Canadian Stroke Best Practices

CANADIAN BEST PRACTICE RECOMMENDATIONS FOR STROKE CARE

Telestroke Toolkit

Update 2017

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Canadian Stroke Best Practice Recommendations

Telestroke ~ Sixth Edition

(Updated March 2017)

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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, Canada (HSF) 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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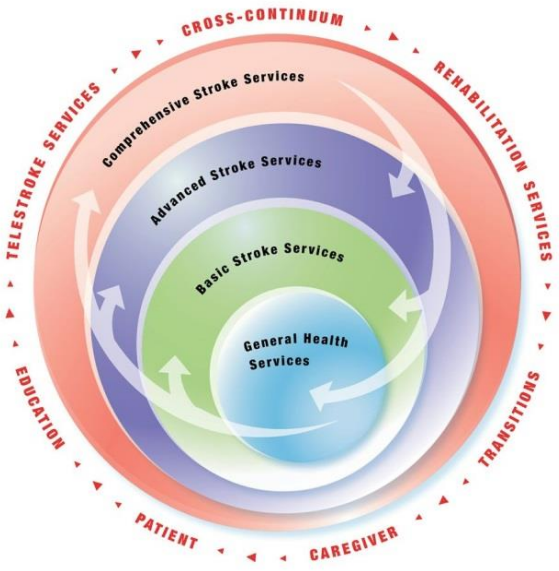


Figure 1: Canadian Stroke Best Practices Optimal Stroke Services Framework

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@heartandstroke.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

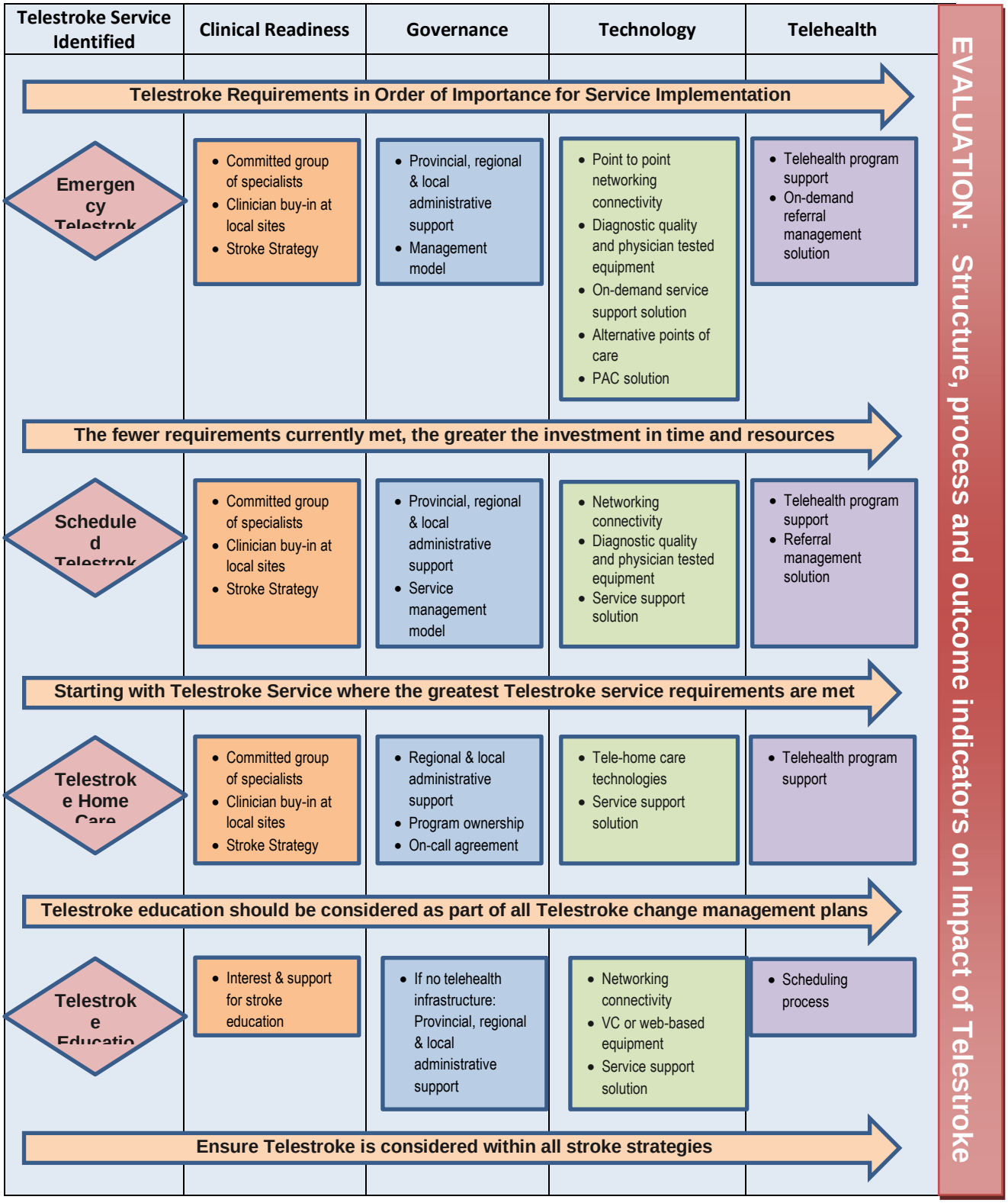
The CTAC Writing Group has developed a comprehensive framework that encompasses the major components of Telestroke (policy and advocacy, readiness and models of delivery, best practices and implementation, technology, and evaluation) within the Donabedian quality domains of structure, process and outcomes. 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.

Telestroke Program Development Roadmap (CTAC 2013)

This roadmap 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 and may be applied across the continuum of care and 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 2: Telestroke Program Roadmap (CTAC, 2013)



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 www.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]

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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;

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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@heartandstroke.ca

Canadian Stroke Best Practice Recommendations
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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 Acute Stroke Management 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 Acute Stroke Management 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 Acute Stroke Management 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 Acute Stroke Management 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 Acute Stroke Management 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* 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

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,

Section Three: CREATING A TELESTROKE PROGRAM: PREPARATION AND READINESS

Table of Contents

3.1 Introduction

Technology has enabled the delivery of cross-continuum stroke services within a variety of facilities and practice settings. Telestroke programs should be established as a service delivery modality within coordinated and integrated stroke care systems across Canada, as most regions include remote or rural areas as well as urban areas. Patients in these smaller locations should have equivalent access to stroke expertise, and available technology makes that possible.

This section of the CTAC Telestroke Implementation Toolkit identifies key components of the planning and preparation phases in establishing a Telestroke program. It includes a checklist of key steps that should be considered in program development, an overview of common models of Telestroke delivery for on-demand (urgent) access and scheduled Telestroke encounters across the continuum.

