CANADIAN STROKE BEST PRACTICE RECOMMENDATIONS

Telestroke

Update 2017

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on Behalf of the
Canadian Stroke Best Practice Recommendations
TELESTROKE Writing Group

Canadian Stroke Best Practice Recommendations

Telestroke ~ Sixth Edition

(Updated January 2017)

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TELESTROKE

Section One: INTRODUCTION and OVERVIEW

Introduction

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 the Heart and Stroke Foundation, and involves over 200 volunteers from across Canada and internationally who have stroke expertise or who have been affected by stroke.

The target audience for these recommendations includes all healthcare providers from a range of health disciplines who are involved in the planning, delivery and monitoring of quality stroke care.

The goal of disseminating and implementing these recommendations is to promote and support evidence-based stroke care across Canada, increase capacity for stroke service delivery, reduce practice variations in the care of stroke patients, and to reduce the gap between current knowledge and clinical practice.

Why is better stroke management important?

- 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 nine covert strokes that result in subtle changes in cognitive function and processes.
- Stroke and other cerebrovascular diseases are the third leading cause of death in Canada.
- Stroke is the leading cause of adult disability, with over 400,000 Canadians living with the effects of stroke.
- The annual cost of stroke is approximately $3.6 billion, taking into account both healthcare costs and lost economic output.
- The human cost of stroke is immeasurable.
- Although there are many proven interventions for stroke prevention, treatment and rehabilitation, they are not widely or consistently applied.

The HSF 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 reintegration 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, and the clinical protocols and processes that are needed to achieve and enhance integrated, high-quality, and efficient stroke services for all Canadians. Through the innovations embodied within the stroke best practices, these guidelines contribute to health system reform in Canada and internationally.

The *Canadian Stroke Best Practice Recommendations* 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 results 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.

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 stroke patients to optimize recovery and outcomes.

Involvement of individuals who have had a stroke, their families and caregivers, is paramount to collaborations and partnerships and emphasized a patient and family-centred approach to stroke care delivery.

Working with interprofessional stroke care team members, other vascular care groups, emergency medical services, community care providers, educators, researchers, health system funders, planners and managers, will strengthen our ability to reduce risk factor prevalence, incidence, morbidity, and mortality from stroke.

Individuals who experience a stroke often present with additional health conditions or issues, which increases the challenges and complexity of comprehensive stroke management. Partnerships and collaborations with healthcare providers from a range of specialties is imperative to ensure people with multimorbidities have optimal control of each condition, do not fall through the cracks, do not receive conflicting or contra-indicated treatments, and do receive support to navigate the healthcare system.

Partnerships and collaborations are also necessary to support stroke care in rural and remote settings where some basic stroke services may not be available. People experiencing a stroke in those regions may not have access to optimal treatment strategies, which may result in poorer outcomes.

This theme aligns with and supports the Heart and Stroke Foundation's *Promote Recovery* mission priority and is included as part of each module for the 2016-2018 update of the *Canadian Stroke Best Practice Recommendations.*

Organization of Stroke Care in Canada

The Heart and Stroke Foundation, in collaboration with the CSBPR advisory committee and key stakeholders have developed a framework to facilitate system improvement through the adoption of evidence-based best practices to deliver optimal stroke care across the full continuum from stroke onset, acute treatment, prevention, and long term recovery.

The conceptual framework shown in Figure 1 is intended to convey how stroke services may be prioritized and organized based on resource availability. The goal k is for each organization involved in the delivery of stroke care services to engage in an ongoing cycle of developing the expertise, processes and protocols needed to provide optimal stroke patient care, taking into consideration the organization's geographic location, patient population, structural and human resources, and relationship to other parts of their healthcare jurisdiction.

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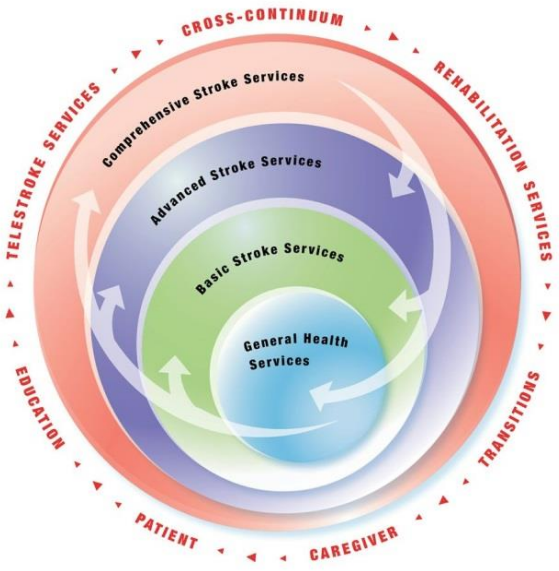


Figure 1: Canadian Stroke Best Practices Optimal Stroke Services Framework

Optimal stroke services include access to stroke experts, diagnostic equipment and expertise, and a range of emergent and timely evidence-based acute and rehabilitation treatment options. These services can be arranged along a continuum of resource availability: 1) minimal, non-specialized services in organizations that provide **general health care,** usually in small rural or remote regions; **2) basic stroke services** which includes direct access to basic diagnostic services including a CT scanner, as well as general medical management without a coordinated approach to stroke care; 3) **advanced stroke care centres** (e.g., also known as primary stroke centres, district stroke centres) with coordinated interprofessional stroke care ideally within a designated stroke unit, staff with stroke expertise, acute stroke treatments such as thrombolysis**,** and use of Telestroke technologies in some centres to support management decision-making; and, 4) **comprehensive stroke care** centres that provide advanced acute stroke services provided by an interprofessional team of stroke experts, support regional models of care; have coordinated stroke program and management protocols, have processes in place to accept patients from outer areas for advanced stroke therapies (such as acute thrombolysis, neurointerventional radiology, neurosurgical services), have a dedicated stroke unit and access to early rehabilitation services, and provide education and leadership for stroke service delivery a across a region.

Once a level of stroke services has been achieved, the organization should implement continuous quality improvement strategies. In some jurisdictions, it may be possible to develop and incorporate components of the next higher level of stroke services.

For more information, refer to the Canadian Stroke Best Practices Overview and Methodology Module at www.strokebestpractices.ca.

Telestroke Module Overview

Partnerships and Collaborations are imperative within stroke care and recovery, and are required at all levels of the systems of care, among healthcare providers, patients, system leaders and the broader community. Results from the Quality of Stroke Care in Canada Report (Canadian Stroke Network, 2011) indicate that many Canadians are not receiving optimal stroke services, and that there are significant geographic variations in care. Telestroke is a care delivery modality that has emerged to bridge the geographic gap between patient and expertise. It can be used to support stroke diagnosis and decisions regarding recanalization therapy, as well as the optimization of stroke prevention and rehabilitation therapies,

Partnerships and Collaborations in Telestroke involve healthcare providers, policy makers, patients, and the public. Telestroke is a tool or care-delivery modality that can be used for both 'on-demand' (urgent, unplanned) and 'scheduled' access to specialized stroke services. To be successful, Telestroke has to be implemented within an established and coordinated stroke system, where stroke experts and referring sites can be connected in an efficient and organized manner and be available for other uses to maximize the value of investment.

