Canadian Stroke Strategy

Canadian Best Practice Recommendations for Stroke Care

Update 2010
# Canadian Best Practice Recommendations for Stroke Care (Update 2010)

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The Canadian Stroke Strategy gratefully acknowledges the task group leaders and members, the consensus panel, and the external reviewers, all of who volunteered their time and expertise to this project. We thank the Canadian Stroke Strategy Information and Evaluation Working Group for its work in updating and confirming the performance measures that accompany each recommendation. Finally, we thank Gail Williams for providing her professional expertise in editing this document.

Funding

The development of these Canadian stroke care guidelines is funded in its entirety by the Canadian Stroke Strategy, a joint initiative of the Canadian Stroke Network and the Heart and Stroke Foundation of Canada. The Canadian Stroke Strategy is funded primarily by the Canadian Stroke Network, which is in turn funded by the Networks of Centres of Excellence program.

No funds for the development of these guidelines come from commercial interests, including pharmaceutical companies.

Citing this Document


Comments

The CSS invites comments, suggestions, and inquiries on the development and application of the Canadian Best Practice Recommendations for Stroke Care (2010). Please forward comments to the Canadian Stroke Network’s Performance and Standards office at bestpractices@canadianstrokenetwork.ca
Executive Summary: What’s New for 2010?

The Canadian Stroke Strategy first issued evidence-based Canadian Best Practice Recommendations for Stroke Care in 2006. Updated every two years, the recommendations are intended to help reduce practice variations and close the gaps between evidence and practice.

The 2010 content update focuses on

- Continuity: Helping people move smoothly through the stroke continuum, from symptom onset to diagnosis, treatment, management, and recovery.

First and most important, the purpose of each update is to ensure that the best practice recommendations continue to reflect contemporary stroke research evidence and expert opinion. Each update involves critical review of the medical literature, which informs decisions regarding modification of the recommendations and the performance measures used to assess the impact of the recommendations. Every attempt is made to coordinate with other Canadian groups who are developing guidelines that relate to stroke, such as hypertension, atrial fibrillation and diabetes.

For 2010 the SCORE (Stroke Canada Optimization of Rehabilitation through Evidence) recommendations for upper and lower limb have been integrated within the Canadian Best Practice Recommendations for Stroke Care. Also new for 2010 is a section on transitions of care to help patients, families, and caregivers access the right type of care in the right settings at the right time. To facilitate uptake of the best practice recommendations by front-line clinicians, the best practice recommendations also include a new section on information about implementation resources.

Transitions of care

When it comes to stroke, time is brain! Access to and continuity of care both have a dramatic impact on outcome and quality of life. The best practice recommendations address the need to make the public more aware of the signs of stroke, risk factors for stroke, and the importance of seeking medical attention immediately after stroke onset. Updated and new recommendations related to transitions of care include:

- Outpatient management of transient ischemic attack and non-disabling stroke
- Supporting patients, families and caregivers through transitions
- Patient and family education
- Interprofessional communication
- Discharge planning
- Early supported discharge
- Community reintegration following stroke
- Use of telestroke technology in stroke management
- End-of-life and palliative care

Other significant changes for 2010

- Atrial fibrillation and carotid endarterectomy recommendations were revised to address the findings of two recently published clinical trials (RE-LY and CREST), which have important implications for stroke prevention.
Intracranial hemorrhage and subarachnoid hemorrhage recommendations were revised and expanded to address immediate assessment and management of these patients.

New recommendations on fall prevention to address an important patient safety issue.

Implementation Resources
The best recommendations in the world are useless if they aren't implemented. The Canadian Stroke Strategy considers implementation — as well as evaluation of the impact of the recommendations — as important as the development process itself. A range of implementation resources has been developed in collaboration with partners and stakeholders. The topics for these resources were identified through a prioritization process during the 2008 Best Practices Expert Consensus Panel. These resources are intended for patients and families, front-line clinicians, managers, decision-makers and funders. They include:

- An Emergency Medical Services template for assessing suspected stroke, and an educational workshop on assessment, initial decision-making, and transportation considerations
- A guide to developing and enhancing acute care and rehabilitation stroke units
- Stroke Secondary Prevention Toolkit
- A Patient and Family Guide for the stroke best practice recommendations
- Two educational programs for stroke nurses: Stroke Patient Management and Advanced Practice in Stroke Nursing
- Slide decks for each section of the best practice recommendations.
- Hyperlinking of each section of the guidelines to available electronic resources and implementation tools, such as StrokEngine and the Stroke Rehabilitation Evidence-Based Review.

Appendix 9 provides a list of implementation resources and links to access them.

Evaluation
Performance measures and outcome tools that evaluate the impact of the implementation of the recommendations are unique components of the Canadian Best Practice Recommendations for Stroke Care. For 2010, each performance measure was reviewed and updated if necessary, and new performance measures were developed for the new recommendations in parallel to the recommendation update process. Following consultation with the Canadian Stroke Strategy, the Canadian Institute for Health Information now has built capacity for organizations to collect data on five key stroke care performance indicators when a stroke patient is discharged from the emergency department or inpatient care.

Other evaluation tools include:
- A Stroke Services Distinction accreditation program in partnership with Accreditation Canada
- An updated performance measurement manual and data dictionary
- Updates to the Canadian Stroke Strategy’s 22 core indicators – Refer to Appendix 8 for more information.
- An electronic audit program to enable core indicator data collection originally created through the Registry of the Canadian Stroke Network and adapted for use in the 2010 Canadian Stroke Audit.
- Data collection templates and tools to improve data quality.

Time is brain. Don’t waste either one.
PART ONE: BACKGROUND and METHODOLOGY

1.0 OVERVIEW

1.1 INTRODUCTION
The Canadian Stroke Strategy (CSS) was established by the Canadian Stroke Network and the Heart and Stroke Foundation of Canada to reduce the burden of stroke by closing the gap between knowledge and practice in stroke management.

Why is better stroke management important?
- Every year, approximately 50,000 strokes and transient ischemic attacks are treated in Canadian hospitals. Moreover, it is estimated that for each symptomatic stroke, there are nine “silent” strokes that result in cognitive impairment.
- Stroke and other cerebrovascular diseases are the third leading cause of death in Canada.
- Stroke is the leading cause of adult disability, with some 300,000 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.

The CSS brings together 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. Its goal is to enhance access to integrated, high-quality, and efficient stroke services for all Canadians, and to contribute to innovative health system reform in Canada and internationally.

There is sound evidence showing what can be done to optimize stroke prevention and care, and compelling results from those who have adopted best practices in organizing and delivering stroke care. By monitoring performance, the impact can be assessed and further action taken. The Canadian Best Practice Recommendations for Stroke Care are presented within this continuous improvement context 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.

The CSS provides a framework to drive system improvement and facilitate the adoption of evidence-based best practices in stroke across the continuum of care. Within this framework, the CSS has established platforms for action and working groups that focus at three levels:
- Nationally to address priority initiatives and support provincial and territorial work through coordination, content development, and communication. Work at this level also includes collaboration and alignment with national agencies and other disease strategies.
- Provincially or territorially to help shape health system planning, funding, and structural change.
Regionally and/or locally to support the implementation of best practices in stroke at the front lines of healthcare.

The goal of the CSS’s best practices and standards platform is to transform stroke prevention and care by ensuring that evidence-based best practices are widely disseminated and used in the Canadian healthcare system. The Best Practices and Standards Working Group (see Appendix 1 for membership list) engages a broad range of contributors through consensus-building initiatives to develop, disseminate, and support uptake of evidence-based best practices, standards, and guidelines.

The Canadian Best Practice Recommendations for Stroke Care, originally released in 2006, is updated every two years to ensure that it is current and coordinated with other similar initiatives nationally and internationally, and that it reflects best practice evidence and stroke management priorities. The CSS aligns its performance measurement and professional development initiatives with the best practice recommendations to enhance recommendation uptake and implementation, and to monitor the impact on patient care and outcomes.

1.2 Scope and Target Audiences

The Canadian Best Practice Recommendations for Stroke Care (Update 2010) presents high-quality, evidence-based stroke care recommendations in a standardized framework to support healthcare professionals in all disciplines. Implementation of these recommendations is expected to contribute to reducing practice variations and closing the gaps between evidence and practice.

Scope: This document provides a synthesis of best practices in stroke care across the continuum from stroke symptom onset to community reintegration and long-term adaptation, and includes stroke care for acute ischemic stroke, transient ischemic attack, subarachnoid hemorrhage, and intracerebral hemorrhage. The recommendations reflect areas of stroke care with the highest levels of available research evidence (Class I, Level A), and those areas that are considered key system drivers of stroke care in Canada (Class I and Class II, Levels A to C). They cover stroke management, management of risk factors such as hypertension and dyslipidemia, and co-morbid conditions such as carotid stenosis, diabetes, and atrial fibrillation.

In this document, the “continuum of stroke care” is defined as including:

- primary prevention, health promotion, and public awareness
- hyperacute stroke management
- acute stroke management
- stroke rehabilitation
- prevention of stroke recurrence (secondary prevention)
- community reintegration
- long-term recovery and adaptation

Target audiences: 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 primary focus is front-line healthcare professionals from a range of disciplines, including primary care practitioners, neurologists, internists, emergentologists, nurses, physiatrists, physical therapists,
occupational therapists, speech-language pathologists, social workers, dieticians, pharmacists, psychologists, and other disciplines and support staff who provide direct care to stroke patients.

The CSS recognizes that human, financial, and system resource limitations make it difficult to implement everything in this document. However, the recommendations and performance measures are presented as "gold standard" benchmarks toward which all organizations and systems should strive. Additionally, they can be valuable tools and information sources for anyone advocating for improved stroke care services.

1.3 **Updates and Revisions**

The Canadian Stroke Strategy conducts a formal review and update of the best practice recommendations every two years. Previous editions of the *Canadian Best Practice Recommendations for Stroke Care* were released in 2006 and 2008. The 2010 update was prepared between September 2009 and September 2010.

When new evidence emerges after publication that alters an existing recommendation, the CSS releases an interim bulletin that outlines the required amendment(s). These bulletins are incorporated into the subsequent update as applicable.

The stroke recommendation development process is guided by a set of core principles that state that the recommendations must be:

- supported by the highest levels of evidence and/or be considered essential to delivering high-quality stroke care
- integral to driving health system change
- aligned with other stroke-related Canadian best practice recommendations, e.g., the management of hypertension, diabetes, and dyslipidemia
- reflective, in their totality, of the continuum of stroke care

1.4 **Context**

The recommendations in this document are better seen as guidelines rather than rigid rules. They are not meant to supplant clinical judgment and consideration of unique patient circumstances.

Every attempt has been made to keep these recommendations up to date; however, given the rapid evolution of stroke research, late-breaking evidence may not be reflected. For this update, the literature review completion date was June 30, 2010.

It was not feasible to present the expert panel with all available evidence, and therefore the primary evidence was initially screened and evaluated by the task groups. Wherever possible, late-breaking evidence was reviewed by the task group leaders to identify areas where the current recommendations might be significantly altered.

1.5 **Organization of Stroke Services in Canada**

Within the Canadian healthcare system, there are generally three types of facilities that provide stroke services. The CSS categorizes these as comprehensive stroke centres, centres providing intermediate stroke services, and centres lacking specialized stroke resources.

*Comprehensive stroke centres* have specialized resources and personnel available 24 hours a day, 365 days a year to assess and manage stroke patients. These facilities have established written stroke protocols for
emergency services; in-hospital acute care and rehabilitation; the ability to offer thrombolytic therapy to suitable ischemic stroke patients; timely neurovascular imaging and expert interpretation; and coordinated processes for patient transition to ongoing rehabilitation, secondary prevention, and community reintegration services. Comprehensive stroke centres have neurosurgical facilities and interventional radiology services, and play a leadership role in establishing partnerships with other hospitals to support stroke services. As a rule, comprehensive stroke centres also have a performance measurement system in place to monitor the quality of stroke care and patient outcomes.

Centres providing intermediate stroke services are staffed with on-site clinicians who have stroke expertise. These centres have written stroke protocols for emergency services, acute care and/or rehabilitation; the ability to offer thrombolytic therapy to suitable ischemic stroke patients or protocols to transfer appropriate patients to a comprehensive stroke centre; timely neurovascular imaging and timely access to expert interpretation on-site or through the use of telemedicine technology; and coordinated processes for patient transition to ongoing rehabilitation and secondary prevention services. Centres providing intermediate stroke services may use telemedicine technology to access stroke expertise from a comprehensive stroke centre to support early management of acute stroke patients.

Centres lacking specialized stroke resources do not have in-facility resources such as clinicians with stroke expertise or neuroimaging. It is important that these centres establish written agreements for timely transfer of stroke patients to centres with higher levels of stroke care. A glossary of terms and definitions can be found in Appendix 5.

2.0 METHODS

2.1 STROKE GUIDELINE DEVELOPMENT FRAMEWORK
The conceptual framework used to guide the identification, selection, development and updating of the Canadian best practice recommendations is the Practice Guideline Evaluation and Adaptation Cycle of Graham and colleagues. This cycle involves the following steps:

1. Establishing an interprofessional guideline development team
2. Establishing a guideline appraisal process using a validated tool
3. Systematic searching for existing practice guidelines
4. Appraising the quality, currency, and content of guideline recommendations
5. Adopting or adapting guidelines for local use
6. Obtaining external expert feedback on the proposed recommendations
7. Selecting final recommendations
8. Obtaining official endorsement
9. Establishing an ongoing review and update process

The methodology for the first edition of the Canadian Best Practice Recommendations for Stroke Care (2006) was based on this framework, and it is applied, with some enhancements, to develop each update.

The rest of section 2 outlines the key activities undertaken in the development process.

2.2 LEADERSHIP AND PARTICIPANTS
The CSS Best Practices and Standards Working Group has overall responsibility for the development and update process. The 2010 update cycle was led by a subgroup of the working group and managed by the Director of Performance and Standards at the Canadian Stroke Network.

An interprofessional group of experts in stroke care participated in topic-specific task groups convened to review, draft, and revise recommendation statements for their topic. Recognized experts within the topic area chaired each task group, and members included stroke neurologists, physiatrists, nurses, emergency physicians, paramedics, physical therapists, occupational therapists, dietitians, speech-language pathologists, pharmacists, stroke survivors, education experts, and professionals from other disciplines as required. This interprofessional approach ensured that all relevant health disciplines for a particular topic area were represented in the development of the recommendations.

A national interprofessional consensus panel was convened to provide further input into the recommendations, and a final review was conducted by an external group of stroke and methods experts before release.

2.2.1 Conflict of Interest: Participants in the development and review process are required to sign confidentiality agreements and to declare all potential conflicts of interest in writing. Only four out of 143 participants declared a minor conflict such as receipt of honoraria to speak about stroke in other venues. None of these conflicts were deemed to prevent unbiased participation in the process. The recommendations were approved following a rigorous development process and through a consensus of independent experts and stakeholders, thereby minimizing the potential influence of any one participant.

The views and interests of the funding body have not influenced the final recommendations.

2.3 Collaborations and Alignment
A guiding principle of the development process is the importance of collaboration with other professional groups that produce stroke-related guidelines in Canada. The goal is three-fold: to increase cross-sector participation on guideline development initiatives in Canada, to ensure consistent recommendations are available in Canada, and to reduce duplication of effort.

Where Canadian guidelines for specific components of stroke care already exist (for example, diabetes management, hypertension, and primary prevention of stroke in patients with atrial fibrillation), the recommendations in those documents are not repeated here. Rather, readers are referred to those original documents for the specific recommendation, while the Canadian Best Practice Recommendations for Stroke Care addresses related structural and process issues for those components.

Current guideline collaborations include Hypertension Canada (Canadian Hypertension Education Program), the Canadian Cardiovascular Society, the Canadian Diabetes Association, the Canadian Stroke Consortium, the Emergency Medical Services Chiefs of Canada, Paramedics Association of Canada, National Stroke Nursing Council, Accreditation Canada, Canadian Institute for Health Information, and the Public Health Agency of Canada.

2.4 Identification of Key Topic Areas and Core Reference Guidelines
The process used to identify key topic areas and core reference guidelines is outlined below.

1. An ongoing structured literature review is conducted every two to three months to monitor emerging evidence and new or updated stroke-related guidelines.
Scans of the primary research literature focused on meta-analyses, systematic reviews, randomized trials, quasi-experimental studies, other related guidelines and reports, and Canadian consensus statements by healthcare professional groups.

3. The strength of the research evidence was graded using a standardized grading system (See Appendix 6). In some areas, the levels of evidence for a given topic varied among selected guidelines or research papers depending on the nature of the research. The totality of the information for each topic provided a comprehensive understanding of the strength of the evidence, the state of the research, and gaps for future inquiry.

4. A detailed literature search for international stroke-related guidelines was also undertaken. The Appraisal of Guidelines Research and Evaluation (AGREE) tool was applied to determine the quality of the guidelines. This tool can be used to assess the process of guideline development based on six domains: identification of a clinical area to promote best practice, stakeholder involvement, rigour of development, clarity and presentation, applicability, and editorial independence. Based on the results of the appraisals, several guidelines met our criteria to be considered as ‘reference guidelines’ for the our development process.

5. Once the high-quality guidelines were identified, a content review was conducted to identify a list of stroke topic areas that were supported by the highest levels of evidence. A secondary list of topic areas with lower levels of supporting evidence but considered being key system drivers (such as acute diagnostic imaging with computed tomography scans) was also compiled.

6. Potential topics that emerged from the research and guideline review were compiled into a “Topic Matrix” to allow easy comparison by topic and strength of evidence.

7. The topic areas and levels of supporting evidence were reviewed and debated by the Working Group. Using a consensus model, a final list of stroke topic areas that were considered most relevant to optimal stroke care in Canada was developed.

8. Topic areas were assigned to one of eight task groups to develop detailed recommendation statements.

Refer to Appendix 6 for the evidence grading system used.
Refer to Appendix 7 for a list of guidelines and significant research trials that were considered during the 2010 update process.

2.5 SYNTHESIS OF BEST PRACTICE RECOMMENDATIONS

Expert task groups (refer to Appendix 2 for a list of task group members) were convened for each segment of the continuum of stroke care, to select relevant recommendations arising from the evidence review and if necessary draft new recommendations based on emerging evidence. Task groups were instructed that recommendations could address structure and/or processes of care at either the system level or the patient level, and that they could be (i) taken directly from other existing guidelines, (ii) adapted from one or more guidelines, or (iii) written by the task group. Appropriate references were to accompany all recommendation statements derived from evidence or existing guidelines.

For the 2010 update, each task group participated in a series of teleconferences between May 2009 and February 2010 to complete their research reviews and develop the recommendations. The Director of Performance and Standards at the CSN participated in all teleconferences to ensure consistency, standardization, and rigour of development across task groups.

The task groups for each topic area:
• Reviewed the results of the structured literature reviews and the primary evidence for each stroke topic area
• Reviewed content from other guidelines
• Considered additional topics that had high levels of supporting evidence but that did not appear on the original topic list
• Wrote the first draft of the recommendations for their topic area
• Provided references for each recommendation
• Developed a rationale and system implications for each recommendation, showing its relevance to stroke care and the possible impact of implementing the recommendation
• Summarized the primary research evidence underpinning the recommendations
• Submitted their work to the CSS Best Practices Working Group for initial review and comment.

2.6 FORMAT OF BEST PRACTICE RECOMMENDATIONS
Each recommendation consists of a number of pieces of significant information, presented as follows.

• The best practice recommendation describes the recommended practice and provides specific direction for front-line staff and caregivers for delivering optimal stroke care.
• The rationale summarizes the importance and the potential impact of implementing the recommendation and states its relevance to stroke care delivery or patient outcomes.
• The system implications provide information on the mechanisms and structures that need to be in place if health systems, facilities, front-line staff, and caregivers are to effectively implement the recommendation (see 2.6.1 for details).
• The performance measures provide managers and administrators with a standardized and validated mechanism to consistently monitor the quality of stroke care and the impact of implementing the best practice recommendation. The most significant performance measures are highlighted in bold type. The others, while also important, are for those able to conduct a more extensive stroke practice evaluation.

Performance measures that are part of the CSS core indicator set are indicated by the notation (core) following the indicator statement. Refer to Appendix 8 for a full list of core indicators.
• The implementation resources and knowledge transfer tools provide links to tools developed or recognized by the Canadian Stroke Strategy and/or their partners and collaborators. These resources include "how-to" guides, educational materials for healthcare professionals and patients. This section also identifies patient assessment and outcome measurement tools that have been found through consensus to be valid, reliable and relevant to stroke populations.
• The summary of the evidence summarizes the most compelling and strongest evidence available as of September 30, 2010 related to the recommendation.

2.6.1 System Implication Categories: Each recommendation is accompanied by system implications. These are actions and mechanisms that are needed for high-functioning systems of stroke care, and that require leadership and/or coordination at the regional or provincial or territorial level. The system implications fall into four broad categories.

First, and central to effective awareness and prevention strategies as well as stroke recovery support, is the need for community-wide efforts. This could include collaborations among non-profit organizations such as the Heart and Stroke Foundation and the YM/YWCA, municipal departments of health and
recreation, expanded roles for community-based healthcare professionals such as pharmacists, and trained volunteers such as those providing peer-to-peer support.

Second is the need for engagement and effective partnerships in the organization and delivery of stroke care across the continuum. This would include collaboration in the development and administration of referral and transfer agreements, stroke care protocols, and communication mechanisms. There should be plans and mechanisms in place to effectively respond to the needs of stroke patients no matter where they live.

Third is the importance of education. This includes professional development for healthcare providers managing patients across the continuum of stroke care as well as education for patients, family members, caregivers, and the community-at-large. Education includes information about stroke and the development of skills and expertise in caring for stroke patients.

Fourth is a strong commitment to continuous performance improvement at all levels of the healthcare system. This requires measurement and monitoring strategies that includes surveillance and monitoring front-line service delivery at national, provincial or territorial, and regional levels.

Responsibility rests with provincial and territorial governments and regional health authorities to ensure all Canadians have access to the best possible stroke care, and to provide the resources necessary to implement and sustain effective evidence-based healthcare services and monitoring strategies for stroke.

### 2.7 PERFORMANCE MEASURES DEVELOPMENT

The CSS Information and Evaluation Working Group (see Appendix 1 for a list of members) was established to develop a framework to measure the quality and consistency of stroke care delivery across the continuum. Members of the working group include experts in measurement and evaluation as well as frontline clinicians with additional training in this area.

As part of its mandate, the Information and Evaluation Working Group developed a set of performance measures for each final recommendation, to monitor the impact of implementing the recommendation on the quality of patient care and/or patient outcomes. The working group also developed accompanying Measurement Notes that identify potential data sources, methods to enhance data collection, challenges to data access, and data quality issues.

The performance measures that support the best practice recommendations are based on the CSS core performance measures for stroke established at a CSS performance measurement consensus conference in 2005 and updated in 2010. Along with the core performance measures, additional measures for each recommendation were developed and validated as necessary to address the full scope of the recommendation.

As a supplement to the best practice recommendations, the Information and Evaluation Working Group created the comprehensive *Canadian Stroke Strategy Performance Measurement Manual*. It includes all performance measures from the best practice recommendations, and shows detailed definitions and calculation formulas. The *CSS Performance Measurement Manual* is for those who would like to conduct a more in-depth evaluation of the implementation and outcomes for specific recommendations. It contributes to increased consistency and standardization of measuring stroke care performance across Canada, and allows for cross-group comparisons and the development of validated national benchmarks. Benchmarks are currently available for a limited number of stroke performance measures, and several
For every best practice recommendation that is implemented, a system for monitoring and measuring its impact must be in place at the local and regional level. The CSS collaborated with research investigators from the Canadian Stroke Network to developed audit tools and data collection mechanisms that are available nationally to support the collection of vital stroke data. In addition, through a partnership with the Canadian Institute for Health Information, a special project has been created to collect data for five of the core indicators as part of routine abstraction of all emergency department and inpatient charts by the hospital. All organizations are encouraged to take part in this project. Additional information can be found in the CSS Performance Measurement Manual.

As with the implementation of the best practice recommendations themselves, it is not expected that users will be able to collect data for all of the performance measures. Therefore, the most significant measures are highlighted in bold type for easy identification. The remaining measures are provided for those who are able to conduct a more extensive evaluation of stroke practices in their region.

### 2.8 National Expert Consensus Process

Following completion of the task group work, the draft recommendations and supporting information were presented for discussion and decision-making to a broad group of stakeholders at a national expert consensus meeting held in Toronto, Ontario in April, 2010 (see Appendix 3 for a list of consensus participants). Consensus participants included the Best Practices Working Group, the chairs of each task group, and invited opinion leaders, stroke survivors, and healthcare professionals external to the development process. The selection of consensus participants was based on ensuring representation from stroke-related health professional disciplines, all sectors of the healthcare continuum, all provinces in Canada, and rural and urban work environments.

The meeting was attended by 58 of the 63 invited participants. The objectives of the 2010 consensus meeting were to:

- Discuss and where necessary modify proposed updates to existing recommendations
- Discuss potential new recommendations or other amendments
- Vote and reach consensus on all recommendations proposed for 2010
- Discuss ongoing implementation strategies
- Conduct a strategic planning exercise to explore capacity and mechanisms to monitor best practice implementation and impact.

Consensus participants received the draft recommendations, including proposed changes to existing recommendations as well as new recommendations, in advance of the consensus meeting. They were asked to review the information, provide feedback to the Working Group prior to the meeting, and indicate their degree of support for each recommendation.

For the first part of the meeting, discussion and debate took place concerning the relevance, current evidence and practice, and barriers to uptake and implementation for each proposed recommendation. Votes were taken after each topic area discussion, with the following results:

- 31 of the 35 proposed recommendations were approved as they were presented or with minor revisions and edits.
- Two recommendations were deferred pending further investigation and revision by the respective task
groups (atrial fibrillation and carotid intervention). These were revised and then reviewed electronically by the consensus participants, and both were accepted.

- Two sets of recommendations from the original Stroke Care Optimization of Rehabilitation through Evidence (SCORE) guidelines pertaining to upper limb and lower limb recovery following stroke were deferred as the writing groups continued to deliberate and review the current evidence. The proposed recommendations were circulated to the consensus panel in August 2010 for review and input. They were voted on electronically and confirmed for inclusion in the 2010 stroke best practice guidelines.
- No recommendations proposed to the consensus panel were rejected or eliminated from the 2010 update of the stroke best practices.

Subsequently, a strategic planning session was held to explore ways of maximizing the impact of the Canadian Best Practice Recommendations for Stroke Care. Objectives included:

- Identifying ongoing implementation strategies
- Exploring capacity to monitor best practice implementation and impact at the local level
- Discussing mechanisms to use performance information to improve implementation of best practices, patient care delivery, and outcomes
- Gathering advice on how the CSS can continue to build its strategy for system-wide improvement across the continuum of stroke care.

Following presentations by Drs. Ian Graham, Anthony Rudd, Judith Shamian and Ben Chan, consensus participants discussed and debated a number of topics, and developed a range of broader directional statements and guidance for the CSS, as follows:

- The need to explicitly recognize the many dimensions of accountability and ensure that all parties who have accountability are held responsible for quality of care and reporting results
- The need for quality and accountability measures at the population level (surveillance), the health system level, and the local service delivery level
- The need for measures of structure, processes of care, and outcomes
- The importance of setting targets that are specific and time-limited
- The importance of disclosure and reporting
- The need for profession-specific best practice summaries
- The need to look at performance through both a patient lens and a provider lens.

Guidance that pertained to specific sections or recommendations within the Canadian Best Practice Recommendations for Stroke Care was as follows:

- Emergency medical services should be integrated more formally with regional stroke programs. Processes should be in place for emergency medical services to collect and report on their performance based on the data they collect.
- Accreditation Canada's Stroke Services Distinction program is an opportunity to promote the routine periodic collection of standardized data aligned directly with stroke best practices for hyper-acute and acute care as well as other components.
- Hospitals and regional health authorities should be encouraged to participate in the CIHI stroke special project as a cost-effective opportunity for feasible and consistent standardized collection of stroke data.
- With respect to hospital-based rehabilitation, benchmarks and standards are required to assess whether the right people are getting access to the right service in the right setting and that resources are being used effectively.
- With regard to stroke secondary prevention services, effective measurement and evaluation mechanisms are needed to compare and contrast the myriad of service delivery models.
- A method of measuring unmet need in the community is required. From a quality perspective, community-based service providers such as municipal recreation programs and the YM/YWCA should be engaged in monitoring and evaluating services and linkages.
- All regional stroke programs should have a region-wide telestroke strategy that ensures that all residents of the region have effective access to available stroke expertise, and data systems should be established to monitor the use and impact of telestroke programs.

2.9 ONGOING DEVELOPMENT
Throughout the 2010 update process, additional emerging topics were suggested by stakeholders and reviewers as being relevant to stroke care and within the scope of the document. Where the evidence did not meet the criteria for inclusion, these topics have been noted and will be considered as part of the 2012 update, using the same comprehensive review that is undertaken for all updates.

Topics under consideration for 2012 include:
- Sleep apnea following stroke
- Management of seizures in patients with stroke
- Vocational rehabilitation for patients with stroke
- Driving for patients following stroke
- New and emerging pharmacotherapies and treatment technologies
- Development of best practice recommendations for other components of the continuum of stroke care, such as long-term care

3.0 KNOWLEDGE MOBILIZATION

3.1 NETWORKING AND DISTRIBUTION
The CSS makes the Canadian Best Practice Recommendations for Stroke Care available openly and at no cost, in English and French. Publication and dissemination strategies have changed in response to user needs and feedback. In 2006, printed documents and CDs were provided to all contacts in the CSS database, to others on request, and to interested groups throughout Canada and internationally. The 2008 Update was published through the Canadian Medical Association Journal as a supplement to subscribers and posted on the CMAJ website with links to the document on the CSS website; the CSS provided a limited number of printed copies upon request. The 2010 Update is available on the CSS website, at www.canadianstrokestrategy.com.

Also on the website, patients and the general public can find A Patient’s Guide to the Canadian Best Practice Recommendations for Stroke Care. The CSS created the patient’s guide in recognition of the fact that the best practice recommendations are lengthy and written primarily for a healthcare audience.

The CSS encourages provincial or territorial and regional stroke strategies to adopt the Canadian Best
Practice Recommendations for Stroke Care in their entirety. While the process and speed of implementation will vary depending on circumstances, the vision of offering integrated, high quality, and efficient stroke services to all Canadians should be shared and supported across the country.

The CSS disseminates the Canadian Best Practice Recommendations for Stroke Care by:

- Posting the recommendations on the CSS website and other central guideline repository websites such as the World Stroke Organization website, the National Guidelines Clearing House, the Internet Stroke Centre, and the Canadian Medical Association website.
- Writing feature articles for publications such as the Canadian Medical Association Journal and the Canadian Stroke Network Brainwaves newsletter.
- Alerting all contacts in the CSS database of Updates and how to access them.
- Encouraging others to set up electronic links to the recommendations (e.g. Canadian Stroke Network, Heart and Stroke Foundation of Canada, provincial stroke strategies).
- Sharing details with all the CSS working groups to ensure alignment and collaboration in dissemination.
- Engaging provincial stroke champions through presentations and discussion.
- Consulting other national guideline groups in related fields (e.g., hypertension, dyslipidemia, diabetes).
- Presenting at national, provincial, and regional meetings of healthcare professionals across healthcare disciplines and across the continuum of stroke care.
- Making presentations to front-line healthcare professionals at the local level and using local consensus processes to review and provide structured assessment of the enablers and barriers to guideline implementation, as well as innovative implementation strategies.
- E-mailing key stakeholders and front-line healthcare professionals working with persons with stroke and their families throughout the continuum of stroke care.
- Highlighting specific recommendations in stroke-related newsletters such as the National Stroke Nursing Council’s newsletter.
- Disseminating the recommendations at international stroke meetings through the World Stroke Organization, the Guidelines International Network, and international partners and collaborators.

The CSS encourages provincial or territorial and regional stroke strategy leaders to use these or other applicable approaches to further disseminate the recommendations and supporting tools to healthcare professionals, health system planners, decision-makers, and funders.

3.2 TOOLS TO SUPPORT IMPLEMENTATION OF THE BEST PRACTICE RECOMMENDATIONS

The national professional development and training platform of the CSS focuses on developing and implementing an integrated professional development and training plan for stroke professionals who care for patients, families, and caregivers. Professional development and training activities are carried out by a sub-group of the Best Practices and Standards Working Group, using a three-pronged approach that encompasses pre-professional education, professional development, and systems change.

Several point-of-care tools have been developed and are available through the websites of the CSS at www.canadianstrokestrategy.ca and the Heart and Stroke Foundation of Canada at www.heartandstroke.ca. These tools address pre-hospital care, acute stroke care, stroke unit care, prevention, and long-term care (refer to Appendix 8 for a list of professional development resources). The target audiences for each tool vary, but generally these tools are relevant to all interprofessional team members in a given setting.
3.3 **ACCREDITATION CANADA STROKE DISTINCTION PROGRAM**

Accreditation Canada, in partnership with the Canadian Stroke Network, created Stroke Services Distinction to recognize health organizations that demonstrate clinical excellence and an outstanding commitment to leadership in stroke care. It offers rigorous and highly specialized standards of excellence that are closely based on the Canadian Best Practice Recommendations for Stroke Care, addressing acute stroke services, inpatient rehabilitation stroke services, and comprehensive stroke services (for use in a regional setting). Organizations that are currently accredited by Accreditation Canada are eligible for participation in the Stroke Services Distinction program.

In addition to standards and protocols, Distinction requires the ongoing submission of data related to a core set of stroke quality indicators, and an on-site visit by expert evaluators with wide-ranging experience in the stroke care field. During the on-site visit, evaluators interact closely with stroke team members to understand the extent to which the standards and best practice recommendations have been operationalized.

Distinction is a new opportunity for stroke care leaders to:
- Be recognized for their exceptional commitment to excellence, innovation, high-quality service, and positive outcomes
- Be part of an innovative strategy to strengthen the uptake and dissemination of stroke best practice recommendations and clinical practice guidelines
- Achieve and maintain quality and safety by demonstrating compliance with national standards of excellence and meeting performance measure thresholds

Stroke Services Distinction takes into consideration the way stroke programs are integrated across the communities they serve. This program is an important new initiative within the CSS quality strategy, and all stroke care programs in Canada are encouraged to undertake this program as a way to drive quality improvement and consistent monitoring of care and service. Participating in Distinction is a valuable tool that helps stroke service organizations across the continuum to identify and celebrate their strengths in stroke care delivery, and identify areas for ongoing quality improvement.

More information about Stroke Services Distinction can be found at [http://www.accreditation.ca/accreditation-programs/distinction/stroke-services](http://www.accreditation.ca/accreditation-programs/distinction/stroke-services)
The recommendations presented in the Canadian Best Practice Recommendations for Stroke Care (Update 2010) are organized into seven sections that reflect a logical flow from public awareness and prevention of first or recurrent stroke to immediate recognition and management, ongoing acute management, rehabilitation, reintegration and collaboration across care transitions. Topics that apply throughout the continuum are presented in section 7.

**Flow of Canadian Best Practice Recommendations for Stroke Care**

**Section 1.0 Public Awareness of Stroke**

**Best Practice Recommendation 1.1 Symptom Recognition and Reaction**

All members of the public should be able to recognize the warning signs and symptoms of stroke, and react immediately by calling 9-1-1 or their local emergency number.

i. Public education on stroke should emphasize that stroke is a medical emergency and that immediate medical attention should be sought. All members of the public should know how to take the appropriate action—that is, to call 9-1-1 or their local emergency number [Evidence Level B].

ii. Public education should include information that stroke can affect persons of any age from newborns and children to adults and be aware of the benefits of early medical attention [Evidence Level C].

Refer to Box 1.1 for the signs and symptoms of stroke.
Box 1.1 Warning Signs and Symptoms of Stroke
Heart and Stroke Foundation of Canada, www.heartandstroke.ca

- **Weakness**: Sudden weakness, numbness or tingling in the face, arm or leg
- **Trouble speaking**: Sudden temporary loss of speech or trouble understanding speech
- **Vision problems**: Sudden loss of vision, particularly in one eye, or double vision
- **Headache**: Sudden severe and unusual headache
- **Dizziness**: Sudden loss of balance, especially with any of the above signs

**ACTION**: Call 9-1-1 or your local emergency number IMMEDIATELY.

**Rationale**

When it comes to stroke, *time is brain!*

Stroke is a medical emergency. Most people do not recognize the five main symptoms of stroke and therefore do not seek immediate medical attention. It is critical that people with ischemic strokes (caused by a blocked artery) arrive in the emergency department as soon as possible, and within at least 3.5 hours of symptom onset, if they are to be eligible to receive clot-busting treatment. In the case of strokes caused by hemorrhage or leaking arteries in the brain, earlier assessment and treatment may allow time for life-saving intervention.

Efforts to enhance emergency medical system response to stroke calls and to encourage the public to recognize stroke signs and symptoms and contact emergency medical services result in timelier treatment and better outcomes.

**System Implications**

- Public awareness initiatives focusing on the signs and symptoms of stroke, the sudden nature of the onset of signs and symptoms, awareness that not all signs or symptoms need to be present or that they may start to fade.
- Enhanced collaboration among community organizations on public education of the warning signs of stroke with a strong emphasis on the urgency of responding when the signs and symptoms of stroke are recognized.
- Training and education for emergency medical services, physicians, and nurses to increase ability to recognize potential stroke patients and provide rapid assessment and management.
- Heightened emergency response with appropriate protocols.

**Performance Measures**

1. **Proportion of the population aware of two or more signs of stroke (core).**
2. **Median time (hours) from stroke symptom onset to presentation at an emergency department.**
3. **Proportion of the population that can name the three main stroke symptoms — sudden weakness, trouble speaking, vision problems.**
4. **Proportion of patients who seek medical attention within 3.5, 4, and 4.5 hours of stroke symptom onset (core).**
5. **Proportion of emergency medical service providers trained in stroke recognition and the use of stroke triage algorithms for prioritizing stroke cases for transport within regions.**
6. **Proportion of the population with a family member who has had a stroke or transient ischemic**
attack that can name two or more signs and stroke symptoms.

**Measurement Notes**

- Performance measures 1 and 2: Data may be obtained from Heart and Stroke Foundation public polls.
- Performance measure 3: Data may be obtained from chart audit data.
- Performance measure 4: The unit of analysis may vary depending on the emergency health services management model used in the province or territory.
- Performance measures 3 and 4: Stroke symptom onset may be known if the patient was awake and conscious at the time of onset, or it may be unknown if symptoms were present on awakening. It is important to record whether the time of onset was estimated or exact. The time qualifies as exact provided that (1) the patient is competent and definitely noted the time of symptom onset or (2) the onset was observed by another person who took note of the time.
- Performance measure 5: Data sources include emergency department triage sheet or admission note, history and physical examination, consultant notes, emergency medical services ambulance records.

**Implementation Resources and Knowledge Transfer Tools**

- Warning Signs and Symptoms of Stroke: [www.heartandstroke.ca](http://www.heartandstroke.ca)

**Summary of the Evidence**

Successful care of the acute stroke victim begins with the public and the health professionals recognizing that stroke is a medical and sometimes a surgical emergency, like acute myocardial infarction and trauma. Stroke interventions such as acute thrombolysis are time sensitive, with the current treatment window being within 4.5 hours after symptom onset. The majority of stroke patients do not receive adequate therapy because they do not reach the hospital soon enough, thus losing an opportunity to potentially reduce the impact of the stroke.

Treating stroke as an emergency involves a four-step response chain:

1. Rapid recognition of and reaction to stroke warning signs
2. Immediate contact with emergency medical system services
3. Priority transport with prenotification to the receiving hospital
4. Rapid and accurate diagnosis and treatment at the hospital

A retrospective study by Hodgson and colleagues examined the effects of television advertising on public knowledge of warning signs of stroke. As a result of the public awareness campaign, public awareness increased, as evidenced by the consistent increase in the percentage of respondents who could name at least two warning signs of stroke, from 52 percent in 2003 to 72 percent in 2005 (p < 0.001). Emergency department records for over 20,000 stroke patients were examined, and during active advertising of the warning signs, a significant increase in the mean number of emergency department presentations for stroke was reported. This effect was not sustained after the campaign, and the rate of emergency department presentations decreased following a five-month advertising blackout. The study also reported a campaign effect (independent of year) for total presentations, presentation within five hours of when the patient was last seen symptom-free, and presentation within 2.5 hours. For transient ischemic attacks, the campaign effect was strong despite no change in presentation numbers. The authors concluded that although many factors may influence the presentation for stroke, there might be an important correlation between the advertising and emergency department presentations, particularly for transient ischemic attacks.

The Heart and Stroke Foundation of Canada commissioned Environics Research Group to conduct two public opinion polls to examine the impact of a national media campaign on the knowledge of stroke warning signs among Canadians. In May 2009, prior to the campaign, approximately 2,700 Canadians from across the country were polled to establish a baseline level of awareness. The campaign objectives were to expand the stroke awareness warning signs message to a national level, to sustain stroke awareness support in Ontario and Alberta, and to launch stroke awareness in all other provinces. The post-campaign study then polled approximately 2,700 Canadians in November and December 2009. These studies found that Canadians’ ability to correctly identify warning signs had improved for...
neither of the five warning signs. There was also an increase in the number of Canadians who could identify at least two (50% to 57%) and at least three (26% to 32%) of the stroke warning signs at follow up. The number of Canadians unable to identify any warning signs decreased in the post-campaign poll (28% to 22%).

A similar evaluation of a stroke media campaign by the New York State Department used the FAST (F - Face drooping, A - Arm weakness, S - Speech slurred, and T - Time to call 9-1-1) mnemonic to develop a multimedia campaign that included print, television, and radio. The study compared pre- and post-stroke knowledge in a region exposed to the media campaign with a control region. A random-digit telephone survey was conducted before and after the campaign in both regions, and found increased recognition of the four FAST signs in the intervention region compared to the control region (60 percent compared to 20 percent). Retention of the information following the campaign was not measured. Stroke awareness was impacted by demographic, socioeconomic, and regional factors at both baseline and follow up. Specifically, younger, less educated, low-income, and non-English speaking Canadians demonstrated lower awareness of stroke warning signs.

Kleindorfer examined the effectiveness of the FAST mnemonic (Face, Arm, Speech, Time) for identifying stroke and transient ischemic attack. The FAST mnemonic identified 88.9 percent of cases of stroke or transient ischemic attack, and was more effective for ischemic stroke than for hemorrhagic stroke.

A large study in Ireland focused on assessing stroke knowledge in persons over the age of 65 years who were considered more vulnerable to stroke. Interviews were conducted with 2,033 people (68 percent response rate). Interview questions assessed knowledge of stroke warning signs and risk factors, and personal risk factors for stroke. Less than half of the overall sample identified established risk factors (e.g., smoking, hypercholesterolemia), with the exception of hypertension (identified by 74 percent). Less than half of the respondents were able to identify some or all of the warning signs (e.g., weakness, headache, with slurred speech [54 percent]) as the exception. Overall, there were considerable gaps in awareness of stroke warning signs with poorest levels evident in those with primary level education only. Some geographic differences were also found. This study emphasizes the need to target high-risk populations with specific educational initiatives as many older adults may not recognize early symptoms of stroke in themselves or others and they may lose vital time in presenting for medical attention.

Mosley and associates examined pre-hospital delays after stroke symptom onset in an attempt to determine patient factors associated with stroke recognition, as well as factors associated with calling for ambulance assistance within one hour of symptom onset. Of 198 patients included in the study, more than half of the calls were made within one hour of symptom onset, and only 43 percent identified the problem as “stroke.” Unprompted stroke recognition was independently associated with facial droop and history of stroke or transient ischemic attacks. Those factors independently associated with a call for ambulance assistance within one hour of onset included speech problems, caller’s family history of stroke, and the patient not being alone at time of symptom onset.

The American Heart Association’s Council on Cardiovascular Nursing and Stroke Council issued a scientific statement providing context for system application of what is known about why people delay seeking treatment for stroke and acute coronary syndrome. This statement pushed for changes in mass public education campaigns, noting that messages showing the benefits of not delaying treatment are more effective than the fear-based messages commonly used by providers.

Although stroke is not typically thought of as a health emergency for children, it does occur in newborns, young children, and adolescents. Cerebrovascular diseases are among the top 10 causes of death in children. Of crucial concern for paediatric stroke patients is the burden of illness caused by developmental and motor impairments that may last throughout their lifetime. Neurologic deficits in this population have been indicated in over 60 percent of older infants and children following a stroke event, and the risk of recurrence is between 10 percent and 25 percent. Recognition of stroke may be difficult, especially in infants and younger children.
### Section 2.0 Prevention of Stroke

#### Definitions of Prevention

**Primary prevention** is an individually based clinical approach to disease prevention, directed toward preventing the initial occurrence of a disorder in otherwise healthy individuals.\(^\text{76,77}\) Primary prevention is usually implemented in the primary care setting, and the physician, advanced practice nurse or patient may initiate a discussion of stroke risk reduction. Primary prevention and health promotion recommendations related to stroke (lifestyle and risk factor management, hypertension screening, dyslipidemia screening, diabetes management, management of atrial fibrillation, and asymptomatic carotid stenosis) emphasize the importance of screening and monitoring those patients at high risk of a first stroke event.

Primary prevention and the reduction of risk factor prevalence in the general population are not main purposes of the Canadian Best Practice Recommendations for Stroke Care; therefore, only selected recommendations related to primary prevention are included. A comprehensive set of recommendations in this area is being developed for inclusion in future updates.

**Secondary prevention** is an individually based clinical approach aimed at reducing the risk of a recurrent vascular events in individuals who have already experienced a stroke or transient ischemic attack and in those who have one or more of the medical conditions or risk factors that place them at high risk of stroke.\(^\text{77}\) Secondary prevention recommendations in this document are directed to those risk factors most relevant to stroke, including lifestyle (diet, sodium intake, exercise, weight, smoking, and alcohol intake), hypertension, dyslipidemia, previous stroke or transient ischemic attack, atrial fibrillation and stroke, and carotid stenosis. Secondary prevention recommendations can be addressed in a variety of settings—acute care, stroke prevention clinics, and community-based care settings. They pertain to patients initially seen in primary care, those who are treated in an emergency department and then released and those who are hospitalized because of stroke or transient ischemic attack.

Recommendations for secondary prevention of stroke should be implemented throughout the recovery phase, including during inpatient and outpatient rehabilitation, reintegration into the community and ongoing follow-up by primary care practitioners. Secondary prevention should be addressed at all appropriate healthcare encounters on an ongoing basis following a stroke or transient ischemic attack.
Best Practice Recommendation 2.1

Lifestyle and Risk Factor Management

Persons at risk of stroke and patients who have had a stroke should be assessed for vascular disease risk factors and lifestyle management issues (diet, sodium intake, exercise, weight, smoking and alcohol intake). They should receive information and counseling about possible strategies to modify their lifestyle and risk factors [Evidence Level B].

Lifestyle and risk factor interventions should include:

2.1.1 Healthy balanced diet: Eating a diet high in fresh fruits, vegetables, low-fat dairy products, dietary and soluble fibre, whole grains and protein from plant sources and low in saturated fat, cholesterol and sodium, in accordance with Canada’s Food Guide to Healthy Eating [Evidence Level B].

2.1.2 Sodium: Following the recommended daily sodium intake from all sources, known as the Adequate Intake. For persons 9 to 50 years, the Adequate Intake is 1500 mg. Adequate Intake decreases to 1300 mg for persons 50 to 70 years and to 1200 mg for persons over 70 years. A daily upper consumption limit of 2300 mg should not be exceeded by any age group [Evidence Level B].

2.1.3 Exercise: Participating in moderate exercise (an accumulation of 30 to 60 minutes) such as walking (ideally brisk walking), jogging, cycling, swimming or other dynamic exercise four to seven days each week in addition to routine activities of daily living. High-risk patients (e.g., those with cardiac disease) should engage in medically supervised exercise programs [Evidence Level A].

2.1.4 Weight: Maintaining a body mass index (BMI) of 18.5 to 24.9 kg/m^2 or a waist circumference of <80 centimetres for women and <94 centimetres for men [Evidence Level B].

2.1.5 Smoking: Addressing smoking cessation and a smoke-free environment every healthcare encounter for active smokers.  
   i. In all healthcare settings along the stroke continuum, patient smoking status should be assessed and documented [Evidence Level A].
   ii. Provide unambiguous, non-judgmental, and personally relevant advice regarding the importance of cessation to all smokers, and offer assistance with the initiation of a smoking cessation attempt—either directly or through referral to appropriate resources [Evidence Level A].
   iii. A combination of pharmacological therapy and behavioural therapy should be considered [Evidence Level A].
   iv. The three classes of pharmacological agents that should be considered as first-line therapy for smoking cessation are nicotine replacement therapy, bupropion, and varenicline [Evidence Level A].

2.1.6 Alcohol consumption: Limiting consumption to two or fewer standard drinks per day; fewer than 14 drinks per week for men; and fewer than nine drinks per week for women [Evidence Level C].

Rationale

A healthy lifestyle reduces the risk of an initial stroke and the risk of a subsequent stroke for patients with a prior stroke. Hypertension is the single most important modifiable risk factor for stroke. A recent research report estimated that reducing sodium in foods would abolish high blood pressure for almost one in three Canadians. Furthermore, this evidence suggests that lowering sodium consumption to adequate intake levels could reduce the incidence of stroke and heart disease by as much as 30 percent.
Regular exercise also reduces the risk of stroke. Smoking is also a significant risk factor, as smokers have up to four times the risk of stroke of nonsmokers.

Although causes of stroke are generally different for children, lifestyle management issues as described above are equally as important for the paediatric population, particularly as the long-term risk of recurrence for children is much higher.

**System Implications**

- Health promotion efforts that contribute to the prevention of stroke in all communities (integrated with existing chronic disease prevention initiatives).
- Stroke prevention offered by primary care providers, and mechanisms to ensure that stroke is addressed during encounters with healthcare professionals throughout the continuum of care.
- A focus on arterial health for paediatric cases—such as diet, exercise, non-smoking, avoidance of drugs.
- National and international efforts to reduce sodium intake and increase public knowledge about the risks of sodium, directly targeting the food industry.
- Access to risk factor management programs (such as hypertension and smoking cessation programs) in all communities, primary healthcare settings and workplaces.
- Government actions to restrict smoking in public areas and discourage smoking through legislation and taxation initiatives.
- Coordinated efforts among stakeholders such as Heart and Stroke Foundations (national and provincial), the Canadian Stroke Network, public health agencies, ministries of health and care providers across the continuum to produce patient, family and caregiver education materials with consistent information and messages on risk factor management.
- Coordinated process for ensuring access to and awareness of educational materials, programs, activities and other media related to risk factor management by healthcare professionals, patients and caregivers, including advertising the availability of educational material, effective dissemination mechanisms and follow-up.
- Educational resources, that are culturally and ethnically appropriate, are available in multiple languages and that address the needs of patients with aphasia.
- Access to healthy living programs, educational materials and healthcare professionals for persons living in rural and remote locations.

**Performance Measures**

1. Proportion of the population with major risk factors for stroke, including hypertension, obesity, history of smoking, low physical activity, hyperlipidemia, diabetes, and atrial fibrillation (core).
2. Annual occurrence of stroke in each province and territory by stroke type (core).
3. Stroke mortality rates across provinces and territories, including in-hospital or 30-day rate and one-year rate (core).
4. Percentage of the population who can identify the major risk factors for stroke, including hypertension, sodium intake, diet, weight, exercise, smoking and alcohol intake.
5. Percentage of people who are aware of the healthy targets for each stroke risk factor.
6. The annual readmission rate for a recurrent stroke event in patients with previous stroke or transient ischemic attack.
Measurement notes

- For performance measures 1, 2 and 3: self-reported data can be extracted from provincial and national health surveys.
- Performance measures 4 and 5: administrative data are available at the local, provincial and national levels.
- Mortality rates need to be risk adjusted for age, sex, stroke severity and comorbidities.

Implementation Resources and Knowledge Transfer Tools

- Sodium 101: www.sodium101.ca
- Sodium Daily Intake Tables: http://www.sodium101.ca
- Canadian Diabetes Association: http://www.diabetes.ca/
- US Tobacco guidelines

Summary of the Evidence

Diet and sodium

Gillman and associates reported that, based on data collected as part of the Framingham Study, age-adjusted risk for stroke decreased as consumption of fruits and vegetables increased such that relative risk (RR) = 0.78 for each increase of three servings per day. This effect was independent of BMI, smoking, glucose intolerance, physical activity, blood pressure, serum cholesterol and intake of energy, ethanol and fat. A meta-analysis of fruit and vegetable consumption and stroke, which included eight studies and 257,551 individuals over a 13-year follow-up period, showed that consumption of five or more servings of fruits and vegetables per day is associated with a lower risk of stroke. Compared with individuals who had fewer than three servings of fruit and vegetables per day, the pooled relative risk of stroke was 0.89 (95% confidence interval [CI] 0.83–0.97) for those with three to five servings per day, and 0.74 (95% CI 0.69–0.79) for those with more than five servings per day.

Analyses of data from the Nurses’ Health Study, the Health Professionals Follow-up Study and the Women’s Health Study supported the association between consumption of fruit and vegetables and reduction of stroke risk in men and women. In an analysis of combined data from the Nurses’ Health Study and the Health Professionals Follow-up Study, Joshipura and associates found that an increase of 1 serving per day of fruits or vegetables was associated with a reduction of risk of six percent and that cruciferous vegetables, leafy green vegetables and citrus fruit (including juice) contributed most to this effect. Liu and colleagues reported a significant inverse relationship between consumption of fruits and vegetables and risk for cardiovascular disease including stroke. When individuals consuming the most fruits and vegetables were compared with those consuming the least, a relative risk reduction of 0.68 was demonstrated in favour of those with higher consumption levels.

Blood Pressure Canada has asserted that the average Canadian diet contains about 3500 mg of sodium a day, with an estimated 1 million Canadians experiencing hypertension due to excess intake of sodium. Blood Pressure Canada has released the following policy goal addressing a daily sodium intake conducive to health: “Given that the Institute of Medicine of the National Academies has established a daily Adequate Intake for sodium of 1200 mg and a daily Tolerable Upper Intake Level of 2300 mg for healthy adults, and that these values have been adopted by the Canadian and American governments for setting public health policy, the goal is to have Canadian adults reduce their sodium intake to within this range.”

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Physical activity
Lee and collaborators published a meta-analysis of 23 studies published between 1983 and 2002 examining the association between physical activity and stroke incidence or mortality.83 Eighteen cohort studies and 5 case–control studies were included for analysis. When both types of study were examined together, highly active individuals were reported as having a 27 percent lower risk of stroke than individuals who were designated as “low active.” Individuals who were designated as moderately active also had a significantly reduced risk of stroke when compared with low active individuals (RR = 0.80, p < 0.001). The benefits of high and moderate levels of activity were reported for both ischemic and hemorrhagic strokes. In that the meta-analysis showed increasing benefit with increasing activity, a dose–response relationship was also established. However, as Lee and collaborators pointed out, given the range of definitions of “level of physical activity” in the studies included for assessment, their analysis suffered from the lack of a single, cohesive definition of what constitutes low, moderate and high levels of activity.83 The question of what type or quantity of activity is required to reach a moderate level and so to benefit from a 20 percent reduction in the risk of stroke is one that needs to be investigated by means of a randomized controlled trial.

Smoking
Tobacco smoking remains a significant risk factor for many chronic diseases including cardiovascular disease. The United States Department of Health and Human Services have stated that tobacco “presents a rare confluence of circumstances: (1) a highly significant health threat; (2) a disinclination among clinicians to intervene consistently; and (3) the presence of effective interventions”. The World Health Organization “M-Power” report describes smoking as a global tobacco epidemic.84 In that report, 6 policies were recommended to reverse the tobacco epidemic, all of which are targeted at the national level. These policies are tobacco use and prevention policies; protection of people from tobacco smoke; assistance in quitting tobacco use; warnings about the dangers of tobacco; enforcement of bans on tobacco advertising, promotion and sponsorship; and raising taxes on tobacco. In Canada, the Public Health Agency of Canada report on cardiovascular disease found that 15.3 percent of the population over the age of twelve self-report being active smokers in 2007; this is an improvement from 19.9 percent reported in 2000.85 Smoking policies and regulations have made notable progression over that same timeframe.