3.2 Telestroke Roadmap

Refer to Page 10 in Section 1 for Telestroke Roadmap

3.3 Telestroke Service Master Checklist (CTAC 2015)

The CTAC Telestroke Master Checklist identifies key components and action items that should be considered in the development of a Telestroke program. Most of these elements are applicable across the continuum (i.e., in hyperacute, acute, rehabilitation, prevention and community settings) and for both urgent on-demand and scheduled applications. This document is intended to support both consulting and referring sites with the implementation of Telestroke services in their facilities. The information provided is a guide – each site can adapt the processes to best reflect the site-specific stroke services model, available technology, setting, patient needs and resources.

A. Service Requirements for Scheduled and On-Demand Telestroke Encounters

Telestroke Service Requirements	Scheduled (e.g., Prevention Clinics, Rehabilitation)	On-demand (e.g., Hyper-Acute)
Administrative structure to manage a Telestroke program (i.e. system coordination, privacy & security,	☐ Depending on scope of service, could be managed at the regional and local levels.	☐ Provincially integrated stroke service delivery solution ☐ Governance & Management Structure resourced

Telestroke Service Requirements	Scheduled (e.g., Prevention Clinics, Rehabilitation)	On-demand (e.g., Hyper-Acute)
contingency planning, supporting documentation and manuals, referral management, contract management, monitoring and evaluation).		to execute Telestroke Service and provide ongoing leadership and management (i.e. Telehealth Program, Health Authority, Stroke Program)
Consulting & Referring Site Service Capacity	☐ Committed consulting group with service capacity ☐ Agreed service delivery model ☐ Compensation Agreement may be required ☐ Referring sites have capacity to support service	☐ Committed consulting group with service capacity ☐ Agreed service delivery model (i.e. service design and service delivery expectations) ☐ Compensation Agreement (contract) ☐ On-call Agreement including alternative points of care solution ☐ Referring Site has capacity to manage patients or transfer protocols in place (i.e. Nursing staff, Imaging Technicians)
Referral Management: Mechanism in place to support coordinated videoconference interaction	☐ Scheduled Telestroke may only need a scheduling system or policy and process documentation (i.e. referral protocols)	☐ On-demand referral management solution either by an organized group of clearly defined referral protocols or with back-up solution

Telestroke Service Requirements	Scheduled (e.g., Prevention Clinics, Rehabilitation)	On-demand (e.g., Hyper-Acute)
Videoconferencing connectivity between consulting sites and designated Telestroke sites	☐ Appropriate technology infrastructure for service delivery solution (i.e. equipment and wiring, telephone, web based solutions) ☐ Bridges can be used to enable connectivity ☐ Appropriately trained service providers	☐ Appropriate technology infrastructure to allow videoconferencing connectivity in the right place & the right time ☐ On-demand connectivity & point to point ☐ Appropriately trained service providers
Technical support services for technical solution and diagnostic imaging	☐ Telestroke service support requirements need to be negotiated with appropriate service support partners and funded to support the Telestroke service requirements (i.e. 24/7, direct contact to support for Telestroke).	☐ Telestroke service support requirements need to be negotiated with appropriate service support partners and funded to support the Telestroke service requirements (i.e. 24/7, direct contact to support for Telestroke). Often short time-frame to respond.
Access to DI and transmission capabilities to consulting sites	☐ DI solution in place to allow for access to image if required	☐ DI solution in place to allow for on-demand timely (rapid) access to CT
Alternative points of care for consultants providing service 24/7 (i.e. home access)		☐ A home and office access solution should be considered for 24/7 emergency Telestroke service so that neurologists can be on-call at alternate points of care (i.e. Home and/or office)

B. On-Demand Emergency Telestroke Referring Site Checklist

	ON-DEMAND EMERGENCY TELESTROKE REFERRING SITE CHECKLIST
Stroke Service Development	☐ Stroke clinical leadership to support Telestroke development and implementation ☐ Approved ED protocols and stroke care pathways for acute stroke management (Canadian Best Practice Recommendations for Stroke Care) ☐ Aligned and integrated with provincial and/or regional stroke service models (i.e. based on service delivery priorities and need identified) ☐ Available 24/7
Laboratory and Diagnostic Imaging	☐ Laboratory provides stat blood work with no down time during hours of Telestroke operation (i.e. 24/7) ☐ The facility has a CT scanner and has the ability to provide STAT CT head scan during Telestroke hours of operation ☐ CT scan must is conducted and transmitted in a timely way to ensure interpretation within 45 minutes of pt arrival ☐ Health Authority and provincial network infrastructure supports rapid transfer of CT from the referring to consulting site
tPA and Organized Emergency Care	☐ Rapid Triage Protocols for Stroke in place (i.e. Alert from EMS for + stroke evaluation with validated clinical tool & acute stroke algorithms) ☐ Patient management protocols within ED align with Telestroke technology placement (i.e. Telestroke bays are identified in consultation with referring site staff). ☐ Responsibility for technology set-up and support assigned and supported by ED staff ☐ Transfer and placement policies and protocols to assist service providers in ensuring patient has access to appropriate level of care post tPA ☐ tPA is readily available within the Emergency Department (i.e. Clot Box). ☐ Process established for meeting benchmarks for delivering tPA in accordance with the guidelines for thrombolytic therapy for an ischemic stroke ☐ Cardiac Monitoring, Neurovitals, BP and temp, blood sugar levels is available for tPA candidates. ☐ ERP sees tPA candidates within 10 minutes of arrival. ☐ ED clinical teams informed, trained and willing to support Telestroke service ☐ ERPs and stroke neurologists extend working relationship to videoconference platform ☐ Pharmacy preparedness for t-PA based on projected volumes (e.g. stock/supplies, distribution, budget)

	ON-DEMAND EMERGENCY TELESTROKE REFERRING SITE CHECKLIST
	☐ All appropriate ED staff and supporting service areas trained in hyperacute stroke management ☐ Stroke pathways and protocols established for acute stroke management by dedicated hospital team ☐ Transfer protocols to higher level site in place and applied when clinically indicated ☐ Consultant available for follow-up consultation
Technology	☐ Connectivity must achieve a minimum symmetrical bandwidth of 384 kbps with quality of service between consulting sites & EDs ☐ Consulting neurologists should have the ability to manipulate the referring site camera to support remote neurological assessment ☐ IM/IT provides rapid response to Telestroke to enable quick response and resolution of AV problems 24-7 ☐ Telestroke (videoconference/DI) trouble escalation procedures and business continuity plans are in place ☐ Minor endpoint cosmetic requirements are completed (Paint/lighting; acoustic panels) ☐ Videoconferencing equipment is located in an accessible location either fixed or stored ☐ Room equipped with compact footprint H.323 videoconferencing that supports high quality (picture/sound) synchronous encounters for patient dx/rx ☐ CT scan viewing should be available within the ED ☐ Service providers must have access to telephone in the event of technical problems ☐ Patient information must travel on a secure network and meet legislated health information privacy standards
Continuity of Care	☐ Stroke patients remaining in their community should have access to secondary stroke prevention clinics and rehabilitation services appropriate to their needs once discharged from hospital ☐ Transfer protocols to higher level site in place and applied when clinically indicated ☐ Consultant available for follow-up consultation