Issues such as increased workload, scheduling challenges, equipment cost and functioning and physician reimbursement have all been posed as barriers to Telestroke implementation. However, Krueger et al., (2011) found that implementation of Telestroke resulted in significant cost-avoidance and was one of four major cost-avoidance drivers in stroke management (along with stroke unit care, tPA administration and early supported discharge).Healthcare providers should work together within systems of care to address the specific barriers to optimal stroke service delivery in their jurisdiction and consider whether a telestroke program could be used to facilitate improvements (Figure 2).

Partnerships and Collaborations in Telestroke implores providers to start thinking beyond the utility of Telestroke in the hyperacute phase for tPA decision-making and administration. There is an emerging set of demonstration projects and research initiatives where Telestroke is used as the care delivery model for prevention and rehabilitation services. These applications enable people access to

expertise to manage risk factors which reduces recurrence rates for stroke, and therefore reduces burden on the healthcare system. Similarly, applications within the rehabilitation realm enable access to physiotherapy, occupational therapy and speech therapy to help further the gains made post stroke (positive patient-related outcomes) and, again, decrease the burden on the healthcare system.

Improved quality and availability of telemedicine technology has made the delivery of cross-continuum services possible within a variety of facilities and practice settings throughout Canada. This technology has been a major driver and opportunity for bridging the gap in access to equitable stroke services regardless of geographic location. The current challenge however, is that this known and available technology is significantly under-utilized for the care of patients who have experienced a stroke, and their family members.

The Canadian Telestroke Action Collaborative (CTAC) is led by an expert group within the *Canadian Stroke Best Practice Recommendations* initiative. The CTAC group is mandated to update current evidence-based recommendations for Telestroke, to gather the knowledge and experience of Telestroke experts across Canada in this implementation toolkit to support uptake of best practices. CTAC's goal is to increase access to stroke specialists through Telestroke care delivery models for hyperacute stroke care, stroke rehabilitation, prevention services, and to support patients returning to the community.

The guiding principles for CTAC in the update of the best practices for Telestroke and the development of a comprehensive Implementation Toolkit include:

- Telestroke programs, whenever possible, should be established within coordinated systems of stroke care (not as stand-alone isolated projects) in order to increase the benefits of investment and enhance sustainability.
- Telestroke programs should be established across the continuum of stroke care, beyond the hyperacute phase, especially given the shortage of stroke rehabilitation experts in many smaller communities, and the increased burden on families and the stroke care system when stroke patients are not able to access services to assist them in achieving optimal recovery.
- Healthcare providers involved in Telestroke programs should be involved in ongoing education to maintain competency in stroke care and in the efficient use of the technology.
- Telestroke initiatives should utilize a quality improvement model, starting on a small scale with minimal technology investment as necessary, but continuing to develop and enhance as capacity increases.

The documents included in this toolkit are intended to support both consulting and referring sites with the implementation of Telestroke services in their facility. The information provided is considered a starting place - examples and templates provided for use by all sites to review, adopt or adapt to meet their own needs.

The information included here should also be considered dynamic – it will change and evolve as new evidence emerges, and we encourage all users to share their own materials with the broader Telestroke community through this resource. All submissions can be sent to strokebestpractices@hsf.ca

Telestroke Definitions

There is considerable variation in the literature and in practice regarding the terminology used to describe Telemedicine and Telestroke services. For the purposes of the information contained throughout the CTAC Telestroke Implementation Toolkit, the following definitions have been accepted and operationalized.

- **Telehealth** is the use of information and communication technology to deliver health services, expertise and information over distance. It includes telephone, internet or web-based e-health and video-based applications, and can be delivered real-time (live) or through store-and-forward (record now, view later) mode.

- **Telemedicine** is the provision of medical expertise for the purpose of diagnosis and patient care by means of telecommunications and information technology where the patient and the provider are separated by distance. Telemedicine may include, but is not limited to, the provision of pathology, medical imaging and patient consultative services (Federation of Medical Regulatory Authorities of Canada). Sometimes telehealth may be used synonymously; however, for this document we use telemedicine, reserving Telehealth to refer to the broader general concept of using technology in healthcare.

For the purposes of this module, the following are the operational definitions for Telestroke:

- **Telestroke** is the use of telecommunication technology to link referring and consulting healthcare sites together for real-time two-way assessment and management of stroke patients. Presently, it is used primarily to extend access to thrombolytic treatment in healthcare facilities that do not have 24/7 on-site stroke expertise. However, Telestroke is also a mechanism for increasing access to stroke expertise and education for secondary prevention, rehabilitation, and recovery.
- **Referring site** is the site where the patient is physically located.
- **Consulting site** is the site providing the stroke expertise to support the referring site in diagnosis and treatment.
- **Telestroke Network** is a formally organized and continuously available integrated group of healthcare facilities that includes at least one comprehensive stroke care centre. The Telestroke Network has appropriate telecommunication infrastructure for real time audiovisual communication and rapid transmission of radiological images between referring and consulting sites.
- **On-Demand Telestroke** is defined as an unplanned, often urgent, Telestroke consultation. Access to unplanned Telestroke services requires 24 hour per day, 7 days per week access, and usually is situated within the emergency department, but can occur elsewhere.

The Canadian Telestroke Action Collaborative Framework

The CTAC Writing Group has developed a comprehensive framework that encompasses the major components of Telestroke (policy and advocacy, readiness and models of delivery, best practices and implementation, technology, and evaluation) within the Donabedian quality domains of structure, process and outcomes. The framework emphasizes patient-centred care, with the patient and their family, represented by the red ‘dots’, included in every component.

The framework also demonstrates the concept that stroke care provided through telestroke technology can occur at any stage along the care continuum, and for a range of intended goals – hyperacute care to support tPA administration and candidate selection for endovascular therapy; rehabilitation and access to physical, occupational and speech therapy; and, community reintegration and home monitoring and support for activities of daily living. Telestroke holds the promise of enabling timely cost-efficient access to best-available stroke care regardless of patient location.