Research has demonstrated that current smokers who smoke 20 or more cigarettes per day have an associated increase of stroke risk approximately 2 to 4 times that of nonsmokers.86–89 Overall, given that an estimated 25 percent of adults are active smokers, approximately 18 percent of strokes may be attributed to active smoking.90

Smoking acts as a risk factor in a dose-dependent fashion, such that heavy smokers have more risk than light smokers, who in turn have more risk than nonsmokers.86,89,91,92 Results of a recent study demonstrated that the relative risk for ischemic stroke associated with smoking fewer than 20 cigarettes per day was 1.56 when compared with nonsmokers and 2.25 when 20 or more cigarettes were smoked per day.93,94

Reported relative risks for hemorrhagic stroke among smokers followed a similar pattern. Within a male population, smoking fewer than 20 cigarettes was associated with a 1.6-fold increase for intracerebral hemorrhage and a 1.8-fold increase for subarachnoid hemorrhage compared with nonsmokers.93,94 When the rate of smoking increased to 20 cigarettes or more, the associated risk increased to 2.1 and 3.2 for intracerebral hemorrhage and subarachnoid hemorrhage, respectively. A study conducted within a female subject population yielded a similar pattern of risk.93

Risk associated with current cigarette smoking is greatest in the middle years and declines with age.91 The Cardiovascular Study in the Elderly (CASTEL) reported that the relative risk associated with current smoking compared with current nonsmokers was 1.60 for fatal stroke.95 Mortality was particularly high among current smokers who had been smoking for 40 or more years (7.2% v. 1.8% for nonsmokers, p < 0.01).95

A systematic review and meta-analysis of smoking cessation therapies found that Bupropion trials were superior to controls at one year (12 RCTs, OR1.56, 95% CI, 1.10–2.21, P = 0.01) and at three months (OR 2.13, 95% CI, 1.72–2.64).96 Two RCTs evaluated the superiority of bupropion versus NRT at one year (OR 1.14, 95% CI, 0.20–6.42), P = < 0.0001 and also at approximately 3 months (OR 3.75, 95% CI, 2.65–5.30). Three RCTs evaluated the effectiveness of varenicline versus bupropion at 1 year (OR 1.58, 95% CI, 1.22–2.05) and at approximately three months (OR 1.61, 95% CI, 1.16–2.21). Using indirect comparisons, varenicline was superior to NRT when compared to placebo controls (OR
Alcohol

A meta-analysis of 35 observational studies examining the effects of alcohol consumption on stroke risk revealed a significant ($p = 0.004$) J-shaped relationship between the amounts of alcohol consumed per day and the risk of ischemic stroke. In that analysis, individuals who consumed 1 to 2 drinks per day had the least risk for ischemic stroke (RR = 0.72), while those having more than 5 drinks per day had the most risk (RR = 1.69) when compared with a group of abstainers. The analysis also confirmed that alcohol consumption has a linear, dose-dependent effect on risk of hemorrhagic stroke. Heavy drinking (more than 5 drinks per day) was associated with a relative risk of hemorrhagic stroke of 2.18. Irregular and binge drinking (more than 5 drinks at one sitting) have also been associated with an increase in risk for hemorrhagic stroke.

Data from the Copenhagen City Heart Study were used to examine whether the type of alcohol consumed was related to the apparent decreased risk of ischemic stroke with moderate alcohol consumption. The overall beneficial effect of moderate alcohol consumption was confirmed; however, the benefit was seen mostly among those individuals who consumed wine. Wine drinking on a daily, weekly or monthly basis was associated with reduced risk of ischemic stroke (RR = 0.68, 0.66 and 0.88, respectively, after adjustments for age, sex, smoking, BMI, physical activity, systolic blood pressure, cholesterol, antihypertensive treatment, triglycerides, education, and diabetes). No similar effect was demonstrated among drinkers of beer or spirits. Both Kiechl and associates and Sacco reported the greatest risk reduction (RR = 0.41 and 0.40, respectively) among wine drinkers; however, this was not significantly lower than among drinkers of beer, liquor or a combination of types of alcohol.

Best Practice Recommendation 2.2

Blood Pressure Management

Hypertension is the single most important modifiable risk factor for stroke. Blood pressure should be monitored and managed in all persons at risk for stroke.

2.2.1 Blood pressure assessment

All persons at risk of stroke should have their blood pressure measured routinely, ideally at each healthcare encounter, but no less than once annually [Evidence Level C].

i. Proper standardized techniques as described by the Canadian Hypertension Education Program should be followed for blood pressure measurement including office, home, and community testing. Details regarding proper blood pressure monitoring techniques for clinicians and patients can be found at [http://hypertension.ca/chep/wp-content/uploads/2008/03/bpposterenglish.jpg](http://hypertension.ca/chep/wp-content/uploads/2008/03/bpposterenglish.jpg)

ii. Patients found to have elevated blood pressure should undergo thorough assessment for the diagnosis of hypertension following the current guidelines of the Canadian Hypertension Education Program [Evidence Level A].

iii. Patients with hypertension or at risk for hypertension should be advised on lifestyle modifications [Evidence Level C].

Refer to recommendation 2.1 for additional information.
### 2.2.2 Blood pressure management

Blood pressure should be managed in all patients to reach optimal control as follows:

1. **For the prevention of first stroke** in the general population, the systolic blood pressure treatment goal is a pressure level of consistently lower than 140 mm Hg [Evidence Level C]. The diastolic blood pressure treatment goal is a pressure consistently lower than 90 mm Hg [Evidence Level A].

2. **For patients who have had a stroke or transient ischemic attack**, blood pressure lowering treatment is recommended to achieve a target of consistently lower than 140/90 mm Hg [Evidence Level C].

3. **In patients with diabetes**, blood pressure lowering treatment is recommended for the prevention of first or recurrent stroke to attain systolic blood pressure targets consistently lower than 130 mm Hg [Evidence Level C] and diastolic blood pressure targets consistently lower than 80 mm Hg [Evidence Level A].

4. **In patients with nondiabetic chronic kidney disease**, blood pressure lowering treatment is recommended for the prevention of first or recurrent stroke to attain a blood pressure consistently lower than 130/80 mm Hg [Evidence Level C].

5. For recommendations on specific agents and sequence of agents for the secondary prevention of stroke, refer to the Canadian Hypertension Education Program guidelines [Evidence Level C].

6. Randomized controlled trials have not defined the optimal time to initiate blood pressure lowering therapy after stroke or transient ischemic attack. Blood pressure lowering treatment should be initiated or modified before discharge from hospital [Evidence Level B].

   **Refer to recommendation 3.3 for blood pressure management during the acute phase of stroke (0 – 72 hours).**

7. For patients with stable symptoms of nondisabling stroke or transient ischemic attack not requiring hospitalization, blood pressure lowering treatment should be initiated or modified to achieve target levels defined in 2.2.2 (ii) when the transient ischemic attack or stroke is diagnosed [Evidence Level B].

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### Rationale

Elevated blood pressure is the single most important risk factor for stroke. One in five adult Canadians has blood pressure in the range of 130–139/85–89 mm Hg, and up to 60 percent of them will develop hypertension within four years. Among persons aged 55 and older with normal blood pressure, 90 percent will develop hypertension if they live to an average age. All adults require ongoing assessment of blood pressure throughout their lives. Each 1 mm Hg increase in blood pressure increases the risk of poor late-life cognitive function by approximately one percent. Epidemiologic studies have shown a graded increase in the risk of stroke as blood pressure increases.

Numerous population-based studies have found that elevated blood pressure is a significant risk factor for first and recurrent stroke; hypertension is estimated to account for about 60 percent of the population-attributable risk for cerebrovascular disease. A number of trials have shown a 28 percent risk reduction in recurrent stroke in patients treated with blood pressure lowering medication. The optimal target for blood pressure in people who have had a stroke has not been formally defined through randomized controlled trials. The current treatment recommendation is to attain a blood pressure of consistently lower than 140/90 mm Hg for people who have had a cerebrovascular event. Epidemiologic data have shown that those with a response to treatment with lower pressures have better outcomes yet...
these treatment trials have not yet clearly defined how far blood pressure should be lowered.

System Implications

- Coordinated hypertension awareness programs at the provincial and community levels that involve community groups, pharmacists, primary care providers and other relevant partners.
- Stroke prevention, including routine blood pressure monitoring, offered by primary care providers in the community as part of comprehensive patient management.
- Increased availability and access to education programs for healthcare providers across the continuum of care on hypertension diagnosis and management for adults and children.
- Increased programs for patients and families on home monitoring of blood pressure and blood pressure self-management programs.

Performance Measures

1. Proportion of persons at risk for stroke who had their blood pressure measured at their last healthcare encounter.
2. Proportion of the population who have diagnosed elevated blood pressure (hypertension).
3. Proportion of the population who are aware of hypertension and the risks of high blood pressure.
4. Proportion of the population who report having hypertension.
5. Percentage of the population with known hypertension who are on blood pressure lowering therapy.
6. Proportion of the population with hypertension who are being treated and have achieved control of their blood pressure within defined targets (as per Canadian Hypertension Education Program guidelines).
7. Proportion of stroke and transient ischemic attack patients who have received a prescription for blood pressure lowering agents on discharge from acute care.
8. Proportion of stroke and transient ischemic attack patients who have received a prescription for blood pressure lowering agents after assessment in a secondary prevention clinic.

Measurement Notes

- Performance measures 1 through 4: data may be available through the Canadian Hypertension Education Program database, the Canadian Community Health Survey, and other provincial and local health surveys and patient self-reports.
- Performance measures 5 and 6: data may be available through audit of primary care physician charts. Prescription information may also be available through provincial drug plan databases, although these may have limitations with respect to the age of those covered by the plans, and there is variation across provinces and territories.
- Performance measures 7 and 8: prescriptions for blood pressure lowering agents may be given during the inpatient stay or during a secondary prevention assessment and follow-up. When tracking these performance rates, it is important to record the setting where this therapy is initiated. Data sources may include physician order sheets, physicians’ or nurses’ notes, discharge summaries or copies of prescriptions given to patients.
- Prescriptions given to a patient do not imply compliance.
- Algorithms to identify incidence and prevalence of hypertension from administrative databases have been validated in Canada and should be used for consistency in measurement when possible.104
Implementation Resources and Knowledge Transfer Tools

- Canadian Hypertension Education Program: [http://hypertension.ca/chep](http://hypertension.ca/chep)
- Canadian Task Force on Preventive Health Care for primary prevention screening guidelines for hypertension
- Aboriginal Hypertension Management Resources: [http://www.heartandstroke.on.ca/site/c.pvI3IeNWJwE/b.5339635/HCP_Hypertension_Program_Resources.htm](http://www.heartandstroke.on.ca/site/c.pvI3IeNWJwE/b.5339635/HCP_Hypertension_Program_Resources.htm)

Summary of the Evidence

Hypertension is a major problem in nearly all countries around the world, including Canada, and it is the most important modifiable risk factor for stroke. The INTERSTROKE study is an ongoing standardized case-controlled study of the contribution of specific risk factors to the burden of stroke across 22 countries. The first report from this study, based on 3,000 stroke cases and 3,000 controls, identified five risk factors which account for more than 80 percent of the risk for stroke, including hypertension, current smoking, abdominal obesity, diet, and physical activity. Among these risk factors, hypertension was the most significant risk factor for stroke and contributed to 34.6 percent of the population-attributed risk (PAR), and this rose to 52 percent when measured blood pressures of greater than 160/90 mm Hg were added to the model. When these results were compared to a similar study conducted for heart disease, hypertension was found to have a more significant impact on stroke than on heart disease. The study further noted that “blood pressure is the most amenable to change in low-income settings because screening programs need modest equipment and little specialized expertise. Additionally, blood pressure is readily reduced by inexpensive generic drugs and non-pharmacological approaches (e.g., salt reduction)” (page 9).

The National Heart, Lung, and Blood Institute Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure has defined normal blood pressure as less than 120/80 mm Hg. A continuous and linear relationship between blood pressure and risk of stroke has been reported, which holds even in individuals with normal blood pressure. Lewington found that an increase of 20 mm HG in systolic and 10 mm HG in diastolic blood pressure can lead to a two-fold increase in stroke mortality in persons aged 40 – 69. Weber reported that the high sensitivity of the relationship between blood pressure and stroke risk is now more fully realized. Single studies do not always have the power to identify the impact that blood pressure changes of only a few millimetres of mercury have on risk. However, a meta-analysis of 61 studies with a total of more than 1 million participants, an average 12-year follow-up and 120,000 recorded deaths showed that each 2 mm Hg reduction in systolic blood pressure was associated with a 7 percent reduction in mortality from ischemic heart disease and a 10 percent reduction in mortality from stroke. A subsequent prospective study by Bestehorn et al found an overall 10-year stroke rate of 26 percent in patients with hypertension and for 16.7 percent f the cohort the risk was greater than 50 percent if they had additional co-morbidities. In a meta-analysis of risk stratification for the prevention of cardiovascular complications of hypertension, Girerd and Giral conclude that each reduction of 2 mm Hg in systolic blood pressure is associated with a 25 percent reduction in stroke events.

Du and associates reported that some 20–30 percent of adult populations are affected, as are over 60 percent of people over 65 years and about 70 percent of stroke patients. Hypertension is quantitatively the largest single risk factor for premature death and disability, because of the large number of people afflicted and the consequences of uncontrolled hypertension. Hypertension is closely associated with the risk of total mortality and the risk of all types of stroke, coronary artery disease, diabetes and renal disease. No other modifiable factor has been identified that contributes more to the development of stroke than hypertension. The authors further emphasized that hypertension should not be regarded so much as a disease but more as one of the treatable or reversible risk factors for premature death due to arterial disease. At least three-quarters of strokes in hypertensive patients are preventable by treatment of elevated blood pressure. However, strokes are caused not by a single risk factor such as hypertension but by the interaction of multiple risk factors, some having a stronger independent relationship with risk of stroke.
than others. The probability of stroke in an individual depends on the presence and level of other risk factors.

A collaborative meta-analysis was conducted to assess the age-specific relevance of blood pressure to cause-specific mortality.\textsuperscript{107} Combining 61 prospective observational studies of blood pressure and vascular mortality, each difference of 20 mm Hg in systolic blood pressure (or, approximately equivalently, 10 mm Hg in usual diastolic blood pressure) was associated with more than a two-fold difference in the stroke death rate, without any evidence of a threshold down to at least 115/75 mm Hg for all vascular deaths. Age-specific associations were found to be similar for men and women and for cerebral hemorrhage and cerebral ischemia.

In a study involving 3845 patients, the benefit of antihypertensive treatment for patients with hypertension who were 80 years or older was investigated (HYVET study).\textsuperscript{111} Patients were randomly assigned to receive either antihypertensive therapy or matching placebo. In this investigation, lowering mean blood pressure by 15.0/6.1 mm Hg was associated with a 30 percent reduction in the rate of fatal or nonfatal stroke (95% CI –1% to 51%, \( p = 0.06 \)), a 39 percent reduction in the rate of death from stroke (95% CI 1% to 62%, \( p = 0.05 \)), a 21 percent reduction in the rate of death from all causes (95% CI 4% to 35%, \( p = 0.02 \)) and a 23 percent reduction in the rate of death from cardiovascular causes (95% CI –1% to 40%, \( p = 0.06 \)).\textsuperscript{113} Fewer serious adverse events were reported in the active treatment group (358 v. 448 in the placebo group, \( p = 0.001 \)). The authors concluded that antihypertensive treatment in patients 80 years of age or older was beneficial.

A Cochrane meta-analysis by Musini and associates also examined the effects of age and blood pressure lowering on overall mortality, cardiovascular mortality and morbidity and withdrawal due to adverse effects in people 60 years and older with mild to moderate systolic or diastolic hypertension.\textsuperscript{112} Fifteen trials (24,055 subjects \( \geq 60 \) years) with moderate to severe hypertension were included which mostly evaluated first-line thiazide diuretic therapy for a mean duration of treatment of 4.5 years. Treatment reduced total mortality, RR 0.90 (0.84, 0.97); event rates per 1000 participants reduced from 116 to 104. Treatment also reduced total cardiovascular morbidity and mortality, RR 0.72 (0.68, 0.77); event rates per 1000 participants reduced from 149 to 106. In the three trials restricted to persons with isolated systolic hypertension the benefit was similar. In very elderly patients \( \geq 80 \) years the reduction in total cardiovascular mortality and morbidity was similar RR 0.75 [0.65, 0.87] however, there was no reduction in total mortality, RR 1.01 [0.90, 1.13]. Withdrawals due to adverse effects were decreased with treatment, RR 1.71 [1.45, 2.00]. The authors concluded that treating healthy persons (60 years or older) with moderate to severe systolic and/or diastolic hypertension reduces all cause mortality and cardiovascular morbidity and mortality. The decrease in all cause mortality was limited to persons 60 to 80 years of age.

The relationship between blood pressure and cardiovascular risk is “continuous, consistent, and independent of other risk factors.”\textsuperscript{106} The American Heart Association guidelines for the primary prevention of ischemic stroke report that the higher the blood pressure, the greater the stroke risk.\textsuperscript{9} The working group acknowledged the benefit of treatment of hypertension for the primary prevention of stroke and concluded that the reduction of blood pressure is generally more important than the agent used to aid in this goal.

Hypertensive patients with a history of cerebral vascular disease are at particularly high risk of stroke recurrence. Gueyffier and associates performed a meta-analysis using all available randomized controlled clinical trials assessing the effect of blood pressure lowering drugs on clinical outcomes (recurrence of stroke, coronary events, cause-specific and overall mortality) in patients with prior stroke or transient ischemic attack.\textsuperscript{114} Nine trials that included a total of 6752 patients were identified, and it was found that the recurrence of stroke, fatal and nonfatal, was significantly reduced in treatment groups compared with control groups consistently across the different sources of data (RR = 0.72, 95% CI 0.61–0.85). There was no evidence that this intervention induced serious adverse effects.

For several reasons, categorizing patients as “hypertensive” or “normotensive” based on an arbitrary blood pressure threshold may not be helpful with respect to secondary stroke prevention. First, the relationship between blood pressure and stroke is continuous and graded, with no evidence of a lower blood pressure threshold for stroke risk.\textsuperscript{107,115} Second, several controlled trials have demonstrated that blood pressure reduction benefits patients who would not normally be designated as hypertensive (Heart Outcomes Prevention Evaluation [HOPE],\textsuperscript{119} PROGRESS\textsuperscript{117}). Blood pressure lowering therapy reduces the risk of vascular events across a wide spectrum of initial blood pressures.\textsuperscript{116,117}
Angiotensin receptor blockers have demonstrated efficacy for the prevention of stroke in both the primary and secondary prevention settings. Three recently completed trials of angiotensin receptor blockers were the Losartan Intervention For Endpoint Reduction Study (LIFE), the Acute Candesartan Cilexetil Therapy in Stroke Survivors Study (ACCESS), and the Study on Cognition and Prognosis in the Elderly (SCOPE). All 3 trials demonstrated consistent relative risk reductions for stroke in the range of 24 percent to 34 percent, despite the enrolment of different patient populations, the use of varying angiotensin receptor blockers and differing interventions in the control group (placebo-based or conventional therapy).

The Ongoing Telmisartan Alone and in Combination with Ramipril Global Endpoint Trial (ONTARGET) compared the ACE inhibitor ramipril, the angiotensin-receptor blocker telmisartan and the combination of the 2 drugs in patients with vascular disease or high-risk diabetes. Patients underwent double-blind randomization, with 8576 assigned to receive 10 mg of ramipril per day, 8542 assigned to receive 80 mg of telmisartan per day and 8502 assigned to receive both drugs (combination therapy). The primary composite outcome was death from cardiovascular causes, myocardial infarction, stroke or hospitalization for heart failure. The researchers found that telmisartan was equivalent to ramipril in patients with vascular disease or high-risk diabetes and was associated with less angioedema. The combination of the 2 drugs was associated with more adverse events without an increase in benefit.

Launer and coworkers assessed the long-term relationship of midlife blood pressure levels to late-life cognitive function in the surviving cohort members of the prospective Honolulu Heart Program. The subjects were 3735 Japanese American men living in Hawaii either in the community or in institutions, with an average age of 78 years at the fourth examination. Cognitive function, measured by the 100-point Cognitive Abilities Screening Instrument, was categorized as good (reference category, with score of 92 to 100), intermediate (score < 92 to 82) and poor (score < 82). Midlife systolic blood pressure and diastolic blood pressure values were measured in 1965, 1968 and 1971. A respondent was classified into one of the following categories if 2 of 3 measurements fell into the following groups: for systolic blood pressure, < 110, 110 to 139, 140 to 159 and ≥ 160 mm Hg; and for diastolic blood pressure, < 80, 80 to 89, 90 to 94 and 95 mm Hg. The risk for intermediate and poor cognitive function increased progressively with increasing level of midlife systolic blood pressure category (p for trend < 0.03 and < 0.001, respectively) when controlled for age and education. For every 10 mm Hg increase in systolic blood pressure there was an increase in risk for intermediate cognitive function of 7 percent (95% CI 3%–11%) and for poor cognitive function of 9 percent (95% CI 3%–16%). The level of cognitive function was not associated with midlife diastolic blood pressure. The authors concluded that early control of systolic blood pressure levels may reduce the risk for cognitive impairment in old age.

**Best Practice Recommendation 2.3**

**Lipid Management**

Patients who have had an ischemic stroke or transient ischemic attack should have their serum lipid levels assessed and aggressively managed [Evidence level A].

**2.3.1 Lipid assessment**

i. **Fasting lipid levels** (total cholesterol, total glycerides, low-density lipoprotein [LDL] cholesterol, high-density lipoprotein [HDL] cholesterol) should be measured every one to three years for men 40 years or older and for women who are postmenopausal and/or 50 years or older [Evidence Level C]. More frequent testing should be performed for patients with abnormal values or if treatment is initiated.

ii. **Adults at any age** should have their blood lipid levels measured if they have a history of diabetes, smoking, hypertension, obesity, ischemic heart disease, renal vascular disease, peripheral vascular disease, ischemic stroke, transient ischemic attack, or asymptomatic carotid stenosis [Evidence Level
2.3.2 Lipid management

i. Patients with ischemic stroke or transient ischemic attack should be managed with lifestyle modification and dietary guidelines as part of a comprehensive approach to achieve LDL cholesterol of < 2 mmol/L [Evidence Level A].

ii. Other parameters may be considered including a 50% reduction in LDL concentration or apolipoprotein B level of <0.80 g/L [Evidence Level B].

iii. Statin agents should be prescribed for most patients who have had an ischemic stroke or transient ischemic attack to achieve current recommended lipid levels [Evidence Level A].

Rationale

High cholesterol and lipids in the blood are associated with a higher risk of both stroke and heart attack. People who have already had an ischemic stroke or transient ischemic attack will benefit from cholesterol-lowering medications with a statin type drug. Aggressive reduction of low-density lipoprotein cholesterol is likely to yield greater benefit than more modest reductions. A 20 to 30 percent relative risk reduction has been reported in recurrent vascular events for patients with a history of stroke without coronary artery disease who are treated with statin agents.

The Cholesterol Treatment Trialists meta-analysis of 14 statin trials showed a dose-dependent relative reduction in cardiovascular disease with low-density lipoprotein cholesterol lowering. Every 1.0 mmol/L reduction in low-density lipoprotein cholesterol is associated with a corresponding 20 to 25 percent reduction in cardiovascular disease mortality and nonfatal myocardial infarction.

With the childhood obesity epidemic, dyslipidemia is becoming a growing issue in paediatric stroke cases; therefore, fasting lipid panels should be part of the assessment of paediatric stroke cases.

System Implications

- Coordinated dyslipidemia awareness programs at the provincial and community levels that involve community groups, pharmacists, primary care providers and other relevant partners.
- Stroke prevention, including lipid level monitoring offered by primary care providers in the community as part of comprehensive patient management.
- Increased availability and access to education programs for healthcare providers across the continuum of care on dyslipidemia diagnosis and management.
- Continued alignment with recommendations and guidelines developed by the Canadian Cardiovascular Society Dyslipidemia group.

Performance Measures

1. Proportion of stroke patients prescribed lipid-lowering agents for secondary prevention of stroke, either at discharge from acute care, through a secondary prevention clinic or by primary care physician.
2. Proportion of the population who report that they have elevated lipid levels, especially low-density lipoprotein.
3. Proportion of stroke patients with a low-density lipoprotein cholesterol between 1.8 and 2.5 mmol/L at three months following the stroke event.

Measurement Notes

- Performance measures 1 and 2: Data may be available through the Canadian Community Health
Survey.

- Performance measure 2: Data sources may include physician order sheets, physicians’ and nurses’ notes, discharge summaries, or copies of prescriptions given to patients.
- Performance measure 3: Blood values should be taken from official laboratory reports where possible.
- Prescriptions for lipid-lowering agents may be given during the inpatient stay or during a secondary prevention assessment and follow-up, either in a stroke prevention clinic or in a primary care setting. When tracking these performance rates, it is important to record the setting where this therapy was initiated.
- Prescriptions given to a patient do not imply compliance.

Implementation Resources and Knowledge Transfer Tools

- Canadian Dyslipidemia Recommendations: [link](http://www.ccs.ca/consensus_conferences/cc_library_e.aspx)

Summary of the Evidence

Summary of the evidence

The causal relationship between dyslipidemia and atherosclerosis is well documented. Screening and appropriate management of dyslipidemia by healthcare providers is imperative in both primary and secondary prevention of coronary artery disease, peripheral vascular disease and stroke. The 2009 update of the Canadian dyslipidemia guidelines provides a detailed description of the current recommended treatment levels and management modalities for dyslipidemia.

They emphasize a need to balance lifestyle and risk factor modifications through behaviors change with pharmacological intervention to maximize treatment and improve outcomes for cardiovascular disease and stroke.

Several systematic reviews of lipid-lowering therapies have affirmed the following points: (1) the relative reduction in stroke risk is on the order of 25–30 percent, (2) ischemic stroke is reduced, with little effect on hemorrhagic stroke and (3) the relative reduction in stroke events is constant irrespective of the baseline risk of stroke. The latter indicates that a greater absolute benefit may accrue from treating patients with a history of stroke or transient ischemic attack, who have a markedly higher baseline risk of recurrent cerebrovascular events.

O’Regan and collaborators conducted a comprehensive review of randomized trials evaluating statin therapy for stroke prevention. Data were pooled using a random-effects model, and meta-regression techniques were employed. Following a thorough search, 42 trials assessing statin therapy for all-stroke prevention (n = 121,285) were included, resulting in a pooled RR of 0.84 (95% CI 0.79–0.91). The pooled relative risk of statin therapy for all-cause mortality (n = 116,080) was 0.88 (95% CI 0.83–0.93). Each unit increase in LDL resulted in a 0.3 percent increased RR of death (p = 0.02). Seventeen trials evaluated the effect of statins on cardiovascular death (n = 57,599, RR 0.81, 95% CI 0.74–0.90), and 11 evaluated non-hemorrhagic cerebrovascular events (n = 58,604, RR 0.81, 95% CI 0.69–0.94). Eleven trials reported hemorrhagic stroke incidence (total n = 54,334, RR 0.94, 95% CI 0.68–1.30), and 21 trials reported on fatal strokes (total n = 82,278, RR 0.99, 95% CI 0.80–1.21). Only one trial reported on statin therapy for secondary prevention. Statin therapy provides high levels of protection for all-cause mortality and non-hemorrhagic strokes, reinforcing the need to consider prolonged statin treatment for patients at high risk of major vascular events, but a need for caution remains for patients at risk of bleeds. A large meta-analysis of various lipid-lowering therapies (including statins, fibrates, niacin, bile acid sequestrants and diet) found that only statins reduced the risk of stroke, with a risk reduction of 26 percent (95% CI 14%–36%) for secondary prevention. Non-statin drug therapy (with 32,550 subjects studied, of whom 73% were randomized in trials employing fibrates) was associated with a nonsignificant risk reduction of seven percent (RR 0.93, 95% CI 0.79–1.08).

The Heart Protection Study contributed a substantial amount of information about the role of statin therapy in persons at high risk of serious vascular events. This study randomized 20,536 patients with a total serum cholesterol of > 3.4 mmol/L to simvastatin or placebo for a mean duration of five years. The inclusion criteria were any of the
following: coronary artery disease, cerebrovascular disease, peripheral vascular disease, diabetes or patients over 65 years with hypertension. The study showed that simvastatin 40 mg once daily rapidly produced a definite and substantial reduction in ischemic stroke (relative risk reduction 25 percent; 95% CI 15%–44%), irrespective of the patient’s age, sex or blood lipid concentrations when treatment was initiated. It also demonstrated that statin therapy reduced the risk of major vascular events among people who have previously had a stroke or other cerebrovascular event, even if they did not already have manifest coronary disease. In addition, there was a highly significant reduction in the simvastatin arm in the frequency of carotid endarterectomy and angioplasty. These benefits were evident in every subgroup tested: patients who had or did not have coronary artery disease; those with cerebrovascular disease, peripheral vascular disease or diabetes; men or women; those over or under 75 years at entry; and those whose LDL cholesterol was over or under 2.6 mmol/L. Treatment benefits were independent of the baseline cholesterol level. The results of the Heart Protection Study imply that the initiation of statin therapy should be based more on the assessment of a patient’s absolute risk of cardiovascular disease, rather than just the baseline LDL cholesterol concentration.

The Stroke Prevention by Aggressive Reduction in Cholesterol Levels trial (SPARCL) randomly assigned 4731 patients who had a stroke or transient ischemic attack within one to six months before study entry, had LDL levels of 2.6 to 4.9 mmol/L and had no known coronary artery disease to double-blind treatment with atorvastatin 80 mg once daily or placebo. The mean LDL level during the trial was 1.9 mmol/L among patients receiving atorvastatin and 3.3 mmol/L in the placebo group. The 5-year absolute reduction in risk of any stroke was 2.2 percent; adjusted hazard ratio (HR) 0.84 (95% CI 0.71–0.99; p = 0.03). The reduction in ischemic stroke (HR 0.78, 95% CI 0.66–0.94) was offset by a statistically significant increase in hemorrhagic stroke (HR 1.66, 95% CI 0.21–1.40). The five-year absolute reduction in risk of major cardiovascular events was 3.5 percent (HR 0.80, 95% CI 0.69–0.92; p = 0.002). The statistically significant increase in hemorrhagic stroke, not seen in other statin trials, remains unexplained.

In the second Stroke Prevention by Aggressive Reduction in Cholesterol Levels (SPARCL2) study, atorvastatin 80 mg/day reduced the risk of stroke in patients with recent stroke or transient ischemic attack. This overall benefit included an increase in the numbers of treated patients having hemorrhagic stroke (n = 55 for active treatment v. n = 33 for placebo), prompting investigators to further explore the relationships between hemorrhage risk and treatment, baseline patient characteristics, most recent blood pressure and most recent LDL cholesterol levels before the hemorrhage. Of 4731 patients, two percent had hemorrhagic strokes as entry events. In addition to atorvastatin treatment (HR 1.68, 95% CI 1.09–2.59; p = 0.02), Cox multivariable regression showed that hemorrhagic stroke risk was higher in those having a hemorrhagic stroke as the entry event (HR 5.65; 95% CI 1.47–26.11; p = 0.01), in men (HR 1.79, 95% CI 1.13–2.84; p = 0.01) and with age (10-yr increments, HR 1.42, 95% CI 1.16–1.74; p < 0.001). There were no statistical interactions between these factors and treatment. Multivariable analyses also found that having stage 2 (JNC-7) hypertension at the last study visit before a hemorrhagic stroke increased risk (HR 6.19, 95% CI 1.47–26.11; p = 0.01), but there was no effect of most recent LDL cholesterol level in those treated with atorvastatin.

Best Practice Recommendation 2.4
Diabetes Management

Patients with diabetes who have had an ischemic stroke or transient ischemic attack should have their diabetes assessed and aggressively managed [Evidence level A].

2.4.1 Diabetes assessment
i. All individuals in the general population should be evaluated annually for the risk of type 2 diabetes on the basis of demographic and clinical criteria [Evidence Level C].
ii. A fasting plasma glucose should be performed every three years in individuals > 40 years of age to screen for diabetes [Evidence Level C]. More frequent and/or earlier testing with either a
fasting plasma glucose or plasma glucose sample drawn two hours after a 75-g oral glucose load should be considered in people with additional risk factors for diabetes [Evidence Level C]. High-risk populations may include those with a family or personal history of diabetes, vascular disease, gestational diabetes, hypertension, dyslipidemia, overweight, abdominal obesity, and polycystic ovary syndrome.

iii. For patients with diabetes and either ischemic stroke or transient ischemic attack, glycated hemoglobin (HbA1C) should be measured, unless there is documentation of a recently obtained level or more intensive glucose-lowering therapy is contraindicated [Evidence Level B].

iv. In all patients, fasting lipid levels (total cholesterol, high-density lipoprotein cholesterol, total glycerides and calculated low-density lipoprotein cholesterol) should be measured at the time of diagnosis of diabetes and then every one to three years as clinically indicated. More frequent testing should be performed if treatment for dyslipidemia is initiated [Evidence Level C].

v. Blood pressure should be measured at every diabetes visit [Evidence Level C].

### 2.4.2 Diabetes management

i. Glycemic targets must be individualized; however, therapy in most patients with type 1 or type 2 diabetes should be targeted to achieve a glycated hemoglobin (HbA1C) level ≤7.0 percent to reduce the risk of microvascular complications [Evidence Level A] and, in individuals with type 1 diabetes, macrovascular complications [Evidence Level C].

ii. To achieve an HbA1C ≤7.0%, patients with type 1 or type 2 diabetes should aim for a fasting plasma glucose or preprandial plasma glucose target of 4.0 to 7.0 mmol/L [Evidence Level B].

iii. The 2-hour postprandial plasma glucose target is 5.0 to 10.0 mmol/L [Evidence Level B]. If HbA1C targets cannot be achieved with a postprandial target of 5.0 to 10.0 mmol/L, further postprandial blood glucose lowering, to 5.0 to 8.0 mmol/L, can be considered [Evidence Level C].

iv. Adults at high risk of a vascular event should be treated with a statin to achieve a low-density lipoprotein cholesterol ≤2.0 mmol/L [Evidence Level A].

v. Unless contraindicated, low-dose acetylsalicylic acid therapy (80 to 325 mg/day) is recommended in all patients with diabetes with evidence of cardiovascular disease, as well as for those individuals with atherosclerotic risk factors that increase their likelihood of cardiovascular events [Evidence Level A].

### Rationale

Diabetes is a major risk factor for cardiovascular disease and is recognized as an independent risk factor for ischemic stroke. Most adults with type 1 or type 2 diabetes should be considered at high risk for vascular disease. The exceptions are younger adults with type 1 and type 2 diabetes with shorter duration of disease and without complications of diabetes (including established cardiovascular disease) and without other cardiovascular disease risk factors. Diabetes increases the risk of stroke and is a particularly potent risk factor in younger individuals, with studies suggesting an increase in stroke risk of as much as 10-fold in some younger subgroups. Overall, diabetes is considered a major risk factor for many conditions and is considered here as part of a comprehensive package supporting prevention and lifestyle management.

### System Implications

- Coordinated diabetes awareness programs at the provincial and community levels that involve community groups, pharmacists, primary care providers and other relevant partners.
- Coordinated education and support programs for persons with diabetes to increase compliance.
and reduce ongoing risks for cardiovascular complications.
- Increased availability and access to education programs for healthcare providers across the continuum of care on management of patients with diabetes and stroke
- Continued alignment with recommendations and guidelines developed by the Canadian Diabetes Association.

### Performance Measures

1. **Proportion of persons with diabetes presenting to hospital with a new stroke event.**
2. Proportion of the population with a confirmed diagnosis of diabetes (type 1 and type 2).
3. Proportion of patients presenting to hospital with a stroke who receive a subsequent diagnosis of diabetes while in hospital for stroke care.

### Measurement Notes

- Data sources may include physician order sheets, physicians’ or nurses’ notes, discharge summaries, or copies of prescriptions given to patients.
- Blood values should be taken from official laboratory reports where possible.
- Trends and benchmarks may be monitored and tracked through the National Diabetes Surveillance System data.
- Performance measure 2: Rates may be obtained for Canada from the Public Health Agency of Canada Diabetes Surveillance database.

### Implementation Resources and Knowledge Transfer Tools

- Canadian Diabetes Association Clinical Practice Guidelines

### Summary of the Evidence

Diabetes is an important modifiable risk factor for a first ischemic stroke. In a review of stroke and diabetes, Idris and colleagues stated that the combination of diabetes and stroke is a major cause of morbidity and mortality worldwide. Evidence from large clinical trials performed in patients with diabetes supports the need for aggressive and early intervention to target patients’ cardiovascular risks to prevent the onset, recurrence and progression of acute stroke. They describe the epidemiology of diabetes and stroke, and report an estimate that the risk of stroke is increased 1.5- to three-fold for patients with diabetes. Diabetes also doubles the risk of stroke recurrence, and stroke outcomes are significantly worse among patients with diabetes, with increased hospital and long-term stroke mortality, more residual neurologic and functional disability and longer hospital stays. From a clinical perspective, diabetes increases the risk of ischemic stroke more than hemorrhagic stroke, resulting in a greater ischemic to hemorrhagic stroke ratio in people with diabetes compared with the general population. Idris and colleagues further reported that although strokes in patients with diabetes are associated with a worse outcome, there is no evidence to suggest that diabetes induces a larger area of cerebral infarction.

The high stroke risk in diabetes may be due to the complex interplay between the various hemodynamic and metabolic components of the diabetes syndrome. Other than the many recognized risk factors associated with acute stroke (e.g., hypertension, dyslipidemia and atrial fibrillation), specific risk factors attributable to diabetes have also been reported. Components of the metabolic syndrome such as insulin resistance, central obesity, impaired glucose tolerance and hyperinsulinemia, both individually and collectively, are associated with an excess risk of stroke disease.

Many diabetes patients exhibit metabolic syndrome and these additional risk factors, such as raised hypertension and cholesterol, multiply the overall risk. Reducing these risk factors to target levels is essential and requires a
multifactorial approach. Lifestyle changes, tight glycemic control, antiplatelet drugs (ASA) and control of lipid levels, (e.g., using statins), can all have significant beneficial effects. Blood pressure control is another vital aspect in reducing risk, and a number of recent studies have provided evidence supporting the use of ACE inhibitors as first-line treatment in patients with diabetes.

Karapanayiotides and collaborators reported that the Framingham Study found a 2.5-fold incidence of ischemic stroke in diabetic men and a 3.6-fold incidence in diabetic women. In the largest case–control study with adjustment for multiple known risk factors, the risk of ischemic stroke for diabetic individuals was increased 2.3-fold. Two other large studies reported similar findings with odds ratios (ORs) of 2.12 and 2.47. However, it is difficult to determine the level of association between diabetes and ischemic stroke, as diabetes is also associated with a two-fold higher incidence of hypertension and cardiac disease and with an increased incidence of asymptomatic carotid artery disease and hyperlipidemia. Karapanayiotides and collaborators concluded that other risk factors for stroke such as hypertension, hypercholesterolemia, cardiac ischemic disease and vascular claudication are significantly more frequent in diabetic individuals, confirming that diabetic patients have high cerebral and cardiovascular risk.

Lehto and coworkers conducted a seven-year follow-up study on diabetic patients and nondiabetic controls to assess risk for stroke. They found diabetic men had a two- to three-fold higher risk, and diabetic women a five-fold higher risk for stroke than corresponding nondiabetic subjects (men: OR 2.4, 95% CI 1.2–4.9 in East Finland; OR 3.3, 95% CI 1.6–6.9 in West Finland; women: OR 5.5, 95% CI 2.4–12.9 in East Finland; OR 5.4, 95% CI 2.3–12.6 in West Finland). Ischemic stroke was the most common cause of stroke in nondiabetic subjects and type 2 diabetes patients in both areas. High fasting plasma glucose was a risk factor for stroke even after adjustment for other variables. In addition to fasting plasma glucose, glycemic control was also assessed by HbA1c, which reflects hyperglycemia during the preceding two months. There was a dose–response relationship between HbA1c and risk of stroke. The duration of diabetes was also an important risk factor for stroke events in type 2 subjects. In addition, low levels of HDL cholesterol (less than 0.90 mmol/L), high levels of total triglyceride (more than 2.30 mmol/L) and the presence of hypertension were associated with a 2-fold increase in the risk of stroke mortality or morbidity.

The Treating to New Targets study showed that intensive lipid-lowering therapy with atorvastatin 80 mg/day provides significant clinical benefit beyond that afforded by atorvastatin 10 mg/day in patients with stable coronary artery disease. A total of 1501 patients with diabetes and coronary artery disease, with LDL cholesterol levels of < 3.36 mmol/L, were randomized to double-blind therapy with either atorvastatin 10 (n = 753) or 80 (n = 748) mg/day. Patients were followed for a median of 4.9 years. The primary end point was the time to first major cardiovascular event, defined as death from coronary heart disease, nonfatal non–procedure related myocardial infarction, resuscitated cardiac arrest, or fatal or nonfatal stroke. The results found end-of-treatment mean LDL cholesterol levels were 2.55 mmol/L with atorvastatin 10 mg and 1.99 mmol/L with atorvastatin 80 mg. A primary event occurred in 135 patients (17.9%) receiving atorvastatin 10 mg, compared with 103 patients (13.8%) receiving atorvastatin 80 mg (HR 0.75, 95% CI 0.58–0.97; p = 0.026). Significant differences between the groups in favour of atorvastatin 80 mg were also observed for time to cerebrovascular event (HR 0.69, 95% CI 0.48–0.98; p = 0.037) and any cardiovascular event (HR 0.85, 95% CI 0.73–1.00; p = 0.044). There were no significant differences between the treatment groups in the rates of treatment-related adverse events and persistent elevations in liver enzymes. The researchers concluded that among patients with clinically evident coronary artery disease and diabetes, intensive therapy with atorvastatin 80 mg significantly reduced the rate of major cardiovascular events by 25 percent compared with atorvastatin 10 mg.

The Action to Control Cardiovascular Risk in Diabetes Study investigators assessed whether intensive therapy to target normal HbA1c levels would reduce cardiovascular events in patients with type 2 diabetes who had either established cardiovascular disease or additional cardiovascular risk factors. Patients (n = 10 251) with a median HbA1c level of 8.1 percent were randomly assigned to receive intensive therapy (targeting an HbA1c level below 6.0 percent) or standard therapy (targeting a level from 7.0 percent to 7.9 percent). The finding of higher mortality in the intensive-therapy group led to a discontinuation of intensive therapy after a mean of 3.5 years of follow-up. During follow-up, the primary outcome occurred in 352 patients in the intensive-therapy group, as compared with 371 in the standard-therapy group (HR 0.90, 95% CI 0.78–1.04; p = 0.16). At the same time, 257 patients in the intensive-therapy group died, as compared with 203 patients in the standard therapy group (HR 1.22, 95% CI 1.01–1.46; p = 0.04). These findings identify a previously unrecognized harm of intensive glucose lowering in high-risk patients with type 2 diabetes.
The Action in Diabetes and Vascular Disease: Preterax and Diamicron Modified Release Controlled Evaluation (ADVANCE) trial randomly assigned patients (n = 11 140) with type 2 diabetes to undergo either standard glucose control or intensive glucose control, defined as the use of gliclazide (modified release) plus other drugs as required to achieve an HbA1c value of 6.5% or less. After a median of 5 years of follow-up, the mean glycated hemoglobin level was lower in the intensive-control group (6.5%) than in the standard-control group (7.3%). Intensive control reduced the incidence of combined major macrovascular and microvascular events (18.1% v. 20.0% with standard control; HR 0.90, 95% CI 0.82–0.98; p = 0.01), as well as that of major microvascular events (9.4% v. 10.9%; HR 0.86, 95% CI 0.77–0.97; p = 0.01), primarily because of a reduction in the incidence of nephropathy (4.1% v. 5.2%; HR 0.79, 95% CI 0.66–0.93; p = 0.006), with no significant effect on retinopathy (p = 0.50).

Best Practice Recommendation 2.5

Antiplatelet Therapy

All patients with ischemic stroke or transient ischemic attack should be prescribed antiplatelet therapy for secondary prevention of recurrent stroke unless there is an indication for anticoagulation [Evidence Level A].

i. Acetylsalicylic acid, combined acetylsalicylic acid (25 mg) and extended-release dipyridamole (200 mg), or clopidogrel (75 mg) are all appropriate options and selection should depend on the clinical circumstances [Evidence Level A].

ii. For adult patients on acetylsalicylic acid, the usual maintenance dosage is 80 to 325 mg per day [Evidence Level A].

iii. In children with stroke the usual maintenance dosage of acetylsalicylic acid is 1 to 5 mg/kg per day for the prevention of recurrent stroke [Evidence Level B]. For teens, the maximum dose should be up to 325 mg per day. Clopidigrel may be considered an alternative for paediatric patients with contraindications to acetylsalicylic acid [Evidence Level C].

iv. Long-term concurrent use of acetylsalicylic acid and clopidigrel is not recommended for secondary stroke prevention unless there is a compelling indication [Evidence Level B]. Refer to recommendation 2.6 for additional information on combination therapy for patients with stroke and atrial fibrillation.

Rationale

Several clinical trials have shown that antiplatelet medications (such as acetylsalicylic acid) reduce the risk of further vascular events after transient ischemic attack or ischemic stroke (25 percent relative risk reduction). This effect is modest and is clinically useful because antiplatelet therapy is tolerated by the majority of patients who have had a transient ischemic attack or ischemic stroke. Trials comparing different antiplatelet therapy regimes show quite small absolute differences in efficacy.

System Implications

- Stroke prevention clinics to improve secondary stroke prevention (effective, consistent prevention with early recognition of risk factors and timely, targeted interventions).
- Optimization of strategies at the local, regional and provincial levels to prevent the recurrence of stroke.
- Stroke prevention awareness and education about secondary prevention for primary care practitioners and specialists who manage stroke patients during the acute phase and after
discharge from acute care.

Performance Measures

1. Proportion of acute ischemic stroke and TIA patients who receive acute antiplatelet therapy within the first 48 hours of hospital arrival (core).
2. Proportion of patients with ischemic stroke or transient ischemic attack prescribed antiplatelet therapy on discharge from acute care (core).
3. Proportion of patients with ischemic stroke or transient ischemic attack prescribed antiplatelet therapy on discharge from secondary prevention clinic care (core).

Measurement Notes

- Data sources include patient chart, nurses’ notes, physicians’ orders and discharge summary note. Documentation quality may affect ability to accurately monitor this performance measure.
- It may be a challenge to measure compliance and prescribing patterns in primary care.
- Some patients may be on anticoagulants and would therefore be considered exclusions to these measures. See Canadian Stroke Strategy Performance Measurement Manual for additional measures on all antithrombotic prescribing (www.canadianstrokestrategy.ca).
- Reasons potentially eligible patients are not prescribed antiplatelet agents should be included in data collection. This information may contribute to the interpretation of the findings of the performance measures and guide quality improvement initiatives.

Summary of the Evidence

Substantial evidence from randomized trials and meta-analyses supports the use of antithrombotic agents in patients who have experienced an ischemic stroke. The most commonly recommended antiplatelet agents for secondary stroke prevention in North America and Europe are acetylsalicylic acid (ASA), clopidogrel and the combination of ASA and extended-release dipyridamole. Although some controversy regarding ASA dosage still exists, most guidelines recommend medium dose ASA (75 to 325 mg/day) as the first choice in secondary prevention of stroke. Other antiplatelet agents are acceptable alternatives. For patients with a stroke due to a cardioembolic source (e.g., atrial fibrillation, mechanical heart valve), warfarin is generally recommended (see recommendation 2.6, “Antithrombotic therapy in atrial fibrillation”) unless contraindicated. Warfarin is not recommended for secondary stroke prevention in patients presumed to have a non-cardioembolic stroke or transient ischemic attack.

Systematic reviews

In a critical review by O’Donnell and colleagues, immediate and long-term ASA therapy was found to reduce the risk of recurrent stroke, myocardial infarction and vascular-related death for patients with ischemic stroke or transient ischemic attack. Oral anticoagulation was not more effective than ASA. In comparison to ASA, long-term clopidogrel reduces the relative risk of stroke, myocardial infarction or vascular death by approximately nine percent. Any benefit of combination antiplatelet therapy with clopidogrel and ASA appears to be offset by an increased incidence of major bleeding complications compared with either agent alone. The combination of ASA and extended-release dipyridamole appeared to reduce the relative odds of stroke, myocardial infarction or vascular death by about 18 percent (OR 0.82, 95% CI 0.74–0.91) compared with ASA alone, without causing more bleeding.

Verro and associates recently published a review of randomized controlled trials comparing ASA plus dipyridamole with ASA alone in patients with stroke and transient ischemic attack to determine the efficacy of these agents in preventing recurrent vascular events. Separate analyses of the incidence of stroke alone and the composite outcome of stroke, myocardial infarction or vascular death were performed, as well as two a priori subset analyses examining effect size based on trials using (1) exclusively immediate-release and (2) predominantly extended-release dipyridamole. Results indicated a significant reduction in the overall risk ratio in favour of ASA plus dipyridamole for stroke (RR 0.77, 95% CI 0.67–0.89) and for the composite end point (RR 0.85, 95% CI 0.76–0.94). Studies using
Immediate-release dipyridamole showed a non-statistically significant trend in favour of the combination for stroke (RR 0.83, 95% CI 0.59–1.15) and for the composite outcome (RR 0.95, 95% CI 0.75–1.19). Studies using predominantly extended-release dipyridamole showed a statistically significant difference in favour of the combination for stroke (RR 0.76, 95% CI 0.65–0.89) and for the composite outcome (RR 0.82, 95% CI 0.73–0.92). These findings indicate that ASA in combination with dipyridamole was more effective than ASA alone in preventing recurrent stroke in patients with minor stroke or transient ischemic attack.\textsuperscript{101} The risk reduction was greater and statistically significant for studies using primarily extended-release dipyridamole, which may be a reflection of a true pharmacologic effect or lack of statistical power in studies using immediate-release dipyridamole.

A 2007 review surveyed the clinical trials and guidelines concerning the use of antiplatelet therapy in the prevention of recurrent stroke after transient ischemic attack or ischemic stroke of arterial origin.\textsuperscript{142} Meta-analyses of the results from the randomized controlled trials demonstrated that, compared with control, the relative risk reduction for recurrent stroke and other serious vascular events was 13 percent with ASA, 13 percent with dipyridamole (95% CI 4% to 21%; \( p = 0.046 \)) and 34 percent with combination ASA and dipyridamole. Compared with ASA, the relative risk of recurrent stroke and other serious vascular events was reduced by 7.3 percent with clopidogrel (95% CI –5.7% to 18.7%) and 18 percent with combination ASA and dipyridamole (9% to 26%, \( p = 0.0003 \)). Long-term treatment with the combination of ASA and clopidogrel was not significantly more effective in preventing serious vascular events than clopidogrel alone, mainly due to an increased frequency of bleeding complications among patients receiving both agents.

An updated Cochrane systematic review assessed the efficacy and safety of dipyridamole relative to control in the secondary prevention of vascular events in patients with vascular disease.\textsuperscript{143} The review included randomized long-term secondary prevention trials with concealed treatment allocation, treatment for more than one month, starting within six months after presentation of an arterial vascular disease. Treatment consisted of dipyridamole with or without other antiplatelet drugs compared with no drug or an antiplatelet drug other than dipyridamole. Twenty-seven trials were included, with 20,242 patients, among whom 1399 vascular deaths and 3090 fatal and nonfatal vascular events occurred during follow-up. Compared with control, dipyridamole had no clear effect on vascular death (RR 1.02, 95% CI 0.90–1.17). This result was not influenced by the dose of dipyridamole or type of presenting vascular disease. In the presence of ASA, dipyridamole appeared to reduce the risk of vascular events compared with control (RR 0.90, 95% CI 0.82–0.97), due to a single large trial (Second European Stroke Prevention Study [ESP S2]) in patients presenting with cerebral ischemia.\textsuperscript{144} The authors concluded that for patients who presented with arterial vascular disease, there was no evidence that dipyridamole, in the presence or absence of another antiplatelet drug, reduced the risk of vascular death, though it may reduce the risk of further vascular events. However, this benefit was found in only one large trial and only in patients presenting after cerebral ischemia. There was no evidence that dipyridamole alone was more efficacious than ASA.

The Antithrombotic Trialists’ Collaboration produced a meta-analysis of randomized controlled trials for antiplatelet therapy in high risk patients.\textsuperscript{138} The findings indicated that ASA and other forms of antiplatelet drugs reduced the incidence of nonfatal stroke by one-quarter. Absolute reduction in the rates of having a serious vascular event were 36 (standard deviation [SD] 6) per 1000 patients treated for two years among those patients with previous stroke or transient ischemic attack. The authors concluded that the benefits of ASA and other antiplatelet drugs substantially outweigh the absolute risks of major extracranial bleeding.

Hankey and coworkers assessed the effectiveness and safety of thienopyridine derivatives (ticlopidine and clopidogrel) compared with ASA for the prevention of serious vascular events in high-risk patients.\textsuperscript{145} Four high-quality and comparable trials, including 22,656 patients at high risk for adverse vascular events, were identified (three compared ASA to ticlopidine and one compared ASA to clopidogrel). The use of a thienopyridine was associated with a marginally significant reduction in the odds of serious vascular event (12.0% v.13%; OR 0.91, 95% CI 0.84–0.98; \( p = 0.01 \)). There was also a reduction in stroke events in favour of thienopyridines compared with ASA (5.7% v. 6.4%; OR 0.88, 95% CI 0.79–0.98) corresponding to an avoidance of 7 (95% CI 1–13) stroke events per 1000 patients treated for two years. In a subgroup analysis of patients with ischemic stroke or transient ischemic attack, the results were similar to those of all patients combined; however, thienopyridine allocation was associated with a larger absolute reduction in stroke (10.4% v. 12.0%; OR 0.86, 95% CI 0.75–0.97) with an avoidance of 16 (95% CI 3–28) stroke events per 1000 patients treated for two years.\textsuperscript{145}
A review by Halkes and colleagues studied five trials of dipyridamole plus aspirin versus aspirin alone for secondary prevention of stroke or TIA, and included the ESPRIT results. A total of 7612 patients. A total of 7612 patients were included in the analyses (five trials). The trial-adjusted hazard ratio (HR) for composite event of vascular death, nonfatal myocardial infarction and non-fatal stroke was 0.82 (95% confidence interval, 0.72 to 0.92). Hazard ratios did not differ in subgroup analyses based on age, sex, qualifying event, hypertension, diabetes, previous stroke, ischemic heart disease, aspirin dose, type of vessel disease and dipyridamole formulation, nor across baseline risk strata as assessed with two different risk scores. Dipyridamole plus aspirin was more effective than ASA alone in preventing recurrent stroke; HR 0.78 (95% CI 0.68 to 0.90). The dose of aspirin was fixed in four trials: 25 mg twice daily, 300 mg three times daily, 325 mg three times daily or 330 mg three times daily. In ESPRIT, the dose of aspirin was left to the discretion of the treating physician, provided it was between 30 and 325 mg daily. The investigators concluded the combination of aspirin and dipyridamole is more effective that aspirin alone in patients with TIA or ischemic stroke of presumed arterial origin in the secondary prevention of stroke and other vascular events. The superiority was found in all subgroups and was independent of baseline risk.

**Clinical trials**

The Prevention Regimen For Effectively avoiding Second Stroke (PRoFESS) trial, randomized, double-blind study, investigated the effects of ASA plus extended-release dipyridamole versus clopidogrel on the prevention of vascular events in patients who had a transient ischemic attack or ischemic stroke within the preceding 120 days. Patients participating in the trial (n = 20,332 across 35 countries) were followed for a period of four years. Stroke recurrence rates were similar in both arms of the trial (9.0 percent among patients assigned to receive ASA plus extended-release dipyridamole and 8.8 percent among patients assigned to receive clopidogrel; HR 1.01, 95% CI 0.92–1.11). Nor was there a significant difference in the composite outcome of stroke, myocardial infarction or vascular death. The trial did not meet its primary end point of noninferiority for ASA plus extended-release dipyridamole versus clopidogrel.