C. Scheduled Telestroke Referring Site Requirements Checklist

	SCHEDULED TELESTROKE REFERRING SITE REQUIREMENTS
Stroke Service Development	☐ Stroke clinical leadership to support Telestroke development and implementation ☐ Approved stroke protocols and stroke care pathways for stroke management (Canadian Best Practice Recommendations for Stroke Care) ☐ Aligned and integrated with provincial and/or regional stroke service models (i.e. based on service delivery priorities and need identified)
Laboratory	☐ Laboratory provides blood work service (if required)
Diagnostic Imaging	☐ The facility has a CT scanner and has the ability to provide CT head scan during Telestroke hours of operation (if required) ☐ Ability to access other imaging or diagnostic tests results electronically beneficial but not mandatory (i.e. EHR)
Service Delivery	☐ Responsibility for technology set-up and support assigned and supported by staff ☐ All appropriate staff and supporting service areas trained in Telestroke ☐ Standardized clinical decision aids and tools accessible to facilitate interaction ☐ Appropriate documentation available to consulting sites
Technology	☐ Connectivity must achieve a minimum symmetrical bandwidth of 384 kbps with quality of service between consulting sites and referral sites ☐ IM/IT provides quick response to Telestroke to enable quick response and resolution of AV problems ☐ Telestroke (videoconference/DI) trouble escalation procedures and business continuity plans are in place ☐ Minor endpoint cosmetic requirements are completed (Paint/lighting; acoustic panels) ☐ Videoconferencing equipment is located in an accessible location either fixed or stored ☐ Room equipped with compact footprint H.323 videoconferencing that supports high quality (picture/sound) synchronous encounters for patient dx/rx ☐ Service providers must have access to telephone in the event of technical problems ☐ Patient information must travel on a secure network and meet legislated health information privacy standards

3.4 Telestroke Program Implementation Plan

Project Phase		Key Requirements
Phase 1	**Planning & Regional Clinical Readiness**	**Provincial:** • Development of a Telestroke Technology and Connectivity Plan, that details alternative points of care solutions, cross HA point to point solution using the provincial networks & DI solutions, EHR and service level requirements. • Development of Telestroke Service Delivery Model, including the development of an on-call rota and a clinical service level agreement with details of referral management, documentation and monitoring and reporting. **Regional and Facility: Clinical Preparation for Acute and Hyper Acute Stroke** • Formal sign-off on hospital designations for stroke care • Bypass and transport protocols for BCAS/EMS that support ACVS • Repatriation agreements for Cross-boundary referrals • Implementation and Embedding of Stroke ED order sets into clinical practice • Coordination of stroke care pathways (from pre-hospital to inpatient acute care) • Protocols and stroke team for acute stroke EDs • Regional engagement initiated (Executive & Clinical Leadership)

Project Phase		Key Requirements
Phase 2	**Pre-Implementation: Provincial Service Development and Regional Preparation**	**Provincial:** • Align Telestroke management and governance within Stroke Care administration • Engage consulting group • Negotiate an on-call compensation agreement where appropriate • Enable consulting sites with Telestroke technology capacity • Negotiate Technical and Clinical Service Level Agreements, including referral management and data collection requirements • Train neurologists within university faculties of medicine • Merge prototype referring sites into new provincial service • Rank Telestroke sites based on clinical need and technology readiness **Regional and Facility:** • Regional Clinical Preparation Continued • All designated Telestroke sites have clear processes that support timely neuro-imaging available during hours of Telestroke operation • Regional Administrative Preparation
Phase 3	**Implementation**	**Facility:** • Conduct a base line site assessment for stroke management and Telestroke • Build your Telestroke implementation team and identify super users • Build awareness of Telestroke within your facility (Communication Plan) • Increase awareness and acceptance of tPA among service providers and clinical support teams • Approve Telestroke algorithm and clinical orders at your hospital • Install network wiring in designated stroke treatment area(s) • Procure, install and commission a videoconferencing unit in the stroke treatment area(s) • Ensure image transfer solution is accessible to your site • Conduct clinical and technology training sessions and a successful mock drill before implementation and monthly • Go Live

Project Phase		Key Requirements
Phase 4	**Ongoing Monitoring & Evaluation Continuous Quality Improvement**	• Debrief (within appropriate time frame) with ED team, imaging, lab, IT if needed after each Telestroke 'encounter' using checklist: identify what went well, what could have been better • Monitoring and reporting

3.5 Models of Telestroke Delivery

The following table provides examples of Telestroke delivery systems, and are based to varying degrees on the 'hub and spoke' model as a means to increase patients' access to treatment with thrombolytic therapy. Consultations were provided remotely by clinicians at one or more facilities with specialized stroke services (hub) to one or more hospitals, usually smaller in size and remotely located, that lacked 24 hours/day access to these specialized services. In some cases, using the 'drip & ship' model, patients were transferred to the consulting hospital following the administration of thrombolytic therapy where they received ongoing care and monitoring. The principles of these models, although applied in these examples for on-demand emergent Telestroke service delivery, are transferable and applicable to scheduled Telestroke care applicable as well.

Example and Reference	Brief description of service	Key findings
TESSA (Austria) **Telemedicine in Stroke in Salzburg** **Johansson T, Mutzenbach SB & Ladurner G. Telemedicine in acute stroke care: the TESSA model. *J Telemed Telecare* 2011;17: 268-272.**	A stroke neurologist at a single stroke unit provided Telestroke services through a videoconferencing system to emergency department physicians at 5 regional hospitals, located 20-129 km from the hub site. ED physicians initiated the consultation by contacting the on-call stroke neurologist at the stroke unit when a possible candidate for thrombolysis was identified. Following thrombolysis, the patient was transferred by ambulance or helicopter to the stroke unit at the hub site for further monitoring and management.	The outcomes of 47 patients who had received thrombolysis using telemedicine were compared with 304 patients treated at the hub sit. There were no significant differences in mean stroke onset to needle time: 133 min (Telestroke) vs. 122 min (stroke unit), p=0.26. There were no significant differences between groups on any of the outcomes assessed including the incidence of intracranial hemorrhage, 3-month mortality or probability of a good outcome (mRS≤2).
TESS (Germany) **Telemedicine in Stroke in Swabia Project** **Wiborg A, Widder B. Teleneurology to improve stroke care in rural areas: The Telemedicine in Stroke in Swabia (TESS) project. *Stroke* 2003;34:2951-2956**	Teleconsultations were provided by 4 senior neurologists located at a single stroke unit in Gunzberg, to physicians at 7 rural hospitals, located 53-136 km from the hub site. In the rural hospitals, all departments had access to the remote stroke unit, although the decisions of if/when to consult were at the discretion of the treating physician.	In this feasibility study, teleconsultations were conducted in 25% of patients admitted with stroke to one of the hub sites. Users of the system reported they were satisfied with the imaging and video quality. Both the local physicians and the hub neurologists considered the contribution of the teleconsultation to be relevant in the areas of diagnosis, assessment of CT scans and therapeutic decision making. (no data on treatment decisions related to thrombolysis treatment were provided)