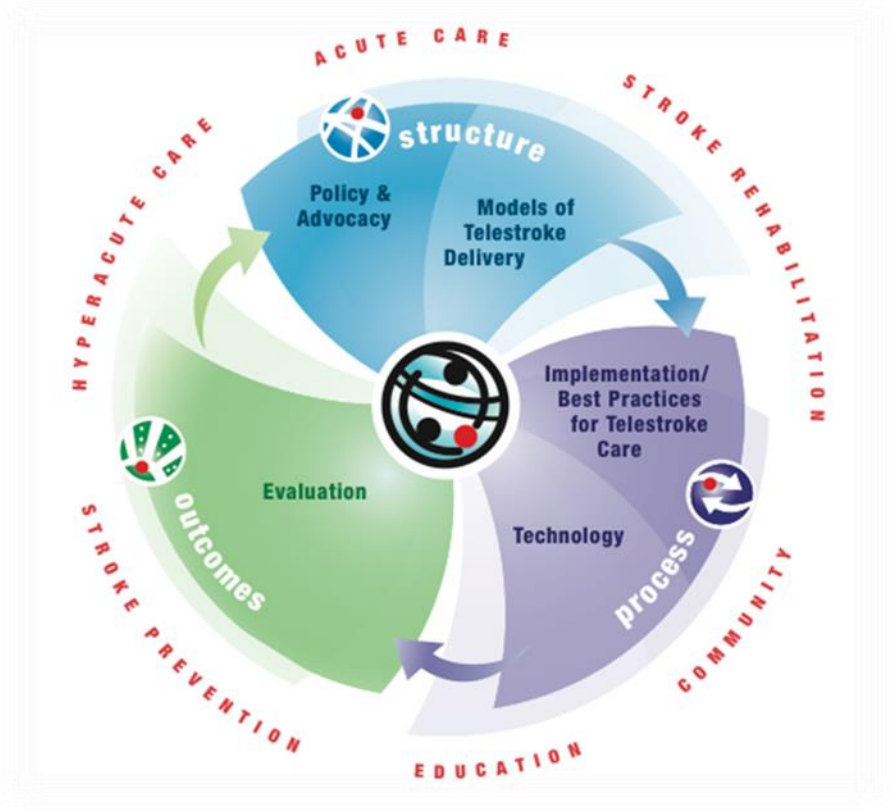
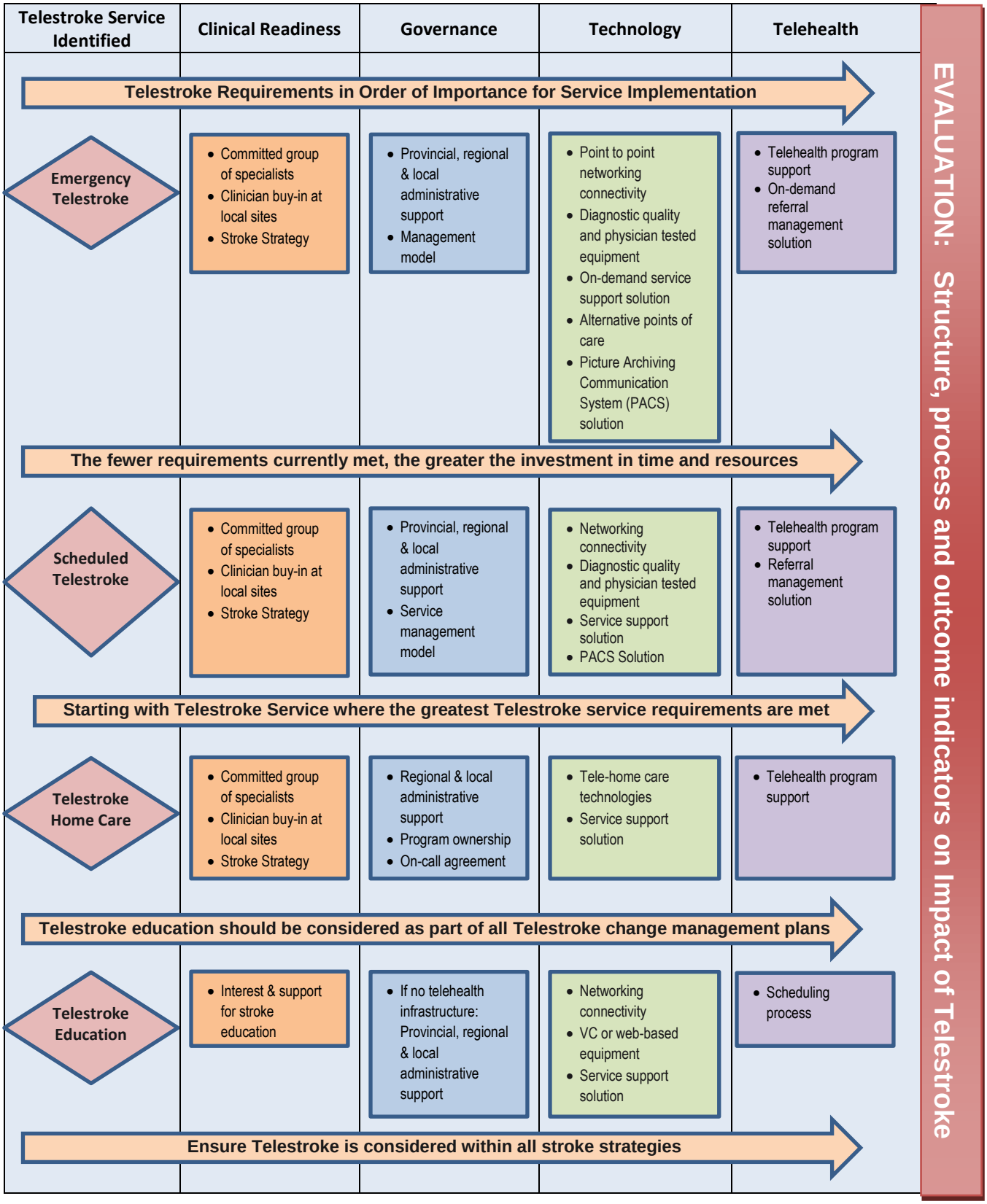


Figure 2:
Telestroke Action Framework
Heart and Stroke Foundation of Canada and Canadian Stroke Network, 2013

Telestroke Program Development Roadmap (CTAC 2013)

This roadmap (Figure 3) provides an overview of critical elements, stages and stakeholders to be considered in the development of a Telestroke program. It has been developed to assist Telestroke project teams in planning all aspects of Telestroke initiation and implementation, may be applied across the continuum of care and utilized for on demand (emergency) and scheduled healthcare encounters using Telestroke technology. Since Telestroke is a care delivery modality, it is imperative to have coordinated supporting structures in place to ensure successful implementation and sustainability. This roadmap identifies high-level key elements to be addressed throughout Telestroke development and implementation.

Figure 3: Telestroke Program Roadmap (CTAC, 2017)



Notable Changes in *Telestroke* 2017 Update

The 2017 update of the *Canadian Stroke Best Practice Recommendations* Telestroke module reinforces the growing body of research evidence available to guide the use of Telestroke technology for assessment, diagnosis, interventions and ongoing management of stroke patients.

Key messages for 2017 include:

- ✓ Telestroke as a care-delivery modality is under-utilized in Canada.
- ✓ Telestroke should be implemented within established stroke systems of care to maximize effectiveness.
- ✓ Telestroke applications include hyperacute care to increase access to acute thrombolysis and to support decision-making for endovascular therapy.
- ✓ Telestroke applications are expanding and processes are being established to leverage Telestroke for broader use to support smaller stroke units with management of complex cases; increase access to rehabilitation services and specialists; provide secondary prevention services to areas where services are not available; and improve community support.