The European/Australian Stroke Prevention Reversible Ischemia Trial (ESPRIT) group conducted a randomized controlled trial in which patients were assigned to ASA (30–325 mg daily) with (n = 1363) or without (n = 1376) dipyridamole (200 mg twice daily) within six months of a transient ischemic attack or minor stroke of presumed arterial origin. The primary outcome was the composite of death from all vascular causes, nonfatal stroke, nonfatal myocardial infarction or major bleeding complication, whichever happened first. Treatment was open, but auditing of outcome events was blinded. Primary analysis was by intention to treat. Mean follow-up was 3.5 years (SD 2.0). Median ASA dose was 75 mg in both treatment groups (range 30–325); extended-release dipyridamole was used by 83 percent (n = 1131) of the patients on the combination regimen. Primary outcome events arose in 173 (13%) patients on ASA and dipyridamole and in 216 (16%) on ASA alone (HR 0.80, 95% CI 0.66–0.98; absolute risk reduction 1.0% per year, 95% CI 0.1%–1.8%). Addition of the ESPRIT data to the meta-analysis of previous trials resulted in an overall risk ratio for the composite of vascular death, stroke or myocardial infarction of 0.82 (95% CI 0.74–0.91). Patients on ASA and dipyridamole discontinued trial medication more often than those on ASA alone (470 v. 184), mainly because of headache. Expressed differently, ESPRIT showed that 104 patients would need to be treated with the combination regimen for 1 year to prevent 1 additional vascular death, nonfatal stroke or nonfatal myocardial infarction.

The Clopidogrel for High Atherothrombotic Risk and Ischemic Stabilization, Management, and Avoidance (CHARISMA) trial randomly assigned 15,603 patients with clinically evident cardiovascular disease or multiple risk factors to receive clopidogrel (75 mg per day) plus low-dose ASA (75 to 162 mg per day) or placebo plus low-dose ASA and followed them for a median of 28 months. The primary efficacy end point, a composite of nonfatal stroke, nonfatal myocardial infarction or vascular death, was reached by 6.8 percent of patients assigned to receive clopidogrel plus ASA and 7.3 percent of those assigned to receive placebo plus ASA (RR 0.93, 95% CI 0.83–1.05; p = 0.22). The respective rate of the principal secondary efficacy end point, which included hospitalizations for ischemic events, was 16.7 percent and 17.9 percent (RR 0.92, 95% CI 0.86–0.995; p = 0.04). Severe bleeding occurred in 1.7 percent of patients assigned to receive clopidogrel plus ASA and 1.3% percent of those assigned to receive placebo plus ASA (RR 1.25, 95% CI 0.97–1.61; p = 0.09). Among patients with multiple risk factors, the primary end point was reached by 6.6% of the clopidogrel plus ASA group and 5.5 percent of the placebo plus ASA group (RR 1.2, 95% CI 0.91–1.59; p = 0.20). Death from cardiovascular causes occurred in 3.9% of patients assigned to receive clopidogrel plus ASA and 2.2 percent of those assigned to receive placebo plus ASA (p = 0.01). In the subgroup with clinically
evident atherothrombosis, a marginally significant reduction in the primary end point of 6.9 percent with clopidogrel and 7.9 percent with placebo was indicated (RR 0.88, 95% CI 0.77–0.998; \( p = 0.046 \)). The investigators concluded that there was a suggestion of benefit with clopidogrel treatment in patients with symptomatic atherothrombosis and a suggestion of harm in patients with multiple risk factors; however, overall, clopidogrel plus ASA was not significantly more effective than ASA alone in reducing the rate of myocardial infarction, stroke or vascular death.

The Management of Atherothrombosis with Clopidogrel in High-risk patients with recent TIA or ischemic stroke (MATCH) trial was a randomized, double-blind, placebo-controlled comparison of ASA (75 mg/day) with placebo in 7599 high-risk patients with recent ischemic stroke or transient ischemic attack and at least 1 additional vascular risk factor who were already receiving clopidogrel 75 mg/day.\(^\text{150}\) Duration of treatment and follow-up was 18 months. The primary end point was a composite of ischemic stroke, myocardial infarction, vascular death or rehospitalization for acute ischemia (including rehospitalization for transient ischemic attack, angina pectoris or worsening of peripheral arterial disease). The primary end point was reached by 596 (15.7%) of the patients assigned to receive ASA and clopidogrel, and 636 (16.7%) of the patients assigned to receive placebo plus clopidogrel (relative risk reduction 6.4%, 95% CI –4.6% to 16.3%; absolute risk reduction 1%, 95% CI –0.6% to 2.7%). Life-threatening bleeding was higher in the group assigned to receive ASA and clopidogrel (2.6%) than in the group assigned to receive placebo plus clopidogrel (1.3%) (absolute risk increase 1.3%, 95% CI 0.6% to 1.9%). Major bleeding was also increased in the group assigned to receive ASA and clopidogrel. There was no difference in mortality between the 2 groups. The investigators concluded that adding ASA to clopidogrel in high-risk patients with recent ischemic stroke or transient ischemic attack was associated with a nonsignificant reduction in major vascular events and an increase in the risk of life-threatening or major bleeding after 18 months of follow-up.

The Clopidogrel versus ASA in Patients at Risk of Ischemic Events (CAPRIE) trial randomized 19 185 symptomatic patients (one-third had experienced a previous stroke, one-third had a previous myocardial infarction, and one-third had peripheral vascular disease) to clopidogrel (75 mg) or ASA (325 mg).\(^\text{151}\) An 8.7 percent (95% CI 0.3%–16.5%; \( p = 0.043 \)) reduction in the primary end point of ischemic stroke, myocardial infarction or vascular death in favour of clopidogrel was reported. Among the patients whose qualifying event was a stroke, the number needed to treat with clopidogrel instead of ASA to prevent a recurrent ischemic event was about 180 per year.\(^\text{152}\)

**Paediatrics**

ASA is frequently used in children for the secondary prevention of recurrent stroke following a transient ischemic attack or stroke event. In adults, it has been demonstrated that treatment with ASA can reduce the risk of recurrent stroke. Data on the efficacy and optimal dosage of ASA for paediatric stroke patients are not yet available,\(^\text{81}\) but it is clear that no treatment is associated with increased risk of recurrent stroke.\(^\text{153}\) ASA use has been recommended as a reasonable option for secondary prevention of arterial ischemic stroke for children not at high risk of recurrent embolism or a hypercoaguable disorder.\(^\text{12}\)

Clopidogrel has been studied as an alternative to aspirin in children when aspirin is not tolerated or failed in children with arterial ischemic stroke.\(^\text{137}\) Seventeen children were included in the study and started on clopidogrel at 1 mg/kg per day up to a maximum of 75 mg per day. Of these, eight were on clopidogrel alone and nine in combination with ASA. Two patients developed significant intracranial hemorrhage while on the combination of clopidogrel and ASA – one has recent surgery and the other had hypertension prior to the start of therapy, as well as marked cerebral atrophy. This small initial investigation concluded that clopidogrel appears to be a reasonable option in children who cannot tolerate aspirin, and the combination of clopidogrel and aspirin should be used with caution.
Best Practice Recommendation 2.6
Antithrombotic Therapy in Patients with Atrial Fibrillation

Atrial fibrillation is a significant risk factor for stroke and should be aggressively managed to reduce the risk of cerebrovascular events.

2.6.1 Primary prevention of stroke in patients with non-valvular atrial fibrillation:

i. Patients with atrial fibrillation should be risk-stratified using predictive indices for stroke risk such as CHADS2, and bleeding risk (such as HEMORR2HAGES). Most patients should receive antithrombotic therapy [Evidence Level B].

ii. Patients with atrial fibrillation at very low risk of stroke (CHADS2 = 0) should receive aspirin (75-325 mg/day)[Evidence Level A].

iii. Patients with atrial fibrillation at low risk of stroke (CHADS2 = 1) should receive either warfarin or dabigatran [Evidence Level A]. Acetylsalicylic acid is a reasonable alternative for some low risk patients, depending on their individual risk/benefit profile [Evidence Level A].

iv. Patients with atrial fibrillation at moderate to high risk of stroke (CHADS2 ≥ 2) should receive either warfarin or dabigatran [Evidence Level A].

v. Patients with atrial fibrillation who are already well-controlled on warfarin with a stable therapeutic International Normalized ration (INR) may continue on warfarin, and may not need to switch to dabigatran [Evidence Level C].

vi. Patients with non-valvular atrial fibrillation who are treated with warfarin should have a target INR of 2.5 (maintained in the range of 2.0 to 3.0); for patients with atrial fibrillation and mechanical heart valves, the target INR is 3.0 (range 2.5 to 3.5) [Evidence Level A].

vii. Dabigatran is preferred over warfarin for patients with atrial fibrillation who meet the inclusion criteria for the RE-LY trial [Evidence Level A].

viii. For patients treated with dabigatran, a dose of 150 mg twice daily is appropriate for most individuals; 110 mg twice daily is recommended for patients aged 80 or more years and for patients at risk of bleeding [Evidence Level B]. The median duration of treatment in the RE-LY trial was 20 months. The long-term safety and effectiveness of dabigatran is currently under investigation.

ix. The combination of ASA and clopidogrel should not be considered as a safer alternative to anticoagulant therapy for patients with atrial fibrillation, and should be reserved for patients in whom anticoagulant therapy is not feasible (e.g. patient refusal or inability to access INR monitoring) or when there are problems maintaining a stable, therapeutic INR. [Evidence Level A]

2.6.2 Prevention of recurrent stroke in patients with non-valvular atrial fibrillation

i. Patients with transient ischemic attack and atrial fibrillation should begin oral anticoagulation (warfarin or dabigatran) immediately after brain imaging has excluded intracranial hemorrhage or large infarct [Evidence Level B].

ii. Dabigatran is preferred over warfarin for patients with atrial fibrillation who would meet the inclusion criteria for the RE-LY trial [Evidence Level A].

iii. Most patients with acute ischemic stroke and atrial fibrillation should receive oral anticoagulant therapy (warfarin or dabigatran) [Evidence Level A]. The decision to start anticoagulant therapy is optimally made during the acute phase of hospitalization. The optimal timing of oral
anticoagulation following acute stroke for patients in atrial fibrillation is unclear; it is common practice to wait two to fourteen days and repeat brain imaging (CT or MRI) to rule out asymptomatic intracranial hemorrhage before starting warfarin [Evidence Level C]. The RE-LY trial of dabigatran did not enroll patients within the first 14 days after stroke, or patients with severe stroke within the previous six months.\textsuperscript{156}

iv. For some patients with \textit{acute ischemic stroke} and atrial fibrillation, the individual’s preferences, level of disability, prognosis, and overall clinical status, including the size of the infarct on neuroimaging, may contraindicate oral anticoagulant therapy [Evidence Level C].

v. For patients presenting with \textit{acute ischemic stroke} and atrial fibrillation, the immediate use of heparin/heparinoid anticoagulation is not recommended [Evidence Level A].

2.6.3 \textbf{Enhancing anticoagulation therapy and minimizing bleeding complications}

i. Patients prescribed warfarin or dabigatran for atrial fibrillation should be educated about the diagnosis of atrial fibrillation, the risk of stroke with atrial fibrillation, the importance of medication adherence, and compliance with international normalized ratio monitoring, if required [Evidence Level B].

ii. For patients with atrial fibrillation who are taking warfarin, careful dosing and consistent international normalized ratio monitoring is recommended to minimize adverse events; warfarin efficacy is dependent on maintaining therapeutic international normalized ratio control, and declines significantly when the international normalized ratio falls below 2.0 [Evidence Level A].

iii. Concomitant antiplatelet therapy with warfarin is not recommended in patients with atrial fibrillation unless there is a specific medical indication such as a coronary stent [Evidence Level B].

iv. With the exception of patients with mechanical heart valves, the addition of acetylsalicylic acid to warfarin in patients with atrial fibrillation has not been shown to be of benefit in stroke prevention [Evidence Level B]

v. Concomitant antiplatelet therapy with dabigatran is not recommended in patients with atrial fibrillation [Evidence Level B].

\textbf{Rationale}

Atrial fibrillation is a significant risk factor for stroke, with one in six patients with ischemic stroke found to have atrial fibrillation. Stroke caused by atrial fibrillation is highly preventable if patients are treated with anticoagulants.

\textbf{System Implications}

- Stroke prevention clinics to improve secondary stroke prevention including management of atrial fibrillation in patients with stroke and transient ischemic attack (effective, consistent prevention with early recognition of risk factors and timely, targeted interventions).
- A process for appropriate outpatient monitoring of patients’ international normalized ratio and follow-up communication with patients taking anticoagulants.
- Optimization of strategies at the local, regional and provincial levels to prevent the recurrence of stroke.
- Stroke prevention awareness and education about secondary prevention for primary care practitioners and specialists who manage stroke patients during the acute phase and after discharge from acute care.
- For patients taking warfarin, access to a dedicated anticoagulant management clinic is associated
with better patient outcomes compared to routine medical care.

**Performance Measures**

1. **Proportion of acute ischemic stroke patients with atrial fibrillation who are treated with anticoagulant therapy unless contraindicated (core).**

2. **Proportion of eligible stroke and transient ischemic attack patients with atrial fibrillation prescribed anticoagulant therapy on discharge from acute care (core).**

3. **Proportion of eligible stroke and transient ischemic attack patients with atrial fibrillation prescribed anticoagulant therapy after a visit to a secondary prevention clinic (core).**

4. Proportion of atrial fibrillation patients taking anticoagulant therapy at the time of hospital admission for acute ischemic stroke or transient ischemic attack.

5. Proportion of atrial fibrillation patients with stroke or transient ischemic attack on antiplatelet therapy and not prescribed anticoagulant therapy.

6. Proportion of atrial fibrillation patients with stroke or transient ischemic attack continuing on anticoagulant therapy at 3 months, 6 months, and 1 year following initiation of therapy.

7. For atrial fibrillation patients on warfarin, the proportion with an international normalized ratio in the therapeutic range at three months.

**Measurement Notes**

- Performance measure 3: reasons why patients with atrial fibrillation and stroke are not on anticoagulants should be collected and reported. These may include contraindications, compliance issues and physician prescribing patterns, among others. This additional information will help to inform the direction for quality improvement initiatives.

- If there is documentation of atrial fibrillation, the chart should be reviewed for medications prescribed to the patient at the time of discharge, specifically including coumadin, warfarin, or heparin.

- Data sources may include discharge summary, history and physical examination, physician’s orders, nurses’ notes from inpatient chart, stroke prevention clinic documents, and primary care charts.

- To measure whether the patient’s International Normalized Ratio was in the therapeutic range, laboratory reports or other reliable documentation are required to verify the International Normalized Ratio levels, and these should be reviewed over a period of time rather than as one single measure.

- Providing a prescription does not ensure patient adherence with medication administration. Adherence can be determined through patient self-report and through International Normalized Ratio measurements over time.

**Implementation Resources and Knowledge Transfer Tools**

- Thrombosis Interest Group of Canada (available at www.tigc.org)

**Summary of the Evidence**

Atrial fibrillation is a common arrhythmia. The prevalence of atrial fibrillation in the general population increases with age; about 12 percent of people aged over 75 years have atrial fibrillation. The incidence of AF in the general population appears to be increasing over time.

Atrial fibrillation is a major risk factor for stroke. The presence of atrial fibrillation increases the risk of stroke approximately five-fold; the relative risk is higher still if there is associated valvular heart disease. Stroke risk also

December 8, 2010
Atrial fibrillation most often causes stroke via embolism of thrombus from the left atrium. Several clinical trials involving many thousands of patients with AF have examined the efficacy of various antithrombotic drug regimens. The majority of the trial evidence concerns prevention of first stroke; the evidence-base for prevention of stroke recurrence in patients with AF is much smaller. Strokes due to atrial fibrillation are generally more severe than those occurring in patients in sinus rhythm. Consequently, atrial fibrillation strokes are associated with higher case-fatality, longer hospitalization, and increased disability.

To characterize the efficacy and safety of antithrombotic agents for stroke prevention in patients who have atrial fibrillation, conducted a meta-analysis of all randomized trials published between 1966 and March 2007, identified by using the Cochrane Stroke Group search strategy. The analysis included 29 trials involving 28,044 patients who had non-valvular atrial fibrillation (mean age 71 years; mean follow-up 1.5 years). Most trials studied warfarin or aspirin in varying dosages and intensities, but other anticoagulants (low-molecular-weight heparin, ximelagatran, and dabigatran) and other antiplatelet agents (clopidogrel, dipryidamole, indobufen, and trifusal) were also tested. There were 3003 participants assigned to placebo or control groups in 12 trials. The average stroke rate for these untreated participants was 13 percent per year in trials that were restricted to those who had previous stroke or TIA (secondary prevention trials) and 4.1 percent per year for those in primary prevention trials.

Compared with control, adjusted-dose warfarin (6 trials, 2900 participants 20 percent of whom had previous stroke or TIA) and antiplatelet agents (8 trials, 4876 participants 29 percent of whom had previous stroke or TIA) reduced stroke by 64 percent (95% CI 49-74%) and 22 percent (95% CI 6-35%), respectively. Adjusted-dose warfarin was substantially more efficacious than antiplatelet therapy (relative risk reduction, 39 percent [95% CI 22-52%]) (12 trials, 12,963 participants 23 percent of whom had previous stroke or TIA). Adjusted dose warfarin doubled the risk of intracranial and major extracranial hemorrhage; however, absolute rates of these adverse events were only 0.2 percent per year.

The largest trial comparing adjusted-dose warfarin with antiplatelet therapy was ACTIVE-W (Atrial fibrillation Clopidogrel Trial with Irbesartan for prevention of Vascular Events), which included 6706 participants. Anticoagulant therapy was superior to the combination of clopidogrel plus aspirin (relative risk reduction, 40 percent [95% CI 18-56%]). The ACTIVE-A trial, published after the meta-analysis by Hart et al, included 7,554 participants in whom warfarin was unsuitable, randomly allocated them to receive clopidogrel plus aspirin or aspirin alone, and followed them for a median of 3.6 years. The results showed that treating 1000 AF patients for one year with clopidogrel plus aspirin prevented eight major vascular events (including two fatal and three disabling strokes) and caused seven major hemorrhages (one fatal).

Also published after the meta-analysis by Hart et al was the BAFTA trial (the Birmingham Atrial Fibrillation Treatment of the Aged study) which recruited 973 patients (12.5 percent of whom had previous stroke or TIA) aged 75 years or more (mean 81.5 years) from primary care, randomly assigned them to adjusted-dose warfarin (INR 2.0 - 3.0) or aspirin 75 mg once daily, and followed them for a mean of 2.7 years. The primary endpoint was fatal or disabling stroke (ischemic or hemorrhagic), other intracranial hemorrhage, or clinically significant systemic embolism. There were 24 primary events (21 strokes, two other intracranial hemorrhages, and one systemic embolus) among participants assigned warfarin and 48 primary events (44 strokes, one other intracranial hemorrhage, and three systemic emboli) among those assigned aspirin (annual risk 1.8% vs. 3.8%, relative risk reduction 52 percent [95% CI 20-72%], p=0.003; treat 50 patients for one year to prevent one event). The annual risk of extracranial hemorrhage was 1.4 percent for patients assigned warfarin and 1.6 percent for those assigned aspirin.

Two trials in the meta-analysis by Hart et al included only patients who recently had a stroke or TIA. The European Atrial Fibrillation Trial (EAF) involved 455 patients who were within three months of TIA or minor stroke, randomly assigned them to warfarin (INR 2.5 to 4.0) or aspirin (300 mg/day), and followed them for a mean of 2.3 years. In the Studio Italiano Fibrillazione Atriale (SIFA) trial, 916 patients within 15 days of TIA or minor stroke were randomized to open-label warfarin (INR 2.0 to 3.5) or indobufen (a reversible platelet cyclooxygenase inhibitor, 100 or 200 mg twice a day), and followed for one year. The combined results showed that anticoagulants were significantly more effective...
than antiplatelet therapy for the prevention of all ischemic vascular events (odds ratio 0.67, 95% CI 0.50–0.91) and for the prevention of stroke recurrence (odds ratio 0.49, 95% CI 0.33–0.72). Warfarin did not significantly increase the frequency of intracranial bleeding. Although major extracranial bleeding complications occurred more often in patients on warfarin (odds ratio 5.16, 95% CI 2.08–12.83), the absolute difference was small (2.8 percent per year versus 0.9 percent per year in EAF and 0.9 percent per year versus zero percent in SIFA). Heparin anticoagulation confers no net benefit over antiplatelet therapy in patients with AF and recent (within 14 days) acute ischemic stroke.

A Danish cohort study investigated the risks of bleeding on monotherapy compared to combined therapy in patients with atrial fibrillation. Records from nation-wide registries were used to identify patients with a first-time hospitalization for AF between 1997 and 2006. A total of 82,854 of 118,606 patients (69.9 percent) surviving AF hospitalization had at least 1 prescription filled for warfarin, aspirin, or clopidogrel after discharge. During mean (SD) follow-up of 3.3 (2.6) years, 13,573 patients (11.4 percent) experienced a nonfatal or fatal bleeding. The crude incidence rate for bleeding was highest for dual clopidogrel and warfarin therapy (13.9 percent per patient-year) and triple therapy (15.7 percent per patient-year). Using warfarin monotherapy as a reference, the hazard ratio (95% confidence interval) for the combined end point was 0.93 (0.88–0.98) for aspirin, 1.06 (0.87–1.29) for clopidogrel, 1.66 (1.34–2.04) for aspirin–clopidogrel, 1.83 (1.72–1.96) for warfarin–aspirin, 3.08 (2.32–3.91) for warfarin–clopidogrel, and 3.70 (2.89–4.76) for warfarin–aspirin–clopidogrel. Triple therapy posed a bleeding risk, which was three times higher than the risk of bleeding for warfarin alone.

In spite of convincing evidence linking AF to stroke, and the benefits of warfarin therapy in reducing this risk, AF patients are often not optimally managed. A recent analysis by Gladstone and colleagues using data from the Registry of the Canadian Stroke Network (RCSN) examined this issue in a cohort of 597 patients presenting to hospital with an ischemic stroke and previously known atrial fibrillation. They found that on admission for stroke, only 40 percent of patients were on warfarin, 30 percent on antiplatelet therapy, and 29% were not on any antithrombotics. Of those taking warfarin, three fourths had a subtherapeutic INR (<2.0) at the time of stroke admission. Overall, only 10 percent of patients with acute stroke and previously known atrial fibrillation were therapeutically anticoagulated (INR >2.0) at admission. Among the high-risk subgroup of stroke patients with a history of atrial fibrillation and a previous TIA or ischemic stroke (n=323), only 18 percent were taking warfarin with a therapeutic INR at the time of admission for their recurrent stroke; 39 percent were taking warfarin with a subtherapeutic INR, and 15 percent were on no antithrombotic therapy. These findings are particularly troublesome given that all subjects selected for inclusion in this study were considered high risk for stroke according to published criteria (low and moderate risk patients were not included), were living independently, and were considered ideal candidates for warfarin therapy (patients with known contraindications to warfarin were excluded from the study).

The problems associated with warfarin therapy have stimulated the development of oral agents that produce more predictable anticoagulation and do not require frequent monitoring. Most of the trial evidence concerns dabigatran, an oral thrombin inhibitor that does not have the drug and food interactions of warfarin or the inconvenience of INR monitoring.

The RE-LY (Randomized Evaluation of Long-term anticoagulant therapy) study tested two doses of dabigatran against warfarin in a non-inferiority trial with a prospective, randomized, open-label (warfarin only), blinded-end-point (PROBE) design. Collaborators in 44 countries enrolled 18,1130 patients (mean age 71 years, 64 percent men) who had AF and at least one of: past stroke or TIA (20 percent of participants), left ventricular ejection fraction less than 40 percent, heart failure symptoms within six months (New York Heart Association class II or higher), age 75 years or higher, or 65-74 years of age plus diabetes mellitus, hypertension, or coronary heart disease. Exclusion criteria included severe valvular heart disease (including prosthetic valves), stroke within 14 days or severe stroke within six months, conditions that increase risk for hemorrhage, creatinine clearance less than 30 mL/min, active liver disease, and pregnancy. Participants were randomly allocated to receive dabigatran, 110 mg (n=6015) or 150 mg (n=6076) twice daily, or warfarin adjusted to an INR of 2.0-3.0 (n=6022), and followed for a median of two years (follow-up was 99.9 percent complete). The primary outcome was a composite of stroke or systemic embolism. Other outcomes included major hemorrhage, stroke, and death.

Dabigatran 150 mg twice daily reduced the risk of stroke or systemic embolism more than warfarin or dabigatran 110
mg twice daily. Rates of major hemorrhage were similar for warfarin and dabigatran 150 mg twice daily; dabigatran 110 mg twice daily was associated with lower rates of major hemorrhage than warfarin. Specifically, the rates of the primary outcome were 1.69 percent per year in the warfarin group, as compared with 1.53 percent per year in the group that received 110 mg bid of dabigatran (relative risk with dabigatran, 0.91; 95% confidence interval [CI], 0.74 to 1.11; P<0.001 for noninferiority) and 1.11 percent per year in the group that received 150 mg bid of dabigatran (relative risk, 0.66; 95% CI, 0.53 to 0.82; P<0.001 for superiority). The rate of major bleeding was 3.36 percent per year in the warfarin group, as compared with 2.71 percent per year in the group receiving 110 mg bid of dabigatran (P = 0.003) and 3.11 percent per year in the group receiving 150 mg bid of dabigatran (P = 0.31). The rate of hemorrhagic stroke was 0.38 percent per year in the warfarin group, as compared with 0.12 percent per year with 110 mg bid of dabigatran (P<0.001) and 0.10 percent per year with 150 mg bid of dabigatran (P<0.001). The mortality rate was 4.13 percent per year in the warfarin group, as compared with 3.75 percent per year with 110 mg bid of dabigatran (P = 0.13) and 3.64 percent per year with 150 mg bid of dabigatran (P = 0.051). A two-fold increase in major bleeding was seen in both dabigatran treatment arms (as well as in the warfarin arm) when ASA was administered concomitantly.

The only adverse effect that was significantly more common with dabigatran than with warfarin was dyspepsia. Dyspepsia occurred in 348 patients (5.8 percent) in the warfarin group and in 707 patients (11.8 percent) and 688 patients (11.3 percent) in the 110-mg and 150-mg dabigatran groups, respectively (p<0.001 for both comparisons). Elevations in the serum aspartate aminotransferase or alanine aminotransferase of more than three times the upper limit of the normal range did not occur more frequently with dabigatran, at either dose, than with warfarin. The rate of myocardial infarction was 0.53% per year with warfarin and was higher with dabigatran: 0.72 percent per year in the 110-mg group (relative risk 1.35; 95% CI 0.98-1.97; p=0.07) and 0.74 percent in the 150-mg group (relative risk 1.38, 95% CI 1.00-1.91; p=0.048). An as yet unpublished trial is testing dabigatran in acute coronary syndromes.

Warfarin patients in the RE-LY trial had a therapeutic INR only about 64 percent of the time.\textsuperscript{171} This is consistent with other clinical trials and underscores the problems with warfarin therapy.\textsuperscript{172} To have a stroke rate similar to that of he dabigatran 150 mg twice daily group, patients assigned to warfarin in RE-LY needed to have a therapeutic INR 80 percent of the time.\textsuperscript{173} This degree of control is unlikely to be achieved in clinical trials or clinical practice.\textsuperscript{174} Ongoing questions remain about dabigatran.\textsuperscript{175} These include: a) the potential safety and utility of the lower, 100 mg twice daily, dose in older patients with renal impairment; b) the safety and efficacy of dabigatran in the longer term, beyond the mean follow-up of two years, which is being evaluated in an ongoing follow-up study of RE-LY patients (NCT00808067); c) the implications, if any, of there being no antidote to dabigatran; and d) the cost of dabigatran.

**Best Practice Recommendation 2.7**

**Carotid Intervention**

**2.7.1 Symptomatic carotid stenosis**

Patients with transient ischemic attack or non-disabling stroke and ipsilateral 50 to 99 percent internal carotid artery stenosis (measured by two concordant non-invasive imaging modalities) should be evaluated by an individual with stroke expertise and selected patients should be offered carotid endarterectomy as soon as possible, optimally within fourteen days of the incident event once the patient is clinically stable [Evidence Level A].

i. Carotid endarterectomy should be performed by a surgeon with a known perioperative morbidity and mortality of less than 6 percent [Evidence Level A].

ii. Carotid stenting may be considered for patients who are not operative candidates for technical, anatomic or medical reasons [Evidence Level A]. Interventionalists should have expertise in carotid procedures and an expected risk of peri-procedural morbidity and mortality rate of less
2.7.2 Asymptomatic and remotely symptomatic carotid stenosis

Carotid endarterectomy may be considered for selected patients with 60 to 99 percent carotid stenosis who are asymptomatic or were remotely symptomatic (i.e., greater than three months) [Evidence Level A].

i. Patients should be less than 75 years old with a life expectancy of more than 5 years, and an acceptable risk of surgical complications [Evidence Level A].

ii. Asymptomatic patients should be evaluated by a physician with expertise in stroke management [Evidence Level A].

iii. Carotid endarterectomy should be performed by a surgeon with a less than 3 percent risk of peri-operative morbidity and mortality [Evidence Level A].

iv. Carotid stenting may be considered in patients who are not operative candidates for technical, anatomic or medical reasons provided there is a less than 3 percent risk of peri-procedural morbidity and mortality [Evidence Level A].

Rationale

Carotid endarterectomy is a surgical procedure that removes atherosclerotic plaque from the proximal internal carotid artery. Successful carotid endarterectomy substantially reduces the risk of recurrent stroke in patients who present with a hemispheric transient ischemic attack or minor stroke and an ipsilateral high-grade carotid stenosis. One death or severe stroke is prevented for every nine patients with symptomatic severe (70 to 99 percent) carotid stenosis treated with carotid endarterectomy (number needed to treat). For selected patients with asymptomatic carotid stenosis, carotid endarterectomy reduces the risk of stroke from about two percent per year to about one percent per year.

System Implications

- Protocols to ensure timely access to diagnostic services for evaluating carotid arteries.
- Development of agreements and processes for rapid access to surgical consults, including a mechanism for expedited referrals as required for carotid interventions.

Performance Measures

1. Proportion of stroke patients with moderate to severe (50 percent to 99 percent) carotid artery stenosis who undergo a carotid intervention procedure following an index stroke event.
2. Median time from stroke symptom onset to carotid endarterectomy surgery (core).
3. Proportion of stroke patients requiring carotid intervention who undergo the procedure within two weeks of the index stroke event.
4. Proportion of stroke patients with moderate carotid stenosis (50 percent to 69 percent) who undergo carotid intervention procedure following the incident stroke event.
5. Proportion of stroke patients with mild carotid stenosis (less than 50 percent) who undergo carotid intervention procedure following the incident stroke event.
6. Proportion of carotid endarterectomy patients who experience perioperative in-hospital stroke, acute myocardial infarction or death.
7. The 30-day in-hospital mortality rate after carotid endarterectomy and stroke rate by carotid
occlusion severity.
8. Proportion of patients who undergo carotid endarterectomy within two weeks, between two and four weeks, between four weeks and three months, and between three and six months of stroke onset.
9. Proportion of patients who wait more than three months for carotid endarterectomy or whose surgery is cancelled because of long wait times.
10. Proportion of patients who experience a subsequent stroke event or death while waiting for carotid endarterectomy.

**Measurement Notes**
- Time interval measurements should be taken from the time the patient or family reports as the time of stroke symptom onset to the actual date of surgery.
- The stroke onset time will depend on patient report or that of a reliable observer at the time of the event.
- Analysis should be stratified between those patients undergoing carotid stenting and those patients undergoing carotid endarterectomy, by severity of stenosis and by whether the patient had symptomatic or asymptomatic carotid artery disease.
- Data source for surgical date should be surgical note, nurses’ notes and discharge summary.
- In some cases, it may be more appropriate or relevant to record the time interval from the first time the patient has contact with medical care until the time of carotid surgery. This has occurred in cases where the patient was out of the country at the time of the stroke event and chose to return to Canada before seeking definitive medical intervention. It is important to note the nature of the start time when calculating turnaround times or intervention times.

**Implementation Resources and Knowledge Transfer Tools**

**Summary of the Evidence**
It has been well established that carotid endarterectomy is beneficial for stroke prevention in appropriate patients. There are three large trials of endarterectomy for symptomatic stenosis: the North American Symptomatic Carotid Endarterectomy Trial (NASCET), the European Carotid Surgery Trial (ECST) and the Veterans Affairs Trial. According to a pooled analysis of these trials, endarterectomy is highly beneficial in symptomatic patients with severe (70–99 percent) angiographic stenosis (NNT = six to prevent one stroke over five years), moderately beneficial for symptomatic patients with moderate (50–69%) stenosis (NNT = 22 to prevent one stroke over five years) and not beneficial for mild (< 50%) stenosis. Guidelines on carotid endarterectomy from the American Heart Association and the Canadian Neurosurgical Society recommend surgery for symptomatic high-grade stenosis (70–99%), but have not been updated to include the most recent evidence regarding symptomatic patients with moderate stenosis or patients with asymptomatic stenosis.

The risks of carotid endarterectomy in relation to the timing of surgery was investigated in a systematic review of the literature on the complications of carotid endarterectomy. The operative risk of stroke and death was not increased in neurologically stable patients when surgery was performed early (< 3 to 6 weeks) rather than late (> 3 to 6 weeks). However, in unstable patients who underwent “urgent” endarterectomy for “stroke-in-evolution” or “crescendo transient ischemic attacks,” there was an increased perioperative risk (20%) that was significantly higher than the risk in stable patients.

A recent study by Gladstone, using data from the Registry of the Canadian Stroke Network (RCSN), examined factors associated with the timing of carotid endarterectomy surgery. A cohort of 1011 patients were found to have symptomatic carotid stenosis, and among those, 105 patients with severe (80 percent of cohort) or moderate (29 percent of cohort) stenosis underwent carotid endarterectomy within six months and were included in the analysis. The median time from index event to surgery was 30 days (interquartile range, 10 to 81). Overall, approximately one third (38 of 105) underwent surgery within two weeks, half (53 of 105) received surgery within 1 month, and one
fourth (26 of 105) had surgery >3 months after the presenting event. In the multivariable analysis, early surgery (within two weeks) was significantly more likely to occur if the index event was a TIA rather than a completed stroke (OR, 2.6; 95% CI, 1.1 to 6.1). Age, sex, and degree of stenosis were not found to be significant predictors of early surgery. Over the study timeframe, there was an improvement in the median time to endarterectomy, decreasing from 74 days in 2003 to 21 days in 2006 (P=0.022 for median regression analysis). The proportion of patients undergoing early carotid endarterectomy (within 2 weeks) improved significantly over time: 18.2 percent in 2003, 25.0 percent in 2004, 45.5 percent in 2005, and 44.8 percent in 2006 (P=0.036; Cochran-Armitage trend test). Patients who did not undergo surgery were significantly older with more severe strokes and more comorbidities. The six-month mortality rate was 3.4 percent in the surgical group and 12.9 percent in the non-surgical group (p=0.0003).

Endarterectomy for symptomatic patients should be performed with a maximum combined perioperative stroke and death rate of six percent, according to the American Academy of Neurology guidelines and the Canadian Neurosurgical Society guidelines; the American Heart Association guidelines recommend a five percent rate for patients with transient ischemic attack and seven percent for patients with stroke. Women appear to have a higher perioperative risk and do not appear to benefit from carotid endarterectomy for symptomatic moderate (50–69%) stenosis, or when performed after greater than 2 weeks for symptomatic, high-grade (70–99%) stenosis. All of these guidelines recommend that endarterectomy for asymptomatic patients be performed with a maximum combined perioperative stroke and death rate of less than three percent.

For the Carotid Endarterectomy Trialists’ Collaboration, Rothwell and associates analyzed pooled data (5893 patients with 33 000 patient-years of follow-up) from the European Carotid Surgery Trial and North American Symptomatic Carotid Endarterectomy Trial. The findings indicated that the benefit from endarterectomy depends not only on the degree of carotid stenosis but also on several other clinical characteristics, including the timing of surgery after the presenting event. In patients with severe stenosis (70–99 percent), surgery was most effective when performed within two weeks of the index transient ischemic attack or stroke (NNT = three to prevent one stroke in five years), and this benefit declined quickly over time (NNT = 125 for patients who undergo surgery more than 12 weeks after the symptomatic event). This time-dependent decline in benefit was even more pronounced in patients with moderate stenosis (50–69%); endarterectomy performed within the first two weeks of the ischemic event was beneficial, but the benefit was lost (and there was net harm) when surgery was delayed more than three months. Therefore, the Carotid Endarterectomy Trialists’ Collaboration recommended that carotid endarterectomy should be done within two weeks of the patient’s last symptoms.

Carotid endarterectomy for asymptomatic carotid artery disease has been controversial. The Asymptomatic Carotid Atherosclerosis Study (ACAS) Group randomized 1662 asymptomatic patients with carotid artery stenosis of 60 percent or greater reduction in diameter to receive carotid endarterectomy, with daily ASA administration and medical risk factor management for all patients. After a median follow-up of 2.7 years, the absolute risk reduction for ipsilateral stroke was 3.0 percent for surgical patients compared with patients treated medically. The MRC [Medical Research Council] Asymptomatic Carotid Surgery Trial (ACST) Collaborative Group randomized 3120 asymptomatic patients with substantial carotid narrowing equally between earlier carotid endarterectomy (half received carotid endarterectomy by one month, 88 percent by one year) and indefinite deferral of any carotid endarterectomy (only four percent per year received carotid endarterectomy) over a 10-year period. Patients were followed for up to five years (mean 3.4 years). The absolute risk reduction for ipsilateral stroke was 3.1 percent. Subgroup analyses found no significant heterogeneity in the perioperative hazards or (apart from the importance of cholesterol) in the long-term postoperative benefits. These benefits were separately significant for males and females, for those with about 70, 80 and 90 percent carotid artery narrowing on ultrasound and for those younger than 65 and 65–74 years of age (though not for older patients, half of whom died within five years from unrelated causes).

Asymptomatic carotid artery stenosis (unlike symptomatic carotid artery stenosis) is a relatively low-risk condition, and these studies confirm its natural history, although there is evidence that patients with higher degrees of asymptomatic stenosis are at a higher risk over time. Overall, the absolute risk reduction with carotid endarterectomy is small (3.0 percent), translating into a number needed to treat of about 33. Gladstone and Sahlas recommended that carotid endarterectomy should be considered only for carefully selected patients with carotid artery stenosis of at least 60 percent who are less than 75 years old, have a good life expectancy and are at low surgical risk. A similar recommendation has been issued by the American Academy of Neurology.
recommended in asymptomatic patients that “it is reasonable to consider carotid endarterectomy for patients between the ages of 40 and 75 years and with asymptomatic stenosis of 60 to 99 percent if the patient has an expected 5-year life expectancy and if the surgical stroke or death frequency can be reliably documented to be < 3 percent (Level A).” The American Stroke Association included a recommendation that “patients with asymptomatic carotid artery stenosis be screened for other treatable causes of stroke and that intensive therapy of all identified stroke risk factors be pursued (Level of Evidence C).”

Practice gaps in carotid disease management have been identified. According to a recent Canadian study, the appropriate patients who are most likely to benefit from endarterectomy are not always being referred, and many procedures are performed inappropriately on patients at low risk of stroke. In an Oxfordshire, United Kingdom, population-based study of transient ischemic attack and stroke patients referred for endarterectomy for > 50 percent stenosis, only six percent had surgery within two weeks of their ischemic event and only 43 percent within three months; 32 percent of patients had a recurrent stroke while awaiting endarterectomy. Stroke prevention clinics have been found to have an important role in promoting adherence to guidelines and ensuring appropriate patient selection and timely referral for this procedure. Delays from presenting event to initial assessment, carotid imaging and endarterectomy are new key indicators that should be monitored as part of stroke quality assurance programs.

Studies that compared carotid endarterectomy to carotid stenting have recently emerged in the research literature. A Cochrane systematic review of 10 trials which included 3178 patients with carotid stenosis comparing endovascular procedures to carotid endarterectomy surgery. The primary outcome comparison of any stroke or death within 30 days of treatment favoured surgery (fixed-effects OR 1.35), but the difference was not statistically significant using the random effects model. Endovascular treatment was significantly better than surgery in avoiding cranial neuropathy (OR 0.15) and myocardial infarction (OR 0.34). There was no significant difference between endovascular treatment and surgery in the following comparisons: 30-day stroke, MI, or death (OR 1.12); 30-day disabling stroke or death (OR 1.19); 30-day death OR 0.99); 24-month death or stroke (OR 1.26); and 30-day death or stroke in endovascular patients treated with or without protection devices (OR 0.75). The authors concluded that results do not support a change in clinical practice away from recommending carotid endarterectomy as the treatment of choice for suitable carotid artery stenosis but support continued recruitment in the large ongoing trials.

A more recent meta-analysis in the British Medical Journal in 2010, which included the results from the International Carotid Stenting Study (ICSS), evaluated the relative short term safety and intermediate term efficacy of carotid endarterectomy versus carotid artery stenting. The analysis included randomized controlled trials which compared carotid endarterectomy with carotid artery stenting in patients with carotid artery stenosis with or without symptoms. The primary end point was a composite of mortality or stroke. Secondary end points were death, stroke, myocardial infarction, or facial neuropathy (as individual end points), and mortality or disabling stroke (as a composite end point). Eleven trials were included (4796 patients) in the analysis, with 10 that reported on short-term outcomes (n=4709) and nine on intermediate term outcomes (1-4 years). The peri-procedural risk of mortality or stroke was lower for carotid endarterectomy (odds ratio 0.67, 95% confidence interval 0.47 to 0.95; P=0.025) than for carotid stenting, mainly because of a decreased risk of stroke (0.65, 0.43 to 1.00; P=0.049), whereas the risk of death (1.14, 0.56 to 2.31; P=0.727) and the composite end point mortality or disabling stroke (0.74, 0.53 to 1.05; P=0.088) did not differ significantly. The odds of peri-procedural myocardial infarction (2.69, 1.06 to 6.79; P=0.036) or cranial nerve injury (10.2, 4.0 to 26.1; P<0.001) was higher in the carotid endarterectomy group than in the carotid stenting group. In the intermediate term, the two treatments did not differ significantly for stroke or death (hazard ratio 0.90, 95% confidence interval 0.74 to 1.1; P=0.314). The authors concluded that carotid endarterectomy was found to be superior to carotid artery stenting for short-term outcomes but the difference was not significant for intermediate term outcomes; this difference was mainly driven by nondisabling stroke. Significantly fewer cranial nerve injuries and myocardial infarctions occurred with carotid artery stenting.

Two randomized trials that directly compared the safety of carotid stenting to carotid endarterectomy in symptomatic patients have been released this past year: the International Carotid Stenting Study and the Carotid Revascularization Endarterectomy versus Stenting Trial (CREST). In the ICSS study, patients with recently symptomatic carotid artery stenosis were randomly assigned in a 1:1 ratio to receive carotid artery stenting or carotid endarterectomy. The primary outcome measure of the trial was the three-year rate of fatal or disabling stroke in any territory, which has not been analyzed yet. The main outcome measure for the interim safety analysis was the 120-day rate of stroke,
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The trial enrolled 1713 patients (stenting group, n=855; endarterectomy group, n=858). Between randomization and 120 days, there were 34 (Kaplan-Meier estimate 4.0%) events of disabling stroke or death in the stenting group compared with 27 (3.2%) events in the endarterectomy group (hazard ratio [HR] 1.28, 95% CI 0.77—2.11). The incidence of stroke, death, or procedural myocardial infarction was 8.5% in the stenting group compared with 5.2% in the endarterectomy group (72 vs. 44 events; HR 1.16—2.45, p=0.006). Risks of any stroke (65 vs. 35 events; HR 1.92, 1.27—2.89) and all-cause death (19 vs. seven events; HR 2.76, 1.16—6.56) were higher in the stenting group than in the endarterectomy group. Three procedural myocardial infarctions were recorded in the stenting group, all of which were fatal, compared with four, all non-fatal, in the endarterectomy group. There was one event of cranial nerve palsy in the stenting group compared with 45 in the endarterectomy group. There were also fewer haematomas of any severity in the stenting group than in the endarterectomy group (31 vs. 50 events; p=0.0197). The investigators concluded that at present, carotid endarterectomy should remain the treatment of choice for patients suitable for surgery. The primary outcome analysis of the efficacy of carotid artery stenting compared with endarterectomy is not yet available.\textsuperscript{194}

The CREST trial is the largest ongoing trial examining the relative effectiveness of carotid artery stenting (CAS) versus carotid endarterectomy (CEA) in preventing stroke, myocardial infarction, and death.\textsuperscript{176} The trial included 2502 patients with a median follow-up period of 2.5 years. The primary end point was the composite of any stroke, myocardial infarction, or death during the peri-procedural period or ipsilateral stroke within four years after randomization. The study results showed no significant difference in the estimated four-year rates of the primary end point between the stenting group and the endarterectomy group (7.2% and 6.8%, respectively; hazard ratio with stenting, 1.11; 95% confidence interval, 0.81 to 1.51; P=0.51). There was no differential treatment effect with regard to the primary end point according to symptomatic status (P=0.84) or sex (P=0.34). The four-year rate of stroke or death was 6.4% percent with endarterectomy (hazard ratio, 1.50; P=0.03); the rates among asymptomatic patients were 8.0% percent and 6.4% percent (hazard ratio, 1.37; P=0.14), and the rates among asymptomatic patients were 4.5% percent and 2.7% percent (hazard ratio, 1.86; P=0.07), respectively. Peri-procedural rates of individual components of the end points differed between the stenting group and the endarterectomy group: for death (0.7% vs. 0.3%, P=0.18), for stroke (4.1% vs. 2.3%, P=0.01), and for myocardial infarction (1.1% vs. 2.3%, P=0.03). After this period, the incidences of ipsilateral stroke with stenting and with endarterectomy were similarly low (2.0% and 2.4%, respectively; P=0.85). The investigators concluded that among patients with symptomatic or asymptomatic carotid stenosis, the risk of the composite primary outcome of stroke, myocardial infarction, or death did not differ significantly in the group undergoing carotid-artery stenting and the group undergoing carotid endarterectomy. During the peri-procedural period, there was a higher risk of stroke with stenting and a higher risk of myocardial infarction with endarterectomy.

The clinical trials and subgroup analysis reports for stenting versus endarterectomy have indicated that patient age greater than 70 years has a significant impact on primary outcomes.\textsuperscript{194} A preplanned meta-analysis was recently reported by the Carotid Stenting Trialists Collaboration that included patient-level data for 3433 patients with symptomatic carotid stenosis who were randomly assigned and analyzed in the Endarterectomy versus Angioplasty in Patients with Symptomatic Severe Carotid Stenosis (EVA-3S) trial, the Stent-Protected Angioplasty versus Carotid Endarterectomy (SPACE) trial, and the International Carotid Stenting Study (ICSS). The data was pooled and analyzed with fixed-effect binomial regression models adjusted for source trial. The primary outcome event was any stroke or death. In the first 120 days after randomization (ITT analysis), any stroke or death occurred significantly more often in the carotid stenting group (153 [9.2%] of 1725) than in the carotid endarterectomy group (99 [5.8%] of 1708, risk ratio [RR] 1.53, [95% CI 1.20—1.95], p=0.0006; absolute risk difference 3.2 [1.4—4.9]). Of all subgroup variables assessed, only age significantly modified the treatment effect: in patients younger than 70 years (median age), the estimated 120-day risk of stroke or death was 50 (5.8%) of 869 patients in the carotid stenting group and 48 (5.7%) of 843 in the carotid endarterectomy group (RR 1.00 [0.68—1.47]); in patients 70 years or older, the estimated risk with carotid stenting was twice that with carotid endarterectomy (103 [12.0%] of 856 vs. 51 [5.9%] of 865, 2.04 [1.48—2.82], interaction p=0.0053, p=0.0014 for trend). In the PP analysis, risk estimates of stroke or death within 30 days of treatment among patients younger than 70 years were 43 (5.1%) of 851 patients in the stenting group and 37 (4.5%) of 821 in the endarterectomy group (1.11 [0.73—1.71]); in patients 70 years or older, the estimates were 87 (10.5%) of 828 patients and 36 (4.4%) of 824, respectively (2.41 [1.65—3.51]; categorical interaction p=0.0078, trend interaction p=0.0013). The conclusions stated by the Trialist Collaboration were that stenting for symptomatic carotid stenosis should be avoided in older patients (age $\geq$70 years), but might be as safe as endarterectomy in younger patients.
SECTION 3.0 HYPERACUTE STROKE MANAGEMENT

**DEFINITION**

Hyperacute stroke care is defined as the healthcare activities that take place between the time of first contact with a potential stroke patient and either admission to hospital or outpatient management in the community.

Fifty-four percent of patients who seek acute care for stroke arrive at the emergency department by ambulance, while a significant proportion of the rest will seek help from their primary care physician. This section addresses management of patients with stroke and transient ischemic attack in these two care settings.

Following extensive consultation, two timelines have been established to provide emergency medical services in Canada within the 4.5 hour-window from symptom onset to administration of thrombolytic therapy. These are:

1. **The pre-hospital phase** that starts with symptom onset and includes on-scene management and transport time, which should be 3.5 hours or less; and
2. **The emergency department phase** that includes the diagnostic evaluation and consideration of treatment options, which should be 60 minutes or less.

### Best Practice Recommendation 3.1

New for 2010

**Outpatient Management of Transient Ischemic Attack and Non-Disabling Ischemic Stroke**

#### 3.1.1 Timing of Initial Assessment

i. Patients presenting to a family physician’s office or other community primary care setting within one week of a suspected transient ischemic attack or non-disabling ischemic stroke should have an immediate clinical evaluation and investigations to establish the diagnosis, rule out stroke mimics, and develop a management plan [Evidence Level B].

ii. Patients who cannot be evaluated as an outpatient within 24 hours from clinical presentation should be transported to an emergency department that has access to neurovascular imaging facilities and stroke expertise [Evidence Level B].

iii. Patients presenting to a family physician’s office or other community primary care setting more than one week following a suspected transient ischemic attack or non-disabling ischemic stroke should be seen by a stroke specialist on a less urgent basis, generally within one month of presentation [Evidence Level B].

#### 3.1.2 Evaluation

i. Patients presenting to a family physician’s office or walk-in clinic with a suspected transient ischemic attack or non-disabling ischemic stroke should be immediately referred to a designated stroke prevention clinic with an interprofessional stroke team, or to a stroke specialist [Evidence Level B].

ii. All patients with suspected transient ischemic attack or non-disabling ischemic stroke should
undergo an assessment that includes an electrocardiogram, brain imaging, and non-invasive vascular imaging (for carotid territory transient ischemic attacks or non-disabling strokes) within seven days of symptom onset, and have a consultation with a stroke specialist [Evidence Level B]. Refer to recommendations 3.2 and 3.3.2 for additional information.

iii. Patients presenting with transient ischemic attack or non-disabling ischemic stroke and motor or speech symptoms should optimally have the assessment on the day of symptom onset [Evidence Level B].

iv. The following laboratory investigations should be undertaken routinely for patients with suspected transient ischemic attack or non-disabling ischemic stroke: haematology, electrolytes, coagulation, renal function, creatine kinase (CK), fasting lipid profile, fasting glucose level and A1c, and thyroid-stimulating hormone (TSH) [Evidence Level C]. Additional blood work may be required if a hypercoagulable or vasculitic cause is suspected. Refer to recommendation 3.2 for additional information.

v. Patients with non-disabling ischemic stroke who are not admitted to hospital should be considered for referral for a comprehensive outpatient assessment of functional impairment, which should include a cognitive evaluation, screening for depression, screening of fitness to drive, and functional assessments for potential rehabilitation treatment [Evidence Level B]. Refer to recommendation 5.1 for additional information.

3.1.3 Management (See also Section 2: Prevention of Stroke)

i. All patients with transient ischemic attack or non-disabling ischemic stroke who are not on an antiplatelet agent at time of presentation should be started on antiplatelet therapy immediately after brain imaging has excluded intracranial hemorrhage [Evidence Level A]. A loading dose of ASA should be at least 160 mg. If clopidogrel is used, a loading dose of 300 mg should be given then maintenance therapy should be started according to parameters set out in recommendation 2.5 for long-term antiplatelet therapy [Evidence Level A].

ii. Patients with transient ischemic attack or non-disabling ischemic stroke with a 50 to 99 percent carotid stenosis on the side implicated by their neurological symptoms, who are otherwise candidates for carotid re-vascularization, should have carotid endarterectomy performed as soon as possible, ideally within two to fourteen days [Evidence Level A]. Refer to recommendation 2.7 for additional information.

iii. Patients with transient ischemic attack or non-disabling ischemic stroke with atrial fibrillation should begin anticoagulation immediately after brain imaging has excluded intracranial hemorrhage or large infarct. For patients on Warfarin, the target therapeutic International Normalized Ratio (INR) is 2.5 with a range of two to three [Evidence Level A]. Refer to recommendation 2.6 for additional information.

iv. All risk factors for cerebrovascular disease must be aggressively managed through pharmacological and non-pharmacological means to achieve optimal control [Evidence Level A]. While evidence of the benefit of modifying individual risk factors in the acute phase is lacking, there is evidence of benefit when adopting a comprehensive approach, including antihypertensives and statin medication [Evidence Level C].

Refer to recommendations 2.2 and 2.3 for additional information.

v. Patients with transient ischemic attack or non-disabling ischemic stroke who smoke should be strongly advised to quit immediately, and be provided with the pharmacological and non-pharmacological means to do so [Evidence Level B].
Refer to recommendation 2.1 for additional information.

### Rationale

*The goal of outpatient management of transient ischemic attack and non-disabling ischemic stroke is rapid assessment and management to reduce the risk of a recurrent, possibly more serious, event.*

There is clear evidence that transient ischemic attacks or minor strokes are unstable conditions that warn of high future risk of stroke, other vascular events, or death. The risk of recurrent stroke after a transient ischemic attack is 10 to 20 percent within 90 days, and the risk is “front-loaded”, with half of the strokes occurring in the first two days following initial symptom onset. The seven-day risk of stroke following a transient ischemic attack can be as high as 36 percent in patients with additional risk factors. Timely initiation of secondary prevention medical therapy and carotid endarterectomy has been shown to significantly reduce the risk of major stroke after an initial transient ischemic attack or non-disabling stroke.

### System Implications

- Education for the public and healthcare providers about the urgency of assessment and management of transient ischemic attack or non-disabling ischemic stroke is critical to reduce the risk of recurrent, potentially more serious events. Patients and families will also require ongoing education and support related to prevention and management of stroke.
- Physicians who work in primary, secondary, and tertiary care settings who have education, training, and knowledge to manage patients with transient ischemic attack or non-disabling ischemic stroke.
- Processes and protocols in community healthcare settings and acute healthcare facilities to enable rapid access to diagnostic tests and expertise for patients with transient ischemic attack or minor stroke.
- Established and accessible stroke prevention clinics, or broader vascular prevention programs in all communities, and healthcare practitioners who are aware of these programs. These resources should be listed, easily accessible to primary care physicians and healthcare providers, and updated annually.

### Performance Measures

1. **Proportion of acute stroke and TIA patients that are discharged alive that are then readmitted to hospital with a new stroke or TIA diagnosis within 90 days of index acute care discharge (core).**
2. **Time from first encounter with medical care (primary care or emergency department) to neurological assessment by a stroke expert (in clinic or other setting).**
3. **Time from first encounter with medical care to brain imaging (CT/MRI) and other vascular imaging (Doppler of cervical arteries, electrocardiogram).**

### Measurement Notes

- Data access and quality with respect to timing of first encounter and referral dates and times.
- Primary care data from physician billing. This should rely on International Classification of Diseases (ICD) codes and not on physician diagnoses as these may be less accurate.
- Measures from other prevention recommendations in this document also apply applicable to this recommendation but are not repeated here.
The purpose of this recommendation is to reduce the risk of recurrent stroke following an initial transient ischemic attack or minor stroke, and to address specific issues of secondary prevention for patients with transient ischemic attack and non-disabling stroke who are not admitted to hospital.