TEMPiS (Germany) **Telemedic Pilot Project for Integrative Stroke Care** **Audebert H, Kukla C, Clarmann von CS, et al. Telemedicine for safe and extended use of thrombolysis in stroke: the Telemedic Pilot Project for Integrative Stroke Care (TEMPiS) in Bavaria. *Stroke* 2005;36:287-91.**	5 neurologists with stroke expertise at 2 comprehensive stroke centres provided teleconsultations to MDs at 12 community hospitals located 200+km away. Two of the spoke hospitals had neurology departments and 10 admitted stroke patients to their general internal medicine departments.	The outcomes of 106 patients admitted to hospitals who had been treated with tPA using the telemedicine system over a one-year period, were evaluated. During the first 12 months, 4,178 stroke patients presented to one of the spoke sites, of which 2.1% were treated with tPA. In the year before TEMPiS was implemented, only 10 patients had been treated with tPA at the community hospitals The mean time from stroke onset to administration of tPA was 141 minutes. 10.4% of patients died in hospital and 25% of patients experienced an ICH within 36 hours of treatment with tPA.
REACH (USA) **Remote Evaluation of Acute Ischemic Stroke)** **Switzer J, Hall C, Gross H et al. A web-based Telestroke system facilitates rapid treatment of acute ischemic stroke patients in rural emergency departments. *J Emerg Med* 2009;36:12-18.**	The REACH system connected a neurologist at a comprehensive stroke centre with emergency physicians at 9 spoke hospitals in rural Georgia located 32-103 miles from the hub centre, through a videoconferencing system. Following treatment with tPA, patients were transferred to the hub site for monitoring of complications and evaluation for additional reperfusion therapies.	The outcomes of 50 patients who received tPA administration remotely using the Telestroke system and 26 patients, who receive tPA at the central tertiary care hospital, were compared. There were no significant differences in the mean onset to treatment times for patients receiving tPA at the tertiary care centre vs. patients receiving tPA remotely (146 vs. 128 min, p=0.0651) or in the percentages of patients experiencing a symptomatic hemorrhage (0 vs. 2, p=1.00).
Pervez M, Silva G, Masrur S, et al. Remote supervision of IV-tPA for acute ischemic stroke by telemedicine or telephone before transfer to a regional stroke center is feasible and safe. Stroke 2010;41:e18-e24.	Physicians at 33 spoke hospitals in were connected to neurologists at a regional stroke centre (RSC). 12 connections were established using videoconferencing and 21, through phone connection. Following treatment with tPA, patients were transferred to the RSC.	Treatment with tPA was initiated in 181 (16.1%) cases at the spoke hospitals and in 115 (38.9%) at the RSC. There were no differences in incidence of symptomatic hemorrhage, 3, 6 or 12 month mortality, or distribution of mRS score between patients treated at the spoke hospitals compared with those treated at the hub.

Section Four: CREATING A TELESTROKE PROGRAM: ESTABLISHING TELESTROKE TECHNOLOGY INFRASTRUCTURE

Table of Contents

4.1 Introduction

Telestroke technology enables clinicians to deliver health care services, expertise and information in real time over distance, thereby improving timely access and eliminating barriers to patient care. Benefits to using telemedicine technology for healthcare delivery can be realized in terms of cost-saving, time savings, increased availability of higher standards of care and the speed with which care can be delivered. A list of technical recommendations has been developed to assist with the advancement of Telestroke programs across the continuum and within any jurisdiction.

In the first section of this chapter, the user will find the technical requirements for both the provider and recipient sites to develop a scheduled Telestroke program, supporting stroke prevention, patient education and rehab services. Part two reviews the technical and clinical needs for an acute stroke program, which is more resource-intensive and involves multiple portfolios. Lastly, checklists are provided to support telehealth readiness, space and equipment recommendations.

Success of Telestroke integration within any organization relies on collaboration of clinicians with telehealth staff and IT staff. It is important to ensure that all essential constituents are represented throughout all phases of planning and development.

It is understood that some sites may not have or be able to implement the entire technology infrastructure at the onset of a Telestroke program. This technological infrastructure can be built on and expanded over time. During early development stages, sites considering or planning for Telestroke, or any telemedicine application, where there may be a lack of capacity in or absence of video-conferencing technology may want to consider using online video-calling software applications (e.g. Skype®) to provide tele-consultation. These programs can be used to facilitate remote consultation at no cost to the patient or healthcare facility using interfaces that are often already familiar to patients and staff. Using these technologies will enable early access to stroke expertise and increase equity in stroke patient care. These technologies should be considered *the minimal capacity and be built upon,* rather than being considered sufficient in place of comprehensive telemedicine video technologies for full Telestroke program operations.

4.2 CTAC Readiness Assessment for Scheduled Telestroke Consultations

BASELINE ASSESSMENT QUESTIONS ON CLINICAL READINESS FOR SCHEDULED TELESTROKE CONSULTATIONS

**NOTE: This is a combination of documents each specific to Clinical Telehealth, all Telehealth sessions, or Stroke Telehealth Sessions.*

A: REQUESTING ORGANIZATION INFORMATION

Organization Name:	
Site:	
Full Mailing Address:	
Primary Contact Person:	
Title	Phone
E-Mail	Fax
Telemedicine Coordinator Name(if applicable):	
E-Mail	Phone
Technical Contact Name:	
E-Mail	Phone

Telehealth components/ services of regional stroke plan confirmed: ☐ Yes ☐ No
Implementation team in place ☐ Yes ☐ No
Review clinical protocols/ processes and document workflow ☐ Yes ☐ No
Completion of privacy impact assessment ☐ Yes ☐ No

B: ADMINISTRATIVE (MEETINGS/INFORMATION)

Describe the anticipated use of Telehealth technology – provide examples. Clinical (patient related): Educational (learning):
How many people will typically participate during a videoconference call? Check all that apply. ☐ Two individuals (one person at each location) ☐ Small group (e.g. small meeting room) ☐ Large group (e.g. boardroom) ☐ All of the above

Do you have a need to call multiple sites at one time (referred to as a multipoint call)? ☐ Yes ☐ No
Do you intend on conducting calls with clients or partners outside of your organization? ☐ Yes ☐ No
Does this align with your organization's current vision, mission and strategic plan? Please Describe:

C: PROGRAM PLANNING FOR TELEHEALTH

How have you prepared your organization for Telestroke? Do you have a communication plan? Do you have a plan for staff involvement (education plan)?
If you have multiple offices - How will you identify which locations are ready for Telehealth?
Does your clinical/medical staff request Telehealth? (Willingness to participate)
Is there staff buy-in for Telehealth implementation and use?
Does your team have concerns, and if so, what are they?
Do your identified Telehealth locations have Network and Internet access?
What is your team's level of comfort with technology?