Guideline Development Methodology:

The *Canadian Stroke Best Practice Recommendations* 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 useful to their work.

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

1. Establish expert interprofessional writing group for module, including stroke survivors and/or caregivers.
2. Systematic search, appraisal and update of research literature.
3. Systematic search and appraisal of external reference guideline recommendations.
4. Update of evidence summary tables.
5. Writing group review and revision of existing recommendations, development of new recommendations as required.
6. Submission of proposed chapter update to the Canadian Stroke Best Practices Advisory Committee.
7. Internal review of proposed chapter update. Feedback to writing group, completion of edits.
8. External review, and final edits based on feedback.
9. Update of educational materials and implementation resources.
10. Final approvals, endorsement and translation of chapter.
11. Public release and dissemination of final chapter update.
12. Continue with ongoing review and update process.

The detailed methodology and explanations for each of these steps in the development and dissemination of the *Canadian Stroke Best Practice Recommendations* is available in the *Canadian Stroke Best Practice Recommendations Overview and Methodology* manual available on the Canadian Stroke Best Practices website at strokebestpractices.ca.

Conflicts of Interest: 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. Any conflicts of interest that are declared are reviewed by the Chairs of the Advisory committee and appropriate HSF staff members for their potential impact. Potential members of any writing group who have conflicts that are considered to be significant are not selected for advisory or writing group membership.

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). Recommendations with this level of evidence may also be made in response to requests from a range of healthcare professionals who seek guidance and direction from the experts in the absence of strong evidence on certain topics that are faced on a regular basis.

Table 1: Summary of Criteria for Levels of Evidence Reported in the *Canadian Best Practice Recommendations for Stroke Care* (Update 2014)

Level of Evidence	Criteria*
A	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	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. Desirable effects outweigh or are closely balanced with undesirable effects or vice versa.
C	Writing group consensus and/or supported by limited research evidence. Desirable effects outweigh or are closely balanced with undesirable effects or vice versa, as determined by writing group consensus.

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

Acknowledgements

The authors wish to acknowledge and thank the many people who contributed to the development and production of the Telestroke recommendations update 2017. This includes internal and external reviewers: Eric Smith, Ed Harrison, Robert Cote, Andrew Demchuk, Denyse Richardson, Alexandre Poppe, Moira Kapral, Farrell Leibovitch, Christine Papoushek, Alan Bell, Barbara Campbell, Cassie Chisholm, Hillel Finestone, Dwayne Forsman, Devin Harris, Michael Hill, Thomas Jeerakathil, Michael Kelly, Noreen Kamal, Eddy Lang, Beth Linkewich, Colleen O'Connell, Jai Shankar, Mikul Sharma, Dawn Tymianski, Katie White, and Samuel Yip. The Stroke, Communications, Translation, and Knowledge Exchange teams at the Heart and Stroke Foundation, including Gavin Arthur, Stephanie Lawrence, Beverly Powell-Vinden, Christelle Desgranges-Farquhar, Roula Abboud, and Mary Elizabeth Harriman.

Declaration of Conflicts of Interest

The following authors have declared conflicts of interest: Dylan Blacquiere, Bayer Advisory Board member, Pfizer Speaker; Frank L. Silver, Canadian Lead, Steering Committee Member for the RESPECT ESUS Study, Boehringer Ingelheim (BI markets Activase (tPA) in Europe and other countries, not in Canada; Dar Dowlatshahi, Speaker and Advisory Board member for Bayer and BMS, Unrestricted Educational Grant from Octapharma; Gord Gubitz, Advisory Board Member for Bayer, BMS, Boehringer Ingelheim; M. Patrice Lindsay, Visiting Professorship and Lecture Series, Australia 2016, travel sponsored by Medtronic; Brian Moses, Speaker for Bayer, BMS, Boehringer Ingelheim, AstraZeneca, NovoNorDisk;

The following authors have declared that they do not have any conflicts of interest: Susan Alcock, Catherine Balg, Sanjit Bhogal, Julie Cole, Marsha Eustace, Norine Foley, Patricia Gallagher, Antoinette Ghanem, Alexander Hoechsmann, Gary Hunter, Khurshid Khan, Alier Marrere, Stephen Phillips, Kelly Rayner, Andrew Samis, Elisabeth Smitko, Colleen Taralson, and Marilyn Vibe.

Funding

The development of the *Canadian Stroke Best Practice Recommendations* is funded in its entirety by the Heart and Stroke Foundation, Canada. No funds for the development of these guidelines come from commercial interests, including pharmaceutical companies. All members of the recommendation writing groups and external reviewers are volunteers and do not receive any remuneration for participation in guideline development, updates and reviews. All participants complete a conflict of interest declaration prior to participation.

Citing the Prevention of Stroke 2014 Module

Dylan Blacquier, M. Patrice Lindsay, …, Frank L. Silver; on behalf of the Telestroke Writing Group. *Telestroke Module 2017*. In Lindsay MP, Gubitz G, Dowlatshahi D, Harrison E, and Smith EE (Editors) on behalf of the Canadian Stroke Best Practices Advisory Committee. *Canadian Stroke Best Practice Recommendations: Telestroke Update 2017.* Sixth Edition 2017; Ottawa, Ontario Canada: Heart and Stroke Foundation.

Comments

We invite comments, suggestions, and inquiries on the development and application of the *Canadian Stroke Best Practice Recommendations.*

Please forward comments to the Heart and Stroke Foundation's Stroke Team at strokebestpractices@hsf.ca

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TELESTROKE WRITING GROUP 2017:

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Canadian Stroke Best Practice Recommendations
TELESTROKE

Section Two: RECOMMENDATIONS

Delivery of Stroke Care using Telestroke Technology

Telestroke Telestroke *Update 2017*	1. Delivery of Stroke Care Using Technology

Telestroke care delivery modalities should be integrated into stroke care planning and service delivery across the continuum to ensure equitable access to care across geographic regions in Canada [Evidence Level C].