Recurrent stroke contributes a disproportionate share of the overall national burden of stroke compared to first-time stroke. Also, recurrent strokes have higher fatality rates and, for those who survive, a greater proportion of patients are unable to return to independent living and require long term nursing care. Recurrent stroke risk is up to ten percent in the week immediately following a transient ischemic attack or minor stroke. Increasing evidence emphasizes the need for diagnostic evaluation and stroke prevention strategies to be delivered promptly after a cerebral ischemic event.

The American Stroke Association published a position statement in 2009 redefining a transient ischemic attack. Their current definition of Transient ischemic attack (TIA) is “a transient episode of neurological dysfunction caused by focal brain, spinal cord, or retinal ischemia, without acute infarction”. This definition has removed the time factor that has traditionally been in the definition of TIA from the World Health Organization: i.e., symptoms lasting less than 24 hours. This definition has not yet been widely endorsed but other groups are examining its validity and sensitivity.

As part of the Oxford Vascular Study, Chandratheva and colleagues studied delay in seeking medical attention following a transient ischemic attack or minor stroke. 190 of 1000 patients interviewed (459 TIA, 541 minor strokes), 300 (67%) with TIA and 400 (74%) with minor stroke sought medical attention within 24 hours and 208 (47%) and 234 (46%), respectively, sought attention within three hours. Most patients (77%) first sought attention through their primary care physician. In patients with TIA, incorrect recognition of symptoms, absence of motor or speech symptoms, shorter duration of event, lower ABCD2 score, no history of stroke or atrial fibrillation, and weekend presentation were associated with significantly longer delays in seeking treatment. Of 129 patients with TIA or minor stroke who had a recurrent stroke within 90 days, 41 (31%) did not seek medical attention after their initial event. These patients were more likely to have had a TIA (P=0.003), shorter duration of event (P=0.02), and a history of TIA (P=0.09) and less likely to have motor (P=0.004) or speech symptoms (P=0.04) compared with those patients who sought medical attention for their initial event. The results of this study emphasize the need for primary care practitioners to be educated in stroke recognition and management and ensure patients who do seek medical attention in their offices are managed with aggressive and appropriate secondary prevention strategies.

Giles and Rothwell conducted a systematic review and meta-analysis to develop overall estimates of the risk of stroke within two and seven days after transient ischemic attack. Eighteen independent studies were identified with data on 10 126 transient ischemic attack patients. Stroke risk at seven days ranged from zero percent to 12.8 percent with substantial heterogeneity between studies (p<0.0001). This heterogeneity was almost completely explained by differences in study methodology, setting, and treatments. The pooled risk of stroke was substantial and calculated to be 3.1 percent (95% CI, 2.0 to 4.1) at two days and 5.2 percent (95% CI 3.9 to 6.5) at seven days. Lowest risk was demonstrated in studies of emergency treatment in specialist stroke services.

Effect of urgent treatment of transient ischemic attack and minor stroke on early recurrent stroke (EXPRESS study): The aim was to determine the effect of rapid treatment following transient ischemic attack and minor stroke in patients who are not admitted directly to hospital. Rothwell et al. prospectively studied the effect on process of care and outcome of more urgent assessment and immediate treatment in clinic, rather than subsequent initiation in primary care, in all patients with transient ischemic attack or minor stroke not admitted direct to hospital. The study was nested within a rigorous population-based incidence study of all transient ischemic attack and stroke (Oxford Vascular Study; OXVASC), such that case ascertainment, investigation, and follow-up were complete and identical in both periods. It was concluded that early initiation of existing treatments after transient ischemic attack or minor stroke was associated with an 80 percent relative reduction in the risk of early recurrent stroke. Further follow-up is required to determine long-term outcome, but these results have immediate implications for service provision.

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**Summary of the Evidence**

The purpose of this recommendation is to reduce the risk of recurrent stroke following an initial transient ischemic attack or minor stroke, and to address specific issues of secondary prevention for patients with transient ischemic attack and non-disabling stroke who are not admitted to hospital.
and public education about TIA and minor stroke.

The *Fast assessment of stroke and transient ischaemic attack to prevent early recurrence (FASTER)* trial examined whether the immediate risk of stroke following transient ischemic attack or minor stroke might be reduced by using clopidogrel in addition to aspirin. Kennedy et al. (2007) investigated the aggressive treatment of these patients using antiplatelets. The hemorrhagic risks of the combination of aspirin and clopidogrel do not seem to offset this potential benefit. The authors were unable to determine the benefits of simvastatin in this setting. Within 24 hours of symptom onset, patients with transient ischemic attack or minor stroke (n=392) were randomly assigned to clopidogrel (300 mg loading dose than 75 mg daily) or placebo (n=194), and simvastatin (40 mg daily; 199 patients) or placebo (n=193). All patients were also given aspirin and were followed for 90 days. The median time to stroke outcome was 1 day (*range* 0–62 days). The trial was stopped early due to a failure to recruit patients at the pre-specified minimum enrolment rate because of increased use of statins. The FASTER trial underscores the high risk of stroke in the immediate aftermath of symptom onset in patients with acute ischemic cerebrovascular events, whose symptoms have completely recovered or are too mild, precluding them from treatment with alteplase. Early aggressive antiplatelet therapy may be associated with a reduction in these events, although at the cost of slightly increased hemorrhagic complications. Early simvastatin use does not seem to have a similar effect, and may attenuate the effect of the antiplatelet strategy. Although it was possible to enroll patients within 24 hours of symptom onset into a prevention trial, the trial failed to meet its recruitment rate target and was stopped prematurely.

The SOS –TIA study conducted in France set up a hospital-based rapid assessment clinic for patients who appeared to have symptoms of ischemia with complete recovery. Referral by telephone was available 24 hours/day. Over a two-year period they saw 1085 patients with suspected TIA, and assessment and imaging was done within 4 hours of arrival. Of these patients, 574 (53%) were seen within 24 h of symptom onset; 701 (65%) patients had confirmed TIA or minor stroke, and 144 (13%) had possible TIA. 108 (17%) of the 643 patients with confirmed TIA had brain tissue damage. Median duration of symptoms was 15 min (IQR 5–75 min). Of the patients with confirmed or possible TIA, all started a stroke prevention program, 43 (5%) had urgent carotid revascularization, and 44 (5%) were treated for atrial fibrillation with anticoagulants. 808 (74%) of all patients seen were sent home on the same day. The 90-day stroke rate was 1.24% (95% CI 0.72–2.12). They concluded that the rapid access clinic reduced the incidence of recurrent stroke compared to expected rates.

Well-validated triage tools for predicting risk of stroke recurrence are not available at this time. The ABCD² rule is a prognostic index based on retrospective data. When this tool was validated against a second data set from Oxfordshire, it did not have strong results in predicting stroke outcomes. A validation of the California and ABCD scores was conducted in four independent groups of patients (n=2893) diagnosed with TIA in emergency departments and clinics in defined populations in the USA and UK. The two groups used to derive the original scores (n=1916) were used to derive a new unified score based on logistic regression. The two existing scores predicted the risk of stroke similarly in each of the four validation cohorts, for stroke risks at 2 days, 7 days, and 90 days (c statistics 0.60–0.81). In both derivation groups, c statistics were improved for a unified score based on five factors: age ≥60 years; blood pressure ≥140/90 mmHg; clinical features: unilateral weakness, speech impairment without weakness; duration; and diabetes. The c-statistics score for ABCD², was 0.62–0.83. At this time, while the ABCD and ABCD² tools are important because they have focused attention upon transient ischemic attack and minor stroke and clinical risk factors for early stroke recurrence, however, their sensitivity is low and their place in routine clinical practice remains unclear.
**Best Practice Recommendation 3.2**

**Emergency Medical Services Management of Acute Stroke Patients**

NOTES on this recommendation

- This recommendation covers management of potential stroke patients between the time of first contact with the local emergency medical services to transfer of care to the hospital, as well as care of suspected or confirmed stroke patients who are being transferred between healthcare facilities by emergency medical services.

- This recommendation is directed to paramedics and those individuals who support emergency medical services, including communications officers and dispatchers. It also applies to other first responders such as emergency medical responders and primary care paramedics who have been trained to screen for stroke and manage potential stroke patients during transfer.

*local variations need to be taken into consideration for pre-hospital time*

Patients who show signs and symptoms of hyperacute stroke must be treated as a time-sensitive emergency and should be transported without delay to the closest institution that provides emergency stroke care [Evidence Level C].

i. Immediate contact with emergency medical services (e.g., 911) by patients or other members of the public is strongly recommended because it reduces time to treatment for acute stroke [Evidence Level B].

ii. The emergency medical services system must be set up to categorize patients exhibiting signs and symptoms of a hyperacute stroke as a high priority [Evidence Level C].

iii. Paramedics should use a standardized acute stroke out-of-hospital diagnostic screening tool [Evidence Level B].

iv. Out-of-hospital patient management should be optimized to meet the needs of suspected acute stroke patients [Evidence Level A].

v. Direct Transport Protocols must be in place to facilitate the transfer of eligible patients to the closest and most appropriate facility providing acute stroke care [Evidence Level C].

vi. Direct Transport Protocol criteria must be based on (1) the local emergency department performance which is recommended as being 60 minutes or less; (2) the pre-hospital phase, including symptom duration and anticipated transport time, being 3.5 hours or less; and (3) other acute care needs of the patient [Evidence Level B].

vii. Paramedics should obtain a history of the stroke event, including time of onset, signs and symptoms, and previous medical and drug history from the patient if able or informant when available [Evidence Level C].

viii. Paramedics must notify the receiving facility of a suspected acute stroke patient so the facility may prepare for patient arrival [Evidence Level C].

ix. Transfer of care from paramedics to receiving facility personnel must occur without delay [Evidence Level C].

x. Patients who are considered ineligible for time-sensitive thrombolytic therapy should be transported to the closest emergency department which provides access to neuroimaging and stroke expertise for assessment and initiation of secondary prevention management [Evidence Level C].

**Rationale**

Acute stroke is a medical emergency and optimizing out-of-hospital care improves patient outcomes. Emergency medical services play a critical role in out-of-hospital (pre-hospital) assessment and
management of suspected stroke patients. Acute interventions such as thrombolytic therapy are time-sensitive and therefore strategies such as re-directing ambulances to stroke centres facilitates earlier assessment, diagnosis, and treatment, and may result in better outcomes.

**System Implications**

- Programs to train all emergency medical services personnel regarding stroke assessment, management, and transport requirements in the pre-hospital phase of care.
- Paramedic education that includes the recognition of the signs and symptoms of acute stroke and the need to provide appropriate out-of-hospital treatment.
- Paramedic education on the use of validated and rapid pre-hospital stroke screening protocols and tools and the ability to incorporate such protocols and tools into all pre-hospital assessments of suspected stroke patients. The Canadian Stroke Strategy has developed assessment tools in collaboration with emergency medical service leaders for implementation across Canada.
- Direct transport agreements (bypass or redirect) between emergency medical service providers and regional health authorities and/or receiving facilities.
- Emergency medical service providers who are able to provide coordinated seamless transport (land, water, and air) and care for acute stroke patients.
- Communication systems such as telemedicine to support access to specialized stroke services.

**Performance Measures**

1. **Time from initial call received by emergency dispatch centre to patient arrival at an emergency department that provides stroke services.**
2. Percentage of (suspected) stroke patients arriving in the emergency department who were transported by emergency medical services.
3. Time from initial call received by emergency dispatch centre to emergency medical services arrival on scene.
4. Time from emergency medical services arrival on scene to appropriate emergency department arrival.
5. Percentage of cases where out-of-hospital time is less than 3.5 hours from symptom onset to arrival at the emergency department (performance target is ≥ 75 percent).
6. Percentage of potential stroke patients transported by emergency medical services who received a final diagnosis of stroke or transient ischemic attack in the emergency department or as an inpatient.

**Measurement Notes**

- Emergency department records and administrative databases track stroke patients who arrive by ambulance (land, air, or water) as a standard data element.
- "Appropriate" emergency department refers to an emergency department that has access to a CT scanner in the facility, provides access to acute thrombolysis, and has medical personnel with stroke expertise available for emergent consult.
- Refer to the Canadian Stroke Strategy Performance Measurement Manual for additional measures related to hospital bypass and pre-notification.

**Implementation Resources and Knowledge Transfer Tools**

- Canadian Stroke Strategy emergency medical services pocket card template
- Canadian Stroke Strategy emergency medical services education package
Summary of the Evidence
The evidence available to support training and appropriate processes for emergency medical services in the transport of stroke patients is underdeveloped at this time. However, several other recommendations presented in the Canadian Best Practices Recommendations for Stroke Care (2010) are dependent on and/or emphasize the need for rapid transport of potential stroke patients to an appropriate acute care facility. For example, interventions such as acute thrombolysis are time-sensitive and require a coordinated system of care in order to maximize access and eligibility to these therapies.

Prehospital delays in the treatment of stroke patients, including identification of stroke as a medical emergency, represent a significant and preventable obstacle to optimal stroke care. Patient delays in seeking care are the greatest barrier to expedient treatment following a stroke event; however, delays often also exist in the identification, transport, and triage of stroke patients. Emergency health services and service providers are a critical participant in systems of care for stroke. Crocco cites the appropriate training of emergency medical service personnel as an essential component of community-wide, coordinated stroke care. In addition, emergency physicians must be engaged in the effort to limit delays if the rates of patients eligible for thrombolytic therapy are to improve.

The Emergency Medical Services Chiefs of Canada recommended 11 key policy points that can be enacted by EMS to improve services in Canada. The areas addressed in their report include: Clear Core Identity; Stable Funding; Systematic Improvement; emergency medical services systems should demonstrate high accountability and transparency for quality emergency medical services; Personnel Development; National Occupational Competency Profile, Leadership Support; Mobilized Health Care; emergency medical services leaders should pursue opportunities to provide enhanced types and levels of healthcare including public health and safety education, emergency response preparedness, disaster management, and pandemic response capability in order to respond to community-defined scopes of practice. All aspects of these policy issues are relevant to stroke care and will require strong advocacy to be fully implemented.

The American Stroke Association/ American Heart Association expert panel on Emergency Medical Services Systems and the Stroke Council issued a policy statement in 2007 regarding implementation strategies for emergency medical services within stroke systems of care. Prehospital delays in the treatment of stroke patients, including identification of stroke as a medical emergency, represent a significant and preventable obstacle to optimal stroke care. Although patient delay in seeking care represents the greatest barrier to expedient care, delays often exist in the identification, transport, and triage of stroke patients. Public education in recognizing stroke symptoms as warranting immediate care and appropriate training of emergency medical service personnel are essential parts of community-wide, coordinated stroke care. In addition, emergency physicians must be engaged in the effort to limit delays if the rates of patients eligible for thrombolytic therapy are to improve.

The use of a standardized stroke diagnostic screening tool by emergency medical service responders has been recommended to increase sensitivity of identifying potential stroke patients on scene, especially those who may be candidates for time-sensitive interventions. The Cincinnati Prehospital Stroke Scale (CPSS) is a three-item scale based on a simplification of the National Institutes of Health (NIH) Stroke Scale. It uses the mnemonic, FAST (“Face”, “Arm”, “Speech”, “Time”), for rapid identification of stroke and transient ischemic attacks. When performed by a physician, it has a high sensitivity and specificity in identifying patients with stroke who are candidates for thrombolysis. In a validation study of this tool with emergency medical service responders, a total of 860 scales were completed on a convenience sample of 171 patients from the emergency department and neurology inpatient service. Of these patients, 49 had a diagnosis of stroke or transient ischemic attack. High reproducibility was observed among prehospital providers for total score (intraclass correlation coefficient [rI], 0.89; 95% confidence interval [CI], 0.87 to 0.92) and for each scale item: arm weakness, speech, and facial droop (0.91, 0.84, and 0.75, respectively). There was excellent intraclass correlation between the physician and the prehospital providers for total score (rI, 0.92; 95% CI, 0.89 to 0.93) and for the specific items of the scale (rI, 0.91, 0.87, and 0.78, respectively). This scale was found to have good validity in identifying patients with stroke who are candidates for thrombolytic therapy, especially those with anterior circulation stroke.
The Los Angeles Prehospital Stroke Screen (LAPSS) is a one-page instrument designed to allow prehospital personnel to rapidly identify acute stroke patients in the field.\textsuperscript{213} A prospective, in-the-field validation study of the LAPSS was conducted by assigning Paramedics to three University of California at Los Angeles-based advanced life support units were trained and certified in use of the LAPSS. Over seven months, paramedics completed the LAPSS on noncomatose, nontrauma patients with complaints suggestive of neurological disease. LAPSS form stroke identification results were compared with emergency department and final hospital discharge diagnoses. LAPSS forms were completed on 206 patients. Paramedic performance when completing the LAPSS demonstrated sensitivity of 91 percent (95% CI, 76% to 98%), specificity of 97 percent (95% CI, 93% to 99%), positive predictive value of 86% (95% CI, 70% to 95%), and negative predictive value of 98 percent (95% CI, 95% to 99%). With correction for the four documentation errors, positive predictive value increased to 97 percent (95% CI, 84% to 99%).\textsuperscript{213}

The predictive value of the Ontario Pre-Hospital Stroke Screening Tool was determined in a retrospective study at a large Canadian regional stroke centre.\textsuperscript{214} Consecutive patient charts were reviewed over a 12-month period following implementation of the tool and were compared with those for the 12-month period prior to implementation. Final diagnoses, treatments, and outcomes were abstracted from a provincial registry, including rates of thrombolysis. Three hundred twenty-five patients were triaged under the emergency medical services (EMS) acute stroke protocol over the study period. The PPV of the screening tool was 89.5 percent (95% confidence interval [CI]: 85.7–92.7%) for acute stroke. Thirty-four patients (11%) had nonstroke conditions, with the most common being seizure (four percent). The rate of administration of tissue plasminogen activator (tPA) for all patients with suspected stroke increased from 5.9 percent to 10.1 percent (p = 0.04) compared with the rate in the 12-month period prior to implementation of the acute stroke protocol. The tPA rate for patients arriving under the stroke protocol was 17.2 percent. Most patients (75%) receiving tPA arrived from outside the hospital catchment area. In this preliminary study, the Ontario Prehospital Stroke Screening Tool had a high PPV for acute stroke and appeared to be effective for identifying patients who required triage to a single regional stroke centre.

<table>
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<th>Best Practice Recommendation 3.3</th>
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<td>Emergency Department Evaluation and Management of Patients with Transient Ischemic Attack and Ischemic Stroke.</td>
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**NOTE on this recommendation**

- **Time is Brain!** The goal of emergency department management is rapid assessment of all patients with a suspected acute stroke. For patients who may be eligible for intravenous tissue plasminogen activator, the target is to complete rapid assessment and initiate treatment within 90 minutes of stroke symptom onset.

All patients presenting to an emergency department with suspected stroke or transient ischemic attack must have an immediate clinical evaluation and investigations to establish the diagnosis, rule out stroke mimics, determine eligibility for thrombolytic therapy, and develop a plan for further management.

Patients presenting with stroke or transient ischemic attack should not be discharged from the ED without diagnostic evaluations, consideration of functional impairments, initiation or modification of secondary prevention therapy, and a plan for ongoing management.

**3.3.1 Initial Evaluation**

i. Patients with suspected acute stroke should have a rapid initial evaluation for airway, breathing and circulation [Evidence Level B].

ii. A neurological examination should be conducted to determine focal neurological deficits and
assess stroke severity [Evidence Level B]. A standardized stroke scale should be used.

iii. Monitoring in the acute phase should include heart rate and rhythm, blood pressure, temperature, oxygen saturation, hydration, swallowing ability, and presence of seizure activity [Evidence Level B].

Acute blood work, including routine chemistry, electrolytes, hematology and coagulation should be conducted as part of the initial evaluation [Evidence Level B]. Refer to Box 3.2 for additional information.

iv. Electrocardiogram and chest X-ray should be completed, especially where the patient has a clinical history or evidence of heart disease or pulmonary disease [Evidence Level B].

3.3.2 Neurovascular Imaging

All patients with suspected acute stroke or transient ischemic attack should undergo brain imaging (MRI or CT) immediately [Evidence Level A], and vascular imaging of the brain and neck arteries as soon as possible [Evidence Level B].

i. If MRI is performed, it should include diffusion-weighted sequences to detect recent ischemia and gradient echo and fluid-attenuated inversion recovery (FLAIR) sequences to determine extent of infarct or presence of hemorrhage [Evidence Level B].

ii. If MRI is not possible as the initial imaging, a non-contrast CT scan of the brain should be performed [Evidence Level B].

iii. Vascular imaging of the carotid and vertebral arteries by duplex ultrasonography, CT angiography (CTA), magnetic resonance angiography (MRA) or catheter angiography should be performed within 24 hours of a transient ischemic attack or ischemic stroke unless the patient is clearly not a candidate for revascularization [Evidence Level B]. Ideally CTA or MRA is performed at the time of the initial CT or MRI.

iv. If not done as part of the original assessment in the emergency department, extracranial vascular imaging should be done as soon as possible to better understand the cause of the stroke event and guide management decisions. Imaging of the intracranial vessels might be warranted in some cases. Duplex ultrasonography, CT angiography (CTA), or magnetic resonance angiography (MRA) of the extracranial and intracranial vessels may be considered. In some circumstances catheter angiography of the extracranial and intracranial vessels should be considered [Evidence Level B].

3.3.3 Cardiovascular Investigations

i. Following an initial electrocardiogram, serial electrocardiograms (i.e., daily) should be done over the first 72 hours post-stroke to detect atrial fibrillation and other acute arrhythmias [Evidence Level B].

ii. Serial electrocardiograms in the first 72 hours combined with a Holter monitor during hospitalization may be considered in order to increase detection of atrial fibrillation [Evidence Level C].

iii. Echocardiography, either 2-D or transesophageal, should be considered for patients with suspected embolic stroke and normal neurovascular imaging in whom there are no contraindications to anticoagulation [Evidence Level B].

3.3.4 Acute Blood Pressure Management
There is a lack of clear evidence from randomized controlled trials to guide the emergent and urgent treatment of elevated blood pressure in the setting of acute ischemic or hemorrhagic stroke. Pharmacological agents and routes of administration should be chosen to avoid precipitous falls in blood pressure [Evidence Level C]. The following recommendations reflect the paucity of evidence in this area and indicate the need for further research.

i. Ischemic stroke eligible for thrombolytic therapy: Very high BP (>185/110mmHg) should be treated concurrently in patients receiving thrombolytic therapy for acute ischemic stroke in order to reduce the risk of secondary intracranial hemorrhage. [Evidence Level B].

ii. Ischemic stroke patients not eligible for thrombolytic therapy: Treatment of hypertension in the setting of acute ischemic stroke should not be routinely undertaken [Evidence Level C]. Extreme blood pressure elevation (e.g. systolic > 220 or diastolic > 120mmHg) may be treated to reduce the blood pressure by ~15 percent, and not more than 25%, over the first 24h with gradual reduction thereafter [Evidence Level C]. Avoid excessive lowering of blood pressure as this may exacerbate existing ischemia or may induce ischemia, particularly in the setting of intracranial arterial occlusion or extracranial carotid or vertebral artery occlusion [Evidence Level C].

3.3.5 Blood Glucose Abnormalities

i. All patients with suspected acute stroke should have their blood glucose concentration checked immediately [Evidence Level B].

ii. Blood glucose measurement should be repeated if the first random glucose value is elevated greater than 10 mmol/L. The repeat measures should include a fasting glucose and an A1c[Evidence Level B].

iii. Hypoglycemia should be corrected immediately [Evidence Level B].

iv. If the repeat glucose levels and the A1c are elevated (fasting glucose greater than 7 mmol/L; A1c greater than 7 percent), the use of anti-hyperglycemic agents should be considered [Evidence level C], and in the longer term, education on lifestyle changes and diabetes [Evidence level A].

Refer to recommendation 2.4 for additional information

3.3.6 Other Investigations that may be required in the Emergency Department

i. Blood cultures if endocarditis is suspected [Evidence level B].

ii. Fasting lipid profile [Evidence level A].

iii. Investigations for hypercoagulability and vasculitis (Evidence Level C).

Refer to Box 3.2 for list of common coagulopathy investigations

Box 3.3 Initial Bloodwork for Assessment of Acute Stroke Patients

All suspected stroke patients: complete blood count (CBC), electrolytes, creatinine, urea, glucose, international normalized ratio (INR), partial thromboplastin time (PTT), thyroid-stimulating hormone (TSH), fasting lipid profile, creatine kinase (CK), troponin test

Arterial coagulopathy screen: anticardiolipin (Antiphospholipid) antibody, Lupus anticoagulant


Vasculitis: erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), antinuclear antibody (ANA), syphilis screen
Rationale:
Patients who present to hospital with suspected stroke often also have significant physiological abnormalities and comorbidities. These can complicate management of stroke. Signs and symptoms that may explain etiology or predict later complications such as space-occupying infarction, bleeding, or recurrent stroke, and medical conditions such as hypertension and the presence of a coagulopathy will have an impact on treatment decisions. An efficient and focused assessment is required to understand the complex needs of each patient.

It is impossible to differentiate infarct from hemorrhage by clinical examination alone. Brain imaging is required to guide management, including the selection of time-sensitive interventions. A CT scan or MRI is important since clinicians may disagree on the clinical diagnosis of stroke (versus not stroke) in about 20 percent of patients.

Initial management of elevated blood pressure in acute stroke patients remains controversial due to the lack of evidence to clearly guide practice. At the same time, this is an area where clinicians often seek guidance from stroke specialists. The recommendations for this area emphasize caution and diligence in monitoring and treating extremely high blood pressure in the first hours after stroke onset.

Diabetes is a major modifiable risk factor for vascular disease that may be first diagnosed at the time of a stroke. Severe hyperglycemia (blood glucose greater than 22 mmol/L) is a relative contraindication to the administration of intravenous alteplase. Hyperglycemia at the time acute stroke increases size of the damaged area in experimental animals and is associated with poor clinical outcomes in epidemiological studies.

System Implications
- Protocols and standing orders to guide initial blood work and other clinical investigations.
- Local protocols for prioritizing stroke patients for rapid access to appropriate diagnostics such as CT scans and duplex ultrasound, communicated to all relevant personnel such as emergency department, imaging, and stroke teams.
- Agreements to ensure patients initially managed in rural hospitals without neurovascular imaging capability have timely access to CT scans within 24 hours at partnering facilities.
- Local protocols, especially in rural and remote locations, for rapid access to clinicians experienced in interpretation of diagnostic images, including access through telemedicine technology.

Performance Measures
1. Proportion of stroke patients who receive a brain CT/MRI within 24 hours of hospital arrival (core).
2. Proportion of patients who do not undergo carotid imaging in emergency who have an appointment booked before discharge for carotid imaging as an outpatient.
3. Median time from time INR drawn to results available.
4. Proportion of patients with blood glucose levels documented during assessment in the emergency department.
5. Proportion of stroke patients who receive a brain CT/MRI within 60 minutes of hospital arrival.
6. Median time from stroke symptom onset to carotid imaging.
7. Proportion of patients with known diabetes who have blood glucose levels in therapeutic range for that patient.
**Measurement Notes**

- Data may be obtained from laboratory reports or patient chart.
- Stratify analysis for patients who arrive within 3.5 hours of stroke symptom onset and those who arrive beyond 3.5 hours.
- Performance measure 1: apply to patients who may be candidates for acute thrombolysis (i.e. who arrive at hospital within 3.5 hours of stroke onset) and for patients who may be eligible for other time-sensitive interventions.
- Performance measures 1 and 2: Time interval measurements for CT and MRI should be calculated from the time the patient is triaged in the emergency department until the time noted on the actual brain imaging scan. Documentation of triage time is recorded on the emergency department chart.
- Performance measure 3: For out-patient carotid imaging, a notation should appear in the discharge summary, or in nursing notes, with an indication that the test has actually been booked prior to the patient leaving the hospital.
- Performance measure 5: Use medical history to determine whether patient was known to have diabetes prior to the stroke event.

**Implementation Resources and Knowledge Transfer Tools**

- Canadian Stroke Strategy emergency medical services pocket card template
- Canadian Stroke Strategy emergency medical services education package
- National Institutes of Health Stroke Scale (NIHSS) and Canadian Neurological Scale (CNS) pocket cards available at [www.heartandstroke.ca/profed](http://www.heartandstroke.ca/profed)
- National Stroke Nurses Council: Best Practice Nursing Care Across the Acute Stroke Continuum: Modules 1&2

**Summary of the Evidence**

An initial assessment of all suspected stroke patients is critical to facilitate rapid access to time-sensitive treatments and to minimize potential negative outcomes of stroke. Neurovascular imaging is considered one of the most important diagnostic tests to perform immediately after patient arrival at hospital, as many management decisions follow the differential diagnosis resulting from imaging.\(^{216}\)

Clinical protocols, pathways and algorithms have been reported in the literature and have been found to have a moderate benefit in efficiencies of early assessments and patient course in hospital. Stroke response protocols are commonly implemented to increase efficiency for emergency medical services and emergency departments receiving stroke patients. These also include the use of tools such as standing order sets, stroke code protocols and prenotification (as described in Recommendation 3.1).

**Neurovascular Imaging:** Despite the absence of randomized trials, there is uniform agreement that non-contrast Computed Tomography (CT) should be the initial imaging study of patients who present with acute ischemic stroke. The primary purpose of the head CT is to exclude intracranial hemorrhage although other important information may be obtained. A head CT should be obtained emergently in those patients potentially eligible for thrombolytic therapy. Strict goals of 25 minutes from presentation to the emergency room to completion of the scan and 45 minutes until interpretation have been recommended based on randomized controlled trials of thrombolytic therapy. Although magnetic resonance imaging may provide more information in specific cases, it is not generally recommended as the initial brain imaging study in patients with an acute stroke. In a decision-analysis model, a policy of ‘scan all immediately’ was more cost-effective than ‘scan all within 48 hours’ or ‘scan patients on anticoagulants or in a life-threatening condition immediately and the rest within 14 days’. Up to 15 percent of children and young adults with stroke have arterial dissections; vascular imaging is required to refine the diagnosis and management decisions.\(^{217}\)
Eight clinical practice guidelines have recommended head CT as the initial imaging study for patients with acute ischemic stroke. Whereas all guidelines recommend obtaining the CT scan promptly, more recent guidelines concerning patients eligible for thrombolytic therapy have established target times of 25 minutes for completion of the CT scan following presentation to the emergency room and 45 minutes for interpretation of the CT scan. Most importantly, CT scanning allows the early detection of intracranial hemorrhage, an absolute contraindication to thrombolytic therapy. CT images also provide information regarding early ischemic changes in the brain, mass effect from edema, middle cerebral artery embolic material (hyperdense MCA sign), other vascular lesions, and prior cerebral infarctions.

Members of the Stroke Council of the American Heart Association have issued specific guidelines for the use of imaging in transient ischemic attacks and acute stroke. The authors strongly recommend CT of the head without contrast enhancement as the initial brain imaging procedure in patients with acute stroke. The authors classified this recommendation as a "strong positive recommendation" resulting from evidence based on one or more well-designed studies of a diverse population using a gold standard reference test in a blinded evaluation appropriate for the proposed diagnostic application.

Wardlaw et al. conducted a cost-effectiveness analysis of the use of CT and tested 13 strategies. The study indicates that of 13 possible imaging strategies, a policy of "CT scan all patients immediately" is dominant. Although the costs of CT scanning are highest for this strategy because of more scanning occurring after hours, these higher costs are offset by savings in the length of inpatient stay because many management decisions and better outcomes depend on accurate early diagnosis of stroke. The costs of after-hours scanning would have to rise markedly (well above the current maximum costs) to outweigh the cost savings in length of stay on current bed occupancy cost figures. The results were sensitive to a fall in the cost of inpatient days. The unusual sensitivity of the incremental cost effectiveness estimates is largely a product of the very small difference in outcome between a strategy of "scan all immediately" and one of "scan all within 48 hours of admission to hospital." Because the majority of patients have cerebral infarction, the main treatment is aspirin, and there is no good evidence of a time dependency of the effect of aspirin up to 48 hours after stroke.

About 15 to 20 percent of ischemic strokes are caused by symptomatic extracranial carotid artery disease. Rapid identification of patients with symptomatic carotid artery disease who would be candidates for carotid revascularization is a management priority. Since patients with carotid territory transient ischemic attack or minor stroke and high-grade ipsilateral carotid artery stenosis are at very high risk of early stroke recurrence, and because the absolute benefit derived from carotid endarterectomy is highly time-dependent, there is a need to quickly rule in or rule out the presence of significant carotid artery disease in appropriate patients. Of all the diagnostic tests, carotid imaging is arguably the most important study to be performed early. Outdated guidelines recommend that it be performed within one week of the presenting event, but more recent expert opinion recommends that it be performed within 24 hours. The opportunity for stroke prevention may be missed if there are delays in diagnosis and treatment of symptomatic carotid disease.

While brain imaging is essential for diagnosis, referral and management of suspected paediatric stroke patients, the wide differential diagnosis for stroke-like presentations in children requires more specific initial imaging, namely magnetic resonance imaging (MRI) compared with adults. MRI can also screen for the site of arterial or venous occlusion (AHA) and is less invasive for infants and young children than other types of imaging. However conventional angiography may be required to diagnose specific arteriopathies requiring specific treatments (anticoagulation for dissection, immunosuppressants for vasculitis). One population-based cohort study investigated cases of arterial ischemic stroke. Of 97 children who had experienced a later childhood stroke, 52 received cerebrovascular imaging and it was found that children with a vascular abnormality had a 5-year cumulative recurrence rate of 66 percent. High-risk patients can be rapidly identified with the use of cerebrovascular imaging. In children, arterial dissection is common (14 percent of childhood stroke) and clinical indicators unreliable. Neck pain is rarely found and 50 percent of cases are non-traumatic.

**Cardiac Investigations:** Detection of atrial fibrillation and treatment to minimize the risk of first or recurrent stroke is not well managed. In a recent study by Douen and colleagues, One hundred forty-four patients with ischemic stroke
admitted to a stroke unit were followed with serial ECGs. These were performed in 143 patients with a baseline of 10 (7%) patients having a history of AF. Serial ECGs detected 15 new AF cases in <two days of admission, thereby increasing the total number of known AF cases to 25 (17.5%), a 2.6-fold increased realization of AF (P < 0.011). Holter was also completed in 12 of 15 new cases of AF but surprisingly identified AF in only 50 percent (6 of 12). Holter monitoring was performed in 126 cases and in this subgroup, there was no statistically significant difference in the rate of AF detection with ECG or Holter. Other studies have also reported the lower sensitivity of Holter monitoring in detecting atrial fibrillation in stroke and TIA patients, although procedures and techniques for both Holter and serial ECGs will impact outcomes.

**Acute Blood Pressure Management:**

Blood pressure is frequently elevated during acute stroke but then returns to pre-stroke levels within a few days after the event. There is a U-shaped relationship between acute blood pressure and outcome after stroke. Elevated blood pressure is a risk factor for intracranial hemorrhage in patients with acute ischemic stroke who are treated with intravenous alteplase. Elevated blood pressure may also increase the risk of hematoma expansion in patients with acute intracerebral hemorrhage.

Despite this observational evidence, there is uncertainty about the optimal management of blood pressure in the hours and days after acute ischemic and hemorrhagic stroke. The data from the trials included in a Cochrane review [Cochrane 1] were too limited to provide reliable guidance on the indications for the use of drugs to lower or raise blood pressure in acute stroke, or precise estimates on the likely effects of these drugs on blood pressure. Concerns persist that excessive blood pressure lowering may be harmful, as demonstrated by several trials that studied vasoactive drugs for their putative neuroprotective properties.

Several ongoing clinical trials are evaluating blood pressure lowering in acute stroke (refer to the Clinical Trials Registry www.stroketrials.org)

**Blood Glucose:** Elevated blood sugar (hyperglycemia) in the acute phase of stroke is common, documented in up to 40 percent of patients. Several large clinical studies have now demonstrated a positive association between post-stroke hyperglycemia and poor outcome from stroke, infarct progression, greater mortality, and reduced functional recovery. Hyperglycemia is clearly shown to have deleterious effects on brain tissue in animal models of cerebral ischemia, increasing the size of the damaged brain tissue and surrounding edema in the brain. It remains unclear as to what extent post-stroke hyperglycemia is a "normal" physiological response, or whether hyperglycemia per se increases cerebral damage in the acute phase. There are accumulating clinical data to suggest that much of this response is associated with impaired glucose metabolism, with the prevalence of previously unrecognized diabetes, or impaired glucose tolerance preceding stroke as high as 42 percent. Although a direct causal relationship has not yet been established, it is probable that an important relationship exists between hyperglycemia and stroke outcome. Patients with hyperglycemia have worse functional outcomes at hospital discharge and are less likely to be living independently at six months and one year post-stroke. Mortality in stroke patients with early hyperglycemia is also significantly higher. To date, no strong evidence exists for a specific strategy for treating hyperglycemia in stroke to improve stroke outcomes; however, practice guidelines uniformly recommend treating elevated glucose levels.

The Glucose in Stroke Trial (GIST-UK), a randomized, controlled trial of glucose treatment with intravenous glucose-potassium-insulin over 24 hours, compared to a normal saline infusion control group, enrolled a total of 933 patients. The primary outcome measure, 90-day mortality, was not significant when the groups were compared. Several factors may have contributed to the negative study result: poor recruitment so this could possibly be an underpowered study. Patients had only modestly elevated glucose levels on study entry and glucose spontaneously decreased in the saline control arm.

Fuentes et al (2009) studied the effect of capillary glucose levels on outcomes in patients with acute stroke. In a multicenter, prospective, and observational cohort study of 476 patients with ischemic stroke within less than 24 hours from stroke onset, capillary finger-prick glucose and stroke severity were determined on admission and three times a day during the first 48 hours. Poor outcome (modified Rankin Scale >2) was evaluated at 3 months. The receiver operating characteristic curves showed the predictive value of maximum capillary glucose at any time within
the first 48 hours with an area under the curve of 0.656 (95% CI, 0.592 to 0.720; \( P < 0.01 \)) and pointed to 155 mg/dL as the optimal cut-off level for poor outcome at three months (53 percent sensitivity; 73 percent specificity). This point was associated with a 2.7-fold increase (95% CI, 1.42 to 5.24) in the odds of poor outcome after adjustment for age, diabetes, capillary glucose on admission, infarct volume, and baseline stroke severity and with a three-fold increase in the risk of death at three months (hazard ratio, 3.80; 95% CI, 1.79 to 8.10). The investigators concluded hyperglycemia of greater or equal to 155 mg/dL at any time within the first 48 hours from stroke onset, and not only the isolated value of admission glycemia, is associated with poor outcome independently of stroke severity, infarct volume, diabetes, or age.

**Best Practice Recommendation 3.4**

**Acute Thrombolytic Therapy**

All patients with disabling acute ischemic stroke who can be treated within 4.5 hours of symptom onset should be evaluated without delay to determine their eligibility for treatment with intravenous tissue plasminogen activator (alteplase).

i. Eligible patients are those who can receive intravenous alteplase within 4.5 hours of the onset of stroke symptoms in accordance with criteria adapted from National Institute of Neurological Disorders and Stroke (NINDS) tPA Stroke Study and the European Cooperative Acute Stroke Study (ECASS III)\(^{207}\) [Evidence Level A].

Refer to Box 3.4 for inclusion and exclusion criteria.

ii. All eligible patients should receive intravenous alteplase as soon as possible after hospital arrival, with a target door-to-needle time of less than 60 minutes [Evidence Level C].

iii. Administration of alteplase should follow the American Stroke Association guidelines: total dose 0.9 mg/kg with 10 percent (0.09 mg/kg) given as intravenous bolus over one minute and the remaining 90 percent (0.81 mg/kg) given as an intravenous infusion over 60 minutes [Evidence Level A].

iv. Features on the initial CT brain scan of an otherwise alteplase-eligible ischemic stroke patient that modify the response to treatment remain poorly defined. Some of the trials of alteplase excluded patients with severe hemispheric stroke if the initial CT scan showed early signs of infarction involving more than one-third of the territory of the middle cerebral artery (i.e., a score of less than five on the Alberta Stroke Program Early CT Score (ASPECTS)).\(^{232}\) In clinical practice, the decision to treat such a patient with alteplase should be based on the clinical judgment of the treating physician, and the wishes of the patient and family, until such time as additional data from randomized controlled trials are made available [Evidence Level B].

v. There remain situations where there are sparse or no clinical trial data to support the use of thrombolytic therapy: paediatric stroke, stroke in patients over the age of 80 years with diabetes, adults who present within the first few hours of onset of an acute ischemic stroke but do not meet current criteria for treatment with intravenous alteplase, and intra-arterial thrombolysis. In clinical practice, the decision to use alteplase in these situations should be based on the clinical judgment of the treating physician, and the wishes of the patient and family, until such time as additional data from randomized controlled trials are available [Evidence Level A].
In Canada, alteplase is currently approved by Health Canada for use in adults with acute ischemic stroke within three hours after the onset of stroke symptoms. Exemptions may apply; e.g., a “Letter of No Objection” from Health Canada is required for clinical trials examining the use of intravenous alteplase for other treatment protocols.

Box 3.4: Criteria for Acute Thrombolytic Therapy

Criteria adapted in accordance with the criteria identified in National Institute of Neurological Disorders and Stroke (NINDS) tPA Stroke Study and the European Cooperative Acute Stroke Study (ECASS III)

Treatment Criteria

- Diagnosis of ischemic stroke causing measurable neurologic deficit in a patient who is 18 years of age or older
- Onset of symptoms more than one hour and less than 4.5 hours before alteplase administration

Exclusion Criteria

**Historical**

- History of intracranial hemorrhage
- Stroke or serious head or spinal trauma in the preceding three months
- Recent major surgery
- Arterial puncture at a non-compressible site in the previous seven days
- Any other condition that could increase the risk of hemorrhage after alteplase administration

**Clinical**

- Symptoms suggestive of subarachnoid hemorrhage
- Stroke symptoms due to another non-ischemic acute neurological condition such as seizure with post-ictal Todd’s paralysis or focal neurological signs due to severe hypo- or hyperglycemia
- Hypertension refractory to antihypertensives such that target blood pressure <185/110 cannot be achieved

**Laboratory**

- Blood glucose concentration below 2.7 mmol/L or above 22.2 mmol/L
- Elevated activated partial-thromboplastin time
- International Normalized Ratio greater than 1.7
- Platelet count below 100,000 per cubic millimetre

**CT or MRI Findings**

- Any hemorrhage on brain CT or MRI
- CT or MRI signs of acute hemispheric infarction involving more than one-third of the middle cerebral artery territory (Alberta Stroke Program Early CT Score (ASPECTS)<5)

**Rationale:**

Meta-analyses of the randomized controlled trials of intravenous alteplase for acute ischemic stroke have shown that thrombolytic treatment can reduce the risk of disability and death, despite the risk of serious bleeding. The latest time for alteplase administration after stroke onset remains imprecisely defined, but currently available data show clear evidence of benefit when given up to 4.5 hours after the onset of symptoms. The available evidence demonstrates a strong inverse relationship between treatment delay and clinical outcome; eligible patients should be treated without delay, regardless of when they present within the treatment window.

**System Implications**

- Local protocols for prioritizing stroke patients for rapid access to appropriate diagnostics such as CT
scans and duplex ultrasound, communicated to all relevant personnel such as emergency department, imaging, and stroke teams.

- A system for rapid access to physicians experienced in administration of acute thrombolysis, including through telemedicine, which includes protocols for contacting physicians and for administration of tissue plasminogen activator.
- Access to specialized stroke units where staff are experienced in managing patients who have received tissue plasminogen activator for stroke.

**Performance Measures**

1. Proportion of all ischemic stroke patients who receive treatment with alteplase (core).
2. Proportion of all eligible ischemic stroke patients who receive treatment with alteplase.
3. Proportion of all thrombolyzed stroke patients who receive alteplase within one hour of hospital arrival (core).
4. Median time (in minutes) from patient arrival in the emergency department to administration of alteplase.
5. Proportion of patients with symptomatic intracerebral hemorrhage following alteplase treatment.
6. Proportion of patients in rural or remote communities who receive alteplase through the use of telestroke technology (as a proportion of all ischemic stroke cases in that community and as a proportion of all telestroke consults for ischemic stroke cases).

**Measurement Notes**

- Data may be obtained from patient charts, through chart audit or review.
- Time interval measurements should be taken from the time the patient is triaged or registered at the hospital (whichever time comes first) until the time of medication administration noted in the patient chart (nursing notes, emergency department record, or medication record).
- When recording if tissue plasminogen activator is given, the route of administration should also be recorded, as there are different times to administration benchmarks for intravenous versus intra-arterial routes.

**Implementation Resources and Knowledge Transfer Tools**

- National Institutes of Health Stroke Scale (NIHSS) and Canadian Neurological Scale (CNS) pocket cards available at [www.heartandstroke.ca/profed](http://www.heartandstroke.ca/profed)
- National Stroke Nurses Council: Best Practice Nursing Care Across the Acute Stroke Continuum: Modules 1&2

**Summary of the Evidence**

The release of the Third European Cooperative Acute Stroke Study (ECASS III) trial in 2008 resulted in an extension of the treatment time window for acute thrombolysis from three hours to four and one half hours. The 2009 update of the Cochrane systematic review of thrombolysis for acute ischemic stroke reflected these changes in practice. The systematic review included 26 trials involving 7,152 patients. Not all trials contributed data to each outcome. The trials tested urokinase, streptokinase, recombinant tissue plasminogen activator, recombinant pro-urokinase or desmoteplase. Four trials used intra-arterial administration; the rest used the intravenous route. Most data came from trials that started treatment up to six hours after stroke; three trials started treatment up to nine hours and one small trial up to 24 hours after stroke. About 55 percent of the data was from trials of intravenous tissue plasminogen activator alone. Very few of the patients (0.5%) were aged over 80 years.

Many trials had some imbalances in key prognostic variables. Several trials did not have complete blinding of
outcome assessment. Thrombolytic therapy, mostly administered up to six hours after ischemic stroke, significantly reduced the proportion of patients who were dead or dependent (modified Rankin 3 to 6) at three to six months after stroke (odds ratio (OR) 0.81, 95% confidence interval (CI) 0.73 to 0.90). Thrombolytic therapy increased the risk of symptomatic intracranial hemorrhage (OR 3.49, 95% CI 2.81 to 4.33) and death by three to six months after stroke (OR 1.31, 95% CI 1.14 to 1.50). Treatment within three hours of stroke appeared more effective in reducing death or dependency (OR 0.71, 95% CI 0.52 to 0.96) with no statistically significant adverse effect on death (OR 1.13, 95% CI 0.86 to 1.48). There was heterogeneity between the trials in part attributable to concomitant antithrombotic drug use (P = 0.02), stroke severity and time to treatment. The analysis also found antithrombotic drugs given soon after thrombolysis may increase the risk of death. The authors concluded thrombolytic therapy appears to result in a significant net reduction in the proportion of patients dead or dependent in activities of daily living. This overall benefit was apparent despite an increase both in deaths (evident at seven to 10 days and at final follow up) and in symptomatic intracranial hemorrhages. The findings of this review also confirm that further trials are needed to identify which patients are most likely to benefit from treatment and the environment in which thrombolysis may best be given in routine practice.

The Third European Cooperative Acute Stroke Study (ECASS III) examined the use of intravenous alteplase 3–4.5 hours after the onset of ischemic stroke. Of a total of 821 patients, 418 were randomly assigned to receive alteplase at a dose of 0.9 mg/kg and 403 to receive placebo. The median time for the administration of alteplase was three hours and 59 minutes after stroke onset. More patients had a favorable outcome (modified Rankin score 0 or 1) with alteplase than with placebo (52.4% v. 45.2%; OR 1.34, 95% CI 1.02–1.76; p = 0.04; NNT = 14). The incidence of intracranial hemorrhage was higher with alteplase than with placebo (for any intracranial hemorrhage, 27.0% v. 17.6%, p = 0.001; for symptomatic intracranial hemorrhage, 2.4% v. 0.2%, p = 0.008 [number need to harm 45]). Mortality did not differ significantly between the alteplase and placebo groups (7.7% v. 8.4%; p = 0.68). There was no significant difference in the rate of other serious adverse events.

ECASS III excluded patients older than 80 years, patients with severe stroke (National Institutes of Health Stroke Severity Score > 25 or imaging evidence of involvement of more than one-third of the middle cerebral artery territory) and patients with a history of the combination of previous stroke and diabetes. These factors most likely contributed to the low death rate, low hemorrhage rate and excellent placebo outcome rate relative to previous trials, and should be taken into consideration when treating patients 3–4.5 hours after stroke onset.

These results were consistent with the benefit predicted by a model derived from a pooled analysis of individual patient data from previous randomized trials of intravenous alteplase versus placebo. The analysis found that earlier administration of alteplase improved the odds ratio of having a favorable outcome by 2.8 for 0–90 minutes, 1.55 for 90–180 minutes and 1.4 for 180–270 minutes, highlighting the importance of initiating treatment without delay.

Post marketing surveillance studies in Canada and Europe have suggested that intravenous alteplase is safe and effective in routine clinical practice when it is administered in accordance with the protocols used in the clinical trials. The Canadian Alteplase for Stroke Effectiveness Study (CASES) assessed the effectiveness of alteplase therapy for ischemic stroke in a prospective national cohort study. Data were collected over 2.5 years between 1999 and 2001 from centres capable of administering alteplase according to Canadian guidelines. A total of 1135 adults were enrolled at 60 hospitals across Canada (an estimated 84 percent of all treated ischemic stroke patients in the country) with follow up at 3 months. An excellent clinical outcome was observed in 37 percent of the patients. Symptomatic intracranial hemorrhage occurred in 4.6 percent of the patients (95% CI 3.4–6.0%); however, 75 percent of these patients died in hospital. No differences in outcomes were observed between rural and urban settings.

In Europe, the Safe Implementation of Thrombolysis in Stroke Monitoring Study (SITS-MOST), involving 6483 adults in 14 countries, showed that the rates of symptomatic intracerebral hemorrhage, mortality and independence in activities of daily living for patients treated with intravenous alteplase in routine clinical practice in accordance with the licensing specifications of the European Medicines Evaluation Agency were similar to the outcomes reported in randomized controlled trials. Comparison of a cohort of 11 865 patients treated within three hours and a cohort of 664 patients treated 3–4.5 hours after stroke onset showed no significant differences in outcome (symptomatic intracerebral hemorrhage, mortality and functional independence).
Best Practice Recommendation 3.5
Acute Aspirin Therapy

All acute stroke patients not already on an antiplatelet agent should be given at least 160 mg of acetylsalicylic acid (ASA) immediately as a one time loading dose after brain imaging has excluded intracranial hemorrhage [Evidence Level A].

i. In patients treated with recombinant tissue plasminogen activator (r-tPA), acetylsalicylic acid (ASA) should be delayed until after the 24-hour post-thrombolysis scan has excluded intracranial hemorrhage [Evidence Level B].

ii. Acetylsalicylic acid (80 to 325 mg daily) should then be continued indefinitely or until an alternative antithrombotic regime is started [Evidence Level A].

Refer to recommendations 2.5 and 2.6 for additional information.

iii. In dysphagic patients, acetylsalicylic acid may be given by enteral tube or by rectal suppository [Evidence Level A].

iv. In paediatric patients, initial treatment with low molecular weight heparin should be considered and continued until cervical artery dissection and intracardiac thrombus is excluded. If neither is present, switch to acute aspirin therapy at dose of 1-5 mg/kg [Evidence Level B].

v. In patients already on acetylsalicylic acid prior to ischemic stroke or transient ischemic attack, clopidigrel may be considered as an alternative [Evidence Level B]. If rapid action is required then a loading dose of 300 mg of clopidigrel could be considered, followed by a maintenance dose of 75 mg once a day.

Rationale

Acute-phase aspirin therapy reduces the risk of early recurrent ischemic stroke. Long-term aspirin therapy reduces the risk of ischemic stroke, myocardial infarction, and vascular death. There are no data from randomized controlled trials to support the use of other antiplatelet regimes in acute stroke patients. In the National Institute of Neurological Disorders and Stroke r-tPA Stroke Study, antithrombotic drugs (including aspirin) were avoided until after the 24-hour post-thrombolysis scan had excluded intracranial hemorrhage. Aspirin therapy also reduces the risk of venous thromboembolism.

System Implications

• Protocols and standing order sets should be developed and available to guide initial management of ischemic stroke and transient ischemic attack patients.

Performance Measures

1. Proportion of ischemic stroke patients who receive acute aspirin therapy within the first 48 hours following a stroke event (core).
2. Median time from stroke onset to administration of first dose of aspirin in hospital.

Measurement Notes

• Time interval measurements should be taken from the time the patient is triaged or registered at the hospital (whichever time comes first) until the time the first dose is administered.
• This indicator focuses on aspirin. Some centres may include other antiplatelet medications, such as clopidogrel, ticlopidine, or ASA combined with extended release dipyridamole. In cases where another agent is used instead of aspirin in the first 48 hours, this should be noted in the indicator definition.
• Possible data sources include history and physical, physician’s admission notes, nurses’ admission notes, medication record.
Summary of the Evidence

The 2008 update of the Cochrane systematic review of aspirin in acute stroke included twelve trials involving 43,041 patients. Two trials testing aspirin 160 to 300 mg once daily started within 48 hours of onset contributed 94 percent of the data. The maximum follow-up was six months. With treatment, there was a significant decrease in death or dependency at the end of follow up (odds ratio 0.95, 95% confidence interval 0.91 to 0.99). For every 1000 patients treated with aspirin, 13 patients will avoid death or dependency (number needed to treat to benefit: 79). Antiplatelet therapy was associated with a small but definite excess of symptomatic intracranial hemorrhages, but this was more than offset by the reduction of recurrent ischemic strokes and pulmonary embolus. The authors concluded antiplatelet therapy with aspirin 160 mg to 300 mg daily, given orally (or by nasogastric tube or per rectum in patients who cannot swallow), and started within 48 hours of onset of presumed ischemic stroke reduces the risk of early recurrent ischemic stroke without a major risk of early hemorrhagic complications and improves long-term outcome.

Several international stroke guidelines referenced in this document state that patients treated with tPA should not receive any antiplatelet or anticoagulant therapy for the first 24 hours after beginning treatment.

Long-term antiplatelet therapy reduces the risk of subsequent serious vascular events by about one quarter. In-hospital initiation of secondary prevention therapy before hospital discharge after an ischemic stroke or transient ischemic attack is associated with high treatment adherence rates three months after hospitalization.

Due to the lack of high-quality, randomized controlled trials in the literature, controversy exists in the discussion of hyperacute management of paediatric stroke patients. The Royal College of Physicians and the American Heart Association paediatric stroke guidelines discussed using low molecular weight heparin if there is a known dissection or cardiac clot, and otherwise using ASA. The American College of Chest Physicians guidelines discuss starting low molecular weight heparin initially, assuming dissection or cardiac clot may be present until proven otherwise.

Although the paediatric research is just emerging, it is clear that transient ischemic attack/stroke recurrence rate in children with arterial ischemic stroke is nearly 50 percent without antithrombotic treatment, demonstrating that paediatric stroke must be promptly diagnosed and treated. Data from the Warfarin-Aspirin Recurrent Stroke Study Trial in the adult sub-groups most similar to children with stroke (i.e. non-hypertensive, non-atherosclerotic) show benefit to anticoagulation over aspirin in preventing recurrent stroke.
Best Practice Recommendation 3.6
Early Management of Acute Subarachnoid Hemorrhage

NOTES on this recommendation

- This recommendation is for patients with subarachnoid hemorrhage (SAH). It applies to the initial assessment in the emergency department within the first few hours of patient arrival.
- Treatment and management of hemorrhagic stroke patients is outside the scope of these recommendations.
- Symptoms include sudden onset of severe headache (sometimes described as “thunderclap headache”) that patients will often characterize as the worst of their life. The headache of SAH is usually associated with nausea, vomiting, meningismus and photophobia and can also be associated with altered level of consciousness. Signs on physical examination vary depending on the location of the aneurysm and the extent of the hemorrhage as well as whether there is intraventricular of intracerebral extension of the subarachnoid hemorrhage. Physical signs can include diminished level of consciousness, cranial nerve palsy, hemiparesis and subhyaloid hemorrhage on fundoscopic exam, but it is important to note that patients with acute SAH often have a NORMAL neurological examination, so the absence of physical findings should not alter the index of suspicion raised by the clinical presentation.