D: READINESS: HUMAN RESOURCES/LEADERSHIP

Have you identified Telehealth champions at the leadership and front line staffing levels?
Has a Clinical Sponsor been identified? ☐ Yes ☐ No
Endorsement by hospital administration/senior management/MAC to move Telestroke initiative forward? ☐ Yes ☐ No
Designated physician sponsor? ☐ Yes ☐ No **Name:**

Designated leadership sponsor? ☐ Yes ☐ No Name:
Designated clinical staff sponsors? ☐ Yes ☐ No Name:
Agreement, in principle, to participate in data collection? ☐ Yes ☐ No

E: CLINICAL WORKFLOW

What are the patient referral patterns to and from your locations?
Do your physicians provide coverage at multiple locations?
In a typical day, about how many patient encounters do you have at your locations?
How many of these encounters could occur via Telehealth?
Please describe potential Clinical Telehealth sessions: Initial Assessment: Follow up: Case Review/Case Conference:
Would any of the above encounters benefit from peripheral videoconference equipment: Digital stethoscope: Hand held camera: Document reader:
Do you anticipate that Telehealth would change your current workflow and delivery of healthcare? How would you plan to address these changes? Can adequate appointment time and human resources be allocated for Clinical Telehealth sessions?

Do your location(s) currently have videoconference equipment? ☐ Yes ☐ No If no, please proceed to the next question. If yes, please answer the following questions. How is it used by your program? Clinical: Learning: Administrative: How often is it used? What is the level of comfort with the Videoconference technology?
Do you have Specialty Clinics? If yes, please describe:

F: RESEARCH AND EVALUATION

Are you considering implementing research/evaluation activities for this initiative in support of your organizational priorities? **GOALS FOR TELEHEALTH** What are your key organizational goals for Telehealth? (circle those that apply) Access to Care Patient Satisfaction Quality of Care Information Transfer Costs/Economics Efficiency Continuity of Care Capacity Building/Knowledge Exchange and Mobilization Other
How will you know if the implementation of Telehealth is successful?
Timelines (Targeted start date)

G: FINANCIAL

Funding for training of all relevant personnel (e.g. MDs, RN's, ED staff, tech support, DI) ☐ Yes ☐ No ☐ in development

Funding for network if needed ☐ No	☐ Yes
Funding for equipment ☐ No in development	☐ Yes ☐

H: TECHNICAL

Which type of videoconference unit would best suit your needs? ☐ Desktop (computer desktop/laptop with videoconferencing capabilities) ☐ Fixed or mounted (does not move) ☐ Mobile (allows you to move from one room/location to another)
What level of video quality do you require? ☐ Standard definition (appropriate for most types of videoconference calls) ☐ High definition (appropriate for clinical related calls requiring increased Image/video quality – e.g. close up of client when doing a detailed physical assessment)
Do you plan on sharing information/content through videoconferencing? ☐ Yes ☐ No
What type of information/content do you intend on sharing? ☐ Documents /presentations – e.g. PowerPoint, Word, Excel, etc. ☐ Medical patient information – e.g. radiology images, lab results, etc. ☐ All of the above

4.3 CTAC ACUTE TELESTROKE IMPLEMENTATION CHECKLIST

NOTE: *General assumptions that all sites have access to jurisdictional basic telemedicine/telehealth network capabilities*

EQUIPMENT AND NETWORK IMPLEMENTATION:	
V/C EQUIPMENT ORDERED ☐ **Yes** ☐ **No**	
Providing Site (consultant):	**Receiving Site (referring site /patient) :**
Equipment Necessary to Deliver Acute Telestroke • Web based Telehealth access OR Traditional Telehealth equipment	Equipment Necessary to Deliver Acute Telestroke • Web based Telehealth access • OR Traditional Telehealth equipment
POWER/NETWORK (Need secure network to support TH connection) ☐ **Yes** ☐ **No**	

Providing Site (consultant):	**Receiving Site (referring site /patient) :**
Power • One 110VAC 15 AMP grounded power outlets (connected to facility backup power) • Grounded standard 120V 60Hz AC electrical outlets	**Power** • One 110VAC 15 AMP grounded power outlets (connected to facility backup power) • Grounded standard 120V 60Hz AC electrical outlets
Network LAN Network port ☐ **Yes** ☐ **No** Data Port (a minimum of one active data port for video conferencing and if applicable, additional data port for computer etc.)	**Network** LAN Network port ☐ **Yes** ☐ **No** Data Port (a minimum of one active data port for video conferencing and if applicable, additional data port for computer etc.)
V/C EQUIPMENT OPERATIONAL (Follow your v/c equipment testing checklist – if needed see ”**High Level Sample of Equipment Testing”**)	
BRIDGE SITE CERTIFICATION AND TESTING COMPLETED ☐ **Yes** ☐ **No**	
CT IMAGE TRANSMISSION SETUP AND OPERATIONAL (E.G. Confirm availability of CT images from regional site by stroke neurologists) • This process must be completed by the DI team, clinical portfolio and IT prior to initiation of TH acute stroke delivery. • Transmission access is separated of video conference process.	
SUPPORT COVERAGE SCHEDULE/ HELP-DESK IN PLACE ☐ **Yes** ☐ **No**	

(Clearly define process on who is called for CT image access or Telehealth issues)

DOWNTIME PROTOCOL ESTABLISHED ☐ **Yes** ☐ **No**
May need to have one for DI and Telehealth downtime issues. Review Planned and unplanned downtime processes.

ROOM FURNISHINGS AND COSMETICS:

(See **"High Level Sample of Room Furnishings and Cosmetics"** for room furnishing and cosmetics when establishing a dedicated Telehealth suite)

- Be cognizant that lighting can affect your image that is being projected. Recommend that you test from The ED for obvious glare
- Determine where the equipment will be stored
- Determine where the camera will be placed during consult (test to ensure no obvious glare)
- Option: Mark "X" on the floor as a reference for camera placement in the future

Please refer to your organization standards for TH room set up

SERVICE IMPLEMENTATION:

MOCK CONSULTATION COMPLETED (AT EACH HYPERACUTE SITE)
☐ **Yes** ☐ **No**

MOCK CONSULTATION ACTION ITEMS COMPLETED (I.E. STATE OF FULL READINESS ACHIEVED)
☐ **Yes** ☐ **No**

FIRST CONSULT
☐ **Yes** ☐ **No**

EVALUATION DATA COLLECTION PROCESS IN PLACE
☐ **Yes** ☐ **No**

4.4 Telestroke Video Equipment Testing Guide

(Based on PHSA High Level Telehealth Equipment Acceptance Testing Procedures)

Projectors - Number of projectors & Model#
1) Check exterior cabinet for dirt/dust
2) Blow out/clean intake and out take filters
3) Clean exterior optics
4) Check screen H and V size and center image position
5) Check contrast and brightness and focus
6) Electronic alignment/visual check for ghosting & color outlines
7) Check for loose or broken I/O connections
8) Visual check and cables for potential problems
9) Test control panel for al functions
10) Test remote control and check batteries
11) Back up system settings (if applicable)
12) Software or firmware update (if applicable)
13) Log bulb usage hours
14) Check proper Aspect and Resolution settings
Projection Screen - Number of screens
1) Test up and down function (if applicable)
2) Check limits (if applicable)
3) Check alignment (if applicable)
4) Clean screen if necessary
Scalers - Number of scalers-
1) Check screen H and V size and center display position
2) Check contrast and brightness
3) Check for loose or broken I/O connections
4) Visual check of cables for potential problems
5) Test control panel for all functions
6) Clean exterior cabinet
7) Check proper aspect ratio & resolution for screen and Projector
Lighting and Screen Relays - Number of controls-
1) Clean exterior face plates
2) Blow out dust in relays
3) Test control panel for all functions
4) Visually check cables for potential problems
Touch Panel Control System - Number of panels-

