & Stroke: Signs of Stroke: <http://www.heartandstroke.ca/stroke/signs-of-stroke>
- Heart & Stroke: FAST Signs of Stroke: <https://www.heartandstroke.ca/stroke/signs-of-stroke/fast-signs-of-stroke-are-there-other-signs>
- Heart & Stroke: What is Stroke?: <http://www.heartandstroke.ca/stroke/what-is-stroke>
- Heart & Stroke: Your Stroke Journey: <https://www.heartandstroke.ca/-/media/1-stroke-best-practices/resources/patient-resources/en-your-stroke-journey-v21>
- Heart & Stroke: Post-Stroke Checklist: https://www.heartandstroke.ca/-/media/1-stroke-best-practices/resources/patient-resources/002-17_csbpr_post_stroke_checklist_85x11_en_v1
- Heart & Stroke: Are You at Risk for Heart Disease or Stroke?: <https://www.heartandstroke.ca/-/media/pdf-files/iavc/health-information-catalogue/en-are-you-at-risk>
- Heart & Stroke: Virtual Healthcare Checklist: <https://www.heartandstroke.ca/-/media/1-stroke-best-practices/resources/patient-resources/csbpr-infographic-virtual-healthcare-checklist>

- Heart & Stroke: The Power of Community, Online peer support:
<https://www.heartandstroke.ca/heart-disease/recovery-and-support/the-power-of-community>
- Aphasia Institute: ParticiPics: <https://www.participics.ca/>
- Canadian Partnership for Stroke Recovery – Video Resources:
<https://canadianstroke.ca/tools-videos/>
- Stroke Engine: <http://strokenengine.ca/>

Summary of the evidence

Virtual stroke rehabilitation, also known as telerehabilitation, refers to the use of information and communication technologies to deliver rehabilitation services from a distance, often using video or telephone conferencing. The most familiar application of stroke telerehabilitation is the provision of therapies that mimic in-person interactions, which are provided synchronously over weeks or months, as required. Remote interventions, monitoring, evaluation and education can also be provided in asynchronous forms, using a variety of technologies. One of the key advantages of telerehabilitation is that it provides the opportunity for people who live in isolated or rural communities access to specialized rehabilitation services, which would otherwise be unavailable to them. Furthermore, telerehabilitation reduces or eliminates transportation problems that are commonly encountered by stroke survivors and their caregivers.

The results from a rapidly expanding volume of literature suggests that virtual stroke rehabilitation can be both feasible and effective compared with in-person encounters. The authors of recently published systematic reviews examining remotely delivered therapy reported that measures of balance, upper and lower extremity motor function, mobility, and performance of activities of daily living, were not significantly different compared to those of persons receiving conventional rehabilitation (Laver et al. 2020, Appleby et al. 2019, Sarfo et al. 2018, Tchero et al. 2018, Chen et al. 2015). In the Cochrane review (Laver et al. 2020), virtual care was also used successfully to treat persons with speech and language impairments and low mood post stroke. Knepley et al. (2021), reported that functional outcomes among those that received virtual stroke rehabilitation were equivalent or better compared with those that received in-person therapy, as was patient satisfaction. Additionally, some virtually provided therapies were less costly than in-person therapy. The outcomes of patients who received virtual rehabilitation services have been shown to be better than those who received conventional outpatient therapy. The Fugl-Meyer Assessment scores of patients who received a 12-week telerehabilitation program were significantly higher compared to those who received the same duration of outpatient therapy (Chen et al. 2020). In the same study, telerehabilitation was found to be non-inferior for the modified Barthel index.

Adaptation of existing rehabilitation programs may offer alternative solutions to in-person therapy. Yang et al. (2021) provided a virtual version of the Graded Repetitive Arm Supplementary Program (GRASP) over 10 weeks, to 9 persons with residual difficulty using their affected upper extremity following remote stroke. There were significant improvements over time for all outcome measures, which included the Arm Capacity and Movement test (ArmCAM), a new assessment tool developed for online use.

Assessment of performance-based measures in a virtual setting has not been well studied and poses challenges. Some previously validated outcome measures may not be appropriate, feasible or valid for virtual use. It remains to be determined whether new assessment tools will need to be developed and validated for virtual use. In some cases, adaptation of an existing measure may be sufficient. For example, Peters et al. (2021) developed a version of the Fugl-Meyer (FM) assessment, suitable for virtual care use (FM-tele) and demonstrated its feasibility. In addition, although the sample size was small (n=5), the proportional agreement between the FM-tele conducted in person and conducted remotely by the same assessor, one week apart, was good. Both patients and assessors reported some issues with technical difficulties, a common complaint when using virtual platforms. Inter-rater reliability of the Balance Scale, Fugl-Meyer Assessment and the Action Research Arm Test has been shown to be good to excellent when comparing in-person assessments with those conducted virtually through videoconference (Gillespie et al. 2021, Amano et al. 2018).