Patients with aneurysmal subarachnoid hemorrhage should be treated as a medical emergency and evaluated immediately by physicians with expertise in stroke management [Evidence Level B].

i. Patients with suspected subarachnoid hemorrhage should have a non-contrast CT scan as soon as possible after hospital arrival to confirm the diagnosis [Evidence Level B].

ii. Patients with a strongly suggestive clinical history of subarachnoid hemorrhage, but negative non-contrast CT scan as reported by a radiologist, should undergo lumbar puncture for cerebrospinal fluid analysis. Xanthochromia evaluation may be more sensitive after a delay of 12 hours from symptom onset, but such a delay may not be practical or clinically appropriate [Evidence Level B].

iii. Cerebrospinal fluid analysis for xanthochromia by spectrophotometry is preferable to visual inspection, but is not routinely available in Canada [Evidence Level B].

iv. Patients with subarachnoid hemorrhage should undergo vascular imaging of the brain. High-quality noninvasive CT angiography may be preferable to catheter angiography as an initial investigation [Evidence Level B].

v. Patients with subarachnoid hemorrhage should have an urgent consultation with a neurosurgeon [Evidence Level B].

vi. Patients with subarachnoid hemorrhage and negative non-invasive vascular imaging should be considered for further imaging with catheter angiography [Evidence Level C].

vii. Patients with aneurysmal subarachnoid hemorrhage and CT evidence of hydrocephalus that is clinically symptomatic should undergo urgent placement of an external ventricular drain or other cerebrospinal fluid diversion technique [Evidence Level B].

viii. Patients who present within 96 hours of a subarachnoid hemorrhage and have an adequate blood pressure should immediately be started on nimodipine 60 mg every four hours by mouth for 14 to 21 days [Evidence Level A].

ix. Patients with subarachnoid hemorrhage should have their blood pressure closely monitored and maintained as normotensive [Evidence Level B]. Treatment for high blood pressure should be initiated while the aneurysm is unsecured to reduce the risk of hypertension-induced rebleeding [Evidence Level B].

x. Patients with an aneurysmal subarachnoid hemorrhage should have the aneurysm secured urgently by endovascular coiling or microsurgical clipping within 24 to 48 hours [Evidence Level B]. For patients with poor prognosis for neurological recovery, an initial course of supportive non-surgical
management may be appropriate [Evidence Level B].

xi. For subarachnoid hemorrhage patients with intraparenchymal extension at the time the aneurysm is secured, urgent evacuation of the hematoma should be considered [Evidence Level C].

xii. Decisions regarding modality of treatment should be based on patient-specific characteristics, which include consideration of patient age, clinical grade, morphology of the aneurysm, medical co-morbidity and institutional experience and resources [Evidence Level B]. However, the International Subarachnoid Aneurysm Trial (ISAT), which studied subarachnoid hemorrhage patients who were technically eligible for either treatment, demonstrated that outcomes were better among those treated by endovascular methods than by microsurgery [Evidence Level A].

xiii. Patients with aneurysmal subarachnoid hemorrhage should receive venous thromboembolism prophylaxis [Evidence Level A].

Refer to section 4.2 for additional information.

Rationale

Subarachnoid hemorrhage is a common and often catastrophic neurosurgical emergency that is prevalent in approximately seven percent of adults with stroke, and also in children. Recent mortality rates in Canada for patients with subarachnoid hemorrhage are just over 40 percent within 30 days of the event, and account for prolonged hospital lengths of stay. Over the past decade, several advances have been made in early treatment of subarachnoid hemorrhage, including endovascular techniques. Prompt recognition and access to expert medical professionals may reduce mortality and morbidity and improve long-term outcomes.

System Implications

- Awareness and education for physicians and nursing staff to recognize hemorrhagic stroke as a medical emergency.
- Protocols for rapid access to neurosurgical specialists for hemorrhagic patient management, including rapid referral process if neurosurgical services not available within the initial treating hospital.

Performance Measures

1. Risk-adjusted mortality rates for subarachnoid hemorrhage in-hospital, 30-day and one year (core).
2. Percentage of subarachnoid hemorrhage patients who receive a consult to a neurosurgeon within 24 hours of hospital arrival.
3. Percentage of subarachnoid hemorrhage patients who receive a CT scan or MRI within 24 hours of hospital arrival
4. Rebleeding rate for subarachnoid hemorrhage patients (stratified by whether patient underwent surgical or endovascular intervention) within 7 days and 30 days of hospital presentation.

Measurement Notes

- Risk adjustment should include age, gender, and initial stroke severity scores, as well as co-morbidities

Implementation Resources and Knowledge Transfer Tools

- American Stroke Association Guidelines for Management of Subarachnoid

Summary of the Evidence

Subarachnoid hemorrhage (SAH) is a medical emergency with potentially devastating effects of early mortality or
significant morbidity. The Public Health Agency of Canada reports mortality rates of 2.9 per 100,000 in 2003, with an annual mortality rate of 42 percent from SAH. The HUNT study of risk factors for SAH found that systolic and diastolic blood pressure were strong predictors of aneurysmal SAH, and there was a substantially increased risk associated with smoking. However, high body mass was associated with reduced risk of aneurysmal SAH. Adequate blood pressure control has been found as an independent risk factor in reducing the severity of SAH, and uncontrolled hypertension has been found to be a predictor of poorer outcomes. 

Eden and colleagues reported that the overall age-adjusted risk ratio for SAH in women compared to men was 1.74 (95% CI 1.16, 2.62). Overall inhospital mortality was 32.2 percent, and no ethnic differences were observed for discharge disability or in-hospital mortality.

Lovelock and colleagues examined trends in case-fatality with subarachnoid hemorrhage through a systematic review and by comparing results from the Oxford Community Stroke Project (1981 to 1986) and the Oxford Vascular Study (2002 and 2008). The analysis did not show reductions in incidence of SAH (RR = 0.79, 95% confidence interval [CI] 0.48–1.29, p = 0.34) and in 30-day case-fatality (RR = 0.67, 95% CI 0.39–1.13, p = 0.14) in the Oxford Vascular Study vs. Oxford Community Stroke Project, but there was a decrease in overall mortality (RR = 0.47, 0.23–0.97, p = 0.04). Following adjustment for age and baseline SAH severity, patients surviving to hospital had reduced risk of death or dependency (modified Rankin score > 3) at 12 months in the Oxford Vascular Study (RR = 0.51, 0.29–0.88, p = 0.01). Among 32 studies covering 39 study periods from 1980 to 2005, seven studied time trends within single populations. Unadjusted case-fatality fell by 0.9 percent per annum (0.3–1.5, p = 0.007) in a meta-analysis of data from all studies, and by 0.9 percent per annum (0.2–1.6%, p = 0.01) within the seven population studies. The authors concluded that mortality due to subarachnoid hemorrhage fell by about 50 percent in their study population over the last two decades, due mainly to improved outcomes in cases surviving to reach hospital.

Timing of aneurysm surgery has been addressed in several nonrandomized clinical series. Kassell et al. observed no preoperative rebleeds in 27 patients with early (less than three days after subarachnoid hemorrhage) surgery compared with seven of 24 patients (29%) with late surgery. At surgery, both groups had the same intraoperative hemorrhage rate (26%). The International Cooperative Study on the Timing of Aneurysm Surgery analyzed management comparison in 3521 patients, of whom 83 percent underwent surgical repair of the ruptured aneurysm. Timing of surgery after subarachnoid hemorrhage was significantly related to the likelihood of preoperative rebleeding (0 to 3 days, 5.7%; 4 to 6 days, 9.4%; 7 to 10 days, 12.7%; 11 to 14 days, 13.9%; and 15 to 32 days, 21.5%). Postoperative rebleeding did not differ among time intervals (1.6 percent overall). Nevertheless, there was no significant difference in overall outcome in this study related to timing of surgery.

In recent years there has been a trend toward early surgery for ruptured aneurysms, especially in good- and moderate-grade patients. In addition, early surgery facilitates the aggressive therapy of vasospasm. deGans and colleagues conducted a review of timing of aneurysm surgery and identified were 1 randomized clinical trial and only 10 out of 268 observational studies (assessing a total of 1814 patients) that fulfilled a set of minimum requirements for methodological quality. In the trial, the RR of poor outcome was 0.42 (95% CI, 0.17–1.04) for patients planned for early surgery and 1.07 (95% CI, 0.56–2.05) for intermediate surgery. The analysis of the observational study data found the RR of poor outcome for patients in good clinical condition at admission was 0.41 (95% CI, 0.34-0.51) for early surgery and 0.47 (95% CI, 0.32-0.69) for intermediate surgery. For patients in poor clinical condition at admission, the RR of poor outcome was 0.84 (95% CI, 0.67–1.05) for early surgery and 0.54 (95% CI, 0.24–1.22) for intermediate surgery. Regardless of surgical timing, early referral to centers with facilities for intensive care of patients with subarachnoid hemorrhage is essential, since many therapies need to be initiated in the acute period.

The most common and relied upon diagnostic tool for SAH is a non-contrast CT of the brain. Studies have reported that the sensitivity of the CT will decrease as the time from symptom onset to scan increases. The ASA guidelines for SAH (2009) report In the first 12 hours after SAH, the sensitivity of CT for SAH is 98 percent to 100 percent, declining to 93 percent at 24 hours and to 77 percent to 85 percent six days after SAH (page 1000).

The International Subarachnoid Aneurysm Trial (ISAT) was a randomized controlled trial that compared endovascular treatment with neurosurgical treatment in patients with aneurysmal subarachnoid hemorrhage. ISAT enrolled 2143 patients...
patients with ruptured intracranial aneurysms and randomly assigned them to neurosurgical clipping (n=1070) or endovascular treatment by detachable platinum coils (n=1073). Clinical outcomes were assessed at two months and at one year with interim ascertainment of rebleeds and death. The primary outcome was the proportion of patients with a modified Rankin scale score of 3–6 (dependency or death) at one year. Trial recruitment was stopped by the steering committee after a planned interim analysis (published 2002). Analysis was per protocol. Final analysis was completed after all patients completed the one-year follow-up (2005). Secondary outcomes included rebleeding from the treated aneurysm and risk of seizures.

The one-year ISAT outcomes are reported for 1063 of the 1073 patients allocated to endovascular treatment, and 1055 of the 1070 patients allocated to neurosurgical treatment. Two hundred and fifty (23.5%) of 1063 patients allocated to endovascular treatment were dead or dependent at one year, compared with 326 (30.9%) of 1055 patients allocated to neurosurgery, an absolute risk reduction of 7.4 percent (95% CI 3.6-11.2, p=0.0001). The early survival advantage was maintained for up to seven years and was significant (log rank p=0.03). The risk of epilepsy was substantially lower in patients allocated to endovascular treatment, but the risk of late rebleeding was higher. The study concluded that endovascular coiling, compared with neurosurgical clipping, for ruptured intracranial aneurysms that were anatomically suitable for either procedure leads to a significant reduction in the relative risk of death or dependency of 23.9 percent (12.4-33.9). This equates to an absolute risk reduction of 7.4 percent (3.6-11.2), which is equivalent to 74 patients avoiding death or dependency at one year for every 1000 patients treated.

Recurrent hemorrhage remains a serious consequence of aneurysmal subarachnoid hemorrhage, with a case-fatality rate of approximately 70 percent for persons who rebleed. In recent years improved diagnosis of subarachnoid hemorrhage and rapid referral to specialized centers have delineated a distinct pattern of rebleeding compared with older studies. In the prospective Cooperative Aneurysm Study rebleeding was maximal (4%) on the first day after subarachnoid hemorrhage and then constant at a rate of one percent to two percent per day over the subsequent four weeks. Several prospective follow-up cohorts have demonstrated that the risk of rebleeding with conservative therapy is between 20 percent and 30 percent for the first month after hemorrhage and then stabilizes at a rate of approximately three percent per year.

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**Best Practice Recommendation 3.7**  
**Early Management of Intracerebral Hemorrhage**

**NOTES on this recommendation**

- This recommendation is for patients with intracerebral hemorrhage. It applies to the initial assessment in the emergency department within the first few hours of patient arrival.
- Treatment and management of hemorrhagic stroke patients is outside the scope of these recommendations.

Patients with intracerebral hemorrhage must be treated as a medical emergency. Intracerebral hemorrhage should be promptly recognized and patients evaluated immediately by physicians with expertise in stroke management [Evidence Level A].

i. Evaluation of patients with acute intracerebral hemorrhage should include questions about anticoagulant therapy, measurement of platelet count, partial thromboplastin time (PTT) and International Normalized Ratio (INR) [Evidence Level A].

ii. Patients with suspected intracerebral hemorrhage should undergo a CT or MRI immediately to confirm diagnosis, location and extent of hemorrhage [Evidence Level A].

iii. Patients with acute intracerebral hemorrhage and an established coagulopathy or a history of anti-coagulant use should be treated appropriately to reverse the coagulopathy (prothrombin complex concentrate, Vitamin K, or fresh-frozen plasma [Evidence Level B].

   a. If there is a persisting strong indication for anticoagulation (e.g. mechanical heart valve),
the decision about when to restart anticoagulant therapy should be made on a case-by-case basis [Evidence Level C].

iv. Administration of recombinant Factor VIIa (NiaStase®) prevents hematoma growth, but increases the risk of arterial thromboembolic phenomena and does not provide a clinical benefit for survival or outcome. It is not recommended for routine use (FAST trial) [Evidence Level A].

v. Patients with cerebellar hemorrhage should be referred for urgent neurosurgical consultation and consideration of evacuation of intracerebral hemorrhage particularly in the setting of altered level of consciousness or new cranial neuropathy [Evidence Level B].

vi. Patients with acute intracerebral hemorrhage should be considered for CT angiography or other imaging modality to exclude an underlying lesion such as an aneurysm, arteriovenous malformation, or tumor [Evidence Level B].

vii. Medically stable patients with an acute intracerebral hemorrhage should be admitted to a Stroke Unit or neuro-intensive care unit [Evidence Level B], and undergo interprofessional stroke team assessment to determine their rehabilitation and other care needs (refer to Recommendation 5.1).

viii. No randomized trials provide specific targets for systolic or diastolic blood pressure in patients with intracerebral hemorrhage at the time of publication of these recommendations [Evidence Level C]. Randomized trials are ongoing.

ix. A majority of patients with acute supratentorial ICH will not require neurosurgical evacuation of the hemorrhage. However, selected patients with acute supratentorial intracerebral hemorrhage may be considered for surgical intervention including placement of extraventricular drain (EVD) for treatment of hydrocephalus, or craniotomy for evacuation of superficial lobar intracerebral hemorrhage [Evidence Level B].

x. Beyond the acutely symptomatic period, patients with intracerebral hemorrhage should be managed similarly to those with ischemic stroke, except for avoidance of antithrombotics [Evidence Level B].

xi. Intracerebral hemorrhage should not be considered an indication for statin therapy [Evidence Level A]. Continued use in patients previously on a statin for another appropriate indication should be reviewed following ICH because of a potential increased risk of recurrent hemorrhage. Currently, there is insufficient evidence to determine whether the potential increased risk of hemorrhage outweighs the potential benefits for prevention of ischemic cardiovascular disease in ICH survivors with other appropriate indications for statins.

### Box 3.7: Symptoms of Intracerebral Hemorrhage:

- Sudden onset of severe headache (sometimes described as “thunderclap headache”) that patients will often characterize as the worst of their life.
- The headache of SAH is usually associated with nausea, vomiting, meningismus and photophobia and can also be associated with altered level of consciousness.
- Signs on physical examination vary depending on the location of the aneurysm and the extent of the hemorrhage as well as whether there is intraventricular of intracerebral extension of the subarachnoid hemorrhage. Physical signs can include diminished level of consciousness, cranial nerve palsy, hemiparesis and subhyaloid hemorrhage on fundoscopic exam, but it is important to note that patients with acute SAH often have a NORMAL neurological examination, so the absence of physical findings should not alter the index of suspicion raised by the clinical presentation.
Intracerebral hemorrhage is a life-threatening emergency and requires prompt recognition and action. Intracerebral hemorrhage commonly occurs in about 12 to 15 percent of all stroke patients admitted to Canadian hospitals, and is associated with high rates of early mortality – 25 to 50 percent in the first 30 days. Patients who survive an intracerebral hemorrhage are often left with moderate to severe persistent functional deficits which place a significant burden on families and the healthcare system.

### System Implications

- Timely access to diagnostic services such as neuro-imaging, with protocols for prioritizing potential stroke patients.
- Timely access to specialized stroke care (i.e. a neuro-intensive care unit) and neurosurgical specialists for hemorrhagic patient management, including rapid referral process if neurosurgical services not available within the initial treating hospital.
- Access to organized stroke care, ideally stroke units with a critical mass of trained staff and an interprofessional team.
- Education for pre-hospital, emergency department, and hospital staff on the characteristics and urgency for management of intracerebral hemorrhage patients.

### Performance Measures

1. **Risk-adjusted mortality rates for intracerebral hemorrhage in-hospital, 30-day and one year (core).**
2. **Percentage of intracerebral hemorrhage patients who receive a CT or MRI within one hour of hospital arrival.**
3. **Percentage of intracerebral hemorrhage patients who require surgical intervention.**
4. Percentage of intracerebral hemorrhage patients who experience intraoperative complications and mortality during surgery for intracerebral hemorrhage.
5. Distribution of functional ability measured by standardized functional outcome tools at time of discharge from hospital.

### Measurement Notes:

- Mortality rates should be risk-adjusted for age, gender, stroke severity and comorbidities
- Time interval measurements should start from symptom onset of known or from triage time in the emergency department as appropriate.

### Implementation Resources and Knowledge Transfer Tools

- ASA Guideline for the Management of Intracerebral Hemorrhage 2010

### Summary of the Evidence

Intracerebral hemorrhage (ICH) is a devastating emergency situation that requires rapid recognition, assessment and management. Presentation differs from ischemic stroke and subarachnoid hemorrhage in that the sudden focal neurological deficits may progress over a few minutes to a few hours and vomiting is more common in ICH than in SAH, as is changes in level of consciousness. Risk factors for ICH appeared to be age, male sex, hypertension, and high alcohol intake. A systematic review of risk factors for ICH found in cohort studies the crude RR for age (every 10-year increase) was 1.97 (95% confidence interval [CI], 1.79 to 2.16). In case-control studies, the crude OR for high alcohol intake was 3.36 (95% CI, 2.21 to 5.12) and for hypertension was 3.68 (95% CI, 2.52 to 5.38). Two cohort studies showed an increasing risk of ICH with increasing degree of hypertension. In cohort and case-control studies combined, the crude RR for sex (male versus female) was 3.73 (95% CI, 3.28 to 4.25); for current smoking, 1.31 (95% CI, 1.09 to 1.58); and for diabetes, 1.30 (95% CI, 1.02 to 1.67).
In a retrospective chart audit, Hill and colleagues (2000) identified 423 index patients with primary ICH (PICH). Of these, 27.4 percent died in the first 30 days of their admission. Predictors of death were reported as age, intraventricular rupture of hemorrhage, and trilobar hemorrhage. The recurrence rate for PICH was 2.4 percent (95% CI 1.4% to 3.9%) per year, whereas the recurrence rate for ischemic cerebrovascular disease was 3.0% (95% CI 1.8% to 4.7%) per year. The only significant predictor of readmission for ICH was lobar location of the index hemorrhage, with a hazard ratio of 3.8 (95% CI 1.2 to 12.0).

Several debates have been published regarding the sensitivity of MRI versus CT scans for detection of ICH. A recent Cochrane review (2009) compared the diagnostic accuracy of diffusion-weighted MRI (DWI) and CT for acute ischaemic stroke, and to estimate the diagnostic accuracy of MRI for acute hemorrhagic stroke. Of the eight studies included in the analysis, two studies addressed hemorrhagic stroke patients. Their findings were that the two studies on hemorrhagic stroke reported high estimates for diffusion-weighted and gradient-echo sequences but had inconsistent reference standards. Chalela and colleagues conducted a single-centre, prospective, blind comparison of non-contrast CT and MRI (with diffusion-weighted and susceptibility weighted images) in a consecutive series of patients referred for emergency assessment of suspected acute stroke. A total of 356 patients were assessed independently by four experts blinded to clinical details. The results found MRI similar to CT for the detection of acute intracranial hemorrhage. MRI detected acute ischaemic stroke in 164 of 356 patients (46%; 95% CI 41-51%), compared with CT in 35 of 356 patients (10%; 7-14%). In the subset of patients scanned within 3 h of symptom onset, MRI detected acute ischaemic stroke in 41 of 90 patients (46%; 35-56%); CT in 6 of 90 (7%; 3-14%). Relative to the final clinical diagnosis, MRI had a sensitivity of 83 percent (181 of 217; 78-88%) and CT of 26 percent (56 of 217; 20-32%) for the diagnosis of any acute stroke.

Kidwell conducted a prospective study in two USA acute hospitals which compared CT scan to MRI for acute ICH. The study was stopped when an interim analysis, completed after the first 200 patients were enrolled, showed that MRI was detecting cases of hemorrhagic transformation not detected by CT. For the diagnosis of any hemorrhage, MRI was positive in 71 patients with CT positive in 29 (P < .001). For the diagnosis of acute hemorrhage, MRI and CT were equivalent (96 percent concordance). Acute hemorrhage was diagnosed in 25 patients on both MRI and CT. In four other patients, acute hemorrhage was present on MRI but not on the corresponding CT—each of these four cases was interpreted as hemorrhagic transformation of an ischemic infarct. They concluded that MRI may be as accurate as CT for the detection of acute hemorrhage in patients presenting with acute focal stroke symptoms and is more accurate than CT for the detection of chronic intracerebral hemorrhage.

A recent publication of the Factor Seven for Acute Hemorrhagic Stroke (FAST) trial reviewed the data to define the frequency of and risk factors for TE with rFVIIa. The analysis included 841 patients presenting <3 hours after spontaneous intracerebral hemorrhage who were randomized to 20 or 80 μg/kg of rFVIIa or placebo. Those with Glasgow Coma Scale score <5, planned early surgery, Coagulopathy, or recent TE were excluded. Myocardial, cerebral, or venous TEs were subject to detailed reporting and expedited local review. A blinded Data Monitoring Committee reviewed all electrocardiograms, centrally analyzed troponin I values, and CT scans. The study found 178 arterial and 47 venous TEs had occurred. Venous events were similar across groups. There were 49 (27%) arterial events in the placebo group, 47 (26%) in the 20-μg/kg group, and 82 (46%) in the 80 μg/kg group (P=0.04). Of the myocardial events, 38 were investigator-reported and 103 identified by the Data Monitoring Committee. They occurred in 17 (6.3%) placebo and 57 (9.9%) rFVIIa patients (P=0.09). Arterial TEs were associated with: receiving 80 μg/kg rFVIIa (OR=2.14; P=0.031), signs of cardiac or cerebral ischemia at presentation (OR=4.19; P=0.010), age (OR=1.14/5 years; P=0.0123), and prior use of antiplatelet agents (OR=1.83; P=0.035). Ischemic strokes possibly related to study drug occurred in seven, five, and eight patients in the placebo, 20 μg/kg, and 80-μg/kg groups, respectively. The authors concluded that higher doses of rFVIIa in a high-risk population are associated with a small increased risk of what are usually minor cardiac events. Future consideration should be given to the effectiveness of rFVIIa in slowing bleeding balanced with the risk of a small increase in arterial TEs.

A Cochrane review (2008) assessed the effects of surgery plus routine medical management, compared with routine medical management alone, in patients with primary supratentorial intracerebral hematoma. Randomized and quasi-randomized trials of routine medical treatment plus intracranial surgery compared with routine medical treatment, in patients with presumed or confirmed primary supratentorial intracerebral hematoma. Intracranial
surgery included craniotomy, stereotactic endoscopic evacuation, or stereotactic aspiration. Four trials were included (non-blinded). Craniotomy and endoscopic evacuation were analyzed separately. Craniotomy showed a non-significant trend towards increased odds of death and dependency among survivors (OR 1.99, 99% CI 0.92 to 4.31). The result was inconclusive in the two trials with patients confirmed as having primary supratentorial intracerebral hematoma by computed tomography. Endoscopic evacuation was not shown to significantly decrease the odds of death and dependency among survivors in one trial involving 100 patients (OR 0.45, 99% CI 0.15 to 1.33). The authors concluded current evidence could not evaluate the effect of craniotomy or stereotactic surgery, or endoscopic evacuation in patients with supratentorial intracerebral hematoma.

**Stroke Unit:** In a prospective randomized study comparing mortality rates among intracranial hemorrhage patients managed on an acute stroke unit versus medical ward, Ronning et al. (2001) found that stroke unit care was associated with reduced mortality at 30 days (39% vs. 63%, p=0.007) and one year (52% vs. 69%, p=0.013). Diringer and Edwards (2001) prospectively followed and analyzed 1,038 ICH patients admitted to a neuro-ICU compared to a general ICU. The thirteen ICUs that admitted >20 patients accounted for 83 percent of the admissions with a mortality rate that ranged from 25 percent to 64 percent. Multivariate analysis adjusted for patient demographics, severity of ICH, and ICU and institutional characteristics indicated that not being in a neuro ICU was associated with an increase in hospital mortality rate (odds ratio [OR], 3.4; 95% confidence interval [CI], 1.65-7.6). Other factors associated with higher mortality rate were greater age (OR, 1.03/year; 95% CI, 1.01-1.04), lower Glasgow Coma Scale score (OR, 0.6/point; 95% CI, 0.58-0.65), fewer ICH patients (OR, 1.01/patient; 95% CI, 1.00-1.01), and smaller ICU (OR, 1.1/bed; 95% CI, 1.02-1.13). Having a full time intensivist was associated with lower mortality rate (OR, 0.388; 95% CI, 0.22-0.67).
SECTION 4.0 ACUTE STROKE MANAGEMENT

Best Practice Recommendation 4.1
Stroke Unit Care

DEFINITION

◆ A stroke unit is a specialized, geographically defined hospital unit dedicated to the management of stroke patients and staffed by an interprofessional team. See the Canadian Stroke Strategy Guide to Stroke Unit Care, at www.canadianstrokestrategy.ca, for a more detailed definition.

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

i. Patients should be admitted to a stroke unit which is a specialized, geographically defined hospital unit dedicated to the management of stroke patients [Evidence Level A].

ii. The core interprofessional team on the stroke unit should consist of healthcare professionals with stroke expertise from medicine, nursing, occupational therapy, physiotherapy, speech-language pathology, social work, and clinical nutrition (dietitian) [Evidence Level A]. Additional disciplines may include pharmacy, (neuro) psychology, and recreation therapy [Evidence Level B].

iii. The interprofessional team should assess patients within 48 hours of admission to hospital and formulate a management plan [Evidence Level C].

iv. Clinicians should use standardized, valid assessment tools to evaluate the patient’s stroke-related impairments and functional status [Evidence Level B].

v. Any child admitted to hospital with stroke should be managed in a centre with paediatric stroke expertise and/or managed using standardized paediatric stroke protocols [Evidence Level B].

Refer to recommendation 5.3 for information on inpatient stroke rehabilitation, which should commence in the acute care hospital.

Rationale

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

System Implications

- Organized systems of stroke care including stroke units with a critical mass of trained staff (interprofessional team). If not feasible, then mechanisms for coordinating the care of stroke patients to ensure use of best practices and optimal outcomes.

- Protocols and mechanisms to enable the rapid transfer of stroke patients from the emergency department to an interprofessional stroke unit as soon as possible after arrival in hospital, ideally within the first three hours.

- Information on geographic location of stroke units and other specialized stroke care models available to community service providers, to facilitate navigation to appropriate resources and to strengthen relationships between each sector along the stroke continuum of care.
Performance Measures

1. **Number of stroke patients treated on a stroke unit at any time during their in-patient hospital stay for an acute stroke event (numerator) as a percentage of total number of stroke patients admitted to hospital (core).**

2. **Percentage of patients discharged to their home or place of residence following an inpatient admission for stroke (core).**

3. Proportion of total time in hospital for an acute stroke event spent on a stroke unit.

4. Percentage increase in telehealth or telestroke coverage to remote communities to support organized stroke care across the continuum.

**Measurement Notes**

- Performance measure 1: calculate for all cases, and then stratify by type of stroke.
- Definition of stroke unit varies widely from institution to institution. Where stroke units do not meet the criteria defined in the recommendation, then a hierarchy of other stroke care models could be considered: a) dedicated stroke unit; (b) designated area within a general nursing unit or neuro-unit where stroke patients are clustered; (c) mobile stroke team care; (d) managed on a general nursing unit by staff using stroke guidelines and protocols.
- Institutions collecting this data must note their operational definition of "stroke unit" to ensure standardization and validity when data is reported across institutions.

**Implementation Resources and Knowledge Transfer Tools**

- Canadian Stroke Strategy Guide to Stroke Unit Care
- National Stroke Nurses Council: Best Practice Nursing Care Across the Acute Stroke Continuum: Module 3

**Summary of the Evidence**

Stroke unit care carries with it some of the strongest evidence for improved outcomes available in the stroke research literature. The typical components of care described in the stroke unit trials are summarized as: a) assessment—medical evaluation and diagnostic testing (including CT scanning), early assessment of nursing and rehabilitation therapy needs; b) early management policies—early mobilization, prevention of complications (e.g. pressure area care, careful positioning and handling), treatment of hypoxia, hyperglycemia, fever and dehydration; and c) ongoing rehabilitation policies (coordinated interprofessional team care, early assessment of needs after discharge). The Stroke Unit Trialists’ systematic review(2009) included 31 randomized and quasi-randomized trials containing outcome information on 6936 patients comparing stroke unit care with alternative service. Of the 31 trials, 26 trials (n= 5592) compared stroke unit care with general wards. The alternative service was usual care provided on an acute medical ward without routine interprofessional input. Organized inpatient (stroke unit) care typically involved: a) coordinated interprofessional rehabilitation, b) staff with a specialist interest in stroke or rehabilitation, c) routine involvement of caregivers in the rehabilitation process, and d) regular programs of education and training. The core characteristics which were invariably included in the stroke unit setting were: interprofessional staffing i.e. medical, nursing and therapy staff (usually including physiotherapy, occupational therapy, speech therapy, social work); and coordinated interprofessional team care with meetings at least once per week. Stroke unit care showed reductions in the odds of death recorded at final (median one year) follow-up (odds ratio 0.86; 95% confidence interval 0.76 to 0.98; p=0.02), the odds of death or institutionalized care (0.82; 0.73 to 0.92; p=0.0006), and death or dependency (0.82; 0.73 to 0.92; p=0.001). The authors concluded that stroke patients receiving organized inpatient care in a stroke unit are more likely to be alive, independent, and living at home one year after the stroke. The benefits were most apparent in units based in a discrete ward. No systematic increase was observed in the length of inpatient stay.
A randomized study examined the frequency and timing of predefined medical complications in stroke patients (n=489) treated in an acute comprehensive stroke unit and an early supported discharge service. During the first week, nearly 64 percent of patients experienced one or more complications, with the most common complications being: pain (23.9%), temperature ≥38°C (23.7%), progressing stroke (18.4%), urinary tract infection (16.0%), troponin T elevation without criteria of myocardial infarction (11.7%), chest infections (11.2%), non serious falls (7.4%), and myocardial infarction (4.5%). Stroke recurrence, seizure, deep vein thrombosis, pulmonary embolism, shoulder pain, serious falls, other infections, and pressure sores were each present in ≤2.5% of patients. During the 3 month follow-up, 82% of patients experienced at least one complication, the most common of which was pain (53.3%), followed by urinary tract infection (27.9%) and non serious falls (25.0%). The severity of stroke on admission was the most important risk factor for developing complications.

Within clinical trials, stroke patients allocated to receive organized inpatient (stroke unit) care are more likely to survive, return home, and regain independence than those allocated to conventional care. However, there are concerns that the benefits seen in clinical trials may not be replicated in routine practice. Seenan et al. (2007) carried out a systematic review of observational studies of stroke unit implementation, comparing the outcomes of stroke patients managed in a stroke unit versus non-stroke unit care. The primary outcome was death within one year and poor outcome was recorded as institutional care or dependency. Twenty-five studies were eligible for review (18 provided data on case fatality or poor outcome). Stroke unit care was associated with significantly reduced odds of death (odds ratio=0.79, 95% CI=0.73 to 0.86; p<0.00001) and of death or poor outcome (odds ratio=0.87, 95% CI=0.80 to 0.95; p=0.002) within 1 year of stroke. Results were complicated by significant heterogeneity (p<0.05), mainly in single-center studies. Although these results are complicated by potential bias and heterogeneity, the observed benefit associated with stroke unit care in routine practice is comparable to that in clinical trials.

In a synthesis of evidence demonstrating the benefits of organized stroke care, Kalra and Langhorne (2007) noted that an important challenge for stroke units is a conceptual shift in the philosophy of stroke care from being predominantly engaged with patient-oriented interventions to a strategy in which the patient and the caregiver are seen as a combined focus for intervention, with the objective of empowering and equipping caregivers to be competent facilitators of activities of daily living when caring for disabled patients after stroke. Research has consistently shown that better outcomes are associated with comprehensive and early processes of stroke-specific assessments, particularly assessments for swallowing and aspiration risk, early detection and management of infections, maintenance of hydration and nutrition, early mobilization, clear goals for function, and communication with patients and their families.

The use of standardized and validated tools for stroke severity and functional assessment enables sound decision-making and care planning. The Canadian Neurological Scale (CNS) was designed to monitor mentation and motor functions in stroke patients. The CNS was initially validated by Cote et al (1989) and found to be internally consistent and to have a high level of interrater reliability. Initial CNS scores were found to be a significant predictor of death, morbidity, and recovery of ADL. Patients with high initial CNS scores were at lower risk of poor outcomes at 6 months. This relationship held even after adjustments were made for other covariates.

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

A more recent study assessed the reliability of both the CNS and the NIHSS at academic medical centres and community hospitals. The intra-class correlation coefficient for NIHSS and CNS, respectively, were 0.93 (95% CI, 0.82 to 1.00) and 0.97 (95% CI, 0.90 to 1.00) for the AMC, 0.89 (95% CI, 0.75 to 1.00) and 0.88 (95%, 0.73 to 1.00) for the
community hospital with neurological services (CH1), and 0.48 (95% CI, 0.26 to 0.70) and 0.78 (95% CI, 0.60 to 0.96) for the community hospitals without neurological services (CH2). More NIHSS items were missing at the CH2 (62%) versus the AMC (27%) and the CH1 (23%, P=0.0001). In comparison, 33 percent, zero percent, and eight percent of CNS items were missing from records from CH2, AMC, and CH1, respectively (P=0.0001). The study found that the levels of interrater agreement were almost perfect for retrospectively assigned NIHSS and CNS scores for patients initially evaluated by a neurologist at both an AMC and a CH. Levels of agreement for the CNS were substantial at CH2, but interrater agreement for the NIHSS was only moderate in this setting. The proportions of missing items are higher for the NIHSS than the CNS in each setting, particularly limiting its application in the hospital without acute neurological consultative services.

**Best Practice Recommendation 4.2**

**Prevention and Management of Complications Following Acute Stroke**

Venous thrombo-embolism risk, temperature, mobilization, continence, nutrition, and oral care should be addressed in all hospitalized stroke patients. Appropriate management strategies should be implemented for areas of concern identified during screening. Discharge planning should be included as part of the initial assessment and ongoing care of acute stroke patients.

**4.2.1 Venous thromboembolism prophylaxis**

All stroke patients should be assessed for their risk of developing venous thromboembolism (deep vein thrombosis and pulmonary embolism). Patients at high risk include those who are unable to move one or both lower limbs and those who are unable to mobilize independently; a previous history of venous thromboembolism; dehydration; and comorbidities such as malignant disease.

i. Early mobilization and adequate hydration should be encouraged for all acute stroke patients to help prevent venous thromboembolism [Evidence Level C].

ii. Patients at high risk of venous thromboembolism should be started on venous thromboembolism prophylaxis immediately [Evidence Level A].
   a. Low molecular weight heparin should be considered for patients with acute ischemic stroke at high risk of venous thromboembolism; or unfractionated heparin for patients with renal failure [Evidence Level B].
   b. The use of anti-embolism stockings alone for post-stroke venous thromboembolism prophylaxis is not recommended [Evidence Level A].

iii. There is insufficient evidence on the safety and efficacy of anticoagulant deep vein thrombosis prophylaxis after intracerebral hemorrhage [Evidence Level C]. Antithrombotics and anticoagulants should be avoided for at least 48 hours after onset [Evidence Level C].

**4.2.2 Temperature Management**

i. Temperature should be monitored as part of routine vital sign assessments, every four hours for first 48 hours and then as per ward routine or based on clinical judgment [Evidence Level C].

ii. For temperature greater than 37.5° Celsius, increase frequency of monitoring, initiate temperature-reducing measures, investigate possible infection such as pneumonia or urinary tract infection [Evidence Level C], and initiate antipyretic and antimicrobial therapy as required [Evidence Level B].

**4.2.3 Mobilization**
Mobilization is defined as “the process of getting a patient to move in the bed, sit up, stand, and eventually walk.”

i. All patients admitted to hospital with acute stroke should be mobilized as early and as frequently as possible [Evidence Level B] (AU), and preferably within 24 hours of stroke symptom onset, unless contraindicated [Evidence Level C]. Some contraindications to early mobilization include, but may not be restricted to, unstable medical conditions, low oxygen saturation, and lower limb fracture or injury.

ii. All patients admitted to hospital with acute stroke should be assessed by rehabilitation professionals as soon as possible after admission [Evidence Level A], preferably within the first 24 to 48 hours [Evidence Level C].

Refer to Section 5 for additional information.

### 4.2.4 Continence

i. All stroke patients should be screened for urinary incontinence and retention (with or without overflow), fecal incontinence, and constipation (time and frequency) [Evidence Level C].

ii. The use of a portable ultrasound is recommended as the preferred noninvasive painless method for assessing post-void residual [Evidence Level C].

iii. Possible contributing factors surrounding continence management should be assessed, including medications, nutrition, diet, mobility, activity, cognition, environment and communication [Evidence Level C]. This should include assessing the stroke patient for urinary tract infections to determine a possible transient cause of urinary retention [Evidence Level C].

iv. Stroke patients with urinary incontinence should be assessed by trained personnel using a structured functional assessment [Evidence Level B].

v. The use of indwelling catheters should be avoided due to the risk of urinary tract infection [Evidence Level A]. If used, indwelling catheters should be assessed daily and removed as soon as possible [Evidence Level A]. Excellent pericare and infection prevention strategies should be implemented to minimize risk of infections [Evidence Level C].

vi. A bladder-training program should be implemented in patients who are incontinent of urine [Evidence Level C], including timed and prompted toileting on a consistent schedule [Evidence Level B].

vii. Appropriate intermittent catheterization schedules should be established based on amount of post-void residual (Evidence Level B).

viii. A bowel management program should be implemented for stroke patients with persistent constipation or bowel incontinence [Evidence Level A].

### 4.2.5 Nutrition and Dysphagia

i. The nutritional and hydration status of stroke patients should be screened within the first 48 hours of admission using a valid screening tool [Evidence Level B].

ii. Results from the screening process should be used to guide appropriate referral to a dietitian for further assessment and ongoing management of nutritional and hydration status [Evidence Level C].

iii. Stroke patients with suspected nutritional concerns, hydration deficits, dysphagia, or other comorbidities that may affect nutrition (such as diabetes) should be referred to a dietitian for:

a. recommendations to meet nutrient and fluid needs orally while supporting alterations in food texture and fluid consistency recommended by a speech-language pathologist or other trained professional [Evidence Level C].
b. consideration of enteral nutrition support (tube feeding) within seven days of admission for patients who are unable to meet their nutrient and fluid requirements orally. This decision should be made collaboratively with the interprofessional team, the patient, and the caregivers and family [Evidence Level B].

Refer to recommendation 6.1 for additional information.

4.2.6 Oral care

i. Upon or soon after admission, all stroke patients should have an oral/dental assessment, including screening for signs of dental disease, level of oral care, and appliances [Evidence Level C].

ii. For patients wearing a full or partial denture it should be determined if they have the neuromotor skills to safely wear and use the appliance(s) [Evidence Level C].

iii. An appropriate oral care protocol should be used for every patient with stroke, including those who use dentures [Evidence Level C]. The oral care protocol should be consistent with the Canadian Dental Association recommendations [Evidence Level B], and should address areas such as frequency of oral care (twice per day or more); types of oral care products (toothpaste, floss, and mouthwash); and management for patients with dysphagia.

iv. If concerns with implementing an oral care protocol are identified, consider consulting a dentist, occupational therapist, speech-language pathologist, and/or a dental hygienist [Evidence Level C].

v. If concerns are identified with oral health and/or appliances, patients should be referred to a dentist for consultation and management as soon as possible [Evidence Level C].

Note: For 2010, the recommendation on Discharge Planning has been moved to Section 6.

Rationale

Acute stroke accounts for one of the longest length of stay of all illnesses in Canadian hospitals and places a significant burden on inpatient resources, which increases further when complications arise. Acute stroke patients are at risk for complications during the early phase of recovery. The priorities for inpatient care are management of stroke sequelae to optimize recovery, prevention of post-stroke complications that may interfere with the recovery process, and prevention of stroke recurrence.

System Implications

- Standardized evidence-based protocols for optimal inpatient care of all acute stroke patients, regardless of where they are treated in the healthcare facility (stroke unit or other ward).
- Ongoing professional development and educational opportunities for all healthcare professionals who care for acute stroke patients.
- Referral systems to ensure rapid access to specialty care such as dentistry.

Performance Measures

1. Percentage of patients with stroke who experience complications (venous thrombo-embolism, pulmonary embolus, secondary cerebral hemorrhage, gastrointestinal bleed, pressure ulcers, urinary tract infection, pneumonia, seizures or convulsions) during inpatient stay.

2. Length of stay for stroke patients admitted to hospital (core).

Measurement Notes

- Risk adjustment to account for other comorbidities, age, and gender.
Summary of the Evidence

Complications following stroke have been well documented in the literature. McLean (2004) reports that depression (26%), patient falls (20%), shoulder pain (24%) and urinary tract infections (15%) are the most common complications observed in hospital. Care of stroke patients in the hyperacute and acute phases of care require attention and diligence in many areas including reduction of complications such as venous-thromboembolism, fever, pressure ulcers and contractures, pneumonia and continence issues.

Venous thrombo-embolism: The risk of venous thromboembolism in patients hospitalized with stroke is 20–50 percent. Additional pre-existing risk factors may increase the risk of venous thromboembolism and pulmonary embolism and should be addressed individually in each patient admitted with an acute stroke. Recommendations for the routine use of prophylactic anticoagulation for venous thrombo-embolism in stroke patients are controversial. The benefit of prophylaxis with an anticoagulant low-density unfractionated heparin or low molecular weight heparin should be weighed against the risk of serious bleeding complications in patients with additional risk factors for venous thromboembolism.

The Royal College of Physicians guidelines states that prophylactic anticoagulation should not be used routinely (Grade A recommendation). Although subcutaneous heparin and low-molecular-weight heparin may prevent venous thrombo-embolism, this beneficial effect may be counterbalanced by an increased risk of intracranial hemorrhage. The American Stroke Association (ASA) and the Scottish Intercollegiate Guidelines Network both recommend prophylactic administration of heparin, low-molecular-weight heparin, or heparinoids to prevent venous thrombo-embolism in immobilized people following a stroke (Grade A recommendations).

The PREVAIL study investigated optimal treatment for venous thrombo-embolism prophylaxis to compare the efficacy and safety of enoxaparin with that of unfractionated heparin for patients with stroke. One thousand, seven hundred and sixty-two patients with acute ischemic stroke who were unable to walk unassisted were randomly assigned within 48 hours of symptoms to receive either enoxaparin (40 mg subcutaneously once daily) or unfractionated heparin (5000 U subcutaneously every 12 hours for 10 days) or low molecular weight heparin, or heparinoids to prevent venous thrombo-embolism in immobilized people following a stroke (Grade A recommendations).

The occurrence of any bleeding was similar with enoxaparin (69 [8%]) or unfractionated heparin (71 [8%]; p=0.83). The frequency of the composite of symptomatic intracranial and major extracranial hemorrhage was small and closely similar between groups (enoxaparin 11 [1%] vs. unfractionated heparin 6 [1%]; p=0.23). Sherman noted no difference for symptomatic intracranial hemorrhage between groups (4 [1%] vs. 6 [1%], respectively; p=0.55); the rate of major extracranial bleeding was higher with enoxaparin than with unfractionated heparin (7 [1%] vs. 0; p=0.015). It was suggested that for patients with acute ischemic stroke, enoxaparin is preferable to unfractionated heparin.

The recommendation around the use of external compression stockings has been removed from this edition of the
Canadian Best Practice Guidelines. In past editions external compression stockings were a recommended intervention that could be used for patients with acute ischemic stroke at high risk of venous thromboembolism in the absence of contraindications. This was based on evidence that showed external compression stockings are effective for surgical patients. However, two more systematic reviews concluded there is currently insufficient evidence of the effectiveness of physical methods to prevent DVT. Of importance, a recent randomized controlled trial study (CLOTS trial 1) has shown that thigh length compression stockings do not significantly reduce the risk of deep vein thrombosis after stroke. The CLOTS trial 1 was a multi-centre study in which 2518 patients were recruited within 3 days of admission after stroke. The primary outcome was a symptomatic or asymptomatic DVT in the popliteal or femoral veins. The primary outcome occurred in 126 (10.0% patients) allocated to thigh-length graduated compression stockings and in 133 (10.5%) in patients who were not treated with graduated compression stockings. Graduated compression stockings were not significant in reducing the risk of the occurrence of DVT (0.5%) compared with no graduated compression stockings. Graduated compression stockings did not affect secondary outcomes including PE and death. Also, graduated compression stockings were not effective in subgroups, such as patients treated early, those with leg weakness and those not given concomitant anticoagulation. However, the use of graduated compression stockings was associated with an increased risk of skin breaks, ulcers, blisters and necrosis.

The use of LMWH was associated with a significant risk reduction for any VTE (odds ratio [OR], 0.54; 95% confidence interval [CI], 0.41 to 0.70; p < 0.001). Limiting the analysis to proximal VTEs also indicated that LMWHs were superior (OR with LMWH vs UFH, 0.53; 95% CI, 0.37 to 0.75; p < 0.001). LMWH use led to fewer PEs as well (OR, 0.26; 95% CI, 0.07 to 0.95; p = 0.042). There were no differences in rates of overall bleeding, intracranial hemorrhage, or mortality based on the type of agent employed. Restricting the analysis to the reports employing enoxaparin did not alter their findings.

One trial has assessed the use of intermittent pneumatic compression (IPC) in conjunction with elastic stockings. The study reported a reduced incidence of asymptomatic DVT for patients with ICH in an ICU setting. However, the study was too small to detect clinical/symptomatic DVT differences between the groups and a higher number of patients in the intervention group discontinued treatment. The ongoing study CLOTS trial 3 may provide direction around the use of intermittent pneumatic compression.

Definitive research evidence is lacking for the use of anticoagulants and antithrombotics for deep vein thrombosis prophylaxis after intracerebral hemorrhage. The use of anticoagulants may increase the risk of worsening the initial hematoma. Orken and colleagues investigated the safety of low dose low molecular weight heparin (LMWH) for DVT prophylaxis in patients with ICH and the effect of heparin on the enlargement of hemorrhage. Seventy-five primary ICH patients were randomized to subcutaneous LMWH (Enoxaparin sodium 40mg/d) or long compression stockings (CS) after the first 48 hours. All patients had cranial computed tomography (CT) scan at admittance, 1, 3, 7 and 21 days, as well as CT pulmonary angiography and bilateral lower extremity venous Doppler on day seven. Hematoma volumes were calculated on the initial and follow-up CTs with ABC/2 method. The study did not find any hematoma enlargement at 72 hours, 7 and 21 days in either group. In addition, no other systemic bleeding complications were observed in LMWH group. Four asymptomatic DVTs were detected (3 in LMWH and 1 in CS group). As a result of the study, investigators were able to calculate the rate of asymptomatic DVT an dPE in ICH patients, at 4% and 2.5% in the LMWH group. The investigators concluded that low-dose heparin treatment after 48 hours of stroke in ICH patients was not associated with an increased hematoma growth, however, sample size was small and should be considered for DVT and PE prophylaxis.

Tetri and colleagues conducted a retrospective review of 407 ICH patients in which 232 had received anticoagulant therapy for DVT prophylaxis using enoxaparin. They found similar three-month mortality rates of 19% in the treated group compared to 21% in the group who did not receive prophylaxis. Hematoma enlargements occurred in 9% and 7% of the treated and untreated patients, whereas symptomatic venous thromboembolic complications were observed in 3% and 2%, respectively. The investigators discuss the fact that the safety of earlier initiation of prophylaxis in the ICH population is unknown and a randomized trial is needed to generate evidence to better guide clinicians.

Temperature management: Increased body temperature following stroke has been reported to result in increased morbidity and mortality and generally poorer recovery and neurological outcomes. The fever may be secondary
to a cause of stroke, such as infective endocarditis, or may represent a complication, such as pneumonia. Monitoring temperature and managing fever are important components of post stroke care to minimize the potential negative impact of fever. Jones and colleagues found that the evidence supports the need for monitoring and recording of blood pressure, oxygen saturation (including consideration of positioning), blood glucose, and body temperature in the acute phase of stroke.\textsuperscript{295} This review reinforced the importance of monitoring physiological parameters in the acute phase of stroke, providing support to the recommendation that monitoring should play a key role within nursing care.

Saini and colleagues (2010) conducted a study to evaluate the effect of temperature and timing of hyperthermia on outcome after ischemic stroke.\textsuperscript{289} Their analysis included data from 5305 patients in acute stroke trials from the Virtual International Stroke Trials Archive (VISTA) data set were analyzed. Data for temperatures at baseline, eighth, 24th, 48th, and 72nd hours, and seventh day were assessed in relation to outcome (poor versus good) based on the modified Rankin Scale at 3 months. Hyperthermia was defined as temperature > 37.2 degrees C and poor outcome as 90-day modified Rankin Scale > 2. The average age of patients was 68.0+/−11.9 years, 2380 (44.9%) were females, and 42.3 percent (2233) received thrombolysis using recombinant tissue plasminogen activator. After adjustment, hyperthermia was a statistically significant predictor of poor outcome. The hazard ratios (95% CI) for poor outcome in relation to hyperthermia at different time points were: baseline 1.2 (1.0 to 1.4), eighth hour 1.7 (1.2 to 2.2), 24th hour 1.5 (1.2 to 1.9), 48th hour 2.0 (1.5 to 2.6), 72nd hour 2.2 (1.7 to 2.9), and seventh day 2.7 (2.0 to 3.8). Gender, stroke severity (National Institutes of Health Stroke Scale score >16), white blood cell count, and antibiotic use were significantly associated with hyperthermia (P < or =0.01). The investigators concluded hyperthermia in acute ischemic stroke is associated with a poor clinical outcome. The later the hyperthermia occurs within the first week, the worse the prognosis. Severity of stroke and inflammation are important determinants of hyperthermia after ischemic stroke.

Mobilization: The goal of early mobilization following stroke is to prevent complications such as pressure sores, painful shoulders, and respiratory complications.\textsuperscript{286,289} It is described as one of the “simplest yet most important components of stroke unit care”.\textsuperscript{297} Health professionals require a research-based approach to deliver safe and effective care to acute stroke patients, including early mobilization, and for early mobilization post stroke, this research base is lacking. In spite of this absence, several well-developed stroke guidelines promote early mobilization following stroke.\textsuperscript{10,16,293,294} In addition, early mobilization is frequently identified as a component of stroke unit.\textsuperscript{298,299} Diserens and colleagues (2006) noted in his systematic review that early mobilization protocols are poorly defined and need to be stratified to better evaluate their clinical effectiveness.\textsuperscript{300} They define ‘early’ mobilization as activities within the first three days following stroke. They define ‘mobilization’ as “any physical activity of the body initiated by either the patient or the environment, independent of body position and, if appropriate, the position in which mobilisation is performed (flat, sitting, upright) should be added” (page 184). Based on their review, they concluded there is a clear benefit of early rehabilitation after stroke that usually includes rapid mobilization in bed and out of bed.

The AVERT trial (A Very Early Rehabilitation Trial for Stroke) is underway with the intent of providing further clarity on this topic. At this time, the safety and feasibility report for AVERT has been published and the full trial is ongoing.\textsuperscript{297} A 2009 Cochrane review was only able to include a single study, which was the AVERT safety and feasibility trial of 71 patients.\textsuperscript{286} The study found that fewer patients who received very early mobilization (within 24 hours) were dead or disabled at three months, however, this was not statistically significant. A secondary analysis examined complication rates at 3 months comparing the intervention and standard care groups.\textsuperscript{276} In this Phase II study there were no significant differences in complication rates between the two groups. Overall, most patients (81.6%) experienced at least one complication, most commonly falls. Another component of the AVERT trial measured patient quality of life at one-year following a stroke using the Assessment of Quality of Life scale (AQoL).\textsuperscript{301} The group who received very early mobilization reported a higher median overall AQoL score (0.32) compared to standard care patients (0.24). This group difference was not significant (p = 0.17), but it was significant at the 75th percentile (p = 0.003) in favour of early mobilization group. Early mobilization patients also reported higher quality of life than standard care patients in the physical function related ‘Independent Living’ domain of the AQoL (p = 0.03 adjusted for age; p = 0.04 adjusted for stroke severity).

Bernhardt’s review (2008) identified the variations in practice for the timing of mobilization following stroke, citing a range from 24 hours to several days.\textsuperscript{102} A Canadian survey study assessed functional mobility training for individuals
admitted to acute care following a stroke event. One third of the 18 responding acute care settings reported that there were no written guidelines related to mobilization or positioning following a stroke and few sites reported provision of stroke-specific education. Arias and Smith (2007) examined practices for early mobilization of acute stroke patients through a survey in the United Kingdom. It was noted that although early mobilization in acute stroke care is recommended in a range of European, American and United Kingdom policy guidelines as a strategy to minimize or prevent complications, the evidence base to support early mobilization in acute stroke is missing. There is a need for a coordinated and consistent approach to early mobilization and physical care for stroke patients in the acute care setting.

Continence: The prevalence of urinary incontinence is difficult to estimate, but it is thought to range between 10 and 20 percent, with higher rates of incontinence expected for women. A Cochrane review (2008) suggested that rates can be as high as 40 to 60 percent of people admitted to hospital following a stroke event, with 25% still having problems at time of discharge. Similar ranges are reported in the 2009 edition of the Evidence-Based Review of Stroke Rehabilitation. More alarming still, 15% of these patients remain incontinent at one year post-stroke. The review set out to determine optimal treatment techniques of urinary incontinence after stroke. Twelve trials (total n=724) were included in the review: three trials assessed behavioral interventions, two assessed professional input interventions, three small trials examined complementary therapies as interventions and three small trials investigated pharmacotherapy and hormonal interventions. The authors concluded that the data was insufficient to effectively guide continence care after stroke, although there was evidence that professional input through structured assessment and management of care may reduce urinary incontinence following stroke. There is a wide range of interventions suggested for dealing with this distressing issue and better evidence is required.

Dumoulin et al. (2007) examined the extent to which occupational and physical therapists identified, assessed and treated urinary incontinence following stroke. The aim of the study was to assess the extent to which the actual practices of rehabilitation professionals reflected best practice recommendations in Canada. Occupational therapists (n=663) and physical therapists (n=656) were randomly selected to participate in a telephone interview. Only 39 percent of occupational therapists and 41 percent of physical therapists identified urinary incontinence after stroke as a problem. Fewer than 20 percent of occupational therapists and 15 percent of physical therapists used best-practice assessments, while only two percent and three percent used best practice interventions respectively. Variables identified to explain between six and nine percent of the variance included: working in Ontario, allocated learning time, and university teaching.