1. **Organization of Telestroke Services for Hyperacute Stroke Management**
   - **i.** Telestroke networks should be implemented to provide access to stroke expert consultations for hyperacute and acute stroke assessment, diagnosis and treatment, including acute thrombolytic therapy with tissue plasminogen activator (tPA) and decision-making for endovascular therapy. [Evidence Level B]. *Refer to CSBPR Hyperacute Stroke Care module for additional information.*
     - **a)** Telestroke modalities including video-conferencing and teleradiology systems may be considered to support screening and decision-making regarding candidacy for endovascular therapy in appropriate cases and to facilitate transfer to endovascular-enabled stroke centres [Evidence Level B]. *Refer to CSBPR Hyperacute Stroke Care module, Endovascular section, for additional information.*
     - **b)** Consulting and referring sites require processes in place to ensure access to stroke experts through Telestroke modalities, available 24 hours a day, seven days a week to provide equitable access to stroke care across geographic regions in Canada [Evidence Level B].
   - **ii.** Standardized, time-driven protocols are required for a coordinated and efficient approach to Telestroke service delivery in the hyperacute phase of stroke to facilitate delivery of advanced stroke therapies in referring sites [Evidence Level B]. *Refer to Telestroke Resource Toolkit for additional details.*
   - **iii.** Clearly defined criteria and protocols are required at referring sites to guide the Telestroke consultation process [Evidence Level B]. This referral system should be part of a coordinated system of stroke care. *Refer to Telestroke Resource Toolkit for additional details and examples.*
   - **iv.** The consultant should be a physician with specialized training in hyperacute stroke management, and must have timely access to diagnostic-quality neurovascular (e.g., brain CT, CTA) images during the Telestroke consultation [Evidence Level A]. *Refer to Telestroke Resource Toolkit Technical section for additional details.*

     Note: The decision to use acute stroke therapies in emergency management requires imaging to rule out hemorrhage. Refer to CSBPR Hyperacute Stroke Care module for additional information regarding imaging and t-PA administration.

v. Real-time two-way audiovisual communication should be in place to enable remote clinical assessment of the patient by the consulting stroke expert [Evidence Level B].

a) The benefits of telephone consultation without video is not well-established [Evidence Level C].

vi. All laboratory and diagnostic results required by the consultant should be made readily available during the Telestroke consultation [Evidence Level B].

vii. Referring physicians should follow an established protocol or algorithm which describes the critical steps and inclusion/exclusion criteria for recanalization therapies, which are agreed upon by both referring and consulting sites [Evidence Level A]. *Refer to CSBPR Hyperacute Stroke Care module recommendations 3 and 4 for additional information.*

viii. Referring physician and nursing staff who may be involved in acute Telestroke consultations should ideally be trained in administration of the National Institute of Health Stroke Scale (NIHSS), to efficiently and competently assist the Telestroke consultant with the remote video neurological examination [Evidence Level B].

ix. The most responsible physician remains the attending physician at the referring site. Decision-making is a consensus process that is achieved in consultation with the attending medical staff at the referring site, the patient and family, and the consulting physician with stroke expertise [Evidence Level C].

x. A consulting physician may be required to provide ongoing guidance to the referring site following initial consultation and should be accessible [Evidence Level C].

xi. Protocols should be in place to define patient transfer criteria to a more advanced stroke care facility when clinically indicated (e.g., endovascular (if available), neurosurgical intervention) [Evidence Level C].

a) The Telestroke system should identify the stroke centres that are able to provide endovascular and neurosurgical care [Evidence Level C].

b) For patients who are deemed eligible for endovascular treatment or neurosurgical interventions, protocols should be in place to define the process for patient transfer [Evidence Level C]. *Refer to CSBPR Hyperacute Stroke Care module for additional information.*

xii. Standardized documentation should be considered for both the referring site and the consulting site (in accordance to hospital processes, jurisdictional legislation and regulatory bodies) [Evidence Level C]. This may include:

a) A consultation note provided by the consulting physician to the referring site at the completion of the consultation, to be included in the patient medical record [Evidence Level C].

b) A discharge summary sent by the referring site to the consulting Telestroke physician to provide feedback about the patient's outcome [Evidence Level C].

c) Data related to the Telestroke consultation and outcome captured and collected by the Telestroke program for continuing quality improvement [Evidence Level C].

d) For patients that are transferred to another hospital (e.g., "drip and ship"), a discharge summary from the receiving hospital to the referring physician and the Telestroke physician [Evidence Level C].

2. **Organization of Telestroke Services for <u>Ongoing</u> Stroke Assessment and Management**

i. Telestroke services should be part of an integrated stroke services delivery plan that

addresses hyperacute stroke care, acute stroke care, stroke prevention, rehabilitation, home-based, and ambulatory care to support optimal patient recovery and family support regardless of geographic location [Evidence Level C].

ii. Telehealth enabling technologies, including real-time two-way video-conferencing with or without medical peripheral devices and potentially asynchronous (store-forward) tools such as an e-referral system for non-urgent consultations and remote patient monitoring devices, can be used to enable consultations and/or service delivery regarding:

a) Optimal in-hospital stroke care (virtual stroke unit) including medical decision making and rehabilitation treatment [Evidence Level C].

b) Stroke rehabilitation services (Telestroke-rehabilitation), where all rehabilitation disciplines should consider the use of telemedicine technology for patient assessment and clinical therapies (e.g., exercise monitoring and intensity adjustments, speech therapies for aphasia) [Evidence Level C].

c) Secondary prevention consultation and follow-up services (virtual neurovascular clinic or stroke prevention clinic) in communities where these services do not exist [Evidence Level A].

d) Home-based patient monitoring through web-based applications may be considered as an alternative to face-to-face clinic visits in instances where frequent patient monitoring is necessary, such as for out-patient rehabilitation services [Evidence Level C].

e) Patients with reduced mobility in long-term care facilities, or those living at a prohibitive distance from the clinic/hospital [Evidence Level C].

iii. Clearly defined criteria and protocols or algorithms should be available for referring sites to determine when and how to access these rehabilitation, prevention and ambulatory services for stroke patients [Evidence Level B].

iv. The consulting healthcare provider may provide documentation to the referring site to be included in the patient medical record, regarding patient progress, treatment plans, plans for ongoing follow-up, and discharge recommendations (in accordance with clinical care processes, organizational requirements, jurisdictional legislation, and regulatory bodies) [Evidence Level C].

3. **Staff Training and Ongoing Education**

i. It is recommended that Telestroke care providers attain and maintain the necessary competencies required in telemedicine in order to provide safe, competent care and to create a satisfactory telehealth encounter for both the patient and the healthcare provider [Evidence Level C].

ii. Referring and consulting service providers should be trained in using the Telestroke system and understand their roles and responsibilities for technical and clinical aspects of a Telestroke consultation [Evidence Level C].

iii. Training should include physicians, nurses, therapists, and any support staff (such as members of technology department), who may be involved in any Telestroke consultation or therapy appointment [Evidence Level C].

iv. Ongoing Telestroke training and education with a regular update cycle is useful to ensure competency of providers [Evidence Level C]. *Refer to Telestroke Resource Toolkit Technical section* for additional information and resources for staff training.

v. Consulting physicians and other healthcare professionals involved in Telestroke consults should have expertise and experience in managing stroke patients [Evidence

Level C].

vi. Continuing education in online and face-to-face formats is useful to ensure remote based practitioners have access to ongoing education [Evidence Level C].

vii. Mock patients may be helpful, especially for hyperacute Telestroke care for new sites, and where the ongoing number of cases is low [Evidence Level C].