Plasma Monitors/LCD - Number of monitors
1) Check screen H and V Size and center display position
2) Check contrast and brightness
3) Electronic alignment (for ghosting and color outlines)
4) Check for loose or broken I/O connections
5) Visual check of cable for potential problems
6) Test control panel for all functions
7) Test remote control and replace batteries
8) Clean exterior cabinet
9) Clean front screen display
10) Log how long monitor has been in use (if applicable)
Interfaces - Number of interfaces
1) Clean exterior
2) Test control panel functions
3) Test to make sure functioning
4) Check for loose or broken I/O connections
5) Visually check cables for potential problems
Creston Control - Number of controls-
1) Test all pages and all buttons
2) Test RF remote control
3) Check for loose or broken I/O connections
4) Visual check of cables for potential problems
5) Clean exterior cabinet
6) Check software version and list here-
7) Back up software
8) Check firmware version and list here-
9) Back up firmware version
Microphones - Number of microphones
1) Clean exterior cabinet
2) Test to make sure working correctly
3) Adjust microphone level for 0 to -3db output to Amp
4) Visually check cables for potential problems
Audio Conference System - Number of systems-
1) Clean exterior cabinet

1) Test all pages and all buttons	2) Test to make sure working correctly
2) Test RF remote control	3) Adjust microphone level
3) Check for loose or broken I/O connections	4) Test control panel for all functions
4) Visual check of cables for potential problems	5) Visually check cables for potential problems
5) Clean exterior cabinet	**Racks -** Number of racks
6) Clean touch screen	1) Clean all panels
7) Check software version and list here-	2) Vacuum dust in the back of rack
8) Back up software	3) Notes:
9) Check firmware version and list here-	**Amplifiers -** Number of amplifiers
10) Back up firmware version	1) Clean exterior
Video Conference System - Number of systems-	2) Test control panel functions
1) Clean exterior cabinet	3) Adjust all input levels
2) Test to make sure working correctly	4) Check for loose or broken I/O connections
3) Adjust microphone level	5) Visually check cables for potential problems
4) Test control panel for all functions	6) Measure audio level with pink noise and record level
5) Visually check cables for potential problems	7) After system off audio default level set to 60-65db
6) Test Compatibility with Health Authority bridge(s) (REV 1)	**CD/DVD Players -** Number of players
VCR's - Number of VCR's	1) Test control panel for all functions
1) Test control panel for all functions	2) Clean internal laser lens
2) Clean VCR heads and adjust tracking	3) Clean exterior cabinet
3) Test remote control and replace batteries	4) Test remote control and replace batteries
4) Check for loose or broken I/O connections	5) Check for loose or broken I/O connections
5) Visual check of cables for potential problems	6) Visual check of cables for potential problems
Satellite/Cable Receivers - Number of receivers	**Speakers -** Number of speakers-
1) Test control panel for all functions	1) Test audio levels same from each speaker
2) Check reception	2) Clean exterior cabinet
3) Clean exterior cabinet	**Audio Processors -** Number of Processors
4) Test remote control and replace batteries	1) Test control panel for all functions
5) Check for loose or broken I/O connections	2) Check software version and list here
6) Visual check of cables for potential problems	3) Back up software
SMART Board - Number of boards	4) Check firmware version and list here
1) Test control panel and mouse functions for all functions	5) BACK UP FIRMWARE VERSION
2) Check alignment SMART board to projector	6) Visual check of cables for potential problems
3) Check each en color to make sure working	**Room Documentation & Software**
4) Check to make sure eraser working	1) Wiring Drawings
5) Check for loose or broken I/O connections	2) Rack Layout
6) Visual check of cables for potential problems	3) Equipment Manuals
	4) Included Equipment software CDs
	5) Crestron Control panel Layouts

4.5 Room Furnishings and Cosmetic Considerations

Table suitability (Color, size, surface type)	
Lighting Type (Reflective, direct, diffused, pot lights, location in room, florescent, incandescent, LED) **Lighting Level:** (500 Lux at participants face) **Lamp type:** (3500 Kelvin lamps with Color Rendering Index of 85) (^Consistent between ON and Sask.) Minimum Kelvin 4100 recommended	
Windows (Brief Description) **Ability to block natural sunlight (or No Windows)** (^Consistent between AB, ON, and BC)	
Wall Surface (Colour, reflectivity - gloss, flat, wallpaper, etc) **Solid, flat finish wall color (tones of blue) or reasonable equivalent.** **Color Options:** • Palette One - Benjamin Moore: Mysterious AF-565 (dark); Amsterdam AF-550 (light) • Palette Two - Benjamin Moore: Silhouette AF-655 (dark); Cinder AF-705 (light) • Palette Three - Benjamin Moore: Flint AF-560 (dark); Storm AF-700 (light) • Palette Four - Benjamin Moore: Montpelier AF-555 (dark); Solitude AF-545 (light) **Or** • Benjamin Moore #HC-152 Whipple Blue (grey/blue) • Canadian Tire Waterproof 788 (grey/blue) • General Paints # 8513+D.2 (medium/blue) Another option is to hang a solid blue curtain for participants to sit in front of. Off-white, suspended acoustical tile ceiling is recommended.	
Current use of room (Meetings, education, training; will this room continue to be used in this fashion; specific requirements for this ongoing use)	
Floor Space (Minimum 10X20 FT) **Room suitability (size)** Ceiling no higher than 10 Ft (9ft recommended) Participants should be able to sit al least 5 to 6 Ft from camera and monitor	
Floor Covering Vinyl / Tile	
Dressing / change room in vicinity/Wheel Chair Access (^Consistent between ON and Sask.)	

Locking door & Privacy or "In Use" sign (^Consistent between ON and Sask.)	
Sink (within reasonable vicinity)	
Heating and Ventilation: (Room temperature 20-24C)	
Security: The space should have a call-bell system for staff or patients to access assistance quickly. Also, working door locks and locking cabinet for Telehealth Equipment if multipurpose room.	
Other comments	
Other devices	