Nutrition and Dysphagia: The FOOD trial (2005) aimed to establish whether routine oral nutritional supplements improve outcome after stroke. The trials are a family of three pragmatic, multicenter, randomised controlled trials. Outcomes of stroke patients who could swallow and who were randomly allocated normal hospital diet or normal hospital diet plus oral nutritional supplements until hospital discharge were measured, primary outcome being death or poor outcome (modified Rankin scale [MRS] grade 3–5). Six months after enrolment, measured unaware of treatment allocation. Over the course of the study, 4023 patients were enrolled across 15 countries. Only 314 (8%) patients were judged to be undernourished at baseline. Supplemented diet was associated with an absolute reduction in risk of death of 0.7% (95% CI –1.4 to 2.7) and an increased risk of death or poor outcome of 0.7 percent (2.3 to 3.8). The anticipated 4% absolute benefit for death or poor outcome from routine oral nutritional supplements for mainly well nourished stroke patients in hospital could not be confirmed. The FOOD trial results would be compatible with a 1 percent or 2 percent absolute benefit or harm from oral supplements. These results did not support a policy of routine oral supplementation after stroke.

Another FOOD trial investigation (2005) examined acute treatment of dysphagic patients. In one trial, patients enrolled within seven days of admission were randomly allocated to early enteral tube feeding or no tube feeding for more than seven days (early versus avoid). In the other, patients were allocated percutaneous endoscopic gastrostomy or nasogastric feeding. In this trial, patients (n=859) were enrolled into the early versus avoid trial. Early tube feeding was associated with an absolute reduction in risk of death of 5.8 percent (95% CI –0.8 to 12.5, p=0.09) and a reduction in death or poor outcome of 1.2 percent (4.2 to 6.6, p=0.7). In the percutaneous endoscopic gastrostomy vs. nasogastric tube trial, 321 patients were enrolled by 47 hospitals in 11 countries. Percutaneous endoscopic gastrostomy feeding was associated with an absolute increase in risk of death of 1.0 percent (10.0 to 11.9, p=0.9)
and an increased risk of death or poor outcome of 7.8 percent (0.0 to 15.5, p=0.05). Early tube feeding might reduce case fatality, but with an increase in the proportion of patients surviving with poor outcome. The results did not support a policy of early initiation of percutaneous endoscopic gastrostomy feeding in dysphagic stroke patients.

Martineau et al. (2005) assessed the nutritional status of patients (n=73) admitted to an acute stroke unit using the scored patient generated subjective global assessment. At time of admission 19.2 percent of patients were malnourished. Malnourished patients, in comparison to nourished patients, had longer lengths of stay (13 vs. 8 days), increased complications (50% vs. 14%), increased frequency of dysphagia (71% vs. 32%), and enteral feeding (93% vs. 59%). No association was found between nutritional status and discharge destination.

Horn et al. (2005) examined the association of patient characteristics, rehabilitation therapies, neurotropic medications, nutritional support, and timing of initiation of rehabilitation with functional outcomes and discharge destination for inpatient stroke rehabilitation patients (n=830). Enteral feeding was identified as an activity associated with better outcome post-stroke.

Oral Care: Poor oral hygiene has been linked with the development of aspiration pneumonia due to bacterial colonization in the mouth. Aerobic gram-negative bacilli has been shown to be common in the mouths of stroke patients and is also correlated with dysphagia. In addition, physical weakness following stroke can prevent patients from being independent in completing their own oral care. Dry mouth, oral ulcers and stomatitis may be caused by medication following a stroke. Patients with dysphagia are also at a high risk due to reduced cough sensation and greater potential for aspiration of their own saliva.

A Cochrane Database Systematic Review was carried out to compare the effectiveness of staff-led oral care interventions with standard care in improving oral hygiene in patients post-stroke. Only one study (n= 67 stroke patients) identified stroke-specific treatment information, comparing an oral healthcare education training program delivered to nursing home care assistants to delayed training intervention in the control group. Results indicated that denture plaque scores were significantly reduced up to six months post-intervention (p<0.00001). Although conclusions are made based on one study, it seems that providing oral care training for caregivers in a nursing home setting improves attitudes towards the provision of oral care post-stroke. This review demonstrated that all members of the interprofessional team could be trained in completing a proper oral screening and to participate in providing regular (at least twice daily) oral care. There is some limited evidence that oral care training sessions for staff can change staff’s knowledge and attitude toward completing oral care and have a positive impact on the patient’s oral hygiene.

Brady et al. (2007) showed limited evidence suggesting that training can change staff knowledge and attitude toward oral care and has a positive impact on patient’s oral hygiene as measured by denture cleanliness. Six months post-intervention the benefits were still evident despite high professional turnover in nursing homes.

An overview of provision of oral care in stroke care settings in Scotland was conducted demonstrating that access to staff training, assessments, protocols, and oral hygiene material varied considerably between units. This overview presented a baseline for the development of oral care protocols in specialized stroke settings. Also, a study examining the oral health condition of elderly stroke survivors at discharge into the community found that, in comparison to a control group, individuals who survived a stroke had significantly higher plaque and bleeding scores at time of discharge. This effect remained evident six months following discharge to the community.

Best Practice Recommendation 4.3
Advance Care Planning, Palliative and End-of-Life Care

New for 2010

DEFINITIONS

Advance care planning is a process of helping a patient reflect on and communicate his or her goals, values, and preferences for future healthcare, to be used should they become incapable of giving informed consent.
Central to this process are conversations between the patient, his or her family, and the healthcare providers. For stroke patients, the goal of advance care planning is a shared understanding of the stroke, comorbidities, and prognosis; the benefits and burdens of potential treatments; types and location of care; and the individual’s goals and values as they pertain to such care. It is an ongoing process that should be reviewed regularly or as the situation changes. These conversations may lead to a written document, often called a personal or advance directive, which names a substitute decision maker, proxy, or agent, and outlines the person's desired medical interventions. Advance care planning can also result in rich conversations about meanings and fears around illness and dying, spirituality, and after-death religious practices.

Palliative care is an approach that focuses on comfort and quality of life for those affected by life-limiting illness. It aims to prevent and relieve physical, social, psychological, or spiritual suffering of stroke patients and their families. Palliative care can complement life-prolonging or disease-modifying therapies post-stroke and need not be reserved for those whose death is imminent.

End-of-life care or terminal care is part of the palliative approach and is the management and treatment of dying patients and their families. The end-of-life period often involves a period of change (e.g. worsening diagnosis) rather than an acute event.

### 4.3.1 Advance Care Planning

Patients surviving a stroke and their families should be approached by the stroke healthcare team to participate in advance care planning [Evidence Level C].

i. Advance care planning may include identifying a substitute decision-maker (proxy or agent), implementing a personal directive [Evidence Level C], and discussion of the patient’s preferences and the medical appropriateness of therapies such as feeding tubes, hydration, treatment of the current illness, admission to intensive care, ventilation, cardio-pulmonary resuscitation, and place of care [Evidence Level B].

ii. The goals of therapy should be revisited periodically and when there is a change in health status [Evidence Level B].

iii. The interprofessional team should have the appropriate communication skills and knowledge to address the physical, spiritual, psychological, ethical, and social needs of palliative or dying patients and their families [Evidence Level C].

### 4.3.2 Palliative and End-of-Life Care

The palliative approach should be used with those experiencing significant morbidity after a stroke, or to optimize end-of-life care for dying stroke patients and their families [Evidence Level B].

i. Communication with patients and their families should provide, on an ongoing basis, information and counseling regarding diagnosis, prognosis, and management, including:
   - the appropriateness of life-sustaining measures including mechanical ventilation, enteral/intravenous feeding, and intravenous fluids [Evidence Level B]
   - oral care [Evidence Level C]
   - assessment and management of pain [Evidence Level B]
   - assessment and management of delirium [Evidence Level C]
   - assessment and management of respiratory distress [Evidence Level B]
   - assessment and management of incontinence, nausea, vomiting, constipation, and skin and wound care [Evidence Level C]

ii. Patients and the healthcare team should have access to palliative care specialists for consultation on
all palliative stroke patients [Evidence Level C].

iii. Palliative care specialists should be involved in the care of all patients with difficult-to-control symptoms, complex or conflicted end-of-life decision making, or complex psycho-social family issues [Evidence Level C].

iv. The interprofessional team should have the appropriate communication skills and knowledge to address the physical, spiritual, psychological, and social needs of palliative or dying patients and their families [Evidence Level C].

v. Palliative care pathways should be considered to introduce and monitor standards of care provided to palliative or dying stroke patients [Evidence Level B].

Rationale
Implementing stroke best practices can contribute to reductions in morbidity and mortality; however, stroke remains the third leading cause of death in Canada. There is evidence of unmet needs in stroke patients who are at the end of life. Recognizing and addressing the needs of the person with a life-limiting stroke or who is close to death after a stroke can enhance the quality of the time left and the satisfaction of the patient, family, caregivers, and the healthcare team.

System Implications
- Established referral process to specialist palliative care services, either within the same organization or through telehealth technology in rural and remote locations.
- Established referral process to spiritual care services.
- Communication training for physicians, nurses, and allied health professionals that addresses supporting patients with poor prognoses and their families.
- Advance care-planning conversations to elicit patient and family goals for care preferences.
- Palliative care pathways that are integrated into care delivery.

Performance Measures
1. **Percentage of stroke patients who have been approached to participate in advance care planning and/or who have a documented conversation with a healthcare provider about resuscitation, hydration, or feeding preferences.**
2. Percentage of stroke patients who identify a substitute decision-maker.
3. Percentage of stroke patients who complete a personal or advance care directive documented on their chart.
4. Percentage of deceased stroke patients who accessed specialist palliative care services.
5. Percentage of stroke patients who die in the location specified in their personal or advance care directive.
6. Percentage of dying patients who were placed on an end-of-life care pathway.

Measurement Notes
- Documentation for the advance care and end-of-life measures may appear in consult notes, nursing notes, or physician notes. Just the presence of an order for palliative consultation should not be accepted as adequate documentation.
- Data quality may be an issue with some of these performance measures. Improved documentation should be promoted among healthcare professionals.
## Implementation Resources and Knowledge Transfer Tools

### Summary of the Evidence

Timely, recurrent, sensitive communication is key to determining the goals of care for every patient who has had a stroke. Advance care planning may provide peace of mind to patients and reduce the stress of families faced with representing their loved ones wishes during a subsequent critical illness. Secondary stroke prevention clinics and community settings are ideal for introducing the concept of ACP or following up on ACP conversations initiated in acute care. It is important to recognize that an individual’s healthcare preferences may change with time or circumstances. They should be reviewed periodically or when there is a change in health status or care location.

Palliative Care is defined by the World Health Organization (WHO) as ‘the active total care of patients whose disease is not responsive to curative treatment; (i.e. chronic disease). Palliative care is comprehensive care that aims to control pain, provide comfort, improve quality of life and effectively manage patients and their families’ psychosocial needs during advanced or chronic illness. Palliative care can be provided in acute care hospitals, long-term care facilities, hospice facilities, or in home settings. The palliative approach, attending to physical, social, psychological or spiritual needs, of patients and their families need not be reserved for those imminently dying.

Effective communication among all involved in EOL care (e.g. patients, family members, nurses, physicians) can help address issues that are important to patients during this period. Components of decision making regarding EOL care include information exchange, discussions about treatment options, and making--or not making--decision. Specific issues important to patients during the EOL period include: being informed of their prognosis; management of pain and symptoms; retaining a sense of autonomy; feeling safe, in control, and cared for; being able to participate in decision making and preparations for death; maintaining relationships; and achieving a sense of completion.

Planning for EOL care has been identified as lacking in many patient-physician encounters while concordance between patient and healthcare providers/surrogate decision-makers understanding of EOL decisions must be ensured. In a recently published study about EOL care needs in patients with acute stroke, Payne et al. reported that patients consistently raised issues related to communication and information provision about stroke and the wish to be involved in their own medical decisions and management.

In these recommendations a distinction is made between generalist and specialist palliative care. Generalist palliative skills (the awareness of the palliative philosophy, sensitive communication and basic symptom management) are required by healthcare providers across all disciplines to function effectively in caring for stroke patients. Specialist palliative care providers (e.g. nurses, physicians, allied health, spiritual care providers and volunteers with advanced palliative care training) and services (e.g. hospice, palliative home care and consult teams) should be available to provide support when suffering persists despite the use of generalist palliative interventions.

There is growing evidence that the use of palliative care pathways for those imminently dying, such as the Liverpool care pathway can enhance quality improvement initiatives in end-of-life care. Palliative care pathways provide a tool to initiate, audit and implement cycles of change in the delivery of care for dying patients. There is moderate evidence demonstrating positive outcomes of such pathways for patients, families and healthcare team, although there is limited evidence for their use specifically in stroke. Developing or using existing pathways that describe standards of care across physical, psychological, social, spiritual domains may allow care teams to optimize the delivery of care to dying patients. Similarly, structured and facilitated programs may enhance the advance care planning process between patients and the healthcare team.
SECTION 5.0 STROKE REHABILITATION

NOTE ON THESE RECOMMENDATIONS:
A brief summary of the current evidence is provided each of the sets of recommendations for stroke rehabilitation. Additional detailed evidence summaries are available for each section from the following to evidence synthesis projects currently sponsored by the Canadian Stroke Network:

i. Evidence-Based Review of Stroke Rehabilitation – www.ebrsr.com
ii. StrokEngine - www.strokengine.ca

Best Practice Recommendation 5.1
Initial Stroke Rehabilitation Assessment

NOTES on this recommendation
- Outpatient rehabilitation includes day hospital, outpatient ambulatory care, and home-based rehabilitation.

All persons with acute stroke should be assessed to determine the severity of stroke and early rehabilitation needs.

i. All patients admitted to hospital with acute stroke should have an initial assessment by rehabilitation professionals as soon as possible after admission [Evidence Level A], preferably within the first 24 to 48 hours [Evidence Level C].

ii. This initial assessment should include assessment of patient function; safety and risk; physical readiness and ability to learn and participate; and transition planning [Evidence Level C].

iii. All patients with acute stroke with any residual stroke-related impairments who are not admitted to hospital should undergo a comprehensive outpatient assessment(s) for functional impairment, which includes a cognitive evaluation, screening for depression, screening for fitness to drive, as well as functional assessments for potential rehabilitation treatment [Evidence Level A], preferably within 2 weeks [Evidence Level C].

iv. Clinicians should use standardized, valid assessment tools to evaluate the patient’s stroke-related impairments and functional status [Evidence Level C].

v. The rehabilitation needs of survivors of a severe or moderate stroke should be reassessed weekly for the first month, and then at intervals as indicated by their health status [Evidence Level C].

Rationale
The first interprofessional assessment after the stroke patient is admitted must identify the physical, cognitive, and communication complications from the stroke to help identify the likely discharge needs.

Early consultation with rehabilitation professionals contributes to reductions in complications from immobility such as joint contracture, falls, aspiration pneumonia, and deep vein thrombosis. There is evidence that an interprofessional approach bringing together clinicians with different skill sets is one of the factors that results in reduced deaths in specialized stroke units. Another key benefit of early consultation with rehabilitation professionals is early discharge planning for transition from acute care to specialized rehabilitation units or to the community.

Patients with milder strokes may have subtle cognitive difficulties that need to be followed; those with severe stroke initially may not be candidates for rehabilitation but still require follow-up because 40 to 50
percent may be able to return home following rehabilitation rather than requiring institutional care. Early assessment can reduce overall costs through improved outcomes and potentially reduced time to discharge.

### System Implications

To ensure patients receive timely stroke rehabilitation assessments, the acute care organization requires:

- An adequate complement of clinicians experienced in stroke and stroke rehabilitation.
- A clear process for patient referral to rehabilitation professionals after admission.
- An interprofessional team that is well resourced to provide prescribed levels of rehabilitation therapy.
- A defined geographic area or unit where individuals with stroke are ensured access to an experienced team.
- Standard expert consensus-based screening assessment tools and training.
- A process for timely referral to specialized stroke inpatient services in all centres (for example, electronic referral system and standardized assessment tools).
- Access to a follow-up clinic to ensure assessment of mild stroke-related difficulties and access to rehabilitation when required. For children, follow-up in their school environments.
- Development of stroke rehabilitation expertise in children’s hospitals and children’s treatment centres.
- Mechanisms to periodically re-evaluate those with severe stroke admitted to nursing homes or continuing care to ensure access to a trial of rehabilitation.
- Coordination and development of strong partnerships in the community to ensure access to comprehensive stroke rehabilitation. This is especially important in more rural and remote geographic locations where telehealth technologies should be optimized.

### Performance Measures

1. **Proportion of stroke patients with a rehabilitation assessment within 48 hours of hospital admission for acute ischemic stroke and within 5 days of admission for hemorrhagic stroke (core).**
2. **Median time from hospital admission for stroke to initial rehabilitation assessment for each of the rehabilitation disciplines.**
3. **Proportion of acute stroke patients discharged from acute care to inpatient rehabilitation (core).**
4. Percentage of stroke patients discharged to the community who receive a referral for outpatient rehabilitation before discharge from acute and/or inpatient rehabilitation hospital (either facility-based or community-based programs).
5. Median length of time between referral for outpatient rehabilitation to admission to a community rehabilitation program.
6. Length of time between referral for outpatient rehabilitation to commencement of therapy.
7. Percentage of those with severe stroke reassessed for rehabilitation following initial assessment.
8. Percentage of those with severe stroke admitted to inpatient rehabilitation.
9. Percentage increase in Telehealth/Telestroke coverage to remote communities to support organized stroke care across the continuum and provide rehabilitation assessments for stroke patients.

### Measurement Notes
Referral information may be found through primary audit of inpatient charts (nurses' notes, discharge summary notes, copies of referral forms) or through databases maintained by organizations that receive and process referrals. These community databases will vary in the amount of information included, and there may be challenges in accessing information contained in these databases.

Most home care organizations monitor when the first service started but cannot determine easily the onset of rehabilitation therapy.

**Implementation Resources and Knowledge Transfer Tools**

- FIM® Instrument
- The Certificate of Stroke Rehabilitation Program: University of Alberta Department of Rehabilitation Medicine

**Summary of the Evidence**

Comprehensive stroke care delivery in the early days and weeks following an acute stroke has been shown to have significant positive impact on stroke outcomes. Comprehensive assessments of a stroke patient’s cognitive and functional status in the first few days following a stroke are essential to developing individualized plans of care and recovery. The World Health Organization’s International Classification of Functioning (ICF) model is commonly used by healthcare professionals to guide assessment and treatment of stroke patients in the acute and post acute phases of care. The ICF considers three perspectives: the body, the individual and societal perspectives. It also includes the two components of body function and structure and activity and participation, all within the context of one’s environment. Early rehabilitation assessments for stroke, as well as goal setting and treatment planning should incorporate aspects of the ICF model during the short and long term recovery of stroke patients.

**Definition of functional assessment:** Standardized or non-standardized method of evaluating a person’s ability to perform basic self-care activities (such as dressing, grooming, personal hygiene, feeding, functional mobility and communication) and instrumental activities of daily living (including meal preparation, home management, communication activities, financial management, shopping and community living skills). Ability to interact socially may also be a component of a functional assessment.

**Benefits of early stroke rehabilitation assessment:** A screening examination for rehabilitation should be performed as soon as the patient’s medical and neurological condition permits, by a person experienced in rehabilitation. The screening examination should incorporate medical information, neurological examination, use of a well-standardized disability (e.g., activities of daily living) instrument and a mental status-screening test. Asberg and Nydevik (1991) felt that the optimal timing for stroke rehab assessment was five to seven days post-stroke onset, although recent trends have been towards decreasing that time, since onset.

The EBRSR reports threshold criteria for admission to a comprehensive rehabilitation program should include medical stability, the presence of a functional deficit, the ability to learn, and enough physical endurance to sit unsupported for at least one hour and to participate actively in rehabilitation. Admission to an interprofessional program should be limited to patients who have more than one type of disability and who therefore require the services of two or more rehabilitation disciplines. Patients with a single disability can benefit from individual services, but generally, do not require an interprofessional program.

One randomized controlled trial published in 2001 addressed both acute and rehabilitative care and sought to quantify the differences between staff interventions in a stroke unit versus staff interventions on a general ward supported by a stroke specialist team. Observations were made daily for the first week of acute care but only weekly during the postacute phase. During the observation period, the stroke unit patients were monitored more frequently and received better supportive care, including early initiation of feeding. Evidence is also emerging for
the rehabilitative effects of swallowing therapy after stroke.\textsuperscript{341-343} Swallowing interventions including diet modifications, swallowing therapy and compensatory swallowing strategies should be implemented as soon as possible by a trained swallowing specialist who is able to complete a full clinical and instrumental assessment.\textsuperscript{344}

Reviews by Cifu and Stewart (1999) and Ottenbacher and Jannell (1993) reported a positive correlation between early rehabilitation interventions and improved functional outcomes.\textsuperscript{340, 346} However, it is not evident whether the relationship is causal. One prospective comparative trial by Paolucci et al. (2000) looked at the outcomes of stroke patients admitted to rehabilitation at differing times following stroke.\textsuperscript{347} They found that those stroke patients who received rehabilitation early did better functionally than those whose rehabilitation was delayed.

Specialized nursing care promotes early recognition of complications and management of skin, bowel and bladder problems. Research suggests that physical therapy will promote better recovery through early mobilization of the patient and management of any lung problems caused by immobility. Occupational therapists focus on improving activities that are meaningful to the patient (self-care, productivity and leisure activities) by reducing stroke-related impairments. Assessment of patient’s discharge environment addresses suitability for discharge home, need for equipment and/or home modification for function and safety. Speech–language pathologists assess swallowing difficulties and provide swallowing therapy and compensatory techniques. The speech–language pathologist is also able to assess the degree of difficulty with communication and initiate appropriate therapy. Augmentative or alternative communication devices will be introduced if necessary. Medical specialists in physical medicine and rehabilitation address complications such as pain, spasticity (increased resistance in the muscles), and bowel and bladder incontinence. Neuropsychology, social work and other allied health professionals may help with the cognitive and psychosocial sequelae of stroke.\textsuperscript{348}

Interpretation of early rehabilitation assessments relies on the use of standardized assessment tools. In Canada, the FIM® Instrument is widely used within inpatient rehabilitation settings, and less consistent in the inpatient acute care setting.\textsuperscript{349} Ween et al. (1996) prospectively analyzed 536 consecutive stroke rehabilitation admissions to try and identify the influence of preselected factors on functional improvement and discharge destination.\textsuperscript{350} Patients with an admission FIM above 80 almost always went home after rehabilitation and so it was recommended that patients with early functional independence measure (FIM) scores greater than 80 (the mildly disabled) are best managed at home as long as appropriate supports are in place. Conversely, patients admitted to rehabilitation with a FIM score of less than 40 almost always required long-term care in a nursing home facility. It was recommended that those with FIM scores less than 40 (the more severely disabled) should likely go to a slower paced or less intensive rehab facility, or a decision should be postponed at the time of initial assessment and reassessed weekly. An admission score of 60 or more was associated with a larger FIM improvement, but the absence of a committed caregiver at home increased the risk of nursing home discharge. Therefore, it was recommended that intensive rehabilitation units are most likely to be effective with moderately severe stroke patients with early FIM scores between 40-80. These patients are generally able to participate fully, show substantial improvement during rehabilitation and have a high probability of discharge home.\textsuperscript{351}
### Best Practice Recommendation 5.2
#### Stroke Rehabilitation Unit Care

**5.2.1 Stroke Unit Care**

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

1. Post–acute stroke care should be delivered in a setting in which rehabilitation care is formally coordinated and organized [Evidence Level A].
2. All patients should be referred to a specialist rehabilitation team on a geographically defined unit as soon as possible after admission [Evidence Level A]. Paediatric acute and rehabilitation stroke care should be provided on a specialized paediatric unit [Evidence Level B].
3. The interprofessional rehabilitation team should consist of a physician, nurse, physical therapist, occupational therapist, speech-language pathologist, psychologist, recreation therapist, patient, and family and/or caregivers [Evidence Level A]. For children, this should also include educators and child-life workers. This core interprofessional team should consist of appropriate levels of these disciplines, as identified by the Stroke Unit Trialists’ Collaboration [Evidence Level B].

**5.2.2 For all settings (hospital, clinic, community) where stroke rehabilitation is provided**

Post–acute stroke care should be delivered by a variety of treatment disciplines, experienced in providing post-stroke care, to ensure consistency and reduce the risk of complications [Evidence Level C].

1. The interprofessional rehabilitation team should assess patients within 24 to 48 hours of admission and develop a comprehensive individualized rehabilitation plan which reflects the severity of the stroke and the needs and goals of the stroke patient [Evidence Level C].
2. Patients with moderate or severe stroke who are rehabilitation ready and have rehabilitation goals should be given an opportunity to participate in inpatient stroke rehabilitation [Evidence Level A].
3. Stroke unit teams should conduct at least one formal interprofessional meeting per week to discuss the progress and problems, rehabilitation goals and discharge arrangements for patients on the unit [Evidence Level B]. Individualized rehabilitation plans should be regularly updated based on patient status reviews [Evidence Level C].
4. Clinicians should use standardized, valid assessment tools to evaluate the patient’s stroke-related impairments and functional status [Evidence Level B].
5. Where admission to a stroke rehabilitation unit is not possible, a less optimal solution is inpatient rehabilitation on a mixed rehabilitation unit (i.e., where interprofessional care is provided to patients disabled by a range of disorders including stroke) [Evidence Level B].

**Rationale**

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

**System Implications**

- Timely access to specialized inpatient stroke rehabilitation services.
- An adequate number of geographically defined stroke units with critical mass of trained staff; interprofessional team care during the rehabilitation period following stroke.
- Stroke rehabilitation units adequately staffed with clinicians with expertise in stroke rehabilitation.
• Resources to enable patient access to appropriate type and intensity of rehabilitation professionals throughout their stay (including weekends when required).
• Protocols and strategies to prevent complications and the recurrence of stroke developed and communicated to all staff.
• System and process changes to allow therapists to spend approximately 80 percent of their time with patients.

### Performance Measures

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

### Measurement Notes

- Performance measure 1: The denominator should be the total number of stroke patients admitted to inpatient rehabilitation.
- Performance measure 2: Data should be correlated with stroke severity scores during analysis.
- Duration and intensity of services by rehabilitation professionals requires a chart review or consistent use of reliable workload measurement tools that are implemented locally or regionally.
- Where patients progress to “rehabilitation status” and may not actually move or change locations. This information could be found in patient records through primary chart audit.

### Implementation Resources and Knowledge Transfer Tools

- Canadian Stroke Strategy Guide to the Implementation of Stroke Unit Care
- National Stroke Nurses Council: Best Practice Nursing Care Across the Acute Stroke Continuum: Module 4

### Summary of the Evidence

The benefits of this approach are substantial and, compared with a general hospital ward, coordinated and organized rehabilitation care in a stroke unit has been shown to reduce hospitalization length of stay and to increase the stroke patient’s walking mobility, functional status and quality of life. Stroke patients should be admitted early to stroke rehabilitation units as this also enhances functional outcomes.\(^{28}\) Stroke is multifaceted and requires a wide range of rehabilitation health professionals. It is important that rehabilitation beds and resources are protected, to provide sufficient intensity of treatment during the inpatient rehabilitation phase. Mobile stroke teams that do not work in a geographically defined unit do not achieve the same benefits.\(^{357,360}\) Evidence suggests that a specialized stroke rehabilitation unit is superior to a general rehabilitation unit; however, this may not be possible due to a lack of a critical mass of stroke patients in a smaller hospital.
Langhorne and Duncan conducted a systematic review of a subset of the studies identified by the Stroke Unit Trialists’ Collaboration, those dealing with post-acute rehabilitation stroke services. They defined intervention as “organized inpatient interprofessional rehabilitation commencing at least one week after stroke” and sought randomized trials that compared this model of care with an alternative. In a heterogeneous group of nine trials (six involving stroke rehabilitation units and three involving general rehabilitation wards) that recruited a total of 1437 patients, organized inpatient interprofessional rehabilitation was associated with a reduced odds of death (OR 0.66, 95% CI 0.49–0.88; \( p < 0.01 \)), death or institutionalization (OR 0.70, 95% CI 0.56–0.88; \( p < 0.001 \)) and death or dependency (OR 0.65, 95% CI 0.50–0.85; \( p < 0.001 \)), which was consistent across a variety of trial subgroups. This review of post-acute stroke care concluded there could be substantial benefit from organized inpatient interprofessional rehabilitation in the post-acute period, which is both statistically significant and clinically important.

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

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

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

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

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

The proportions of patients who had experienced death, death or institutionalization, and death or dependency at the end of scheduled follow-up were similar between studies that compared mobile stroke teams with general medical ward care. There was strong evidence that mobile stroke teams do not reduce mortality (OR 1.13, 95% CI 0.83–1.55), the combined outcome of death or dependency (OR 0.97 95% CI 0.72–1.32), the need for institutionalization (OR 1.23, 95% CI 0.70–2.17) or the length of hospital stay (OR 7.0, 95% CI −1.73 to 15.73). Patients receiving mobile stroke team care fared significantly poorer than patients who had been managed on a comprehensive stroke unit. Although the total number of patients included in the review was relatively small, the authors concluded that mobile stroke team care did not have a major impact on clinically important outcomes.
All patients with stroke should begin rehabilitation therapy within an active and complex stimulating environment [Evidence Level C] as early as possible once medical stability is reached [Evidence Level A].

i. Patients should receive the intensity and duration of clinically relevant therapy defined in their individualized rehabilitation plan and appropriate to their needs and tolerance levels [Evidence Level A].

ii. Stroke patients should receive, through an individualized treatment plan, a minimum of three hours of direct task-specific therapy by the interprofessional stroke team for a minimum of five days per week [Evidence Level A].

iii. The team should promote the practice of skills gained in therapy into the patient’s daily routine in a consistent manner [Evidence Level A].

iv. Therapy should include repetitive and intense use of novel tasks that challenge the patient to acquire necessary motor skills to use the involved limb during functional tasks and activities [Evidence Level A].

v. Stroke unit teams should conduct at least one formal interprofessional meeting per week at which patient problems are identified, rehabilitation goals set, progress monitored and support after discharge planned [Evidence Level B].

vi. The care management plan should include a pre-discharge needs assessment to ensure a smooth transition from rehabilitation back to the community. Elements of discharge planning should include a home visit by a healthcare professional, ideally before discharge, to assess home environment and suitability for safe discharge, determine equipment needs and home modifications, and begin caregiver training for how the patient will manage activities of daily living and instrumental activities of daily living in their environment [Evidence Level C].

Rationale

A number of important elements must be present on inpatient stroke rehabilitation units to obtain benefits. These include adequate intensity of therapy, task-oriented training, excellent team coordination and early discharge planning. Both animal and human research suggests that the earlier rehabilitation starts, the better the outcome. In fact, people who start rehabilitation later may never recover as much as those who start early. Early-intensive rehabilitation care for both acute and subacute stroke patients improves arm and leg motor recovery, walking mobility and functional status, including independence in self-care and participation in leisure activities. It is important that the rehabilitation be tailored to the tasks that need to be retrained and developed. Another vital component is the need for all of the professionals involved to work together as a coordinated, specialized team, meeting regularly to discuss the rehabilitation goals and progress. Early discharge planning, including home assessment and caregiver training, identifies potential barriers to discharge and promotes efficient transition back to the community.

System Implications

- Timely access to specialized, interprofessional stroke rehabilitation services, regardless of geographic location of patients’ home community.
- A critical mass of trained healthcare providers functioning as a coordinated interprofessional team during the rehabilitation period following stroke.
- Adequate clinician resources to provide the recommended intensity of individualized therapies for stroke patients.
- Establishment of protocols and partnerships between inpatient rehabilitation and community care providers to ensure safe and efficient transitions between hospital and community. Particular
Considerations should be made for patients residing in more rural or remote locations.

- Optimization of strategies to prevent the recurrence of stroke.
- Stroke rehabilitation support initiatives for caregivers.
- Process for patients and caregivers to re-access the rehabilitation system as required.

**Performance Measures**

1. **Median length of time from stroke admission to an acute care hospital to assessment of rehabilitation potential by a rehabilitation healthcare professional.**
2. **Median length of time between stroke onset and admission to stroke inpatient rehabilitation.**
3. **Number or percentage of patients admitted to a stroke unit — either a combined acute care and rehabilitation unit or a rehabilitation stroke unit in an inpatient rehabilitation facility — at any time during their hospital stay (acute and/or rehabilitation) (core).**
4. **Final discharge disposition for stroke patients following inpatient rehabilitation: percentage discharged to their original place of residence, percentage discharged to a long-term care facility or nursing home, percentage discharged to supportive housing or assisted living (core).**
5. **Percentage of patients requiring readmission to an acute care hospital for stroke-related causes (core).**
6. **Median length of time spent on a stroke unit during inpatient rehabilitation.**
7. **Median number of days spent in “alternate level of care” in an acute care setting before arrival in inpatient rehabilitation setting.**
8. **Change (improvement) in functional status scores using a standardized assessment tool from admission to an inpatient rehabilitation program to discharge.**
9. **Total number of days spent in inpatient rehabilitation, by stroke type.**
10. **Number of patients screened for cognitive impairment using valid screening tool during inpatient rehabilitation.**
11. **Time from stroke onset to mobilization: sitting, standing upright, walking with or without assistance.**
12. **Median number of days spent in alternate level of care or inpatient rehabilitation while waiting for return to home or placement in a residential or long-term care setting.**

**Measurement notes**

- Some acute care hospitals provide combined acute and rehabilitation stroke units, where patients progress to “rehabilitation status” and may not actually move or change locations. This information could be found in patient records through primary chart audit.
- Many performance measures require primary chart audit of inpatient rehabilitation records. Documentation quality by rehabilitation staff may create concerns about data availability and data quality.
- The Canadian Institute for Health Information has a database known as the National Rehabilitation Reporting System. This database includes data on all inpatient rehabilitation encounters to designated rehabilitation beds. It is mandated in some provinces to submit data to the National Rehabilitation Reporting System; in other provinces, it is optional. The National Rehabilitation Reporting System has information on over 80 percent of all inpatient rehabilitation encounters in Canada and can distinguish stroke cases from other rehabilitation patients by diagnosis.
Duration or intensity of services by rehabilitation professionals requires a chart review or consistent use of reliable workload measurement tools implemented locally or regionally.

For performance measure 2, efforts should be made to collect information on reasons for delay, if any, in admission to inpatient rehabilitation from acute care. These may include such issues as bed availability, patient health status and other aspects of the referral and transfer process. This information may provide direction on areas to target quality improvement initiatives.

### Implementation Resources and Knowledge Transfer Tools

- Canadian Stroke Strategy Guide to the Implementation of Stroke Unit Care
- Link to EBRSR
- Link to StrokEngine
- The Certificate of Stroke Rehabilitation Program: University of Alberta Department Rehabilitation Medicine

### Summary of the Evidence:

#### Importance of adequate intensity of inpatient rehabilitation

A review by Cifu and Stewart found four studies of moderate quality that reported a positive correlation between early onset of rehabilitation interventions following stroke and improved functional outcomes. The authors noted that early onset of rehabilitation was strongly associated with improved functional outcomes.

Ottenbacher and Jannell conducted a meta-analysis including 36 studies with 3717 stroke survivors and demonstrated a positive correlation between early intervention of rehabilitation and improved functional outcome. According to the Evidence-Based Review of Stroke Rehabilitation, the intensity of rehabilitation needs to be considered. De Wit and colleagues studied four European countries (Belgium, United Kingdom, Switzerland and Germany) and found that gross and functional recovery were better for patients in the German and Swiss centres. In an earlier study of the same centres, it was reported that German and Swiss patients received more therapy per day in comparison with patients in the other centres.

The Evidence-Based Review of Stroke Rehabilitation (EBRSR) concluded that there was strong evidence that greater intensities of physiotherapy and occupational therapy resulted in improved functional outcomes after stroke. The authors highlighted, however, that the overall beneficial effect of intensified therapy was modest and positive benefits may not hold over time.

The EBRSR indicates that the weight of evidence suggests that more intensive therapy is associated with greater rehabilitation gains. However, the European Stroke Organization’s 2008 Guidelines for the Management of Ischemic Stroke and Transient Ischemic Attack have indicated that currently available data do not allow for recommendations on minimal or maximum therapy times. Nevertheless, the current standard of care at publicly-funded stroke rehabilitation facilities in the United States is to provide at least three hours of therapy. Failure to do so results in a loss of reimbursement.

#### Important elements of inpatient stroke Rehabilitation

The Ottawa Panel Evidence-Based Clinical Practice Guidelines for Post-Stroke Rehabilitation include various types of physical rehabilitation techniques used for management of patients following a stroke event. Evidence was identified and synthesized, serving as the basis for the 147 recommendations put forward by the panel. The final recommendations supported the use of therapeutic exercise, task-oriented training, gait training, balance training, constraint-induced movement therapy, treatment of shoulder subluxation, electrical stimulation, transcutaneous electrical nerve stimulation, therapeutic ultrasound, acupuncture, and intensity and organization of rehabilitation after stroke. For patients with subacute stroke, clinically important benefit was demonstrated for enhanced upper-limb treatment (Evidence Level A), enhanced physiotherapy (Evidence Level A) and enhanced occupational therapy (Evidence Level A).

Effective discharge planning is essential for the successful reintegration of individuals living with stroke into the community and should be considered at all transition points along the continuum of stroke care. Discharge planning...
Recommendations 5.4 – 5.5
SCORE Recommendations for upper and lower limb management following stroke

NOTES on these recommendations
These recommendations have been revised and reformatted to assist clinicians to better follow the rehabilitation evidence for motor recovery. Clinicians should identify the therapeutic goal of interest at the top of each section.

The most important and feasible recommendations are early in the section. Each recommendation is followed by the supporting evidence levels according to the amount of time since the stroke, with early being defined as less than six months and late being defined as greater than six months.

For 2010, the recommendations for shoulder pain have been moved to this section from the cross-continuum section. In addition, the recommendations for the upper limb have been added as part of a full integration and update of the previous SCORE recommendations for stroke rehabilitation.

5.4 SCORE Recommendations for Upper Limb and Shoulder

Best Practice Recommendation 5.4.1
Management of the Arm and Hand

**Therapeutic Goal: Improved arm and hand skill for independence**

i. Exercise and functional training should be directed towards enhancing motor control for restoring sensorimotor and functional abilities. [Evidence Levels: Early – Level A; Late – Level A].

ii. Engage in repetitive and intense use of novel tasks that challenge the patient to acquire necessary motor skills to use the involved limb during functional tasks and activities [Evidence Levels: Early – Level A; Late – Level A].

iii. The Upper extremity program should include strength training to improve impairment and function after stroke for upper extremity. Spasticity is not a contra-indication to strength training\(^{374}\) [Evidence Levels: Early - Level A; Late - Level A].

iv. Therapists should provide a graded repetitive arm supplementary program for patients to increase activity on ward and at home. This program should include strengthening of the arm and hand (small wrist weight, putty, hand gripper), range of motion (stretching, active exercises), and gross, fine motor skills (e.g., blocks, Lego, pegs), repetitive goal and task-oriented activities designed to simulate partial or whole skill required in activities of daily living (e.g. folding, buttoning, pouring, and lifting). The GRASP protocol suggests one hour per day, six days per week \(^{375}\) [Evidence Levels: Early-Level A; Late-Level C].

v. Following appropriate cognitive and physical assessment, mental imagery should be used to enhance sensory-motor recovery in the upper limb [Evidence Levels: Early-Level A; Late-Level B].

vi. Functional Electrical Stimulation (FES) should be used for the wrist and forearm to reduce motor
impairment and improve functional motor recovery [Evidence Levels: Early-Level A; Late-Level A].

vii. Intensive Constraint Induced Movement Therapy (CIMT) should not be used for individuals in the first month post stroke until further research is completed [Evidence Levels: Early-Level A; Late-N/A].

viii. Consider the use of intensive CIMT for a select group of patients who demonstrate at least 20 degrees of wrist extension and 10 degrees of finger extension, with minimal sensory or cognitive deficits. Intensive training should involve restraint of the unaffected arm for at least 90 percent of waking hours, and at least six hours a day of intense upper extremity training of the affected arm for two weeks [Evidence Level: Between 3 and 6 months-Level A; Late- Level A].

ix. Consider the use of modified CIMT for a select group of patients who demonstrate at least 20 degrees of wrist extension and 10 degrees of finger extension, with minimal sensory or cognitive deficits. Modified CIMT consists of constraint of the unaffected arm with a padded mitt or arm sling for a minimum of six hours a day with two hours of therapy for fourteen days [Evidence Levels: Early- Level A; Late- Level A].

x. EMG biofeedback systems should not be used on a routine basis. (adapted from RCP) [Evidence Levels: Early- Level A; Late- Level A].

xii. For patients whose arm and hand are predicted to be less than stage three as measured by the Chedoke-McMaster Stroke Assessment, enhance sensory-motor recovery of the upper limb by using sensory motor stimulation [Evidence Levels: Early- Level B; Late- Level B]. This consists of passive and active-assisted range of movement that also includes placement of the upper limb in a variety of positions within the patient’s visual field (Adapted from HSF-AH 1.2a) [Evidence Levels: Early-Level C; Late Level C].

xii. There is insufficient evidence to recommend for or against neurodevelopmental treatment in comparison to other treatment approaches for motor retraining following an acute stroke [Evidence Levels: Early-Level B; Late Level B].

xiii. Use adaptive devices for safety and function if other methods of performing specific tasks are not available or cannot be learned [Evidence Levels: Early- Level C; Late Level C].

xiv. Assess the need for special equipment on an individual basis. Once provided, equipment should be re-evaluated on a regular basis. [Evidence Levels: Early-Level C; Late-Level C].

Rationale:

Stroke frequently affects the function of the arm and a large number of stroke survivors with arm weakness at stroke onset do not regain normal function. Bilateral arm function is critical for almost every daily activity. A number of techniques have been developed for those individuals who have some minimal arm movement.

The rehabilitation techniques that can be used are expanding and speak to the need for increased access to therapy time to carry out these techniques.

System Implications

To achieve timely and appropriate assessment and management of arm and hand function the organization requires:

• Initial standardized arm and hand function assessment performed by clinicians experienced in stroke and stroke rehabilitation.

• Timely access to specialized, interprofessional stroke rehabilitation services.

• Timely access to appropriate type and intensity of rehabilitation for stroke survivors.
• Access to appropriate equipment
• Long-term rehabilitation services widely available in nursing and continuing care facilities, and in outpatient and community programs.

### Performance Measures

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

### Measurement Notes

- A data entry process will need to be established to capture the information from the outcome tools such as the Chedoke-McMaster Stroke Assessment
- The FIM ® Instrument data can be found in the National Rehabilitation Reporting System database at the Canadian Institute of Health Information for contributing organizations.

### Implementation Resources and Knowledge Transfer Tools

- FIM ® Instrument
- Chedoke-McMaster Stroke Assessment
- Chedoke-McMaster Arm and Hand Activity Inventory
- Chedoke-McMaster Spasticity sub-scale
- Modified Ashworth Scale
- Box and Block Test
- Nine Hole Peg Test

### Summary of the Evidence:

There is strong evidence that treatment of the upper extremity and hand post-stroke using effective interventions can impact on motor recovery and functional outcomes beyond the improvement that has been seen with conventional therapies.

Functional Electrical Stimulation (FES): A high quality study found FES in addition to conventional therapy more effective than conventional therapy alone in the early period post-stroke for improving hand function and dexterity. However these improvements were not maintained in the long-term (at 32 week follow-up). The findings related to functional independence are conflicting. While two studies of FES found no improvement in functional independence with FES, a more recent study found significant differences in favour of FES in conjunction with occupational therapy versus occupational therapy alone. For patients late after stroke (>6 months) there is strong evidence that FES with conventional therapy is more effective than conventional therapy alone for improving hand function and dexterity, and range of motion.

Strength training is effective in improving upper limb function as shown in a meta-analyses. Strength training improves upper-limb function in individuals with stroke: a meta-analysis. Strength training should not be avoided in those with spasticity as spasticity has not been shown to be a contraindication to the use of strengthening.
Task-oriented training along with strengthening is superior to neurodevelopmental treatment (NDT) treatment and other conventional therapies. Task-oriented training involves practicing real-life tasks (such as answering a telephone), with the intention of acquiring or reacquiring a skill (defined by consistency, flexibility and efficiency). The tasks should be challenging and progressively adapted and should involve active participation. This is in contrast to therapy defined as repetitive training, where a task is usually divided into component parts and then reassembled into an overall task once each component is learned. Repetitive training is usually considered a bottom-up approach, and is missing the end-goal of acquiring a skill. This may explain, in part, why a meta-analyses on repetitive task training post-stroke found no significant difference in upper limb outcomes for repetitive task use versus other therapies. The authors do add a cautionary note regarding the variability in the treatments and the relatively few studies on which to base findings.

Constraint-induced movement therapy – CIMT (constraint of the unaffected arm for at least 90 percent of waking hours, and at least six hours a day of intense UE training of the affected arm) improves upper limb for selected patients who demonstrate some degree of active wrist and arm movement and minimal sensory or cognitive deficits. Intensive Constraint induced therapy should not be used for individuals in the first month post stroke until further research is completed based on a high quality RCT that compared the effectiveness of two intensities of CIMT versus traditional UE therapy acute stroke. Those receiving high-intensity CIMT had significantly less improvement in motor function at 14 and 90 days compared to the other two groups. In the subacute phase one high quality RCT has found CIMT more effective for improving UE grip strength than traditional therapy late after stroke.

Modified constraint-induced movement therapy – mCIMT (constraint of the unaffected arm with a padded mitt or arm sling for a minimum of six hours a day with two hours of therapy for usually a minimum of 14 days). In acute stroke there is conflicting evidence from three high quality RCTs regarding whether mCIMT is more effective than conventional therapy for improving motor function and it has not been found to be more effective than traditional therapy for functional independence. In the subacute phase post-stroke two high quality studies have found mCIMT improves motor function over traditional therapy while one did not. The use of mCIMT late after stroke has been studies extensively with strong evidence that mCIMT is more effective than traditional rehabilitation for improving UE motor function.

To increase the number of hours of therapeutic use of the upper limb, it is recommended that clinicians prescribe a Graded Repetitive Arm Supplementary Program (GRASP) one hour per day six days per week on hospital ward or at home to extend practice outside of direct therapy time. The GRASP program should include strengthening (small wrist weight, putty, hand gripper), range of motion (stretching, active exercises), and gross, fine motor skills (e.g., blocks, Lego, pegs), along with repetitive goal and task oriented activities designed to simulate partial or whole skill required in ADL (e.g. folding, buttoning, pouring, and lifting).

Similarly, the use of motor imagery has been shown in a high quality study to improve arm function as compared to traditional therapy alone and may be a valuable adjunct to other upper limb interventions, and as a precursor or adjunct to the use of mCIMT. Other interventions focused on improving upper limb function such as mirror therapy, virtual reality and robot-assisted therapy may be used in conjunction with the interventions listed in the recommendations as interventions that are showing promise as adjunctive strategies for upper limb treatment.

Given the strong evidence from three high quality randomized controlled trials that biofeedback does not improve upper limb outcomes over conventional therapy, its use is not recommended.

Finally, while clinicians often place an emphasis on the use of bilateral upper limb activity, evidence from a 2010 Cochrane Review suggests that bilateral upper limb training is not more effective for improving arm function than interventions focused only on the more affected limb. Simultaneous bilateral training for improving arm function after stroke.
Best Practice Recommendation 5.4.2

Range of Motion and Spasticity in the Shoulder, Arm and Hand

**SCORE, New for 2010**

**Therapeutic Goal:** Maintain Range of Motion and Reduce Spasticity in the Shoulder, Arm and Hand

1. Spasticity and contractures should be treated or prevented by antispastic pattern positioning, range-of-motion exercises, stretching and/or splinting [Evidence Levels: Early-Level C; Late-Level C].

2. For patients with focal and/or symptomatically distressing spasticity, consider use of chemodenervation using Botulinum toxin to increase range of motion and decrease pain [Evidence Levels: Early-Level C; Late-Level A].

3. Consider use of tizanidine for spasticity in patients with generalized, disabling spasticity resulting in poor skin hygiene, poor positioning, increased caregiver burden or decreased function [Evidence Levels: Early-Level C; Late-Level B].

4. Recommend against prescription of benzodiazepines during stroke recovery period due to possible deleterious effects on recovery, in addition to deleterious sedation side effects [Evidence Levels: Early-Level B; Late-Level B].

**Rationale:**

Spasticity is an important problem after stroke that results increased tone or resistance to movement in muscles after stroke. If spasticity is not managed appropriately there may be loss of range of motion at involved joints of the arms called contractures. These contractures may interfere with functional use of the limbs.

**System Implications**

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

- Organized stroke care available, including stroke units with critical mass of trained staff and interprofessional team during the rehabilitation period following stroke.
- Timely access to specialized, interprofessional stroke rehabilitation services.
- Timely access to appropriate type and intensity of rehabilitation for stroke survivors.
- Optimization of strategies to prevent or manage spasticity both initially post stroke and at follow-up assessment.
- Long-term rehabilitation services widely available in nursing and continuing care facilities, and in outpatient and community programs.

**Performance Measures**

1. Change (improvement) in functional status scores using a standardized assessment tool from admission to an inpatient rehabilitation program to discharge.

2. Change in shoulder, arm and hand functional status scores using a standardized assessment tool (such as the Chedoke-McMaster Stroke Assessment pain scale) from admission to an inpatient rehabilitation program to discharge.

3. Median length of time from stroke admission in an acute care hospital to assessment of rehabilitation potential by a rehabilitation healthcare professional.
4. Median length of time spent on a stroke unit during inpatient rehabilitation

**Measurement Notes**
- A data entry process will need to be established to capture the information from the outcome tools such as the Chedoke-McMaster Stroke Assessment
- The FIM ® Instrument data can be found in the National Rehabilitation Reporting System database at the Canadian Institute of Health Information for contributing organizations.

**Implementation Resources and Knowledge Transfer Tools**
- FIM ® Instrument
- Chedoke-McMaster Stroke Assessment
- Modified Ashworth Scale
- Visual analog 10-point Likert pain scale

**Summary of the Evidence**

Although it is a common clinical practice, there is a dearth of evidence that positioning, range-of-motion or stretching exercises help to prevent or treat spasticity or contracture following stroke. While the results from a few RCTs with small sample sizes, 407-410 were conflicting with regard to benefit, a recent meta-analysis, 411 reported that shoulder positioning programs were not effective in preventing or reducing the loss of shoulder external rotation range of motion.

There is strong evidence that treatment with Botulinum toxin–type A reduces focal spasticity in the finger, wrist and elbow. Among the results from five randomized controlled trials with sample sizes greater than 50, all reported statistically significant decreases in modified Ashworth Scale scores following treatment, compared with placebo. 412-416 Although range of motion was not a commonly assessed outcome improvements have been reported in elbow passive range of motion. 415

In cases where spasticity is generalized, and it would be impractical to inject multiple muscle groups, or where patients are adverse to receiving injections, the use of oral agents may be considered as an alternative treatment to botulinum toxin. Tizanidine has been well-studied in other conditions including multiple sclerosis and acquired brain injury. There is a single open-label trial of the use of tizandine following stroke. 417 Following 16 weeks of treatment in which 47 patients received a maximum daily dose of 36 mg (mean 20 mg), there was a decrease in mean total modified Ashworth Scale scores (9.3 vs. 6.5, p=0.038). There were also significant improvements in pain, quality of life, and physician assessment of disability. The side effect profile of tizandine is superior to that of other oral agents including baclofen. Common side effects include dry mouth, sedation, and asthenia. Rare side-effects include elevated liver enzymes and hallucinations. 418

For further information and references, please consult the Evidence Based Review of Stroke Rehabilitation at [http://www.ebrsr.com/uploads/Module_10_upper_extremity_formatted.pdf](http://www.ebrsr.com/uploads/Module_10_upper_extremity_formatted.pdf)
**Best Practice Recommendation 5.4.3**  
**Management of Shoulder Pain following Stroke**

*Therapeutic Goal: Maintain Pain Free Shoulder and Arm*

5.4.3.1 Assessment and Prevention of Shoulder Pain

- i. The presence of pain and any exacerbating factors should be identified early and treated appropriately [Evidence Level C].
- ii. Joint protection strategies include:
  - a. Positioning and supporting the limb to minimize pain [Evidence Level B].
  - b. Protection and support for the limb to minimize pain during functional mobility tasks using slings, pocket, or by therapist and during wheelchair use by using hemi tray or arm troughs [Evidence Level C].
  - c. Teaching patient to respect the pain. [Evidence Level C].
- iii. Overhead pulleys should not be used [Evidence Level A].
- iv. The shoulder should not be passively moved beyond 90 degrees of flexion and abduction unless the scapula is upwardly rotated and the humerus is laterally rotated [Evidence Level A].
- v. Educate staff and caregivers about correct handling of the hemiplegic arm [Evidence Level A].

5.4.3.2 Management of Shoulder Pain

- i. Treat Shoulder pain and limitations in range of motion through gentle stretching and mobilization techniques focusing especially on external rotation and abduction [Evidence Level B].
- ii. Reduce hand edema by:
  - a. Active self-range of motion exercises in conjunction with elevation [Evidence Level C] to gain full range of movement of the fingers, thumb and wrist.
  - b. Retrograde massage [Evidence Level C].
  - c. Gentle grade 1-2 mobilizations for accessory movements of the hand and fingers [Evidence Level C].
  - d. Cold water immersion (Level B) or contrast baths [Evidence Level C].
- iii. Consider using FES to increase pain free range of motion of lateral rotation of the shoulder [Evidence Level A].
- iv. Consider use of acetaminophen or other analgesics for pain relief [Evidence Level C].
- v. Consider the use of botulinum toxin injections into subscapularis and pectoralis muscles for individual with hemiplegic shoulder pain [Evidence Level C].

5.4.3.3. Assessment and Management of Complex regional pain syndrome

(Also known as shoulder-hand syndrome, Reflex sympathetic Dystrophy, Sudeck's atrophy)

- i. A bone scan may be used to assist diagnosis of this condition [Evidence Level C].
- ii. Oral corticosteroids in tapering doses may be used to reduce swelling and pain due to this condition [Evidence Level B].

**Rationale:**
The incidence of shoulder pain following a stroke is high, with as many as 72 percent of adult stroke patients reporting at least one episode of shoulder pain within the first year after stroke. Shoulder pain can delay rehabilitation and recovery of function; the pain may mask improvement of movement and function or may inhibit patient participation in rehabilitation activities such as therapy or activities of daily living. Hemiplegic shoulder pain may contribute to poor functional recovery of the arm and hand, depression and sleeplessness. Preventing shoulder pain may affect quality of life.

System Implications

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

• Organized stroke care, including stroke units with a critical mass of trained staff and an interprofessional team during the rehabilitation period following stroke.

• Initial assessment of active or passive upper extremity range of motion of shoulder, based on Chedoke-McMaster Stroke Assessment score and assessment of external rotation performed by clinicians experienced in stroke rehabilitation.

• Timely access to specialized, interprofessional stroke rehabilitation services for the management of shoulder pain.

• Timely access to appropriate rehabilitation therapy intensity/ treatment modalities for management or reduction of shoulder pain in stroke survivors.

• Equipment for proper positioning of limb (pillows, troughs).

• Long-term rehabilitation services widely available in nursing and continuing care facilities, and in outpatient and community programs.

Performance Measures

1. Length of stay during acute care hospitalization and inpatient rehabilitation for patients experiencing shoulder pain (as compared with patients not experiencing shoulder pain).

2. Proportion of stroke patients who experience shoulder pain in acute care hospital, inpatient rehabilitation and following discharge into the community (NRS tool has a self report question about pain on admission/discharge)

3. Proportion of stroke patients who report shoulder pain at three-month and six-month follow-up.

4. Pain intensity rating change, from baseline to defined measurement periods.

5. Motor score change, from baseline to defined measurement periods.

6. Range of shoulder external rotation before and after treatment for shoulder pain.

7. Proportion of patients with restricted range of motion related to shoulder pain.

Measurement notes

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

• Some data will require survey or chart audit. The quality of documentation related to shoulder pain by healthcare professionals will affect the quality and ability to report some of these performance measures.