Clinical Considerations (New for 2017)

i. Routine checks of Telestroke equipment (both video-conferencing and imaging systems such as PACS) ensure that in an emergency situation the equipment is functioning well. This may be done as part of routine checks on other emergency equipment (such as crash carts). Some systems may have a back-up system or alarms formal functioning equipment, but this varies by sites.

ii. Where electronic health records are available, health information sharing regulations should be developed to allow sharing of an individual patient's record at both sending and receiving facilities in ways that comply with provincial/federal privacy legislation.

iii. Efforts should be made to ensure that the telestroke technology is designed with ease of use and simplicity of operation in mind to facilitate adoption of the technology and to decrease the time required to meet educational requirements.

Rationale

Telestroke technology is a care delivery modality that is available to support equitable and timely access to optimal stroke services across the continuum of care and across geographic regions. In many communities there are no neurologists, physicians with stroke expertise, or experts in stroke rehabilitation and recovery. Telestroke is a cost-effective tool to support health systems in closing the urban/rural and tertiary/primary care gap.

Telestroke enables improved communication and better networking to increase access to stroke expertise, regardless of the physical location of the patient or the treating hospital (facility).

In the hyperacute setting, the short therapeutic time window for initiating thrombolytic therapy for acute ischemic stroke patients does not allow for long distance transport to regional stroke centres. Telestroke brings an experienced stroke consultant into the local emergency department virtually (i.e., "electronically"). Patients assessed by a stroke expert through a Telestroke system who are not deemed to be candidates for tissue plasminogen activator may still benefit from the stroke specialist's assessment and recommendations for optimal investigations and treatment, e.g., early triage and management of transient ischemic attack and minor stroke patients.

In the past few years, Telestroke as a care delivery tool has expanded beyond the hyperacute phase of stroke care. New evidence is starting to emerge of r the benefits and effectiveness of Telestroke in facilitating optimal stroke recovery following the acute phase, by increasing timely access to rehabilitation specialists and therapeutic programs through remote connections in medical care facilities and patient home settings.

System Implications

- Telestroke services should be considered as part of larger regional or provincial stroke delivery plans that "virtually" decentralize expertise to support clinical care in less well-resourced areas. Inherent in such a system are clear criteria, protocols, algorithms, and service agreements concerning the transfer and repatriation of patients when clinically indicated.
- The human resource implications are considerable and include establishing the appropriate number of physicians to participate in on-call schedules, and right-sizing the work force taking into account the time taken away from consulting practitioners' clinical duties at their own place of work.

  - Commitment and funding for Telestroke network development is required at the facility, regional and/or provincial levels.
  - A governance structure with a clear framework of accountabilities for Telestroke services.

- There are different models for implementing Telestroke in acute stroke management: whether referring sites manage patients post thrombolytic therapy ("drip and stay") or transfer them to a comprehensive stroke centre ("drip and ship") should be considered taking into account availability of resources and expertise at the referring site.
- Involvement of administrators and providers from all parts of the continuum of care are important to ensure a coordinated Telestroke effort (e.g., EMS, emergency, radiology, laboratory, inpatient units, ICU, and rehabilitation services).
- Patient and family education and informed consent protocols for Telestroke consultation.
- Clear guidelines and processes for physician reimbursement established at the outset of a Telestroke program.
- Appropriate emergency and intensive care services at referring sites, especially to manage patients who receive tissue plasminogen activator, such as 24-hour per day CT imaging, protocols for using intravenous tissue plasminogen activator, and intensive care teams.
- Service agreements that address the availability of maintenance and technical support, to ensure the clinical requirements of Telestroke are met. (For hyperacute applications, these supports should be available 24 hours a day, 7 days a week).
- The need for all users of a Telestroke system to be aware of their roles and responsibilities, and be familiar with operating the technology, including regular updates to maintain competence.
- Agreements and protocols for interprovincial consultations where appropriate.
- Processes established for monitoring and evaluation of Telestroke services.
- Licensing requirements for telemedicine vary between provinces and territories. Physicians should be aware of the jurisdictional requirements where the patient is located. Physicians may have to be licensed in multiple jurisdictions, which would include their location and the patients. 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.

  Telemedicine may present additional challenges with patient consent. In addition to receiving a patient's informed consent for proposed treatment, physicians may want to ask patients to read and accept standard terms and conditions for telemedicine services, documenting consent and discussions.

  CMPA assistance is available for telemedicine if the patient is located in Canada. There are exceptions for assistance if the patient was located outside of Canada temporarily.

  For more information please access the CMPA website at the below link.

  https://www.cmpa-acpm.ca/en/safety/-/asset_publisher/N6oEDMrzRbCC/content/telemedicine-challenges-and-obligations

Performance Measures

Jurisdictions may consider using one or some of the following indicators for monitoring telestroke services:

1. Proportion of patients who arrive at a designated referring hospital with stroke symptoms who receive a Telestroke consult as (a) the proportion of total stroke cases treated at the referring site; and (b) the proportion of patients with acute ischemic stroke arriving at the hospital within

3.5, 4 and 5 hours of symptom .

2. Proportion of Telestroke cases where an urgent follow-up is required with the stroke specialist due to complications or unexpected events.
3. Time to initiation of Telestroke consult from: *(note: add local benchmarks)*
    a. stroke symptom onset (last time patient was known to be normal)
    b. arrival in emergency department
    c. completion of the CT scan
4. Number of Telestroke referrals where stroke specialists were inaccessible or access was delayed due to
    a. multiple conflicting calls (Telestroke and other)
    b. technical difficulties preventing video-transmission
5. Proportion of Telestroke patient consults who are treated with tPA.
6. Proportion of Telestroke patient consults who are transferred to a comprehensive stroke centre for acute endovascular treatment.
7. Proportion of stroke patients managed with Telestroke who received tPA, who (a) had a symptomatic secondary intracerebral hemorrhage, (b) systemic hemorrhage, (c) died in hospital, or (d) were discharged to long-term care, home or to inpatient rehabilitation.
8. Proportion of patients managed with Telestroke where the Telestroke consultant's note is found in the patient's chart.
9. Median number of scheduled rehabilitation appointments for stroke patients accessing rehabilitation services through Telestroke modalities (report values separately for each service accessed – e.g., physiotherapy, speech therapy).
10. Median duration per scheduled rehabilitation appointment for stroke patients accessing rehabilitation services through Telestroke modalities (report values separately for each service accessed – e.g., physiotherapy, speech therapy).
11. Proportion of stroke patients discharged from an emergency department in a location without a prevention clinic who receive a scheduled prevention appointment through Telestroke modalities.

Measurement Notes

- Refer to the Canadian Stroke Best Practices Performance Measurement Manual for detailed indicator definitions, numerators and denominators, and additional analysis considerations.
- An attempt should be made to document information about all consecutive patients with stroke at the hospital using Telestroke for the denominator.
- Documentation for Telestroke consultations is often not standardized, making it harder to gather performance measure information.
- For indicators related to actual therapies, please refer to the appropriate section regarding the therapy in the Recommendations.