Virtual Stroke Rehabilitation Evidence Tables and Reference List available at [csbpr7-virtual-stroke-rehabilitation-evidence-table-final.ashx \(strokebestpractices.ca\)](https://strokebestpractices.ca/csbpr7-virtual-stroke-rehabilitation-evidence-table-final.ashx)

Refer to the CSBPR [Rehabilitation and Recovery following Stroke](#) and CSBPR [Transitions and Community Participation Following Stroke](#) modules for additional evidence for each element of stroke rehabilitation.

Appendix 1 Virtual stroke rehabilitation writing group 2022

Name	Professional role	Location	Declared conflicts of interest
Salbach, Nancy M. PT, BSc, BScPT, MSc, PhD	Toronto Rehabilitation Institute Chair at the University of Toronto Professor, Department of Physical Therapy, Rehabilitation Sciences Institute, University of Toronto Senior Scientist, The KITE Research Institute, University Health Network	Toronto, Ontario	Heart & Stroke Foundation, University of Toronto payment made to my institution Support for manuscript Canadian Institutes of Health Research grants, payment made to my institution German Academic Exchange Service payment made to me Support for meeting attendance
Yao, Jennifer MD, FRCPC	Medical Manager, Acquired Brain Injury Program, G.F. Strong Rehab Centre Clinical Associate Professor University of British Columbia, Dept. of Medicine, Division of Physical Medicine and Rehabilitation	Vancouver, British Columbia	No conflicts
Mountain, Anita MD, FRCPC	Medical Lead, Acquired Brain Injury Program Queen Elizabeth II Health Sciences Centre Assistant Professor Division of Physical Medicine & Rehabilitation ,Department of Medicine Dalhousie University	Halifax, NS	No conflicts
Blacquiere, Dylan MD, MSc, FRCPC	Ottawa Stroke Program, Division of Neurology, The Ottawa Hospital Assistant Professor	Ottawa, Ontario	University of Ottawa Honorary for lecture (medical humanities)

	University of Ottawa, Department of Medicine, Division of Neurology		
Corriveau, Hélène, PT, PhD	Full professor physiotherapy department, School of rehabilitation, université de Sherbrooke	Sherbrooke, Québec	No conflicts
Fung, Joyce PhD, PT	Associate Professor McGill University, School of Physical and Occupational Therapy	Montreal, Quebec	No conflicts
Natalie Gierman, MHSc., PMP	In previous role as Senior Manager, Health Systems and Research, Heart and Stroke Foundation of Ontario Director of Clinical Services and Education, Aphasia Institute	Toronto, Ontario	No conflicts
Inness, Elizabeth L. PT PhD	Lead, KITE Innovations & Rehabilitation Clinics, Affiliate Scientist, KITE- Toronto Rehabilitation Institute, University Health Network Assistant Professor (status only) Department of Physical Therapy, Rehabilitation Sciences Institute, Temerty Faculty of Medicine, University of Toronto	Toronto, Ontario	No conflicts
Linkewich, Elizabeth OT Reg. (Ont), MPA	Director, Regional Stroke and Neurovascular Programs and North & East GTA Stroke Network, Sunnybrook Health Sciences Centre, Practice-Based Research, Sunnybrook Research Institute	Toronto, Ontario	No conflicts

	Lecturer Occupational Science & Occupational Therapy, University of Toronto		
O'Connell, Colleen MD FRCPC	Medical and Research Director, Stan Cassidy Centre for Rehabilitation Horizon Health Network Assistant Professor, Dalhousie University Faculty of Medicine Dalhousie Medicine New Brunswick Clinical Research Director, Institute for Biomedical Engineering University of New Brunswick	Fredericton, New Brunswick	Advisory Board for the Canadian Stroke Best Practice Recommendations Volunteer on the non-profit education and advocacy organization Sustain Our Abilities
Sakakibara, Brodie PhD	Investigator, Centre for Chronic Disease Prevention and Management, The University of British Columbia Assistant Professor The University of British Columbia, Department of Occupational Science and Occupational Therapy	Kelowna, British Columbia	Michael Smith Foundation for Health Research Scholar Award Payments made to institution CIHR Project Grant Payment to institution CIHR Project Grant Reviewer Payment made to me Centre for Collaboration, Motivation, and Innovation Volunteer; unpaid
Smith, Eric E. MD	Neurologist Department of Clinical Neurosciences, Cumming	Calgary, Alberta	Canadian Institutes of Health Research, Brain Canada, Weston Brain Institute. Weston Family Foundation