4.6 Mock Telestroke Consultation Plan – Referring Site

#	Activity	Expected Response	Lead	Completed
1	ER staff notified of test stroke patient	ER staff knows when patient will arrive	ER staff	
2	Clinicians locate Acute Stroke Assessment form to identify likely candidates for t-PA.	Telestroke inclusion/exclusion checklist available	ER staff	
3	Clinicians screen patients using Assessment form and determine patient may be a candidate for t-PA	Patient screened	ER staff	
4	ER staff pulls the Telestroke package and Emergency Department Acute Stroke Care Orders are ordered	Telestroke package available	ER staff	
5	Patient sent for a CT scan ('Telestroke' noted on requisition)	CT scan performed	CT technician	
6	CT tech completes study and pushes image to the CT image access system		CT technician	
7	ER staff locate Telestroke Call Centre telephone number	Telestroke Call Centre telephone number available	ER staff	
8	ER staff call Telestroke Call Centre and notify them of a Mock Telestroke consult	Telestroke Call Centre receives telephone call	ER staff & Telestroke Call Centre	
9	Telestroke Call Centre refers to the Telestroke on-call schedule and pages Telestroke Neurologist on-call (Dr. Neurologist on call for mock)	Telestroke Call Centre has correct name and contact information of on-call physician, on-call neurologist receives call/page	Telestroke Call Centre	
10	Neurologist responds to page by calling Telestroke Call Centre and is connected via telephone to a physician at the referring site	Referring site speaks on the telephone to on-call neurologist	Neurologist on call & Telestroke Call Centre	
11	Neurologist accesses the room with the Telestroke system workstation	Neurologist physically located at MERGE/eFilm workstation	Neurologist on call	
12	Neurologist powers up the Telestroke system workstation and logs in		Neurologist on call	
13	Neurologist accesses and reviews CT image of referring site patient on his/her workstation	Image accessed, data fields correct	Neurologist on call	
14	ER staff locate the Tandberg Intern	Tandberg moved from secure, locked location	ER staff	

15	ER staff prepare the Tandberg Intern for possible videoconferencing (location, lighting, etc.)	Tandberg in place for videoconference	ER staff	
16	ER staff plug the Tandberg Intern into both the power source and the network port	Machine works and welcome screen appears	ER staff	
17	Neurologist establishes videoconference connection with referring site Tandberg Intern	Video conference connection established	Neurologist on call & ER staff	
18	Neurologist confirms the video image is clearly displayed	Neurologist can see referring site - image clearly displayed with no packet loss	Neurologist on call	
19	Neurologist asks whether his/her voice is audible to the referring site	Referring site can see and hear neurologist	Neurologist on call	
20	Neurologist successfully controls the camera at the referring site (far end) and can zoom in and out, tilt up and down and pan from side to side	Neurologist can control the camera at the referring site	Neurologist on call	
21	Referring site physician confirms the video image is clearly displayed	Referring site can see neurologist - image clearly displayed with no packet loss	Neurologist on call	
22	Referring site physician asks whether his/her voice is audible to the neurologist	Neurologist can hear referring site	Referring site physician	
TEST PROBLEM RESOLUTION				
23	ER staff identify a test problem and are able to locate the contact information for the Local Telemedicine Service Desk	Local Telemedicine Service Desk telephone number available	ER staff	
AFTER THE CONSULT				
24	Referring Physician completes and faxes Billing Information Form to Neurologist.	Billing Info form available and faxed to neurologist	Referring site physician	

ADAPTED FROM THE ONTARIO TELEMEDICINE NETWORK AND THE ONTARIO STROKE NETWORK, 2013

Section Five:
IMPLEMENTATION OF A TELESTROKE PROGRAM

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5.1 Introduction

This section of the Telestroke Toolkit focuses on the implementation of a Telestroke program. This Section will assist in planning and preparation for activation of a new Telestroke program along any stage of the continuum of care, and once readiness and commitment by an organization has been confirmed and the technical infrastructure operational.

Implementation requires a well organized, approach that includes all stakeholders who are engaged in the Telestroke road map *(Section One, Page 10)* that will ensure success and confidence to be able to "go live" as a Telestroke program. Included in this section are key tools that can be utilized to facilitate and guide the implementation planning and preparation for launch of a Telestroke program. Tools include: a Telestroke Roadmap which outlines key requirements related to Telestroke service, Clinical Readiness, governance, technology and telehealth planning. Clinical Checklists which detail key components of both scheduled and on-demand Telestroke services are included and should be used as guides to confirm all key elements are in place. The Telestroke Clinical Workflow Map outlines the various steps in Emergency Department acute stroke management. The Telestroke ED Protocol is a detailed example of the steps of acute stroke management using Telestroke. A Telestroke Education plan is a sample developed to assist the key individuals/champions in the ED overseeing the implementation of Telestroke and provides an indication of the breadth of education and the steps required. *Similar educational tools for scheduled Telestroke consultations are in development and will be added to the toolkit as they become available*. Telestroke Training Case study is provided to also support education

activities for clinicians. A Mock Consult plan has been provided that can be used to consolidate planning and education for the Telestroke program, and help identify areas requiring further attention prior to the launch of the program.

This section of the toolkit also includes sample templates on topics such as new site eligibility screening and a new site readiness template that can be adapted to reflect the local organization and used as a component of identification of new Telestroke sites. These templates have been provided by established Telestroke programs across Canada, and we encourage all users of this toolkit to submit the tools, educational materials and other resources developed for Telestroke so this toolkit can continue to be enhanced. Kindly submit all resources you wish to share to strokebestpractices@heartandstroke.ca

5.2 CTAC Telestroke Program Roadmap

Refer to page 10

5.3 CTAC Checklist

Refer to page 30

Section Six: CREATING A TELESTROKE PROGRAM: EVALUATION OF TELESTROKE SERVICES

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6.1 Introduction

Telestroke modalities are a Telestroke Call Centre component of comprehensive stroke programs to enable equitable access to stroke expertise across the continuum of care and across geographic regions. An economic cost-avoidance analysis of Canadian stroke care delivery demonstrated significant savings to the healthcare system by implementing Telestroke services (Krueger et al, Stroke, 2011). In Canada, there remain considerable variations in access to stroke services and in the uptake and implementation of Telestroke. Therefore, a key step for all stroke and Telestroke programs is to establish an evaluation strategy during the development phase, and carry it through implementation. The data collected through evaluation should be used to inform opportunities for ongoing improvement and decision-making regarding continued and expanded investments in Telestroke and program sustainability.

Evaluation strategies for Telestroke should include all stages along the continuum of care and address structure, process and outcomes, as outlined in our *CTAC 2013 Telestroke Framework*. Within these strategic domains the following quality dimensions should be measured for each application of Telestroke along the continuum of care:

Accessibility – extent to which patients who should get access to stroke expertise are actually receiving that access, as well as wait times, need for transfers to more advanced level of care

Effectiveness – the impact of access to specialized stroke services through Telestroke on patient outcomes, complications, length of stay, readmissions, and recurrent stroke

Efficiency – cost savings, streamlining of care, timely availability of Telestroke services on demand

System Integration and Continuity – extent to which the continuity of care for patients is preserved with the use of Telestroke technology as part of their episode of care, and extent to which transitions are seamless, and follow-up care and providers clearly defined

Patient Experience- patients perceptions of the Telestroke encounter

Provider Experience – healthcare provider perceptions of the Telestroke encounter, their educational preparation and competency level to participate in Telestroke

Technical efficiency and responsiveness – the extent that the technology is functioning without incident or technical difficulties that could negatively impact and of the above dimensions of quality

6.2 CTAC Core Performance Measures for Telestroke

The CTAC core performance indicators for Telestroke were developed through a rigorous consensus process, including a series of Delphi surveys through the Canadian Stroke Quality of Care Study (Lindsay, Silver, Jaigobin, Watson; 2006). These core indicators continue to be reviewed and revised as part of the bi-annual review and update of the Telestroke chapter of the Canadian Best Practice Recommendations for Stroke Care. A full data dictionary data collection, calculation and reporting of these indicators can be found in *the Canadian Stroke Quality Performance Measurement Manual* at www.strokebestpractices.ca