Implementation Resources and Knowledge Transfer Tools

Refer to *Telestroke Implementation Resource Toolkit* (under review) for comprehensive implementation tools for developing a business case, and planning for a Telestroke program, including implementation, technological considerations, and evaluation approaches**.**

Summary of the Evidence

Hyperlink to Telestroke Evidence Table and Reference list

Traditionally, telestroke has been regarded as a means to enhance decision-making and management

of thrombolysis treatment for patients with ischemic stroke. More recently, its application has been expanded further along the stroke continuum to include provision of secondary prevention counseling, rehabilitation therapies and patient education.

In its most common form, telestroke is used to increase access to thrombolytic treatment at facilities that lack 24 hour, 7 days a week onsite stroke expertise, using 2-way audiovisual equipment to carry out a detailed stroke examination, combined with a system to reliably transmit CT scan results. The safety, feasibility and efficacy of the "spoke and hub" model, which connects a tertiary stroke center to one or more distant primary care centers, has been established in many studies conducted in Europe and North America (LaMonte et al. 2003, Wiborg et al. 2003, Schwamm et al. 2004, Audebert et al. 2005, Waite et al. 2006, Vaishnav et al. 2008, Legris et al. 2016). In some of these studies, although minor technical difficulties were reported, the number of patients treated with t-PA increased at the spoke sites where telestroke systems were implemented and the symptom onset, to treatment time decreased. Choi et al. (2006) reported that a significantly greater percentage of patients received treatment with t-PA during the implementation of the telestroke system compared with the 13-month period prior (4.3% vs. 0.81%, $p<0.001$). Following the implementation, Pedragoasa et al. (2009) reported a significant decrease in the mean time from symptom onset to treatment (210 min vs. 162 min; p=0.05) and an increase in the percentage of patients treated within the 3-hour window (30% vs. 68%, p=0.04). Sanders et al. (2016) reported that as their telestroke system grew over time from 7 to 20 participating centres, there were significant reductions in key process times (door-to-needle, call-to-needle and door-to-call). However, large variations in t-PA use have been noted in regions with several spoke hospitals. Switzer et al. (2014) reported that among a telestroke network with two hub hospitals and 15 and 17 spoke hospitals, the rate of t-PA use varied from 0.85-8.74/10,000 emergency department visits/year.

The results from several studies indicate the outcomes of patients treated with t-PA through telemedicine vs. traditional in-hospital care, are similar. Zhai et al. (2015) conducted a systematic review & meta-analysis including the results of 8 studies that compared the outcomes of patients treated with t-PA through telemedicine vs. traditional in-hospital care. Telestroke systems were not associated with increased odds of symptomatic ICH (OR=1.08, 95% CI 0.47-2.5, p=0.85) or mortality (OR=0.95, 95% CI 0.82-1.11, p=0.51. In one of the larger studies (n=6,610), although a higher percentage of eligible patients at two academic stroke centres were treated with t-PA over a one-year period, there were no differences in the incidence of ICH (2.7% vs. 7.8%, p=0.14), 7-day mortality (0.9% vs. 3.5%, p=0.37) or in-hospital mortality (4.5% vs. 3.5%, p=0.74), compared with those admitted to 12 regional hospitals offering telestroke services (Audebert et al. 2005). Schwab et al. (2007) compared 170 patients who received t-PA following telestroke consultation and 132 consecutive patients who had been treated in one of the two stroke centres and received t-PA over the same time period. Mean time from stroke onset to administration of t-PA was similar (141 vs. 144 min). There were no statistically significant differences in mortality between groups at either 3 months (11.2% vs. 11.5%, p=0.55) or 6 months (14.2%, vs. 13%, p=0.45), nor were there differences in the proportion of patients who experienced a good outcome (mRS score ≥1) at 3 months (38.2% vs. 33.7%, p=0.26) or 6 months (39.5% vs. 30.9%, p=0.10). In one study, both videoconferencing and telephone consultations were used to provide telestroke services at 33 spoke hospitals. Patients were subsequently transferred to the regional stroke centre (RSC) following treatment with t-PA (Pervez et al. 2010). Treatment with t-PA was initiated in 181 (16.1%) cases at the spoke hospitals and in 115 (38.9%) at the RSC. There were no significant differences in the distribution of patients in each mRS category or deaths between the spoke and hub hospitals at 3, 6 or 12 months following treatment.

Perhaps the most recent innovation in telestroke services is the use of mobile stroke units, referring to ambulances which are equipped with specialized equipment, such as on-site laboratories and CT scanners, and are staffed with additional personnel with stroke expertise. These vehicles have been shown to be both feasible and effective. Kunz et al. (2016) compared the outcomes of patients who received thrombolysis therapy using the mobile stroke unit, STEMO from 2011-2015 with patients who received thrombolysis, but arrived to hospital via traditional emergency medical services. A significantly higher proportion of patients in the STEMO group were treated ≤ 90 minutes of stroke (62% vs. 35%, p<0.0005) and were living without severe disability at 3 months (83% vs. 74%, p=0.004). The 3-month mortality was also significantly lower in the STEMO group (6% vs. 10%, p=0.022). However, there was no significant difference in the primary outcome, the number of patients who achieved an excellent outcome (mRS 0-1) at 3 months (53% STEMO vs. 47% conventional, p=0.14). There were no significant differences in the safety outcomes between the 2 groups (sICH 3% vs. 5%, p=0.27 and 7-day mortality 2% vs. 4%, p=0.23). Adjusting for baseline characteristics, STEMO was an independent predictor of living without severe disability at 3 months (OR=1.86, 95% CI 1.20-2.88, p=0.006), but not for the primary outcome (OR=1.40, 95% CI 1.00-1.97, p=0.052). For patients treated with t-PA, mobile ambulances were associated with shorter mean process times, including door-to-needle, last known well to needle, and alarm to treatment decision, compared with non-telestroke treated patients (Belt et al. 2016, Itrat et al. 2016, Ebinger et al. 2014).

The outcomes of patients treated with t-PA at spoke hospitals (drip and stays model) appear to be worse compared with those of patients treated at hub hospitals (drip and ship model). Heffner et al. (2015) reported that the drip and stay patients had higher odds of in-hospital mortality (OR=6.8, 95% CI 2.2-21.7) and hospital stays > 6 days (OR=4.3, 95% CI 2.4-7.8) compared with patients treated at the hub (i.e, without telestroke) compared with patients treated with t-PA at a spoke hospital (drip and ship patients). Thy also reported the odds of long-term survival (2,500 days) were significantly higher in the combined drip and ship and hub groups treated with t-PA. Yaghi et al. (2015) reported similar results, among patients with moderate to severe stroke. Patients with NIHSS scores ≥8 in the spoke group were significantly more likely to experience a poor outcome (mRS ≥3 at 3 months: 76% vs. 50%, p=0.026). Among patients with mild stroke (NIHSS score <8), there was no difference in the numbers of patients with a poor outcome, or 30-day mortality, whose treatment after t-PA was located at the hub or stroke hospital. The elements of care associated with specialized stroke units (dedicated staff, core interdisciplinary team), which may be lacking at spoke hospitals, have been well-established and may account for the differences in outcomes between these groups, notwithstanding similar treatment with t-PA.