	School of Medicine, University of Calgary Calgary Stroke Program, Foothills Medical Centre		Payments made to University of Calgary – Grant UpToDate Payments made to me. Not related to manuscript topic. Royalties/Licenses Alnylam, Bayer, Biogen, Cyclarion, Javelin, Eli Lilly Payments made to me. On topics not related to the manuscript. Consulting Fees U.S. National Institutes of Health Payments made to me Associate Editor, American Heart Association Payments made to me Participation on a board
Tang, Ada PT PhD	Associate Professor McMaster University	Hamilton, Ontario	Heart and Stroke Ontario Clinician-Scientist (Phase 2) Personnel Award, paid to institution CIHR, Brain Canada Project Grants, paid to institution DSMB for CanStim No payments
Timpson, Debbie BSc(PT), MD, FRCPC	Chief of Rehabilitation Pembroke Regional Hospital	Pembroke, Ontario	No conflicts
Vallentin, Tina MSc(A), SLP, Reg. CALSPO	Patient Experience Specialist Hamilton Health Sciences	Hamilton, Ontario	No conflicts
White, Katie B.Sc. PT, M.Sc	Lead, Provincial Clinical Initiatives and Innovation Provincial Health Services Authority, Stroke Services BC	Vancouver, British Columbia	No conflicts

Appendix 2 Virtual stroke rehabilitation external reviewers 2022

Name	Professional Role	Location	Declared Conflicts of Interest
Barclay, Ruth PhD, MHSc, BMR(PT)	Associate Professor, Department of Physical Therapy, University of Manitoba Department of Physical Therapy, College of Rehabilitation Sciences, Rady Faculty of Health Sciences, University of Manitoba, Winnipeg, Manitoba	Manitoba	CIHR, Canadian Frailty Network, CPSR-REPAR - currently funded projects: 1 as PI, 2 as co-PI, 3 as co-I; CFN – 1 currently funded project as co-I; CPSR-REPAR– 1 currently funded project as co-I; Member of Canadian Partnership for Stroke Recovery CanStroke Recovery Trials Platform - Winnipeg site Member of Canadian Partnership for Stroke Recovery CanStroke Recovery Trials Platform; CIHR funded trial as PI Member of Canadian Partnership for Stroke Recovery CanStroke Recovery Trials Platform - Winnipeg site lead for ABC and TRAIL. co-PI for CIHR funded GO-OUT study, co-I and Winnipeg lead for CIHR funded study on HRQL and older adults
Boe, Shaun MPT, PhD	Associate Dean Research, Faculty of Health Professor, School of Physiotherapy Dalhousie University	Nova Scotia	None to declare
Boyce, Joy OT Reg. (NS), Occupational Therapist. BScOT and BA Hons,	Occupational Therapist. BScOT and BA Hons Nova Scotia Health Authority	Nova Scotia	None to declare
Halibi, Mary Lou BSc., MSc. OT	Lead Special Projects- Stroke Cardiovascular Health and Stroke Strategic Clinical Network	Alberta	None to declare

	Alberta Health Services		
Kagan, Aura PhD	Executive Director of Applied Research and Education Aphasia Institute	Ontario	AphasiaAccess; Tavistock Trust for Aphasia Advisory; Reviewer
Hill, Kelvin BAppSC (physiotherapy) GDipBus&Co m	Stroke Foundation Australia National Manager, Clinical Services	Australia	None to declare
Laver, Kate B App Sc (OT), M Clin Rehab, Certificate in Implementatio n Science (UCSF), PhD Associate Professor	ARC Discovery Early Career Research Fellow Occupational Therapist Department of Rehabilitation, Aged and Extended Care College of Medicine and Public Health Flinders University		Conduct research trials (non commercial)
Sheehy, Lisa PT (Reg ON), PhD	Affiliate Investigator, Bruyère Research Institute	Ontario	Jintronix Inc. Jintronix has provided industry support for a project that I am working on now, to partially pay my salary
Shi, Jing (Jennifer) BScOT, MD, FRCPC	Physical Medicine and Rehabilitation Assistant Professor, University of Saskatchewan Medical Director of Stroke Rehabilitation, Saskatoon City Hospital	Saskatchew an	None to declare
Shumway, Elyse M.A., Reg. CASLPO, CCC-SLP,	Speech-Language Pathologist	Ontario	None to declare

	Aphasia Institute, Manager Clinical and Education Services		
Singh, Hardeep OT Reg. (Ont.), PhD	Assistant Professor, Occupational Science & Occupational Therapy, University of Toronto Occupational Science & Occupational Therapy, University of Toronto	Ontario	March of Dimes Canada I hold the March of Dimes Paul J.J. Martin Early Career Professorship at the University of Toronto
Symcox, Erin RN BN CNN(C)	Nurse Clinician	Alberta	None to declare
MacKay- Lyons, Marilyn MSc, PhD	Professor, Dalhousie University Affiliated Scientist, Nova Scotia Health	Nova Scotia	Co-investigator in Clinical Trial
Nelson, Michelle LA PhD	Research Scientist, Lunenfeld-Tanenbaum Research Institute; Sinai Health Assistant Professor, Institute of Health Policy, Management and Evaluation; University of Toronto Chief Knowledge Officer; March of Dimes Canada Lunenfeld-Tanenbaum Research Institute; Sinai Health Institute of Health Policy, Management and Evaluation; University of Toronto March of Dimes Canada	Ontario	None to declare