• Audit tools at a local level may be helpful in collecting shoulder pain data on patients who experience shoulder pain.

Implementation Resources and Knowledge Transfer Tools

• Visual analog pain scale
Summary of the Evidence:

The use of supportive slings and supports has been evaluated in the context of improving shoulder alignment among patients with existing shoulder subluxation. The use of these devices has been demonstrated to reduce the amount of subluxation upon radiographic evaluation; however, neither the presence, nor resolution of pain was assessed in these studies. In a small controlled trial, the proportion of patients who wore a hemisling reported a lower incidence of pain compared with patients who did not. There have been two RCTs examining the use of strapping to prevent the development of shoulder pain, with conflicting results. The use of overhead pulleys was found to result in an increase in the development of shoulder pain compared with the control condition (passive range of motion exercises) in the single RCT examining this intervention.

Ada & Foongchomcheay conducted a meta-analysis to examine the effect of electrical stimulation on shoulder subluxation following stroke. This review included the results from six RCTs. The authors suggested that there was evidence that early treatment following stroke, in addition to conventional therapy, helps to prevent the development of hemiplegic shoulder while later treatment helps to reduce pain. More recently, Church reported that 176 patients randomized to receive surface FES treatments for four weeks following acute stroke, in addition to conventional therapy, had similar outcomes in terms of pain and function compared to patients who received sham treatment. Koyuncu and colleagues also reported no differences in shoulder pain of all patients during resting, passive range of motion or active range of motion following 20 sessions of surface FES in addition to inpatient rehabilitation, compared with patients who did not receive FES treatments.

Three different treatment approaches to aid in the reduction of hand edema following stroke have been studied, including passive motion exercises, neuromuscular stimulation and intermittent pneumatic compression. The results from two small uncontrolled trials suggest that neither passive motion exercises nor neuromuscular stimulation are effective means to reduce hand edema. Based on the results from a single RCT there is evidence that two hours of intermittent pneumatic compression for one month was no more effective than standard physical therapy as a means to decrease edema.

There is no definitive therapeutic intervention for complex regional pain syndrome (CRPS). Although a wide variety of preventative measures and treatments have been used including exercise, heat, contrast baths, hand desensitization programs, splints, medications, and surgical options, there is little evidence that many of the commonly-used treatments are effective. Although physiotherapy is regarded as the cornerstone of integrated treatment, no controlled trials have been conducted to evaluate its effect in preventing the development of CRPS. A single trial using historical controls evaluated the benefit of an exercise program to reduce the incidence of CRPS following stroke. There is some evidence that oral corticosteroids are more effective than either NSAIDS or placebo in improving symptoms of CRPS.

For further information and references, please consult the Evidence Based Review of Stroke Rehabilitation.
5.5  SCORE Recommendations for Lower Limb and Gait

Best Practice Recommendation 5.5.1  
Lower Limb Mobility and Transfer Skills

Therapeutic Goal: Improve Basic Mobility and Transfer Skills

i. Task-oriented Training (i.e. Training that is progressively adapted, salient, and involves active participation) is recommended to improve transfer skills and mobility [Evidence Levels: Early-Level C; Late-Level C].

ii. Task-oriented training consisting of an extra 11 to 13 reps/days of sit-to-stand practice with eyes open and minimal use of arm support should be included in the patient’s therapy program [Evidence Levels: Early-Level A; Late-Level C].

iii. Spasticity should not limit the use of strength training in the leg [Evidence Levels: Early-Level C; Late-Level C].

iv. Assess the need for special equipment on an individual basis. Once provided, equipment should be evaluated on a regular basis [Evidence Levels: Early-Level C; Late-Level C].

v. Ankle foot orthoses may help some patients with foot drop; they should not be used routinely without proper assessment prior to prescription and follow-up to establish their effectiveness in the individual [Evidence Levels: Early-Level A; Late-Level A].

vi. Functional electrical stimulation (FES) should be considered for use in improving muscle force, strength and function (gait) in selected patients. Functional electrical stimulation must not be assumed to have sustained effects [Evidence Levels: Early-Level A; Late-Level A].

vii. Lower extremity orthotic devices may be helpful if ankle or knee stabilization is needed to help the patient walk. Prefabricated bracing can be used initially, and more expensive customized bracing reserved for patients who demonstrate a long-term need [Evidence Levels: Early-Level C; Late-Level C].

viii. There is insufficient evidence to recommend for or against neurodevelopmental therapy (NDT) in comparison to other treatment approaches for motor retraining following an acute stroke [Evidence Levels: Early-Level B; Late-Level B].

ix. Recommend that wheelchair prescriptions be based on careful assessment of the patient and the environment in which the wheelchair will be used [Evidence Levels: Early-Level C; Late-Level C].

Rationale:

Stroke frequently affects balance and the use of the legs. Before being able to walk stroke survivors must develop basic abilities to stand and transfer safely. Sit to stand training is a feasible strategy that any member of the team on a daily basis. Some individuals may not achieve independence in walking and will require a wheelchair.

System Implications

To achieve timely and appropriate assessment and management of basic mobility, postural control and transfer skills the organization requires

- Organized stroke care available, including stroke units with critical mass of trained staff and interprofessional team during the rehabilitation period following stroke.
- Initial assessment performed by clinicians trained and experienced in stroke rehabilitation.
• Timely access to specialized, interprofessional stroke rehabilitation services.
• Timely access to appropriate intensity of rehabilitation for stroke survivors, including sit to stand training.

Performance Measures

1. Change (improvement) in functional status scores (FIM® Instrument sub scores transfers and locomotion) from admission to an inpatient rehabilitation program to discharge.
2. Change (improvement) in functional status score (Berg balance) from admission to an inpatient rehabilitation program to discharge.
3. Average hours per day (minimum of three) of direct task-specific therapy provided by the interprofessional stroke team.
4. Average days per week (minimum of five) of direct task specific therapy provided by the interprofessional stroke team.

Measurement Notes

• Therapy time may be extracted from rehabilitation professional workload measurement systems where available

Implementation Resources and Knowledge Transfer Tools

- FIM® Instrument (Functional Independence Measure)
- Chedoke-McMaster Stroke Assessment: Impairment stages of leg, foot and postural control scales
- Timed Up and Go Test
- 6-Minute Walk Test
- Berg Balance Scale
- Chedoke McMaster lower limb activity inventory

Summary of the Evidence

A Cochrane review on physical therapy treatment approaches for the recovery of postural control and lower limb function following stroke included 21 trials.440 Eight trials compared a neurophysiological approach with another approach, eight compared a motor learning approach with another approach, and eight compared a mixed approach with another approach. A mixed approach was significantly more effective than no treatment or placebo control for improving functional independence (standardized mean difference 0.94, 95% confidence intervals [CI] 0.08 – 1.80). There was no significant evidence that any single approach had a better outcome than any other single approach or no treatment control.

Strength training should not be avoided in those with spasticity as spasticity has not been shown to be a contraindication to the use of strengthening.441

Task oriented sit to stand training consisting of an extra 11 to13 reps/daily of sit-to-stand practice with eyes open and minimal use of arm support should be included in the patient’s therapy program for patients with difficulty rising from a chair and who have difficulty with postural control.442,443 Both studies found significantly greater improvement in sit-to-stand compared to controls. Specifically, Barreca’s study found a significant between-group difference in the number of patients who were successful in standing up twice from a 16-inch high surface without the use of their hands following sit-to-stand training from various heights three times weekly for 45 minutes until the task was achieved or discharge.442 Dean and colleagues (2000) found greater force production through the affected limb during sit to stand.443
**Task oriented training** In a high quality RCT Salbach and colleagues found that balance self-efficacy was better in those who received a task-oriented targeted walking intervention versus a control group.\(^{444}\) Cheng and colleagues assigned individuals to repetitive sit to stand and symmetrical standing training with a biofeedback trainer versus conventional therapy.\(^{445}\) There was no short term benefit in sit to stand but at six months the task oriented group had significant improvements and less mediolateral sway than the control group.

_For additional information and more extensive reviews of the literature, please refer to:_
StrokEngine [www.strokengine.ca/](http://www.strokengine.ca/)
Evidence Based Review of Stroke Rehabilitation [www.ebrsr.ca](http://www.ebrsr.ca)

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**Best Practice Recommendation 5.5.2**

**Lower Limb Spasticity Following Stroke**

**Therapeutic Goal:** Maintain Range of Motion and Reduce Spasticity of the Leg

i. Spasticity and contractures should be treated or prevented by antispastic pattern positioning, range-of-motion exercises, stretching and/or splinting. (SCORE) [Evidence Levels: Early-Level C; Late-Level C].

ii. For post-acute stroke patients with focal and symptomatically distressing spasticity consider use of chemodenervation using botulinum toxin injection to increase range of motion. [Evidence Levels: Early-Level C; Late-Level A].

iii. Consider use of tizanidine in patients with generalized spasticity. [Evidence Levels: Early-Level B; Late-Level B].

iv. Recommend against prescription of benzodiazepines during stroke recovery period due to possible deleterious effects on recovery, in addition to deleterious sedation side effects. [Evidence Levels: Early-Level C; Late-Level C].

**Rationale:**

Spasticity is an important problem after stroke that results in increased tone or resistance in muscles after stroke. If spasticity is not managed appropriately then there may be loss of range of motion at involved joints of the legs called contractures. These contractures may interfere with functional use of the limbs although in other cases patients may use their spasticity in a functional manner to walk post stroke.

**System Implications**

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

- Organized stroke care available, including stroke units with critical mass of trained staff and interprofessional team during the rehabilitation period following stroke.
- Initial assessment performed by clinicians experienced in stroke rehabilitation.
- Assessment for AFO should be considered to correct significant ankle inversion
- Timely access to specialized, interprofessional stroke rehabilitation services.
- Timely access to appropriate intensity of rehabilitation for stroke survivors.

**Performance Measures:**
**Measurement Notes:**

**Implementation Resources and Knowledge Transfer Tools**
- Functional Independence Measure (FIM® Instrument)
- Chedoke-McMaster Stroke Assessment

**Summary of the Evidence**

There have been very few studies published examining the prevention or treatment of spasticity or contracture using antispastic pattern positioning, range of motion exercises, stretching and/or splinting in the lower extremity. One small RCT (n=16) reported that eight sessions of functional task practice combined with ankle joint mobilizations, provided over four weeks, resulted in increased ankle range of motion, compared with a group that received therapy only, in the chronic stage of stroke. The subjects in the intervention group gained 5.7 degrees in passive ankle range of motion compared with 0.2 degree degrees in the control group (p<0.01).

There have been fewer studies examining the use of Botulinum toxin–type A (BT-A) in the lower extremity compared with the upper. Three RCTs that compared BT-A with placebo have been published. Kaji and coworkers (2010) randomized 120 patients with lower limb spasticity following stroke greater than six months to receive a single treatment of 300 U Botox® or placebo. There was a significant mean reduction in modified Ashworth Scale scores at weeks four, six and eight in the treatment group compared with the control group; however, there were no significant differences between groups at week 10 or 12. Pittock and colleagues compared escalating doses of BT-A with placebo and found that the highest dose of BT-A (1,500 U Dysport®) was associated with the greatest relief of calf spasticity compared with placebo at four, eight and 12 weeks following treatment. Lower doses (500 and 1,000 U) resulted in significant reductions in spasticity at week four only. Burbaud and colleagues randomized 23 adult hemiparetic stroke patients with ankle plantar flexor and foot invertor spasticity to receive a single injection of botulinum toxin and one of placebo in random order, at day 0 and day 90. Following treatment, there was a significant reduction in spasticity associated with the ankle movement (extensors and invertors).

For further information and references, please consult the Evidence Based Review of Stroke Rehabilitation

**Best Practice Recommendation 5.5.3**  
**Lower Limb Gait following Stroke**

**Therapeutic Goal: Improve Walking Ability and Speed**

i. Task-specific training is recommended to improve performance of selected tasks for the lower extremity [Evidence Levels: Early-Level B; Late-Level B].

ii. Consider Treadmill based Gait training (without body support) to enhance walking speed, endurance, and walking distance in persons post stroke. Treadmill training is suggested for 30 min, five days per week for two to three weeks [Evidence Levels: Early-Level C; Late-Level B].

iii. There is no conclusive evidence that body weight supported treadmill training (BWSTT) is superior to over ground training to enhance walking abilities. BWSTT could be considered when other strategies for walking practice are unsuccessful in those patients with low ambulatory function [Evidence Levels: Early-Level B; Late-Level B].

iv. Following appropriate medical evaluation, patients should participate regularly in an aerobic exercise program that takes into consideration the patient’s co-morbidities and functional limitations, to improve gait speed, endurance, stroke risk factor profile, mood and possibly cognitive abilities [Evidence Levels: Early-Level B; Late-Level B].

**Rationale:**

Stroke frequently affects balance and the use of the legs. Walking is critical to regaining normal roles in society. The ability to walk also requires sufficient balance to avoid falls. One critical element is walking endurance and speed for walking to be a feasible alternative to wheelchair mobility.

**System Implications**

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

- Organized stroke care available, including stroke units with critical mass of trained staff and interprofessional team during the rehabilitation period following stroke.
- Initial standardized assessment performed by clinicians experienced in stroke rehabilitation.
- Timely access to specialized, interprofessional stroke rehabilitation services.
- Timely access to appropriate intensity of rehabilitation for stroke survivors.
- Access to appropriate equipment.
- Access to ECG monitored exercise stress testing and experienced physician to develop appropriate intensity of aerobic exercise.

**Performance Measures:**

1. **Change (improvement) in functional status scores (FIM® Instrument sub score locomotion) from admission to an inpatient rehabilitation program to discharge.**
2. **Change (improvement) in functional status score (CMSA lower limb sub scale) from admission to an inpatient rehabilitation program to discharge.**
3. Average hours per day (minimum of three) of direct task-specific therapy provided by the interprofessional stroke team.
4. Average days per week (minimum of five) of direct task specific therapy provided by the interprofessional stroke team.

**Measurement Notes:**

- Therapy time may be extracted from rehabilitation professional workload measurement systems.
A number of treatment interventions are effective in enhancing lower limb function and gait post-stroke.

**Aerobic exercise** has been shown to be effective but often features a “cocktail” of different types of treatment (e.g. strength training, flexibility training as well as a strong aerobic training component, bicycling, water aerobics) so conflicting research findings may be due, in part, to the combination of different treatments. Overall the findings suggest that studies that include only cycling training do not find benefits greater than control intervention. In the sub-acute phase (>1 month) there is strong evidence from two high quality studies that aerobic exercise is effective in improving endurance and balance while the evidence on walking distance is conflicting, with Duncan finding effectiveness and Katz-Leurer finding no benefit versus conventional treatment. Of note, the intervention by Duncan and colleagues was for a longer period (12-14 weeks and included endurance, strength, balance, and upper extremity exercise) versus Katz-Leurer’s progressive cycling program for eight weeks.

**For aerobic exercise late after stroke** the evidence is weaker with limited evidence that aerobic activity improves endurance and conflicting evidence regarding walking distance. Pang and colleagues found a significant effect of the 19 week FAME program that included 19 weeks of cardiorespiratory fitness, mobility, balance and leg muscle strength exercises compared to the control group who received a 19-week seated upper extremity exercise program, but Lee’s group found no greater improvement after 10 to 12 weeks of aerobic cycling. Similarly, Chu and colleagues found a significant difference in walking speed following eight weeks of water-aerobics versus a control treatment of hand and arm exercise offered in sitting while Lee found no effect after aerobic cycling. The use of lower limb strengthening alone does not have a positive effect on gait speed or walking distance.

**Task oriented training** (also called task-specific training) involves practicing real-life tasks, with the intention of acquiring or reacquiring a skill. The tasks should be challenging and progressively adapted and should involve active participation. The few studies on patients in the acute stage (<one month) suggest that task-oriented training is not more effective than Bobath treatment to improve lower extremity motor function, or walking speed. It should be noted that the Richards and colleagues’ study may not have been adequately powered to find significant results but showed a trend in favor of the task oriented training group. In the subacute stage (>one month) there is moderate evidence from one high quality RCT that task-specific training may improve walking endurance and functional mobility. Late post stroke (>six months) task-specific training improves gait endurance and speed but not functional mobility as measured by timed up and go compared to various control interventions.

**Treadmill training** should be considered for increasing walking speed, endurance and distance late post stroke. In a high quality RCT, the treadmill group had better walking speed, endurance, and walking distance following an intervention consisting of 2.5 weeks/5 days week for 30 min of treadmill training versus a control intervention consisting of outdoor walking. Macko and colleagues (2005) also found significantly greater improvement in ambulatory performance and mobility function in the group receiving 6 months of treadmill training versus conventional rehabilitation.

**Treadmill training with body weight support (BWS)** has been found to be effective for patients with initial poor ambulatory status. Walking speed was significantly faster at post-treatment and at three-month follow-up for patients with sub-acute stroke who received BWS treadmill training as compared to treadmill training without BWS but only in patients with low ambulatory status. Kosak and colleagues (2000) also found significant improvements in walking speed in sub-acute patients with low ambulatory status (but not high ambulatory status)treated with BWS compared to aggressive bracing-assisted walking over ground. Similarly, in a high quality...
RCT studied patients with acute stroke who were non-ambulatory initially. The group that received treadmill training for up to 30 minutes per day walked independently significantly earlier (on average two weeks earlier at five weeks compared to at seven weeks) versus a control group that received 30 minutes of over ground walking. Franceschini and coworkers (2009) compared 60 minutes five days a week for four weeks of treadmill training with BWS to over ground gait training in patients with sub-acute stroke and found no differences before the groups on measures of functional walking measures or walking speed.

For additional information and more extensive reviews of the literature, please refer to:
StrokEngine www.strokengine.ca/
Evidence Based Review of Stroke Rehabilitation www.ebrsr.ca

**Best Practice Recommendation 5.6**

**Outpatient and Community-Based Stroke Rehabilitation**

After leaving hospital, stroke survivors must have access to specialized stroke care and rehabilitation services appropriate to their needs (acute and/or inpatient rehabilitation) [Evidence Level A].

i. Early supported discharge should be considered for patients discharged to the community [Evidence Level A].

Refer to Recommendation 6.5 for additional information.

ii. People who have difficulty in activities of daily living, including self-care, productivity and leisure, should receive occupational therapy or interprofessional interventions targeting activities of daily living [Evidence Level A for adults; Evidence Level C for pediatrics].

iii. Patients who are identified as high risk for falls in the community should have a comprehensive set of interventions implemented, such as an individually prescribed exercise program, in order to prevent or reduce the number and severity of falls [Evidence Level A].

iv. People with difficulties in mobility should be offered an exercise program specific to those difficulties and monitored throughout the program [Evidence Level B].

v. Patients with aphasia should be taught supportive conversation techniques [Evidence Level A].

vi. Patients with dysphagia should be offered swallowing therapy and opportunity for reassessment as required [Evidence Level A].

vii. Children affected by stroke should be offered advice on and treatment aimed at achieving play, self-care, leisure and school-related skills that are developmentally relevant and appropriate in their home, community and school environments [Evidence Level B].

viii. Stroke survivors should be provided with a cardiovascular fitness program to maximize functional outcomes after stroke (and as part of overall vascular risk reduction). Patients should be prescribed modified activities to allow age appropriate target heart rates to be achieved for 20 to 30 minutes three times per week [Evidence Level B].

**Rationale**

More than 70 percent of patients who have experienced a stroke will require some form of rehabilitation by at least one rehabilitation discipline such as physical or occupational therapy or speech-language pathology. Stroke survivors who receive outpatient stroke rehabilitation have been found to have greater improvement in key outcomes compared with patients in the community who do not participate in outpatient rehabilitation. Community-based rehabilitation may be defined as care received once the patient has passed the acute stage and has transitioned back to their home and community.
In smaller communities and rural and remote settings, access to outpatient and/or community rehabilitation presents a significant challenge.

### System Implications

There is a marked lack of outpatient and community-based rehabilitation resources and the health system must provide the following:

- Organized and accessible stroke care in communities.
- Increased number of experienced clinicians experienced practicing in outpatient and community rehabilitation.
- Timely access to stroke rehabilitation services in the community after discharge.
- Optimization of strategies to prevent the recurrence of stroke.
- Stroke rehabilitation support for caregivers.
- Long-term rehabilitation services widely available in nursing and continuing care facilities, and in outpatient and community programs.
- Increased use of telemedicine technologies to broaden access to outpatient rehabilitation services.

### Performance Measures

1. **Percentage of stroke patients discharged to the community who receive a referral for ongoing rehabilitation before discharge from hospital (acute and/or inpatient rehabilitation) (core).**
2. Median length of time between referral for outpatient rehabilitation to admission to a community rehabilitation program.
3. Frequency and duration of services provided by rehabilitation professionals in the community.
4. Change in functional status scores, using a standardized measurement tool, for stroke survivors engaged in community rehabilitation programs.
5. Length of time between referral for ongoing rehabilitation to commencement of therapy.
6. Percentage of persons with a diagnosis of stroke who receive outpatient therapy after an admission to hospital for a stroke event.
7. Percentage increase in Telehealth/Telesstroke coverage to remote communities to support organized stroke care across the continuum and provide rehabilitation assessments and ongoing rehabilitation monitoring and management for stroke survivors in the community.
8. Number of stroke patients assessed by physiotherapy, occupational therapy, speech–language pathologists and social workers in the community.

### Measurement notes

- Many performance measures require targeted data collection through audits of rehabilitation records and community program records. Documentation quality may create concerns about data availability and data quality.
- Information regarding frequency and duration of services by rehabilitation professionals requires a chart review or consistent use of reliable workload measurement tools that are implemented locally or regionally.
- Data availability regarding community programs varies considerably across programs, regions and provinces. Efforts should be made to introduce standard audit tools for collection of these data.

### Implementation Resources and Knowledge Transfer Tools

| FIM ® Instrument | Chedoke-McMaster Stroke Assessment | Reintegration to Normal Living Index | Leisure section of the Assessment if Life Habits (LIFE-H) | Stroke Impact Scale |

**Summary of the Evidence**

Across healthcare domains, there have been progressive shifts in post acute care from hospitals to community settings. Options for specialized stroke care and rehabilitation may include outpatient services, day hospital programs, community-based or home-based rehabilitation services or other alternative services. While there are several options for ongoing rehabilitation environments, the location should be based on clients’ “medical status, function, social support, and access to care.”

Wade (2003) notes that there is currently no universally accepted definition of community rehabilitation. As a result, the term can be used to describe almost any combination of therapeutic services provided outside of the hospital setting.

In a comparison of inpatient and outpatient stroke rehabilitation, Weiss and colleagues (2004) noted three disadvantages of inpatient rehabilitation that support outpatient and community-based therapy. First, inpatient rehabilitation is very expensive, differing among countries and type of setting, with the cost ranging from US$235 to US$450 per patient per day. Second, in an inpatient setting patients are separated from their home and social context. Third, hospital staff emphasize the recovery of physical function, focus on discharge as the endpoint in rehabilitation and pay little attention to psychosocial issues that patients may experience after discharge.

It has been suggested that a more balanced approach between institution and community should be adopted and that home rehabilitation should be emphasized.

Outpatient and community-based stroke rehabilitation may be characterized by:

- a case coordination approach
- an interprofessional team of specialists in stroke care and rehabilitation
- services that are delivered in the most suitable environment based on client issues and strengths
- emphasis on client- and family-centred practice
- focus on clients’ re-engagement in and attainment of their desired life activities and roles
- enhancement of clients’ quality of life after stroke
- provision of intensive rehabilitation services where indicated to promote and assist in the achievement of client goals

**Comparison of models of outpatient and community-based rehabilitation:**

In a review of rehabilitation intervention factors that affect functional outcomes following stroke, Cifu and Stewart reported the results of three “moderate quality” randomized controlled trials examining the differences in functional outcomes between groups of patients who had received either home-based therapy or day hospital treatment. These authors concluded that “overall, the available literature demonstrates that participation in outpatient, home health, and day rehabilitation programs is strongly associated with improved functional outcomes after stroke.”

In a systematic review of randomized controlled trials of stroke patients, the effects of therapy-based rehabilitation services targeted toward patients residing in the community were analyzed. Researchers identified and analyzed 14 randomized controlled trials of stroke patients (n = 1617 patients) residing in the community and receiving a therapy intervention and compared this to conventional or no care. Electronic databases were searched for the years 1967 to 2001 to ensure all potentially relevant trials were included in the review. Therapy services were defined as those provided by physiotherapy, occupational therapy or interprofessional staff working with patients primarily to improve task-oriented behaviour and hence increase activity and participation. The results indicated that therapy-based rehabilitation services reduced the odds of a poor outcome (Peto OR 0.72 95%CI 0.57–0.92; p = 0.009) and increased personal activity of daily living scores (standardized mean difference 0.14, 95% CI 0.02–0.25; p = 0.02). For every 100
stroke patients resident in the community receiving therapy-based rehabilitation services, 7 (95% CI 2–11) patients would be spared a poor outcome, assuming 37.5 percent would have had a poor outcome with no treatment. The authors concluded that therapy-based rehabilitation services targeted toward stroke patients living at home appear to improve independence in personal activities of daily living.

A meta-analysis using individual patient level data to evaluate the effect of outpatient occupational therapy interventions on the enhancement of personal activities of daily living and leisure activities, reported that patients receiving additional therapies had greater independence at the end of the intervention.486

For patients with moderate to severe strokes, specialized stroke care and rehabilitation result in improved functional outcomes. Enhanced stroke rehabilitation for these patients reduces length of hospital stay and increases the likelihood of discharge home.487 Community-based stroke rehabilitation services can enhance mobility and fitness, reduce or prevent the number and severity of falls, and enable clients to access relevant information about community programs and resources.352 In addition, occupational therapy can improve function in activities of daily living and extended activities of daily living. Such interventions may reduce the potential for hospital readmission as well as reducing healthcare and caregiver burden.

**Benefits of aerobic exercise**

A randomized controlled trial assigned older individuals (aged >50 years) with chronic stroke (n = 63) to either a community-based group exercise program or a control group.488 The intervention group received a one-hour fitness and mobility exercise session, three times a week for 19 weeks. The control group participated in a seated upper-extremity program. Pang and associates concluded that significant gains were made for the intervention group in cardiorespiratory fitness, mobility and paretic leg muscle strength in comparison to the control group.488 Pang and collaborators conducted a systematic review of aerobic exercise following stroke.372 Seven randomized controlled trials were included which investigated effect of exercise for patients in the acute, subacute and chronic stages. The findings from this review suggested a significant benefit of exercise therapy regardless of the phase of recovery after stroke.

The Evidence-Based Review of Stroke Rehabilitation (EBRSR) examined the evidence related to cardiovascular and aerobic exercise following stroke and concluded that there was strong evidence to suggest that, “while cardiovascular training post stroke improves level of physical fitness and gait performance, it does not result in additional improvement in activities of daily living performance.” 28 A review suggested that, although limited, there is evidence that exercise trainability is feasible and safe in the early phases of stroke recovery when appropriate screenings and monitoring are employed.471

**Benefits of supportive conversation techniques:** There is moderate evidence that Supported Conversation for Adults with Aphasia, a technique for training conversation partners, is associated with enhanced conversational skill for both the trained partner and the individual with aphasia. There is limited evidence, based on several small studies, that training conversation partners is associated with increased well-being and social participation in addition to positive communication outcomes.

**Benefits of follow-up of dysphagia:** There is moderate evidence that rehabilitative strategies for dysphagia are associated with enhanced swallowing function.344 An estimate of incidence of dysphagia after stroke is difficult to determine; however, it is thought that the range is anywhere between 23 percent and 50 percent. While there are few clinical trials investigating effective treatment for post-stroke dysphagia, keeping patients safe during the spontaneous recovery phase is important. Singh and Hamdy suggested that this could be achieved through compensatory strategies such as changing food consistencies, regulating bolus size, head rotation before swallowing and the chin tuck maneuver.344 There is no evidence to support the use of drug therapy for dysphagia treatment after stroke.

**Pediatric stroke rehabilitation:** Given the plasticity of the young brain, rehabilitation for children following stroke or transient ischemic attack can likely lead to vast improvements in long-term outcomes.573,489 As with adult stroke patients, rehabilitation of children who have experienced a stroke or transient ischemic attack should involve an interprofessional team to ensure enhanced outcome and quality of life for the child and family.31 Neuropsychologic
assessments document cognitive and language deficits and assist in planning educational programs after a child’s stroke. The rehabilitation team must be cognizant that the emotional well-being of the family following a stroke may influence recovery of the child.41
SECTION 6.0 MANAGING STROKE CARE TRANSITIONS

This section for 2010 was created to help patients, families, and caregivers understand and move through the transitions along the continuum of stroke care. The recommendations in this section relate to particular aspects of transition management for healthcare professionals, patients, families, and caregivers.

DEFINITIONS

◆ **Transition** refers to the movement of patients among healthcare locations, providers, different goals of care, and across the various settings where healthcare services are received.

◆ **Transition management** includes working with patients, families, and caregivers to establish and implement a transition plan that includes goal setting and that has the flexibility to respond to evolving needs. Successful transition management requires interprofessional collaboration between healthcare providers, clients, families, and caregivers. It encompasses the organization, coordination, education, and communication required as patients, families and caregivers move through the stages and settings for stroke treatment, recovery, reintegration, adaptation, and end-of-life care.

◆ **The goal of transition management** is to facilitate and support seamless patient, family, and caregiver transitions across the continuum of care, and to achieve and maintain optimal adaptation, outcomes, and quality of life for the family system following a stroke. This incorporates physical, emotional, environmental, financial and social influences.
The Canadian Stroke Strategy *Transitions of Stroke Care Model* identifies the most common points of transition for stroke patients along the continuum of care. The arrows are presented as unidirectional for simplicity of the diagram. However, in many instances stroke patients will move back and forth between different stages or settings of care during short-term and long-term recovery and reintegration.
**Best Practice Recommendation 6.1**

**Supporting Patients, Families and Caregivers Through Transitions**

Patients, families, and caregivers should be prepared for their transitions between care environments by being provided with information, education, training, emotional support, and community services specific to the transition they are undergoing [Evidence Level C].

i. Patients, families and caregivers should be assessed to determine their needs and readiness for information and education, training, psychosocial support, and health and social services [Evidence Level B].

Refer to recommendation 6.2 for additional information.

ii. Patients, families and caregivers should be prepared with appropriate and realistic expectations regarding role changes, and the availability of services and resources within changing care environments [Evidence Level C].

iii. Support should include:
   a) written discharge instructions from care providers that identify action plans, follow-up care, and goals, provided to the patient, family, and primary care giver [Evidence Level C].

   Refer to recommendation 6.3 for additional information.

   b) access to a contact person in the hospital or community (designated case manager or system navigator) for post-discharge queries [Evidence Level C].

   c) access to and advice from health and social service organizations (e.g., through single points of access to all organizations) [Evidence Level C].

   d) referrals to community agencies such as stroke survivor groups, peer survivor visiting programs, and other services and agencies [Evidence Level C].

   Refer to recommendation 6.5 for additional information.

**Rationale:**

Stroke is a life-altering event that may require an extended recovery period and often leaves patients with ongoing functional impairments. Increasingly, families and informal caregivers are expected to take on tasks and responsibilities that require knowledge and skills that may be beyond their scope. This increases the caregiver burden, which often results in depression among caregivers of stroke patients (as high as 60 percent has been reported).

Similar post-stroke depression rates occur in patients and are linked to poorer recovery outcomes.

**System Implications**

- Protocols to involve families in healthcare team transition planning meetings and collaborative discussion of goal setting at all transition points.
- Resources and mechanisms to plan and deliver community-based services which consider the needs of the survivor and family/caregiver (e.g., home care services)
- Models of care that include technology such as telemedicine, regular telephone follow-up and web-based support.

**Performance Measures**

1. The change in burden of care for family members and informal caregivers measured at defined intervals throughout the recovery period following stroke and at transition points.
2. The number and percentage of patients diagnosed with post-stroke depression, measured at each transition point as a proportion of all stroke patients.

**Measurement Notes**
- Standardized and validated measures of depression and caregiver burden should be used to track occurrence and changes to these areas.

**Implementation Resources and Knowledge Transfer Tools**
- Canadian Stroke Strategy Patient and Family Guide to Stroke Best Practices
- *Timing it Right*
- Care Transition Measure 491

**Summary of the Evidence**
Cameron and Gignac conducted a conceptual review to discuss family caregivers of stroke survivors changing needs for education and support across the care continuum. Through this review they developed a framework known as “Timing is Right.” The five stages discussed are 1) event/diagnosis; 2) stabilization; 3) preparation; 4) implementation; 5) adaption. The first two phases occur during acute care, the third occurs during acute care and/or in-patient rehabilitation, and the final two phases occur in the community. During phase one (event/diagnosis) caregivers often focus on the current health event and treatment and whether or not the event is deemed life threatening by healthcare professionals. Phase two (stabilization) occurs in the acute care centers. Healthcare professionals determine the extent of the disability resulting from the stroke. Caregivers often appear calmer or express some relief in this phase, but they generally have yet to realize the extent of the physical and cognitive disability experienced.

Phase three (Preparation) occurs before the patient returns home. At this time, the patient’s medical condition has stabilized and the clinical emphasis is on preparing the patient to ultimately return home. As discharge approaches, caregivers become increasingly concerned about their abilities to provide care in the home and they specifically want information and training to assist with the provision of physical care in the home and signs of potential problems. Caregivers may also seek information about community services and assistance so they can submit applications to appropriate organizations or plan ahead. Many caregivers may experience additional strain as they struggle to partially re-establish existing family and work routines. Phase four (implementation) occurs when the patient returns to the home environment. At this time, the responsibility for providing care shifts from health care professionals to family caregivers. Patients are learning how to adapt to living in their home environment. Caregivers are “learning the ropes” as they attempt to apply the skills they have learned in the acute or rehabilitation environments to helping their family members in the home environment. Their focus is often on the provision of physical care as they attempt to develop routines. Phase five (adaptation) occurs when the home routine has been established and the stroke survivor and family caregiver begin to shift their attention to resuming usual activities in the community (i.e., community re-integration). Caregivers are actively supporting stroke survivors community re-integration including trying to find activities and work that are accessible (if needed). In addition, caregivers will develop strategies so they can resume their valued activities (e.g., respite, day programs, etc). Application of this framework has the potential to benefit future intervention efforts by identifying gaps in caregiver education, training and support.

Visser-Meily and coworkers conducted a literature review that included ten randomized controlled trials and four non-randomized studies focused on the transitions of care and needs of families and caregivers. The RCTS identified four main intervention approaches. The first, Providing specialist services, includes interventions directed at improving and facilitating discharge from hospital. Typically a stroke nurse or stroke organizer visited the patient and family to give information about health services and therapies available in the community and to give advice and emotional support to both stroke patients and their caregivers. The trials found significant overall improvements for caregivers including emotional state, satisfaction with care, increases in knowledge, and improvements in health relation quality of life and social activities of daily life. In six trials, the intervention and control groups did not differ for caregiver outcomes. In two trials, however, negative caregiver outcomes were reported in the intervention groups: a worse state of general health among caregivers in one RCT and dissatisfaction with provision of information.
coupled with a greater caregiver burden in the other.

The second intervention approach is Psychoeducation, based on five randomized controlled trials. Education was directed at gaining general knowledge about stroke or more specific knowledge about cognitive aspects. Three of the five trials reported significant improvements for caregivers. Positive effects included an increase in knowledge about and improvements in mental health. One trial reported an increase in knowledge but deterioration in social functioning in the intervention group. The third intervention, based on four trials, addressed Counseling needs. Counseling elements included learning of goal setting, problem solving, and coping strategies. Three trials found significant improvements for caregivers following counseling. Positive effects included facilitating and maintaining adaptive changes in family function; improvements in problem solving skills and measures of vitality, greater caregiver preparedness, and less depression; and increases in knowledge about care, use of active coping strategies, and seeking social support. The fourth intervention of Peer support was not addressed in any randomized trials and remains an ongoing gap in research knowledge.

Kalra and collaborators performed a randomized controlled trial with a structured caregiver training intervention (n=151) or usual care (n=149).\textsuperscript{494} Usual care was comprised of information on management of stroke; involvement in goal setting and discharge planning; informal instruction on facilitating transfers, mobility, and ADL; and information on community services and benefits. Structured caregiver training comprised usual care plus three–five sessions (30–45 min each) and an at home session of instruction and relevant hands-on training (tailored to individual patients) on pressure ulcer prevention, continence, nutrition, positioning and lifting, mobility and transfers, gait facilitation, ADL, and communication. At twelve months, patients in the caregiver training group had improved mood and quality of life, but did not differ from the usual care group for mortality, institutionalization, or function. Caregivers in the training group had improved mood and quality of life and reduced burden of care compared with the usual care group groups did not differ for caregiver function. Mean costs of care over one year were lower in the training group than in the usual care group.

Visser-Milley and coworkers examined 211 couples shortly after the patient’s admission to a rehabilitation center, two months after discharge, one year post stroke and three years poststroke to assess the changes in psychosocial functioning of spouses (burden, depressive symptoms, harmony in the relationship between patient and spouse).\textsuperscript{495} A significant effect of time (P<0.01) was found for all four aspects of spouses’ psychosocial functioning. Although burden decreased, harmony in the relationship and social relations also decreased. The depression score showed a nonlinear pattern with an initial decrease but a long-term increase. All outcomes were significantly related to caregiver coping strategies. A total of 15 percent to 27 percent of the variance in psychosocial functioning could be explained. Findings highlight the need to monitor the long-term psychosocial functioning of spouses with stroke as part of a family-centered approach. Not only burden, but also depressive mood, harmony in the relationship, and social relations are aspects of psychosocial functioning that need more attention, as demonstrated by results of negative long-term effects of stroke on these aspects of caregiver quality of life. Because passive and active coping strategies were most strongly associated with the course of psychosocial functioning, assessment of these spouses’ coping strategies should be a routine part of stroke care. Psychosocial interventions should, if applicable, teach spouses how to cope actively with the consequences of the stroke, how to decrease the negative consequences for family functioning and harmony in the relationship, and how to ask for support.

Bjorkdahl and collaborators conducted a randomized controlled trial (n=36) to evaluate if an intervention with information about stroke and its consequences, as well as practical advice and training in the home setting reduces or affects the burden of care for next-of-kin.\textsuperscript{496} Rehabilitation in the home setting was compared with outpatient rehabilitation. In the home setting, counseling about the stroke and its consequences was included. The burden of the two groups did not differ. After the intervention, there was a tendency to a lower burden for the home setting. The burden for the home setting was then unchanged from three weeks to one year, while outpatient rehabilitation showed a reduced burden over time. For the home setting, significant correlations to activity level were seen after the intervention. Findings suggest that information and counseling have a positive affect both on patient outcome and caregiver burden.

High physical dependence, advancing age, and increased anxiety in caregivers or patients and poor family support are simple and easily assessable measures of caregiver risk, which can be used in clinical practice to target caregiver
interventions. McCullagh and coworkers conducted a randomized controlled trial (RCT) of caregiver training in stroke patients undergoing rehabilitation. Stroke patients had a mean age of 74.11 years, and 120 (52%) were men. The mean age of caregivers was 65.7 ± 12.5 years, 149 (64%) were females, and 116 (50%) had received caregiver training. The mean caregiver burden score was 48.13 and 38.11 (score range of bad to good 88 to 22) and QOL score was 75±16 and 75±15 (score range of bad to good 0 to 100) at 3 months and 1 year, respectively. CBS and QOL correlated with each other and with patient (age, dependency, and mood), caregiver (age, gender, mood, and training), and support (social services and family networks) variables. Of these, only patient and caregiver emotional status, caregiver age and gender, and participation in caregiver training were independent predictors of either outcome at three months. Patient dependency and family support were additional independent predictors at one year. Social services support predicted institutionalization but not caregiver outcomes.

Smith and coworkers conducted a qualitative study to learn about family caregivers experiences and support needs during the rehabilitation phase. Nine caregivers participated in 40-60 minute in-depth qualitative interviews within the first six months post stroke. An overriding theme was differences in personal needs between older and younger caregivers. Five younger caregiver (≤55 years of age) and four older caregivers (>55 years of age) were interviewed. Younger caregivers identified informational support and training as important parts of their social support whereas older caregivers did not. Younger caregivers were also more likely to complain or criticize the healthcare system and staff than older caregivers. A common theme among older caregivers was to focus on the importance of keeping a positive outlook throughout the experience. The results from this study suggest that support programs should consider age as a factor when tailoring interventions.

Blonder and collaborators examined the effects of patient neurobehavioral characteristics such as hemispheric side of stroke, language, affect perception, stroke severity, and mood on caregiving partners’ mood, perceptions of psychological stress, and marital satisfaction the negative correlation between patient depression and spousal marital satisfaction was statistically significant ($r_1 = -0.585, p = 0.007$). There was also a trend for hemispheric side of stroke to correlate with spousal stress ($r_1 = 0.498, p = 0.025$), such that strokes in the left hemisphere were associated with greater stress, whereas strokes in the right hemisphere were associated with less stress. These results show that patient depression in particular constitutes a risk factor for marital dissatisfaction in the first few months following stroke. Given that spousal partners provide a large portion of informal support to stroke patients, successful treatment of patient depression may have benefits at the level of the individual, family, and community.

Van den Heuvel and collaborators attempted to identify caregivers at high risk for burn-out, and to find indications regarding the organization of an intervention for caregivers of stroke patients through structured interviews. ‘Confidence in own knowledge’ consisted of two factors: perceptions of the disease, resources and patient care (alpha = 0.94), and perceptions of self-efficacy (alpha = 0.86). The two factors together explained 49.5% of the total variance. From this point the first factor will be called confidence in knowledge about patient care, and the second factor confidence in knowledge about self-efficacy. Severe cognitive, behavioural and emotional changes in the patient constitute the main risk factors for caregiver burn-out. Women, younger caregivers and caregivers in poor physical health were also identified as risk groups. Caregivers with high-perceived self-efficacy, satisfied with social support, and frequently using the coping strategy confronting, experience less strain, higher mental well-being and greater vitality. Duration of the caregiver role does not influence caregivers’ strain, mental well-being or vitality. Support programs should focus on self-efficacy, social support, and the coping strategy confronting. No specific moment could be identified at which support programs should be offered.
**Best Practice Recommendation 6.2**  
**Patient and Family Education**

Stroke survivor, family and caregiver education is an integral part of stroke care that must be addressed at all stages across the continuum and at all transition points of stroke care for both adult and pediatric patients [Evidence Level A]. Patient and family education should include information sharing, teaching patients self-management skills, and training of caregivers.

i. Educational content should be specific to the phase of care or recovery and appropriate to the readiness and needs of the stroke survivor, family, and caregiver [Evidence Level B]. The scope of the educational content should cover all aspects of stroke care and recovery [Evidence Level A].
   a. General education topics should include treatment goals within each environment; community services; information about community resources that should be broadly encompassing (e.g., the broad range of therapy and treatment resources available, counseling and support groups, home renovation resources, financial/tax consultants); on-going practical information and how to seek help if problems develop [Evidence Level C]; information about the availability and potential benefits of local stroke groups [Evidence Level C].

ii. Education should be interactive, up to date, ongoing, and provided in a variety of languages and formats (e.g., written, oral, group counseling approach), and ensure communicative accessibility for stroke survivors [Evidence Level B]. Specific team members should be designated to provide and document education [Evidence Level C].

iii. Patient education should promote self-efficacy through mastering self-management skills, including action planning, modeling behaviors and problem-solving strategies, reinterpreting symptoms, and social persuasion through group support and guidance for individual efforts [Evidence Level B].
   a. Key topics in self-management training should include exercise, symptom management techniques, risk factor management, secondary stroke prevention, nutrition, fatigue and sleep management, use of medications, managing emotions of fear, anger and depression, cognitive and memory changes, training in communication with health professionals and others, and health-related problem-solving and decision making [Evidence Level B].

iv. Family and caregiver education should include training in personal care techniques, communication strategies, physical handling techniques [Evidence Level B], other daily living activity goals and preferences, how to access community services and resources, problem-solving techniques, health system navigation, and self-management [Evidence Level C].

**Rationale**

Education is an ongoing and vital part of the recovery process for stroke, which must reach the survivor, family members and caregivers. Education about stroke facilitates better understanding and supports coping and self-management. Skills training for caregivers reduces depression and perceived burden and improves quality of life. The information provided at each phase of acute care, rehabilitation, community reintegration and long-term recovery should be relevant to the patient's and the family's changing needs. Simple distribution of pamphlets is not sufficient; the delivery should be interactive and adapted to the communication challenges the stroke survivor faces, including language, cognitive, hearing, or visual.
impairment.

System Implications

- Coordinated efforts among stakeholders such as Heart and Stroke Foundations (national and provincial), Canadian Stroke Network, public health agencies, ministries of health, and care providers across the continuum of stroke care to produce patient, family and caregiver education materials with consistent information and messages.
- Resources, such as stroke recovery support groups, available in the community to provide ongoing support and education following hospital discharge.
- Coordinated process for ensuring access to and awareness of educational materials, programs, activities and other media related to stroke by healthcare professionals, patients and caregivers, including advertising the availability of educational material, effective dissemination mechanisms and follow-up.
- Access to training for care providers in programs that facilitate communication with stroke survivors with aphasia.
- English and French educational resources that are culturally, ethnically, and linguistically appropriate, and that address the needs of patients with aphasia.

Performance Measures

1. Proportion of stroke patients with documentation of education provided to patient, family and/or caregivers at each stage throughout the stroke management and recovery process (core).
2. Total time spent on patient/family education during a healthcare encounter for stroke.

Measurement Notes

- Quantity and method of patient education are very important elements of this recommendation. Measurement of patient and family education should be expanded when feasible to capture these aspects.
- Data sources include all documents, charts, and records related to patient care across the healthcare system (primary care, acute care, follow-up clinics, inpatient and outpatient rehabilitation programs, community programs and services) and may be obtained through primary chart audit or review, and various logging and audit practices of individual groups.
- Documentation quality by healthcare professionals involved in the patient’s care may affect ability to monitor this indicator reliably.

Implementation Resources and Knowledge Transfer Tools

- Canadian Stroke Strategy Patient and Family Guide to Stroke Best Practices
- Accreditation Canada Stroke Distinction Program – Evaluation Criteria for the delivery of patient and family education

Summary of the Evidence

Patient and family education are important aspects of post-stroke care and the responsibility of all healthcare team members. A conceptual review to highlight the changing needs for education and support across the continuum of stroke care for family caregivers of stroke survivors was conducted by Cameron and Gignac. The focus of care, the
individuals primarily responsible for providing that care, and patients’ self-care abilities change across care environments. Often family members who provide support also experience changes in their caregiving role. To date, however, interventions for family caregivers have not explicitly considered their changing support needs. Cameron and Gignac developed the “Timing It Right” framework, highlighting family caregivers’ changing experiences and corresponding support needs, and identified five phases of caregiver support: (1) event and diagnosis, (2) stabilization, (3) preparation, (4) implementation and (5) adaptation. The first two phases occur during acute care, the third occurs during acute care and/or inpatient rehabilitation, and the final 2 phases occur in the community. Recognition of family caregivers’ changing support needs across the continuum of stroke care will assist healthcare professionals to provide more timely and appropriate support.

Clinical practice guidelines across the stroke continuum provide strong consensus regarding the need to provide patients and family members with stroke education during hospitalization, and to provide information or other resources for social support and services. Nine randomized controlled trials of a heterogeneous group of education and support strategies for stroke patients and caregivers have provided modest evidence of some measurable benefit for patient and caregiver outcomes; negative studies tended to have small sample sizes and may have been able to detect only very large effects.

A Cochrane systematic review was conducted to assess the effectiveness of information provision strategies in improving outcomes for stroke patients and/or their identified caregivers. The review identified seventeen trials and eleven contributed data to the meta-analyses. There were significant effects in favour of the intervention on patient knowledge (standardized mean difference (SMD) 0.29, 95% confidence interval (CI) 0.12 to 0.46), caregiver knowledge (SMD 0.74 95% CI 0.06 to 1.43), patient depression scores (weighted mean difference (WMD) -0.52, 95% CI -0.93 to -0.10), and one aspect of patient satisfaction (odds ratio (OR) 2.07, 95% CI 1.33 to 3.23). Post-hoc subgroup analyses showed that strategies, which actively involved patient and caregivers, had a significantly greater effect on patient anxiety (P<0.05) and depression (P0.05) than passive strategies. The authors concluded that there is some evidence to support the routine provision of information to stroke patients and their families. Although the best way to provide information is still not clear, the results of this review suggest that strategies which actively involve patients and caregivers should be used in routine practice.

Desrosiers and colleagues conducted a randomized controlled trial (n = 62 individuals with stroke) to evaluate the effect of a leisure education program on participation in and satisfaction with leisure activities and well-being, depressive symptoms and quality of life after stroke. Experimental participants (n = 33) received the leisure education program at home once a week for 8 to 12 weeks, while control participants (n = 29) were visited at home at a similar frequency. There were statistically significant differences between the groups for satisfaction with leisure and participation in active leisure, as well as for the improvement of depressive symptoms. The results indicate the effectiveness of the leisure education program for improving participation in leisure activities, improving satisfaction with leisure and reducing depression in people with stroke.

Inadequacies in the provision of written education materials to stroke patients and their caregivers have also been reported by Hoffman and colleagues. In their recent study, 20 stroke team health professionals were asked about their use of and perspectives on written education materials. Seventy percent of participants provided materials to 25 percent or fewer of stroke patients, and 90 percent believed that patients and caregivers are only occasionally or rarely provided with sufficient written information. Health professionals were uncertain which team members provided written information and identified the need to improve the quality of materials used. It is suggested that stroke teams implement a system that facilitates the routine provision of high-quality written materials to patients and caregivers, communication among team members, and documentation and verbal reinforcement of the information provided.

Koenig and coworkers prospectively studied ischemic stroke patients (n = 130) undergoing inpatient rehabilitation and their caregivers (n = 85) to measure stroke knowledge and prestroke personal health behaviours, using the Stroke Education Assessment. Fifty-two percent of patients could not name any stroke risk factors or stroke warning signs, and 35 percent were unable to identify appropriate actions to take in a stroke emergency. Older patients were less knowledgeable than younger patients, while caregivers were more knowledgeable than patients. Regarding prestroke personal health behaviours, 28 percent of patients reported medication nonadherence.
The training of caregivers in preparation for caregiving during hospitalization and in the first few months at home was identified in a recent study by King and Semik, as discussed in the Evidence-Based Review of Stroke Rehabilitation (EBRSR), 12th edition. The researchers sampled 93 caregivers over a period of two years following stroke. Caregivers reported that preparation for caregiving was an unmet need upon discharge. Similarly, Grant conducted a randomized controlled study involving 30 primary family caregivers. Caregivers were randomly assigned to receive either a home visit or telephone contact from a registered nurse to develop social problem-solving skills to manage caregiving issues or they were assigned to a control group that received a brief sham telephone call. Intervention participants received an initial three-hour training session before discharge from rehabilitation. Once at home, caregivers assigned to the intervention group also received home visits and telephone contact of up to 45 minutes and then subsequent diminishing contact over the next three months. At two and five weeks, the telephone contact group demonstrated significantly reduced levels of depression ($p < 0.01$ and $p = 0.05$, respectively). While both intervention groups demonstrated less depression at 13 weeks, differences between intervention and control groups were nonsignificant. Level of caregiver education was significantly associated with the presence of positive problem-solving skills ($p < 0.05$). Significant differences in caregiver preparedness were demonstrated between the telephone group and the other groups at both two and five weeks but not at 13 weeks. Lower levels of caregiver preparedness were demonstrated to be significantly associated with positive perceptions of preparedness at the two-week and five-week assessments ($p < 0.05$).

A study by Kalra and collaborators involved 300 caregivers of stroke patients who were randomized to either intervention or control groups. Participants in the control group received conventional care, which included information on stroke and on prevention and management option, and included goal-setting for rehabilitation and discharge planning. They were encouraged to attend nursing and therapy activities to learn about patient abilities and to receive informal instruction on patient transfers, mobility, activities of daily living and advice on community services, benefits and allowances. The intervention group received caregiver training that included conventional care and instruction by appropriate professionals on common stroke-related problems such as skin care integrity and management, continence, nutrition, positioning, gait facilitation and advice on benefits and local services. The intervention group also received “hands on” training in lifting, handling, facilitation of mobility, transfers, continence, assistance with personal care and communication, all designed to the needs of the patient. Results of the study demonstrated that care costs for patients whose caregivers had received training were lower than the control group ($p = 0.001$). Training was associated with less caregiver burden ($p = 0.0001$), anxiety ($p = 0.0001$) and depression ($p = 0.0001$), as well as improved quality of life ($p = 0.001$). Training was also associated with lower levels of patient anxiety ($p < 0.0001$) and depression ($p < 0.0001$). Patients of trained caregivers reported higher quality of life ($p = 0.009$). A subsequent study reported that patients involved in the training had shorter lengths of stay and received less physiotherapy and occupational therapy.

Hare and colleagues conducted research to identify the long-term support needs of patients with prevalent stroke and their carers identified from practice stroke registers. Patients and their carers were invited to attend focus groups at the university, a nursing home or in the community. Twenty-seven patients and six carers participated in the study. Three major themes emerged from the focus group discussions about the long-term needs of stroke patients and their carers: emotional and psychological problems; lack of information available for patients and their families; and the importance of primary care as the first point of contact for information or problems, even if these were nonmedical. The researchers concluded that better methods of providing information for long-term survivors of stroke and of addressing their emotional and psychological needs are required. Primary care could be a key setting for helping to provide more inclusive services for both patient and carer.
Best Practice Recommendation 6.3
Interprofessional Communication

Sharing timely and up-to-date information as stroke patients transition across care settings and stages of care is essential to ensure seamless transitions and continuity of care. A process should be in place to ensure timely and effective transfer of relevant patient-related information at all points of access and transition in the healthcare system [Evidence Level B].

i. Information shared across transitions should be complete, up-to-date, accurate and appropriate to the transition settings and information needs of the receiving healthcare providers [Evidence Level B].

ii. The patient should have an up-to-date care plan defining ongoing medical, rehabilitation, psychosocial, and functional needs. The care plan should be culturally appropriate and take into consideration the patient and family's preferences and goals. The care plan should be available to everyone involved in the patient's care across the continuum [Evidence Level B].

iii. At the time of any transition, written discharge instructions for patients that include action plans, follow-up care, and goals should be provided for the patient, family and the primary care provider. The discharge instructions should include diagnoses, significant interventions, complications, medications at discharge (with appropriate prescriptions), explicit instructions for medication adjustment, plans for follow-up, functional abilities of the patient at time of transfer, and delineation of respective roles and responsibilities of caregivers [Evidence Level B].

Rationale

Stroke patient care tends to be complex and require ongoing monitoring and management. Clear communication in a timely manner is essential to ensure continuity of care, patient safety, and reduce risk of complications and adverse events resulting from the confusion and ambiguity that can arise during transition points.

System Implications

- Processes to ensure timely discharge summaries sent to primary care and other relevant healthcare professionals to facilitate continuity of care at transition points.
- Processes for coordination of ongoing medical management through primary care, community services, follow-up, and access to required healthcare services (e.g., ongoing rehabilitation or acute care).
- Resources available to enable appropriate and timely access to services at the next stage of care with the required specialties, intensity, and frequency.
- Following stroke, providing the right care and services in the right settings at the right times.
- Staff who are aware of patient/client's right to privacy and who comply with privacy legislation and patient preferences when releasing patient/client information.

Performance Measures

1. Percentage of patients for whom a discharge summary is completed within 48 hours of transition and received by the patient/family and the care provider at the next stage of care.
2. Percentage of patients with documentation that a plan of care has been established on discharge from acute care and/or inpatient rehabilitation, and with the patient’s primary care provider after discharge to the community.
Measurement Notes

- Performance measure 1: A copy the discharge summary should be included in acute care or inpatient rehabilitation chart, and in the chart of the primary care provider. It can be electronic or hard copy.
- Performance measure 2: Applies at all transition points across the continuum.