Component 1: Organization of Telestroke Care Delivery	
1.	For remote, designated Telestroke hospitals without neurologists or stroke specialists on site, if CT/MRI technology is available, processes and technology should be implemented to support remote neurological assessment of patients with acute ischemic stroke using Telestroke. Are each of the following processes in place and actively used (Y/N for each): a. a coordinated mechanism for rapid access to remote stroke expertise 24 hours pe day and seven days per week b. a means of transmitting CT/MRI images c. a means of establishing 2-way videoconferencing d. a means for ongoing access to stroke specialist for ongoing advice regarding patient treatment and management as required
2.	Referring and consulting hospitals require harmonized clinical protocols to support assessment and management of acute stroke patients. Are the following Harmonized protocols in place between referring and consulting sites (Y/N for each): a. Inclusion and exclusion criteria for administration of t-PA (in accordance with published NINDS protocols) [17] b. Blood pressure control prior to and following t-PA administration c. Neurological monitoring following t-PA administration d. Management of patients with intracerebral hemorrhage post t-PA

3.	Percentage 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.
4.	Percentage of Telestroke cases where an urgent follow-up is required with the Stroke specialist due to complication or unexpected event.
5.	For Telestroke cases requiring additional consults with the stroke specialist, the time from the first consult to subsequent consults (Hours: minutes).
6.	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
7.	Percentage of patients managed with Telestroke where the Telestroke consultant's note is found in the patient's chart.
Component 2: Emergent Evaluation of Acute Ischemic Stroke	
8.	Percentage of Telestroke referrals where stroke specialists were inaccessible due to: a. multiple conflicting calls (Telestroke and other) b technical difficulties preventing video-transmission
9.	Percentage of Telestroke consults initiated within 30 minutes of ED arrival for all potentially t-PA eligible patients who present to designated Telestroke hospitals with suspected acute ischemic stroke within four hours of symptom onset.
10.	Percentage of Telestroke consults where the stroke specialist is able to view the CT/MRI within 15 minutes of requesting it.
11.	Percentage of Telestroke consults where the stroke specialist is able to make a videoconferencing connection with the designated Telestroke ED within 15 minutes of initial contact by the central referral system.
12.	Time to initiation of Telestroke consult a. from arrival in ED. b. from CT scan completion.
13.	Median time from patient arrival in ED at the referring centre to start of CT scan.
14.	Percentage of patients undergoing brain imaging at the referring site where CTA is completed with initial CT scan.
Component 3: Management of Patients Receiving Thrombolytic Therapy	
15.	Percentage of acute Telestroke patient consults who are treated with tPA.

16.	a. Median time from arrival in ED to t-PA administration. **b.** Median time from Telestroke consult initiation to administration of tPA
17.	Percentage of Telestroke patient consults who are transferred to a comprehensive stroke centre for acute endovascular treatment.
18.	Percentage of Telestroke consults that have an absolute contraindication for t-PA.
19.	For all Telestroke patients who receive t-PA: a. Percentage of cases with repeat CT/MRI imaging done at 24-72 hours b. Percentage of cases with repeat CT/MRI imaging done at 24-72 hours that are made available to the stroke specialist.
20.	For all Telestroke patients who receive t-PA, ppercentage of cases with a follow-up between the consulting site and the stroke specialist.
Component 4: Outcomes following a Telestroke Consultation	
21.	Percentage of patients transferred to the regional/enhanced district stroke centre due to deterioration post t-PA requiring neurological or neurosurgical care not available at designated Telestroke hospital.
22.	Total length of stay for patients who received thrombolysis through a Telestroke consult from time of triage in the emergency department until discharge from inpatient care at the Telestroke site.
23.	Median Rankin and NIHSS scores at discharge for all patients who received a Telestroke consult (whether or not t-PA was given).
24.	Percentage of stroke patients with and without a Telestroke consults who died in the ED or during their inpatient stay following admission for stroke at: a. the Telestroke site for patients who remain at the Telestroke site b. the comprehensive centre for patients transferred after Telestroke consult.
25.	Percentage of patients with a Telestroke consult discharged to: a. their place of residence prior to stroke, b. inpatient rehabilitation c. a long-term care facility.
26.	Proportion of stroke patients who received a Telestroke consult who experienced at least one of the following complications during their ED or inpatient stay (both t-PA and non-tPA patients): a. symptomatic secondary intracerebral hemorrhage (tPA cases) b. Intracerebral hemorrhage or other hemorrhage (all cases) c. Recurrent stroke d. Systemic complications of UTI, DVT, and/or pneumonia (recorded individually)
27.	Number of patients in a hospital/region receiving t-PA before and after Telestroke program initiated.
Component 5: Organization of Telestroke Services for <u>Ongoing</u> Stroke Assessment and Management	

28.	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).
29.	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).
30.	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.

Section SEVEN: TELESTROKE RESOURCES AND CONTACTS

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7.1 Introduction

The Canadian Telestroke Action Collaborative has brought together recognized leaders in Telestroke and telemedicine from across the country to develop this implementation toolkit. The Telestroke Summit, held in New Brunswick in May 2013, expanded this group to include a wide range of stakeholders at all levels of involvement, including funders and system leaders, healthcare administrators, physicians, nurses, rehabilitation specialists and technical experts.

The Canadian Telestroke Action Collaborative will continue to grow and include more front-line stroke care professionals, patients and families. Part of the commitment made by Summit participants was to openly distribute information relating to Telestroke approaches, protocols, methods and documentation to support colleagues in other centres who are in the pre-planning, planning and early implementation stages of Telestroke program development within their own jurisdictions.

CALL TO

The CTAC collaborative members consider this toolkit a living document and we invite all groups who are engaged in Telestroke activities across the continuum to submit their tools, educational materials and other resources developed for Telestroke so this toolkit may continue to be enhanced.
Kindly submit all resources you wish to share to

strokebestpractices@heartandstroke.ca

7.2 Telemedicine Advocacy, Research and Service Organizations in Canada

Organization Name	Website Address
Canadian Association for Drugs and Technologies in Health	http://www.cadth.ca/
Canada Health Infoway	https://www.infoway-inforoute.ca/
Ontario Telemedicine Network	http://otn.ca/en
Alberta Telehealth Network	http://www.health.alberta.ca/initiatives/telehealth.html
International Association of Telemedicine and eHealth	http://www.isfteh.org/

7.3 Canadian Telestroke Action Collaborative Core Members 2013

MEMBER	PROFESSIONAL ROLE	LOCATION
Taralson, Colleen Co-Chair	Stroke Services Coordinator (Edmonton and Area), Alberta Health Services; Alberta Provincial Stroke Strategy	Alberta
Lindsay, Patrice Co-Chair	Director, Best Practices and Performance, Stroke, Heart and Stroke Foundation; Registered Nurse; Adjunct Faculty, Institute of Health Policy, Management and Evaluation, University of Toronto	Ontario
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