The results from several RCTs, also suggests that outcomes and indicators associated with telestroke services provided by videoconferencing and telephone only, are similar. In the Stroke Team Remote Evaluation using a Digital Observation Camera (Stroke DOC) trial, Meyer et al. (2008) randomized patients to receive telestroke (n=111) using real-time, 2-way audio/video or telephone (n=111) consultations, to assess the patient's candidacy for t-PA treatment. Consultations were provided by staff at a single hub institution to patients located at 4 remote sites. The number of patients treated with t-PA was similar between groups (28% vs. 23%, p=0.425). Mean times from stroke onset to t-PA were 157 and 143 min in the telemedicine and telephone groups, respectively (p=0.137). There were no differences between groups (telemedicine vs. telephone) in the occurrence of ICH (7% vs. 8%, p=1.00), good outcome at 90 days, defined as a mRS score of 0-1 (30% vs. 32%, p=1.00), or 90-day mortality after adjustment for baseline NIHSS score (OR=3.4, 95% CI 0.6-19, p=0.168). However, correct treatment decisions were made more often using videoconferencing (98% vs. 82%, p=0.0009). In a follow-up study (Meyer et al. 2012), which assessed 6 and 12-month outcomes, there were no

differences between groups in mortality or the proportion experiencing a good outcome at either assessment point.

The cost-effectiveness of telestroke services is difficult to determine. Few studies have been conducted and all models were very sensitive to assumptions related to the number of spoke and hub hospitals, the number of patients treated and the number of subsequent transfers. However, it appears that if evaluated over the lifetime horizon, telestroke services are cost-effective. For example, Nelson et al. (2011) used a decision analytic model to compare the costs and outcomes associated with patients presenting with acute ischemic stroke to spoke hospitals with and without telestroke access. Lifetime costs for usual care and telestroke were $130,343 vs. $133,527, resulting in an incremental cost-effectiveness ratio of $2,449/QALY, which was well below the $50,000/QALY usually used to establish a willingness-to-pay threshold. Using a base case of a 90-day time horizon, the ICER increased to $108K/QALY. More recently, Nelson et al. (2016) compared in-hospital costs prior to the implementation of the telestroke system (up to 2 years prior) and up to 3 years after the start date of the telestroke system. A decision analytic model was used to estimate the probabilities of the consequences of treatment decisions at critical points (e.g. t-PA vs. no t-PA), from both the hub, and spoke perspectives. From the spoke perspective, if the hospitals assumed 50% and 100% of the implementation costs, the ICERs were ~26,000 and 51,000, respectively. From the hub perspective, if the hospitals assumed 50% and 100% of the implementation costs, the ICERs were ~47,000 and 22,363, respectively. From both perspectives, more severe strokes were associated with lower ICERs. A decision analytic model developed by Switzer et al. (2012) predicted that 114 fewer ischemic stroke patients would present to the hub hospital each year, and 16 more patients would present to one of the spoke hospitals, leading to an overall costs savings of $358,435 during the first 5 years, from the network perspective. The model also predicted that 45 additional patients could be treated with t-PA and 20 more could receive endovascular therapy if a telestroke system were in place. This would also result in an additional 6.1 patients being discharged home each year, with an equal number of decreases in admissions to rehab and nursing homes. With cost sharing arrangements between spoke and hub hospitals, the model predicted that each hospital could save $45K over 5 years.

The feasibility and effectiveness of telestroke has also been evaluated in the context of rehabilitation therapy, where it is often referred to as “telerehabilitation” or “telerehab”. The results of these studies have been ambiguous. Chen et al. (2016) included the results of 7 RCTs that included patients who received rehab therapies through telemedicine systems for a minimum of 4 weeks in duration via virtual reality based training, telephone, or the internet. There was no additional benefit associated with telerehab, compared to usual care. The mean Barthel Index scores, Berg Balance Scale scores and Fugl-Meyer (Upper Extremity) scores were similar between groups. A Cochrane review (Laver et al. 2013) included the results of 10 RCTs examining telerehabilitation. The number of trials, which could be pooled were limited as the treatment contrasts and outcomes assessed were highly variable. Although the authors reported no significant differences between groups in upper-limb function or performance in ADL, they concluded that there was insufficient evidence to support or refute the effectiveness of telerehabilitation following stroke. Chumbler et al. (2012, 2015) evaluated the effectiveness of a Stroke Telerehabilitation program (STeleR) among 52 veterans who had suffered a stroke within the previous two years. The intervention, which focused on improvement of functional mobility, included 3 components: 3x 1 hour televisits to the participant’s home, 5 telephone calls and an in-home messaging device system to instruct patients on functional exercises and adaptive strategies. At 6 months, there were no significant differences in the primary outcomes, the Telephone Version of FIM, the Late-Life Function and Disability Instrument or Falls Efficacy Scale, between groups. There was a significant difference between groups, from baseline to 6 months, in the mean Stroke-specific

Patient Satisfaction with Care Scale (hospital care sub score) at 6 months, favouring the STeleR group, but not in the home care sub scale.

Lai et al. (2004) conducted an 8-week therapy program designed to improve strength and balance and to provide social support and education, which was delivered by a physiotherapist located off site to patients at a community centre for seniors, via videoconferencing. There was significant improvement at the end of the intervention in all outcomes assessed including the Berg Balance Scale, State Self-Esteem Scale, SF-36, and a 10-item stroke knowledge test. In addition, 63% and 37% of participants rated the clinical effectiveness of the program as good and excellent, respectively. In another positive trial, telerehab was used to provide in-home therapy to patients with moderate upper-extremity motor impairment one year following stroke (Piron et al. 2009). Patients in the intervention group performed exercises using a PC-based virtual reality system, where a therapist provided feedback remotely. Patients in the control group received conventional physical therapy. The duration of the program for patients in both groups was one month. At the end of the program, although minor problems with the quality of the broadband transmission were reported, patients in the tele-rehab group had significantly higher Fugl-Meyer Assessment (upper-extremity) scores compared with patients in the control group (53.6 vs. 49.5, $p<0.05$). The gains achieved were maintained at 1-month follow-up.

The use of telestroke to support secondary stroke prevention has gained some momentum. Across Canada and in some other jurisdictions, telestroke is being used to support stroke prevention for people with stroke living in geographic areas that are more rural and/or lack local access to stroke expertise. Currently, there is a lack of research evidence to quantify the benefits and differences in outcomes compared to areas not using telestroke. This knowledge gap should drive future research agendas,