Implementation Resources and Knowledge Transfer Tools

- Canadian Interprofessional Health Collaborative: http://www.cihc.ca
- Centre for Advancement of Interprofessional Education: http://www.carpe.org.uk
- University of Toronto- Centre for Interprofessional Education: http://www.ipe.utoronto.ca

Summary of the Evidence

Research into transitions across care settings, particularly for stroke has just recently begun to emerge. Common to most investigations into transitions of care are the premises that there are significant safety and quality issues during transitions, and an interprofessional approach with clear communication and transfer of information are essential to ensuring patient safety through transitions. Many patients have more than one physician caring for them and this adds to both the burden of communicating information to all relevant providers, and to the risk of an adverse event due to lack of communication.

In 2008, the National Transitions of Care Coalition was formed and engages healthcare professionals from across disciplines to address key issues in transitions of care. They propose a framework for transitions of care and communication among providers at all transition points which includes the following elements: an accountable provider; a tool for plan of care; use of health information technology; care team processes of care; information transfer; patient and family education; and monitoring of outcomes.

A systematic review of discharge from hospital cited lack of communication between physicians as a significant factor is adverse events. The study found direct communication between hospital physicians and primary care physicians occurs infrequently (in 3-20 percent of cases studied), and the availability of a discharge summary at the first post discharge visit was low (12%-34%) and did not improve greatly even after four weeks (51%-77%); this affected the quality of care in approximately 25 percent of follow-up visits. They also reported that discharge summaries often lack key information required by the responsible physician at the next stage of care. A study by Van Walraven and colleagues highlighted that discharge summaries should be disseminated to all physicians who see patients after discharge from hospital. Due to the poor dissemination of discharge summaries, physicians have “to rely on patients’ recall or on other sources of information, such as interim discharge reports or telephone calls to hospital physicians.” This lack of complete information creates additional pressures on already busy physicians and often leads to incomplete follow-up and understanding of the intended plan of care following transition.

In a prospective study of 400 patients, Forster reported the incidence of adverse events during transitions of care was one in five. These occurred during discharge from hospital to home within three weeks of leaving hospital, and two-thirds (66%) were related to adverse drug events. Another prospective cross-sectional study involving 2644 patient discharges reported approximately 40 percent of the patients had pending test results at the time of discharge and that 10 percent of these required some action, yet the outpatient physicians and patients were unaware of these results.

Tregunno (2009) reported “The fundamental aim of any handover is to achieve the efficient transfer of high quality clinical information at times of transition of responsibility for clients.” Arora and Farnan (2007) identified factors that contribute to the risks for patients during care transitions. They cited inefficient and unstructured systems for communication of important clinical data, such as medication changes or tests that are pending; lack of a longitudinal patient relationship; and [lack of] standardized follow-up procedures. The infrequency of hospitalist-
primary care physician communication and omission of details of patients’ hospital course have further adverse impacts on patient care.

**Best Practice Recommendation 6.4**

**Discharge Planning**

Discharge planning should be initiated as soon as possible after the patient is admitted to hospital (emergency department or inpatient care) [Evidence Level B].

i. A process should be established to ensure that patients, families and caregivers are involved in the development of the care plan, which needs to include discharge planning [Evidence Level C].

ii. Discharge planning discussions should be ongoing throughout hospitalization to support a smooth transition from acute care [Evidence Level B].

iii. Information about discharge issues and possible needs of patients following discharge should be provided to patients and caregivers soon after admission [Evidence Level C].

iv. Discharge planning activities should include patient, family and team meetings, discharge and transition care plans, a pre-discharge needs assessment, caregiver training, post discharge follow-up plan, and review of patient and family psychosocial needs [Evidence Level B].

**Rationale**

Effective discharge planning is essential for smooth transitions through the continuum of stroke care. Delayed or incomplete planning leads to prolonged hospital stays and an increased risk of adverse events following discharge. Patients, family members and healthcare providers involved in each phase of care should all be involved in discharge planning to ensure effective and safe transitions.

**System Implications**

- Adequately resourced community health and support services for stroke patients.
- Capacity for case management or healthcare personnel with dedicated responsibilities for discharge planning.
- Protocols and pathways for stroke care along the continuum that address discharge planning throughout the stage of care.
- Strong relationships and formal agreements among healthcare providers within regions to increase the efficient and timely transition of patients.
- Processes, protocols, and resources for conducting home assessments by interprofessional team members soon after the stroke.
- Access to patient self-management and caregiver training and support services as required to ensure a smooth transition.

**Performance Measures**

1. **Length of stay of stroke patients in acute inpatient care (core).**
2. Average number of alternate level of care days per stroke patient in acute care settings.

**Measurement Notes**

- Length of stay should be calculated as total length of stay, and then also measured against active and alternate level of care components.
- Median values should be reported for length of stay.
• Use Canadian Institute for Health Information standardized definitions and methods to calculate alternate level of care days.
b) They can be safely managed at home [Evidence Level B].

c) They have access to comprehensive interprofessional community rehabilitation services and caregiver or support services [Evidence Level A].

iii. Early supported discharge should not be offered to patients with moderately severe to severe stroke [Evidence Level A].

iv. To work effectively, early supported discharge services must have elements similar to those of coordinated inpatient stroke teams including:

   a) A case coordination approach [Evidence Level B].

   b) An inter-professional team of specialists in stroke care and rehabilitation working in collaboration with community-based healthcare professionals [Evidence Level B].

   c) Emphasis on client- and family-centered practice, setting client goals and ongoing review of goal attainment [Evidence Level C].

   d) Stroke rehabilitation services with intensity established based on individual client needs and goals [Evidence Level B].

   e) Services that are delivered in the most suitable environment based on client issues and strengths [Evidence Level C].

   f) Regular team meetings to discuss assessment of new clients, review client management, goals, and plans for discharge [Evidence Level A].

   g) Family meetings to ensure patient and family involvement in management, goal setting, and planning for discharge from the early supported discharge program [Evidence Level A].

   h) Negotiated withdrawal and discharge from early supported discharge program [Evidence Level C].

Rationale

Early supported discharge is a model of care that links inpatient care with community rehabilitation and other services. Patients are often discharged home after a shorter length of hospital stay and receive an intensive program of rehabilitation within their home environment. Skills learned once the patients are home may be better retained since they are in the real-life environment compared to learning similar skills in hospital. Successful early supported discharge programs have reported better patient outcomes and reduced readmissions to hospital.

System Implications

- Dedicated resources for a specialized interprofessional team who provide rehabilitation services to patients immediately following discharge.

- Early supported discharge services that have similar elements and membership as those of organized stroke teams.

- Early supported discharge services targeting stroke survivors with mild to moderate disability, and considered only where there are adequate community services for rehabilitation and caregiver support.

Performance Measures

1. Readmission rates to acute care for patients discharged to the community with an early supported discharge program (within 30 days and 90 days).
2. Patient’s and/or family’s experience and satisfaction with care received.
3. Provider’s experience and satisfaction with the quality of interaction and collaboration among providers involved in care transitions.
4. Change in functional status from discharge from hospital to discharge from early supported discharge program.

Measurement Notes

- Readmission rates for early supported discharge patients should be compared to patients from the same facility or region discharged without early supported discharge.
- Risk adjustment should include age, gender, and stroke severity. If available co-morbidities should also be included in the models.
- Standardized scales, such as the FIM® Instrument, should be used for measuring functional status.

Implementation Resources and Knowledge Transfer Tools

Summary of the Evidence

Early supported discharge has been a controversial topic in the stroke research literature. The efficacy of early supported discharge for acute stroke patients was evaluated by the Early Supported Discharge Trialists (2004). The purpose of this review was to determine whether early supported discharge, with appropriate community support, could be as effective as conventional inpatient rehabilitation. Early supported discharge interventions were designed to accelerate the transition from hospital to home. Six of the trials provided coordinated interprofessional team care that was provided in the patients’ homes. One trial provided a wide range of services that were not centrally coordinated.

A variety of outcomes were assessed comparing early supported discharge with conventional care at the end of scheduled follow-up, which ranged from three months to one year. While early supported discharge programs were associated with shorter periods of initial hospitalization, their impact on the well-being of caregivers remains unknown.

There is strong evidence that stroke patients with mild to moderate disability, discharged early from an acute hospital unit, can be rehabilitated in the community by an interprofessional stroke rehab team and attain similar functional outcomes when compared to patients receiving inpatient rehabilitation. A key argument for ESD is that the home provides an optimal rehabilitation environment, since the goal of rehabilitation is to establish skills that are appropriate to the home setting.

Early supported discharge has been found to have similar outcomes for patients with milder strokes, compared to inpatient rehabilitation, although cost saving benefits are less clear.

Appropriately resourced ESD services provided for a selected group of stroke patients can reduce long-term dependency and admission to institutional care as well as reducing the length of hospital stay. No adverse impact was observed on the mood or subjective health status of patients or carers.

This systematic review revealed that recognition of the impact of stroke on patients and carers is improving with many studies focusing on the longer-term aspects of stroke recovery. Earlier discharge may have important implications for those involved. The greatest benefits were seen in the trials evaluating a coordinated interprofessional early discharge team and with patients with mild-moderate disability.

Langhorne and colleagues reported additional patient level analysis from their original Cochrane review, which examined the effects of patient characteristics and differing levels of service provision (more coordinated v. less organized) on the outcome of death and dependency. The results from an unpublished study were included in this analysis. The levels of service evaluated were as follows: (1) early supported discharge team with coordination and delivery, whereby an interprofessional team coordinated discharge from hospital and post discharge care and provided rehabilitation therapies in the home; (2) early supported discharge team coordination, whereby discharge and immediate post-discharge plans were coordinated by an interprofessional care team, but rehabilitation therapies...
were provided by community-based agencies; and (3) no early supported discharge team coordination, whereby therapies were provided by uncoordinated community services or by healthcare volunteers. There was a reduction in the odds of a poor outcome for patients with a moderate initial stroke severity (BI 10-20), (OR= 0.73; 0.57-0.93), but not among patients with severe disability (BI< 9) and also among patients who received care from a coordinated multidisciplinary ESD team (0.70; 0.56-0.88) compared to those without an ESD team. Based on the results of this study, it would appear that a select group of patients, with mild to moderately disabling stroke, receiving more coordinated ESD could achieve better outcomes compared to organized inpatient care on a stroke unit.

Outcome data reported on a review of 11 trials (1597 patients) found patients tended to be a selected elderly group with moderate disability. The ESD groups showed significant reductions (P < 0.0001) in the length of hospital stay equivalent to approximately eight days. Overall, the odds ratios (OR) (95% confidence interval (CI)) for death, death or institutionalization, death or dependency at the end of scheduled follow up were OR 0.90, 95% CI 0.64 to 1.27, P = 0.56, OR 0.74, 95% CI 0.56 to 0.96, P = 0.02 and OR 0.79, 95% CI 0.64 to 0.97, P = 0.02, respectively. The greatest benefits were seen in the trials evaluating a coordinated ESD team and in stroke patients with mild-moderate disability. Improvements were also seen in patients' extended activities of daily living scores (standardized mean difference 0.12, 95% CI 0.00 to 0.25, P = 0.05) and satisfaction with services (OR 1.60, 95% CI 1.08 to 2.38, P = 0.02) but no statistically significant differences were seen in carers' subjective health status, mood or satisfaction with services.

An interesting observation in the trial of the ESD service in Southwest Stockholm (seen at five years follow-up after stroke) was an increased independence in extended ADL, frequency of household activities and a favorable outcome as regards to resource use. Similar benefits were also observed in another study of ESD. By three months after stroke, the home intervention group showed a significantly higher score on the SF-36 Physical Health component than the usual care group. The total number of services received by the home group was actually lower than that received by the usual care group. The authors of this study concluded that prompt discharge combined with home rehabilitation appeared to translate motor and functional gains that occur through natural recovery and rehabilitation into a greater degree of higher-level function and satisfaction with community reintegration, and these in turn were translated into a better physical health.

Key components of ESD that have been reported as contributing to favorable outcomes included: in-hospital and discharge planning: a case manager or ‘key worker’ based in the stroke unit who constituted the link between the stroke unity and the outpatient care, guaranteeing continuity in both time and personnel, and enabling the smooth transition from the hospital to the home; protocols and meetings which ensured that the activities were interdisciplinary; patient motivation and focusing on more realistic rehabilitation goals; partnership between patient and therapist with significantly more patients receiving the ESD reporting that they were actively involved in planning their rehabilitation; Encouraging more focus on self-directed activities; and, more realistic understanding of future recovery.

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### Best Practice Recommendation 6.6

**Community Reintegration following Stroke**

People with stroke living in the community should have regular and ongoing follow-up to assess recovery, prevent deterioration, maximize functional and psychosocial outcomes, and improve quality of life [Evidence Level B].

i. Post–acute stroke patients should be followed up by a primary care provider to address stroke risk factors, ongoing rehabilitation needs, and to continue treatment of comorbidities and sequelae of stroke [Evidence Level C]. This follow-up ideally should occur at least every six months and for at least three years following stroke.
ii. Stroke survivors and their caregivers should have their individual psychosocial and support needs reviewed on a regular basis [Evidence Level A].

iii. Stroke survivors living in the community who have difficulty with activities of daily living should have access, as appropriate, to therapy to improve or prevent deterioration in activities of daily living [Evidence Level A].

iv. Stroke survivors and their caregivers should be monitored and assessed for depression [Evidence Level C].

Refer to recommendation 7.2 for additional information.

v. Any stroke survivor with declining physical activity, activities of daily living or mobility at six months or later after stroke should be assessed for appropriate targeted rehabilitation [Evidence Level A].

vi. Infants and children, in whom new motor, language, behaviour or cognitive deficits emerge over time, should have ongoing follow-up and assessment throughout their development [Evidence Level C].

vii. School-age stroke survivors in the community should have ongoing assessments of education and vocational needs throughout their development [Evidence Level C].

Rationale

The post-discharge period is consistently reported by stroke survivors and their families to be a stressful and challenging time as they adjust to new roles and potentially altered functional and cognitive abilities of the stroke survivor. Patients and their families often lose the social, emotional, and practical support offered by an inpatient stroke service. The evidence shows that when there is coordination of care beyond the inpatient setting and community support services are provided, patient outcomes and patient and caregiver satisfaction improves.

In children, regular follow-up is necessary to screen for other neurologic sequelae, as 30 percent of pediatric stroke survivors develop concurrent neurologic complications, including seizures, migraine, headaches, and movement disorders that may not manifest in the immediate acute and post-acute phases of stroke.

System Implications

- Adequate follow-up care providers in all provinces and territories to support community reintegration of stroke survivors.
- Assistance for stroke survivors and their families with an evolving care plan and regular follow-up assessments.
- Healthcare professionals and caregivers in the community and long-term care settings with stroke care expertise and access to ongoing education.
- Ongoing support in the form of community programs, respite care, and educational opportunities available to support caregivers who are balancing personal needs with caregiving responsibilities.
- Strategies to assist stroke survivors to maintain, enhance, and develop appropriate social support, and to re-engage in desired vocational, social, and recreational activities.
- Lists of community resources and processes to access these resources provided to all patients and families.

Performance Measures
1. **Proportion of patients who are discharged from acute care who receive a referral for home care or community supportive services.**

2. **Percentage of readmissions to acute care for stroke-related causes following discharge to the community, stratified by type of stroke.**

3. Percentage of stroke patients with documentation that information was given to patient or family on formal and informal educational programs, care after stroke, available services, process to access available services, and services covered by health insurance.

4. Number of patients referred to a secondary prevention team by the rehabilitation team.

5. Number of visits to primary care within specified time frames for stroke-related issues.

6. Number of visits to an emergency department within specified time frames.

7. Percentage of patients who return home following stroke rehabilitation who require community health services (e.g., home care or respite care).

8. Length of time from hospital discharge (whether from acute care or inpatient rehabilitation) to initiation of community health services.

9. Frequency and duration of community health services, stratified by the type of service provided.

10. Number of readmissions from stroke rehabilitation to acute care for stroke-related causes.

11. Percentage of patients who return to the community from acute hospital stay or following an inpatient rehabilitation stay who require admission to long-term care or a nursing home within six months or one year.

12. Median wait time from referral to admission to nursing home, complex continuing care or long-term care facility.

13. Documentation to indicate that assessment of fitness to drive and related patient counseling was performed.

14. Number of patients referred for driving assessment by occupational therapist in the community.

15. Measure of burden of care for family and caregivers of stroke survivors living in the community.

**Measurement Notes**

- Performance measure 1: data may be obtained from inpatient chart documentation or community support services documentation. Informal education or education received by primary care providers may be difficult to track unless specific audit tools are developed and implemented in local areas. Also refer to some of the performance measures listed in recommendation 2.1.

- Emergency department visits can be tracked through the Canadian Institute for Health Information database for participating institutions or hospital records if the patient returns to the emergency department of the hospital where inpatient stay occurred.

- The Canadian Institute for Health Information holds an administrative data set for complex continuing care and long-term care, which uses a minimal data set that is mandated in several regions across Canada. This data set uses the Resident Assessment Instrument tool for assessing functional status. At this time there are no validated comparison models between the Functional Impact Measure and the Resident Assessment Instrument.

- Hospital readmissions from inpatient rehabilitation to acute care can be obtained from hospital administrative data nationally and provincially.

- Visits to primary care and indicators related to information and education are difficult to measure. They could be obtained through surveys and standardized audit tools at the local or regional level.

**Implementation Resources and Knowledge Transfer Tools**

December 8, 2010
Stanton examined the process of adaptation for both the person who had the stroke and for their partner.

The post-discharge period is consistently reported by stroke survivors and their families to be a difficult time. Patients and their families often lose the social, emotional and practical support offered by an inpatient stroke service. In one study, only 10 percent of families were actively in contact with professional rehabilitation services after hospital discharge. In general, caregivers cope with physical limitations better than cognitive or emotional ones. When the psychosocial needs of patients and their caregivers are regularly addressed through social support, improved outcomes are observed, including reduced caregiver burden, reduced incidence of anxiety, reduced emotionalism and depression, reduced hospital readmissions and failed discharges, and facilitated reintegration of the patient in family and social roles. The evidence shows that when support services are provided, patient and caregiver satisfaction improves.

Ongoing rehabilitation (beyond six months after stroke) can further improve activities of daily living and fitness. Stroke rehabilitation involves programs to reduce impairments, enhance recovery and adapt to persisting disabilities. There is now evidence to show that after stroke, patients continue to decline. The risk of deterioration in ability can be reduced or reversed by further rehabilitation input. Therapy-based rehabilitation services can reduce poor outcomes (i.e., prevent hospital readmission), promote participation in desired activities, increase activities of daily living and reduce external home care supports. For every 100 stroke patients living in the community and receiving therapy-based rehabilitation services, seven patients are spared a poor outcome.

“Rehabilitation after stroke must also address ‘participation.’ This may require planned withdrawal of medical and rehabilitation services and substituting them with leisure and social activity to encourage independence and reintegration to normal life.” The interprofessional team should encourage the use of community resources such as peer and/or family support groups, social and recreational activities and transportation resources. “Community support can help buffer the effects of disability on the patient, family and caregivers. Living with disabilities after a stroke is a lifelong challenge. For many stroke patients and their families, the real work of recovery begins after formal rehabilitation.” Community service providers would serve 3 major roles for patients and caregivers: provide caregiver training related to life at home following stroke; provide feedback and guidance regarding linkages to community resources; and, conduct follow-up with stroke survivors and caregivers at regular intervals.

Studies looking at quality of life up to 4 years post stroke found the percentage of depression for caregivers is high and caregivers should receive ongoing assessment. Anderson examined the effect of stroke on 173 patients and their family caregivers, finding that more than a third of people who cared for stroke patients at home regarded their own health as only fair or poor. The author reported that access to help from professional rehabilitation services was patchy and inconsistently available, and that “care became a burden rather than a pleasure, social function and personal relationships deteriorated, and contact with the outside world slipped away.” Low mood was a major influence of outcome and a main component of quality of life. For caregivers, it contributed substantially to the burden of care. To alleviate the suffering, Anderson stated that the social, psychological, family and economic aspects of stroke must be directly addressed. Patients and associates, in exploring the components of care most valued by patients, undertook a qualitative study using in-depth interviews of stroke patients and their caregivers 10 months after the stroke. These researchers found that as the acute phase of stroke passes, patients and caregivers increasingly desired support related to rehabilitation, discharge, prognosis, etc. The researchers stated, “more information is needed about the stages of the stroke caregiver so that care may be tailored to respond sensitively and flexibly to the different stages.”

Stanton examined the process of adaptation for both the person who had the stroke and for their partner. Using in-depth interviews and observations of stroke survivors and their partners four to seven months after stroke, Stanton
found that the majority of “adaptation” to stroke occurred upon returning home (after discharge). Role strain, physical exhaustion and the quality of the relationship between the stroke survivor and the partner had an ongoing influence on post-stroke adaptation. Stanton indicated, “An emphasis on physical recovery and the management of self-care tasks in rehabilitation appears to be insufficient to facilitate the achievement of clients’ goals.” She also noted that access to rehabilitation services in the clients’ home and community environment may help clients and partners to remove barriers that limit resumption of past activities, break the “downward cycle that can lead to partner exhaustion and depression” and improve quality of life.

In a systematic review of randomized controlled trials of stroke patients, the effects of therapy-based rehabilitation services targeted toward patients residing in the community was analyzed. Reviewers sought to identify the proportion of patients who had deteriorated or were dependent in performing personal activities of daily living at the end of follow-up. The main results identified a heterogeneous group of 14 trials including 1617 patients. Therapy-based rehabilitation services reduced the odds of a poor outcome (Peto OR 0.72, 95% CI 0.57–0.92; p = 0.009) and increased personal activity of daily living scores (standardized mean difference 0.14, 95% CI 0.02–0.25; p = 0.02). For every 100 stroke patients resident in the community receiving therapy-based rehabilitation services, 7 (95% CI 2–11) patients would be spared a poor outcome, assuming 37.5 percent would have had a poor outcome with no treatment. “Comprehensive understanding and involvement of the person, family/caregiver, and environmental system are required for stroke rehabilitation. Without adequate resources and support it is difficult for patients to sustain the gains made during inpatient care or to make further progress in the community. It is essential that the treatment team know the patient (including history, expectations, coping style, resources and emotional support system) in order to fully engage him/her in the treatment process. Motivation and hope for improvement are critical factors for functional improvement.”

Early evaluation of physical and cognitive disability is the key to preventing avoidable complications and to planning rehabilitation. Following childhood stroke, there may be significant issues in accessing therapy. A coherent care plan for rehabilitation is integral to the process and should take into account all of the child’s needs and practical resources to ensure the needs are met in the community. Ongoing follow-up and assessment are crucial to the well-being of the child and family, as lasting cognitive deficits will affect all areas of daily functioning.
SECTION 7.0 CROSS-CONTINUUM TOPICS IN STROKE MANAGEMENT

The recommendations in Section 7 apply across the continuum of stroke care, from symptom onset through short-term recovery. Telestroke is a new recommendation for 2010 and emphasizes the need to use alternative methods to increase access to stroke expertise for all stroke patients. In addition, screening for and management of vascular cognitive impairment and post-stroke depression should be revisited beyond the post-acute recovery phase and return to the community.

Best Practice Recommendation 7.1
Telestroke

DEFINITIONS

- **Telestroke** is the use of telecommunication technology to link referring and consulting healthcare sites for real-time assessment and management of stroke patients. It is used primarily to extend access to thrombolytic treatment in healthcare facilities that do not have 24/7 on-site stroke expertise. Telestroke is also a mechanism for increasing access to stroke expertise and education in the post-acute period, focusing on secondary prevention, rehabilitation, and recovery.
- **Referring site** is the site where the patient is physically located.
- **Consulting site** is the site that has 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 tertiary stroke care centre, and that has appropriate telecommunication infrastructure for real-time audiovisual communication and rapid transmission of radiological images between referring and consulting sites.
- Refer to Box 7.1 for Technical Components of Telestroke Delivery.

Telestroke networks should be implemented wherever acute care facilities do not have on-site stroke care expertise to provide 24/7 acute stroke assessment and treatment with tissue plasminogen activator in accordance with current treatment guidelines [Evidence Level C].

7.1.1 Organization of Telestroke Delivery for Hyperacute Stroke Management

Standardized protocols should be established to ensure a coordinated and efficient approach to telestroke service delivery in the hyperacute phase of stroke to facilitate delivery of thrombolytic therapy in referring sites [Evidence Level B].

i. Telestroke consultation should be continuously available at the referring and consulting sites [Evidence Level C].

ii. Clearly defined criteria and protocols should be available for referring sites to determine when and how to initiate a telestroke referral [Evidence Level B].

iii. Two-way audiovisual communication should be in place to enable remote clinical assessment of the patient [Evidence Level A].

iv. The consultant should be a physician with specialized training in stroke management, and must have access to diagnostic-quality CT images during the telestroke consultation (see Technical Notes below) [Evidence Level A].

   a. Compared with traditional bedside evaluation and use of intravenous tissue plasminogen activator, the safety and efficacy of intravenous tissue plasminogen activator administration based solely on telephone consultation without CT interpretation via teleradiology is not well established (Evidence Level C).

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

vi. 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].

vii. A consulting physician should remain available to provide ongoing guidance to the referring site as required [Evidence Level C].

viii. Standardized documentation should be completed by both the referring site and the consulting site [Evidence Level C].

ix. At the completion of the consultation, the consulting physician should provide a consultation note to the referring site to be included in the patient medical record [Evidence Level C].

7.1.2 Organization of Telestroke Delivery for Ongoing Stroke Management

i. Two-way audiovisual communication should be in place to enable post-acute stroke prevention and rehabilitation services in communities where these services do not exist [Evidence Level A].

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

iii. The consulting healthcare provider should provide documentation to the referring site to be included in the patient medical record [Evidence Level C].

7.1.3 Staff Training and Ongoing Education

i. Service providers should be trained in using the telestroke system and understand their roles and responsibilities. Telestroke training and education should be ongoing to ensure competency [Evidence Level C].

ii. Referring physicians should know the inclusion and exclusion criteria for thrombolytic therapy and they should be familiar with the NIH Stroke Scale (NIHSS) so that they are able to assist the telestroke consultant with the video neurological examination. Ideally referring physicians should be certified in the NIHSS [Evidence Level B].

iii. Consulting physicians should have expertise and experience in managing stroke patients [Evidence Level C].

Rationale

Telestroke enables improved communication and better networking to increase access to and distribution of optimal stroke care. It assists in closing the urban/rural and tertiary/primary care gap. In many communities there are no neurologists or physicians with expertise in stroke care, and the short therapeutic time window for initiating thrombolytic therapy for acute ischemic stroke patients does not allow them to be transported long distances to regional stroke centres. Telestroke brings an experienced stroke consultant into the local emergency department “electronically”. Patients assessed by a telestroke system who are not deemed to be candidates for tissue plasminogen activator still benefit from the stroke specialist’s assessment and recommendations for optimal investigations and treatment.

Telestroke networks can also be used to facilitate early triage and management of transient ischemic attack and minor stroke, and may play a valuable role in post-acute rehabilitation and support. 198, 203, 533

System Implications

- Telestroke network development as part of larger regional or provincial stroke delivery plans, to ensure adequate clinical stroke services within communities that lack physicians with special expertise in stroke care.
**Performance Measures:**

1. **Percentage of patients who arrive at a designated referring hospital with stroke symptoms who receive access to stroke expertise through telestroke 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 hours.**

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
   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. Percentage of telestroke consults who are treated with tPA.

6. Proportion of stroke patients managed with telestroke who received tPA, who had a symptomatic secondary intracerebral hemorrhage, systemic hemorrhage, died in hospital, were discharged to long-term care vs. home or to rehabilitation.

7. Percentage of patients managed with Telestroke where the Telestroke consultant’s note is found in the patient’s chart.

**Measurement Notes**

- 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.

**Implementation Resources and Knowledge Transfer Tools**

- BC Telestroke tools
Given the vast geographic size of Canada there is an insufficient number of hospitals with the resources to manage patient with acute stroke. Acute stroke assessment and decision making for thrombolysis is complicated. Given the relative shortage of stroke specialists, most of whom are located in tertiary care hospitals, the most effective solution to this problem to date has been the use of established telecommunication technology to develop “Telestroke networks” for real time audio-visual assessment of acute stroke patients at a distance. The “spoke and hub” model of a tertiary stroke center connected to a number of distant primary care centers has been employed effectively in a growing number of telestroke networks throughout Europe and North America many of which have now been operating successfully for over a decade.533, 535

The term “Telestroke” was first used by Levine and Gorman referring to real time audio and video connection allowing two way communication usually between a tertiary center with a stroke specialist providing an emergent stroke consultation to a stroke patient and attending medical staff at a distant site that lacks 24 hours per day, 7 days a week onsite stroke expertise.536 This is accomplished with mobile or fixed compact telemedicine units located in the acute care ED environment that transmit high fidelity audio and video signals over high band width, secure, reliable cable and/or wireless networks to a viewing terminal at the distant tertiary site. Critical to a properly functioning telestroke system is the transmission of DICOM format images of the patient’s CT scan of the head (with or without vascular imaging studies) to the tertiary center for review by the on call stroke specialist. Current technology is user friendly, robust and provides high quality two-way images more than adequate to carry out a detailed stroke examination and discussion with the patient, family and on site medical team. Technology is not a limiting factor.

With a functioning telestroke system, as outlined above, the stroke specialist in the tertiary center is provided all the necessary components required for acute treatment decision making. From the clinical assessment done with the assistance of medical staff at the distant site information is acquired regarding the nature of the clinical stroke syndrome, time frame involved, location and severity of the deficit, presumed arterial territory involved, and presence or absence of significant clinical contraindications to thrombolysis and reperfusion. High quality CT images allow elimination of hemorrhagic stroke syndromes and determination of the extent and severity of ischemic damage. The stroke expert can then discuss with the attending team, patient and family at the distant site the nature of the stroke process, general prognosis and potential treatment options and their relative risks and benefits. The patient and medical team at the distant site receive essentially the same access to emergency stroke consultation as is available in the tertiary stroke center. This assessment and decision making process can take less time with a Telestroke system as compared to waiting for a local on call neurologist to arrive.537 Current evidence suggests that decision making is more accurate when all components of the evaluation are used (audio-visual assessment and PACS images) than when limited evaluation is performed as with phone with or without PACS. 538

In summary, Telestroke systems extend the effective distribution of stroke expertise and increases access of the population at large to standardized evidence based stroke care under the direction of a stroke specialist. In a disease process with a very limited time window for treatment, telestroke systems counter the effect of geography and transport times and increase the number of stroke victims who have an opportunity for reperfusion in a time frame that offers potential for improved clinical outcome. The emergency projection of stroke expertise to the patient bedside increase the number of patients with potential for treatment with r-tPA, reduces the risk of protocol violations and complications, and increases the number of stroke patients who can be treated locally in their own communities. Although difficult to quantify, telestroke consultations are also an excellent example of subspecialty input at the teachable moment and represent a critical component of skill transfer from tertiary to primary center.

In Ontario 75 percent of acute stroke patients assessed by a telestroke system are not treated with r-tPA however they receive the benefit of subspecialty advice regarding other aspects of treatment and investigation which impacts on all types of stroke. Early triage of TIAs and minor stroke is another example of the potential impact of telestroke networks.198, 201, 533 Just as an acute stroke rapid triage system represents only one component of the larger system of...
the stroke care continuum in a tertiary stroke center, a telestroke system in a primary stroke center is just one component of general stroke care improvement that comes with membership in a stroke care network. Telestroke networks and systems should be viewed as a facilitator of improved communication and better networking to increase access to and distribution of optimal stroke care. It assists in closing the urban-rural and tertiary-primary care gap.

The success of telestroke programs has been documented in numerous reports from centers in Europe and North America and the development and use of telestroke networks is supported by national and international guidelines. A number of factors will influence the practicality and feasibility of implementing telestroke networks including financial resources, population size, physician willingness and availability, access to CT, and distances and transport times.

Box 7.1 Technical Components of Telestroke Delivery

1. **Telehealth Network/Provider**
   Ideally, a telestroke program should be supported by a regional telehealth provider that provides connectivity between participating hospitals and consulting physicians. The Telehealth provider would also be responsible for data privacy and security, initiating new sites, maintenance, and ensuring quality of service.

2. **Imaging**
   - CT imaging must be available 24/7 with a technologist on site to allow emergency department arrival to CT time to be less than 30 minutes.
   - CT imaging should include axial 3 to 5 mm cuts from the foramen magnum to the vertex.
   - CT angiography, CT perfusion, and MRI are not necessary for IV tPA but if these images are available they should be provided to made available to the consulting physician.
   - Images should be stored and transmitted in the Digital Imaging and Communication in Medicine (DICOM) format. This format is the standard for handling, storing, printing, and transmitting medical imaging information.

3. **Picture Archiving Communication System (PACS)**
   - Images are stored and made available to the consulting physician using a PACS system.
   - The communication protocol TCP/IP is used to communicate between systems.

4. **Consulting Site: Physician Access to Images and Video Conferencing**
   - The consulting site physician should have access within 15 minutes or less to a computer and video conferencing system to review the patient's brain images and to connect for video conferencing.
   - Ideally, to shorten the delay in obtaining the consulting physician’s opinion, access should be provided both at the consulting site physician’s home and office/hospital.

5. **Referring Site: Audio Video Conferencing**
   - Requires high definition video conferencing system with 1.5 Mb bandwidth per call of voice quality such as Tandberg, PolyCom technologies.
   - Local Area Network on 100 Mbps which must support voice quality of service (QOS) with maximum 150 Mbps or less delay end to end in both directions.
   - Video Conferencing Gateway L. 323 (protective firewall)

6. **Consulting Site: Audio Video Conferencing**
7. System reliability
- Must maintain best practice and follow Information Technology standards.
- System reliability depends on process formation and requires collaborative change management protocols from both referring and consulting sites.
- All points on the network should be continuously monitored to ensure sites and workstations are up 24/7.

8. Technical support
- 24/7 IT support on call for PACS servicing.
- 24/7 IT support on call for video systems.
- Monitoring Network to ensure 24/7 connectivity.
- Local and or remote system service contract arrangement.

Best Practice Recommendation 7.2
Dysphagia Assessment

Patients with stroke should have their swallowing ability screened using a simple, valid, reliable bedside testing protocol as part of their initial assessment, and before initiating oral intake of medications, fluids or food [Evidence Level B].

i. Patients who are not alert within the first 24 hours should be monitored closely and dysphagia screening performed when clinically appropriate [Evidence Level C].

ii. Patients with stroke presenting with features indicating dysphagia or pulmonary aspiration should receive a full clinical assessment of their swallowing ability by a speech–language pathologist or appropriately trained specialist(s) who should advise on safety of swallowing ability and consistency of diet and fluids [Evidence Level A].

iii. Patients who are at risk of malnutrition, including all patients with dysphagia, should be referred to a dietitian for assessment and ongoing management. Assessment of nutritional status should include the use of validated nutrition assessment tools or measures [Evidence Level C].

Refer to recommendation 4.2.5 for additional information.

Rationale
Dysphagia, or difficulty swallowing, occurs in approximately 55 percent of people with new-onset strokes. Only about 50 percent of those affected recover their normal swallowing ability by six months after onset. Dysphagia may lead to poor nutrition and dehydration\textsuperscript{541, 542} and can result in aspiration leading to pneumonia. Use of a screening tool followed by a detailed swallowing analysis by a trained healthcare professional can enhance early recognition of dysphagia.

System Implications
• Development and delivery of educational programs to train appropriate staff to perform an initial swallowing screening for stroke patients. This may include staff across the continuum, such as in emergency departments, acute inpatient units, rehabilitation facilities, and community and long-term care settings.
• Access to appropriately trained healthcare professionals such as speech–language pathologists, occupational therapists, and dietitians who can conduct in-depth assessments.

Performance Measures

1. **Proportion of stroke patients with documentation that an initial dysphagia screening assessment was performed in the emergency department or during hospital admission (core).**
2. **Proportion of stroke patients with poor results on initial screening who then receive a comprehensive assessment by a speech–language pathologist or other appropriately trained healthcare professional.**
3. **Median time in minutes from patient arrival in the emergency department to initial swallowing screening by a trained clinician.**

Measurement notes

- Data sources include emergency department records, nursing notes, medical notes, and allied healthcare professional notes.

Implementation Resources and Knowledge Transfer Tools

- Ontario Stroke Network OREG Dysphagia Screening Tools Review

Summary of the Evidence

In 1994, it was estimated that dysphagia was present in approximately 21,000 new stroke patients older than 65 years of age, and that only half of these patients would recover their swallowing ability within the first week. Based on a systematic review of the stroke literature, it was estimated that 55 percent of patients demonstrate some degree of dysphagia during their acute care stay. Dysphagia tends to be less frequent and persistent after hemispheric stroke than in brain stem stroke. There is evidence for an increased risk for pneumonia in stroke patients with dysphagia (RR 3.17, 95% CI 2.07–4.87) and an even greater risk in stroke patients with aspiration (RR 11.56, 95% CI 3.36–39.77).

There is emerging evidence that a systematic program for screening, diagnosis and treatment of dysphagia in acute stroke patients may yield dramatic reductions in pneumonia rates, feeding tube dependency and length of hospital stay. Prompt attention to dysphagia screening, followed by appropriate assessment and management, is a deterrent to concomitant problems of aspiration, compromised nutrition and hydration. Westergren (2006) describes the screening activities as “a simple process aiming at identifying those having difficulties with eating” and the assessment process “as a more complex process involving the use of a multitude of parameters and sometimes invasive measures (such as testing of pharyngeal sensation and gag reflex) or instrumental procedures [such as Videofluoroscopic Study of Swallowing (VFSS) and Fiberoptic Endoscopic Examination of Swallowing (FEES)] to determine functions with a focus on specific details.”

A systematic review by Westergren (2006) examined non-instrumental (besides pulse oximetry) and non-invasive screening methods for bedside detection of eating difficulties among persons with stroke. Among the 17 articles included in the review, 14 dealt with dysphagia and four with eating difficulties. The Standardized Bedside Swallowing Assessment was used in the dysphagia studies. This screening tool involves three stages: general assessment (conscious level, postural control, voluntary cough, voice quality and ability to swallow saliva), sipping water from a spoon, and if safe then proceeding to drink water from a glass. Inter-observer and intra-observer reliability levels for SSA vary between studies, with values of Kappa = 0.24–0.48 between doctors and SLTs, 0.50–1.00.
between doctors, 0.79 between SLTs, as quoted by Smithard et al. 1997, 1998. Nurses who completed an education and training program achieved very good agreement (Kappa 0.88, exact agreement 94%) between screening and summative clinical judgment of swallowing function (n = 68, Perry 2001a).

Using the SSA for detection of aspiration shows variable sensitivity (47% to 68%), specificity (67% to 86%), PPV (positive predictive value 38% to 50%) and NPV (negative PV 85% to 88%) when used by SLTs and doctors. Using the SSA for detection of dysphagia (‘summative clinical judgment’) showed a sensitivity of 97%, specificity 90%, PPV 92% and NPV 96% and an accuracy of 86% when used by nurses. Thus, SSA is more specific for dysphagia in general than for aspiration specifically. SSA has been shown to be a stronger predictor of complication rates and functional outcome than the VFSS.

Bedside screening of each new stroke patient may involve observation of the patient’s level of alertness to participate in the screening process. It should include an evaluation of the patient’s oral motor function and oral sensation, as well as the presence of a cough. It may also include trials of fluid such as that included in the Toronto Bedside Swallow Screening Test (TOR-BSST©) or the Burke test. These tools recommend that water be administered using a preset protocol and that signs of impaired swallowing be monitored. Coughing during and up to one minute following test completion and/or “wet” or hoarse voice are suggestive of an abnormal swallow. A cautionary note here is that silent aspiration may occur in patients who do not cough or complain of any problems with swallowing or have no wet-sounding voice. If there is silent aspiration, the patient may not display any signs or symptoms on the trial swallows. It is possible for them to not demonstrate obvious problems during the initial screen and still be aspirating. Therefore all stroke patients, regardless of their screening result, should be informally monitored during their hospital stay for symptoms of swallowing problems.

A screening test should be simple to use and have proper psychometric validation before it is implemented as part of the existing stroke care program. The TOR-BSST© has been validated on over 300 patients with stroke and shown to have high reliability and high accuracy in detecting dysphagia, regardless of severity, in both acute and rehabilitation patients with stroke. Patients who have problems identified on the initial swallowing screen should be referred for specialized assessment and management to a speech–language pathologist as soon as possible. A complete assessment of swallowing includes a full bedside (clinical) assessment and, if deemed necessary, an instrumental assessment such as a video fluoroscopic or fibreoptic endoscopic assessment of swallowing.

Results from these assessments assist in determining the severity, type and prognosis of dysphagia and in planning a management program. The management program should include compensatory techniques (such as texture modifications and swallowing postures) and rehabilitative techniques. Appropriate dysphagia management reduces the risk of complications of dysphagia such as aspiration, malnutrition and dehydration as well as assists in overall recovery. Malnutrition as a result of dysphagia is a valid concern, and nutritional status should be assessed in patients with dysphagia.

For more information related to nutrition and dysphagia, refer to recommendation 4.2, “Components of acute inpatient care—Nutrition and Dysphagia.”

Best Practice Recommendation 7.3
Identification and Management of Post-Stroke Depression

All patients with stroke should be considered to be at high risk for depression. During the first assessment, the clinical team should determine whether the patient has a history of depression or risk factors for depression [Evidence Level B].
i. All patients with stroke should be screened for depression using a validated tool [Evidence Level A] (SCORE). Screening should take place at all transition points and whenever clinical presentation indicates. Transition points may include:
   a. upon admission to acute care, particularly if any evidence of depression or mood change is noted
   b. before discharge to the community from acute care or during early rehabilitation if transferred to inpatient rehabilitation setting
   c. periodically during inpatient rehabilitation
   d. periodically following discharge to the community

ii. Patients identified as being at risk for depression during screening should be referred to a healthcare professional with expertise in diagnosis and management of depression in stroke patients [Evidence Level B]. These patients should be referred to a psychiatrist or psychologist where available.

iii. Patients with mild depressive symptoms should be managed by “watchful waiting,” with treatment being started only if the depression is persistent [Evidence Level A].

iv. Patients diagnosed with a depressive disorder should be given a trial of antidepressant medication, if no contraindication exists. No recommendation is made for the use of one class of antidepressants over another; however, side effect profiles suggest that selective serotonin reuptake inhibitors may be favoured in this patient population [Evidence Level A].

v. In adult patients with severe, persistent or troublesome tearfulness, selective serotonin reuptake inhibitors are recommended [Evidence Level A].

vi. Treatment should be monitored and should continue for a minimum of six months if a good response is achieved [Evidence Level A].

vii. Routine use of prophylactic antidepressants is not recommended in post-stroke patients [Evidence Level A].

viii. Patients should be given information and advice about the impact of stroke, and the opportunity to talk about the impact on their lives [Evidence Level B].

ix. Patients with marked anxiety should be offered psychological therapy [Evidence Level B].

x. Patients and their caregivers should have their psychosocial and support needs reviewed on a regular basis as part of long-term stroke management [Evidence Level A].

Rationale:

Post-stroke depression may affect as least one in every four individuals who have had a significant stroke event. The stroke patient is at greatest risk in the first six months after a stroke. Depression may affect a patient’s ability to participate in post-stroke therapy and is associated with slower progress in rehabilitation and increased length of stay. Clinicians need to be watchful and recognize depression before it interferes significantly with therapy and the patient’s well being. Standardized screening assessments for depression can indicate that depression exists and also can be used to monitor progress. However, there is no single, universally accepted tool for the assessment of post-stroke depression. An alternative to verbal scales to assess mood should be sought when assessing someone who is aphasic.11

Anxiety should be assessed and treated, especially when found in conjunction with depressive symptoms. Antidepressant medications and counseling appear to be helpful in treating this condition. Aphasic patients provide a unique challenge for assessment and treatment.

System Implications

- Education for primary care practitioners and healthcare providers across the continuum of stroke
care on assessment and recognition of post-stroke depression.

- Timely access to appropriate clinicians who are able to evaluate severity of depression.
- Timely access to specialized therapies to manage post-stroke depression, including medication and counseling as required.
- Process for ongoing monitoring of any patient with positive screening for depression during referral process.
- Mechanisms to support caregivers of stroke survivors.
- Optimization of strategies to prevent the recurrence of stroke.

**Performance Measures:**

1. Proportion of acute stroke patients with documentation indicating assessment or screening for depression was performed either informally or using a formal assessment tool in the acute care or rehabilitation setting.
2. Proportion of acute stroke patients referred for additional assessment or intervention for a suspected diagnosis of depression.
3. Proportion of stroke patients treated with antidepressants at one month, three months, six months, and one year following the initial stroke event.

**Measurement Notes**

- This recommendation and corresponding performance measures apply across the continuum of stroke care and should be considered in the acute, early rehabilitation, and longer-term recovery phases.
- When monitoring these performance measures it is important to record the measurement time frame and relevant stage of the stroke continuum.
- Data for measurement may be found through primary chart audit. Data quality will be dependent on the quality of documentation by healthcare professionals.
- For patients referred to psychiatry, information may be available through provincial physician billing databases.
- For persons over 65, information on medication prescriptions may be available through provincial and territorial senior drug benefit plan databases.

**Implementation Resources and Knowledge Transfer Tools**

- StrokEngine
- EBRSR

**Summary of the Evidence:**

Post-stroke depression may lead to adverse effects on the success of rehabilitation following a stroke event, suggesting the importance of early identification of symptoms early in the rehabilitation process. Post-stroke depression has a negative impact on functional recovery and social activity. A reduction in social activity can also adversely affect mood. It is crucial to monitor the level of social activity and/or withdrawal from social events of stroke survivors. Risk factors associated with increased risk for post-stroke depression include being female, past history of depression or psychiatric illness, social isolation, functional impairment and cognitive impairment. It has been reported that 21.6 percent of patients were depressed when assessed within the first month of stroke. The proportion of incident cases increased to 5.1%, 6.0%, 5.6% and 7.1% at three, six, nine and 12-month assessments, respectively. While the incidence of major depression after stroke may decrease over the first 24 months following stroke, it increases again after this time period.
Every individual should be screened for depression following a stroke event using a standardized tool. Such tools include the Hospital Anxiety Depression Scale, the Beck Depression Inventory and the Geriatric Depression Scale.

The Hospital Anxiety Depression Scale is a bidimensional scale divided into two subscales: anxiety and depression. Bjelland and associates found a mean correlation of 0.56 between the subscales. Teasell and collaborators previously summarized the sensitivity and specificity of this tool. O'Rourke and coworkers demonstrated a sensitivity of 80 percent and specificity of 79 percent with a cut-off of 6/7 on the depression subscale, while Bjelland and associates determined optimal sensitivity and specificity at a cut-off of 8/9 (sensitivity and specificity at approximately 80%). Of 24 papers reviewed by Bjelland and associates, only 1 included individuals who had experienced a stroke. Using a stroke population, Aben and collaborators determined an optimal cut-off of 11/12 for the Hospital Anxiety Depression Scale total, with sensitivity nearly 87 percent and specificity close to 70 percent. The scale is quick, easy to use and well tolerated by patients; however, one item, “I feel as if I am slowed down,” has been identified as problematic.

The Beck Depression Inventory is used for the detection and assessment of severity of depression. The inventory includes 21 self-rated items and takes between 5 and 10 minutes to complete. It has been suggested that the Beck Depression Inventory may be the most suitable scale for assessing depression after stroke; however, despite the optimal cut-off for the presence of depression within the stroke population, there is concern with the high rate of misdiagnosis (approximately 31 percent) and the authors have noted difficulties completing the scale with a stroke population. In the Evidence-Based Review of Stroke Rehabilitation, Teasell and collaborators assessed the thoroughness with which the reliability, validity and responsiveness of the tool was presented within the literature. The Beck Depression Inventory was given a rating of excellent on measures of rigour and results for reliability, while receiving poor ratings (i.e., minimal information available) on measures of rigour and results for responsiveness. No information relating to the Beck Depression Inventory was reported for the floor/ceiling component of responsiveness.

The Geriatric Depression Scale is a self-rating screening tool with 30 items, which takes approximately five to seven minutes to administer. Using the aforementioned Evidence-Based Review of Stroke Rehabilitation assessment, the Geriatric Depression Scale was given a rating of excellent on measures of rigor and results for reliability (test–retest and internal consistency) and validity (excellent, meaning most major forms of testing were reported). There was no information available regarding the responsiveness of the tool. It is worth noting that the Geriatric Depression Scale has been reported to have better sensitivity and specificity among higher-functioning individuals. Of particular concern for use within a stroke population are the varied reports of this scale’s ability to detect depression in patients with moderate to severe cognitive impairment. As a result, it has been suggested that it should not be used for screening these patients.

Once screening has occurred, it is imperative that, when appropriate, patients be referred to a psychologist or psychiatrist with expertise for further assessment and diagnosis. There is no evidence that the provision of information alone helps resolve clinical depression in stroke patients. A systematic evidence-based review of counseling and psychologic therapies has looked at the level of expertise that is required for working with patients with depression. It concluded that generic counseling should only be offered to those with minor degrees of psychologic distress, and that patients with complex psychologic issues should be treated by staff with therapeutic expertise.

About 15 percent of post-stroke patients experience uncontrollable laughing or crying, and, if not treated, this can develop into clinical depression. When this lability interferes with the patient’s rehabilitation or complicates the patient’s relationship with family members, pharmacotherapy has been found to be beneficial. Literature suggests that post stroke depression is treatable with a variety of medications, with SSRIs and tricyclic antidepressants being the most frequently studied.  When compared with placebo, heterocyclic antidepressant medications demonstrated
a significant treatment effect. Robinson and associates compared a heterocyclic antidepressant with an SSRI and found nortriptyline (a heterocyclic drug) to be more effective than the SSRI fluoxetine. Robinson and associates observed that nortriptyline improved the Hamilton Depression Scale scores significantly more than fluoxetine and/or placebo. In addition, the response rate of nortriptyline was significantly greater than those of both fluoxetine and placebo. While the results of the Lipsey and colleagues study were promising, the authors noted confusion, drowsiness and agitation were significant side effects that may pose risks to elderly patients. Likewise, while the heterocyclic combination of imipramine and mianserin significantly improved melancholia scale scores, Lauritzen and collaborators noted that a significant number of patients with myocardial infarction were excluded. Furthermore, those with cardiac arrhythmia, heart block, urinary outlet obstruction and narrow-angle glaucoma were advised against the use of heterocyclic antidepressants. This relatively high incidence of side effects associated with heterocyclic antidepressants, especially in elderly patients, must be taken into account when deciding on their use.

SSRIs selectively block serotonin reuptake rather than blocking both serotonin and norepinephrine reuptake. There is conflicting evidence (three positive studies, two negative studies) regarding the effectiveness of SSRIs in treatment for poststroke depression. Fruehwald and associates found benefit with fluoxetine at 12 and 18 weeks after treatment initiation. The drug effect was found to be quicker than for the heterocyclic drugs, taking effect three weeks into the treatment. Furthermore, side effects were found to be mild and transient and significantly less severe than those associated with the heterocyclic drugs. SSRIs work faster and have fewer and less severe side effects than heterocyclic drugs. Efficacy of heterocyclic drugs in the treatment of post-stroke depression has strong evidence. However, side effects mean they should be used with caution in the elderly population.

The incidence of post-stroke delirium is high, but with variably reported incidence (between 7.6 percent and 48 percent). The onset of delirium after stroke may lead to a significantly elevated risk of mortality, poor functional outcome, cognitive impairment and/or institutionalization. Several guidelines have discussed general management of delirium, as have several Cochrane reviews. These guidelines emphasize the current paucity of quality controlled data to guide interventions related to delirium after stroke, the pre-eminence of nonpharmacologic and preventive measures, the identification and treatment of occult reversible coexistent etiologies, as well as the time-limited, symptom- or sign-targeted use of pharmacologic treatments for management of agitation, use of sedation for normalizing the sleep–wake cycle and amelioration of psychotic symptoms that do not originate from neurologically mediated perceptual disturbances.

Among the pharmacologic interventions, the strongest data exists for the safety and efficacy of very low dose haloperidol; however, controversy surrounds the association between haloperidol, other conventional antipsychotics and second-generation (atypical) antipsychotics, and increased vascular mortality. The warning related to increased stroke or vascular mortality risk for the class of atypical antipsychotics has been strongest for chronic institutional use versus the acute, low risk of glucose dysregulation, respiratory depression, but not acute vascular events after stroke or in general management of delirium. There is no evidence to support the use of benzodiazepine monotherapy, nor good evidence to support the use of cholinesterase inhibitors for individuals with delirium, unless superimposed on pre-existing dementia or cognitive impairment responsive to cholinesterase inhibitor therapy.

Best Practice Recommendation 7.4
Vascular Cognitive Impairment and Dementia

All patients with vascular risk factors and those with clinically evident stroke or transient ischemic attack should be considered at high risk for vascular cognitive impairment.

Patients considered at high risk for cognitive and perceptual impairment are those with vascular risk factors such as hypertension, age > 65, hyperlipidemia, diabetes, clinical stroke, neuroimaging findings of
covert stroke or white matter disease, hypertension-associated damage to other target organs, and/or those patients with cognitive or functional changes that are clinically evident or reported during history-taking.

**7.4.1 Assessment**

i. All high-risk patients should be screened for cognitive impairment using a validated screening tool [Evidence Level B].

ii. Screening to investigate a person’s cognitive status should address arousal, alertness, attention, orientation, memory, language, agnosia, visuospatial/perceptual function, praxis and executive functions such as insight, judgment, social cognition, problem-solving, abstract reasoning, initiation, planning and organization [Evidence Level C].

iii. The Montreal Cognitive Assessment is considered more sensitive to cognitive impairment than the Mini Mental Status Exam in patients with vascular cognitive impairment. Its use is recommended when vascular cognitive impairment is suspected [Evidence Level B]. Additional validation is needed for the Montreal Cognitive Assessment as well as other potential screening instruments such as the 5-minute protocol from the Vascular Cognitive Impairment Harmonization recommendations.

iv. Post-stroke patients should also be screened for depression, since depression has been found to contribute to cognitive impairment in stroke patients. A validated screening tool for depression should be used [Evidence Level B].

Refer to recommendation 7.3 for additional information

v. Post-stroke patients who have cognitive impairment detected on a screening test should receive additional cognitive and/or neuropsychologic assessments as appropriate to further guide management [Evidence Level B].

**7.4.2 Timing**

i. All patients considered at high risk for cognitive impairment should be assessed periodically as indicated by severity of clinical presentation, history and/or imaging abnormalities to identify cognitive, perceptual deficits, depression, delirium and/or changes in function [Evidence Level C].

ii. Those who have had a transient ischemic attack or stroke should be assessed using a validated screening tool and, where indicated, undergo a more in-depth assessment of cognitive and perceptual status at various transition points throughout the continuum of stroke care [Evidence Level C]. Transition points may include:

   a. during presentation to emergency when cognitive, perceptual or functional concerns are noted
   b. upon admission to acute care, particularly if any evidence of delirium is noted
   c. upon discharge home from acute care or during early rehabilitation if transferred to inpatient rehabilitation setting
   d. periodically during in-patient rehabilitation stage according to client progress and to assist with discharge planning
   e. periodically following discharge to the community by the most appropriate community healthcare provider according to client’s needs, progress and current goals.

**7.4.3 Management**
i. All vascular risk factors should be managed aggressively to achieve optimal control [Evidence Level A].

Refer to section 2 for additional information

ii. Patients who demonstrate cognitive impairments in the screening process should be referred to a healthcare professional with specific expertise in this area for additional cognitive, perceptual and/or functional assessments [Evidence Level B].

   a. Additional assessments should be undertaken to determine the severity of impairment and impact of deficits on function and safety in activities of daily living and instrumental activities of daily living, and to implement appropriate remedial, compensatory and/or adaptive intervention strategies [Evidence Level B].

   b. A team approach is recommended, and healthcare professionals may include an occupational therapist, neuropsychologist, psychiatrist, neurologist, geriatrician, speech-language pathologist or social worker [Evidence Level C].

iii. An individualized, patient-centred approach should be considered to facilitate resumption of desired activities such as return to work, leisure, driving, volunteer participation, financial management, home management and other instrumental activities of daily living [Evidence Level C].

iv. Intervention strategies including rehabilitation should be tailored according to the cognitive impairments and functional limitations as well as remaining cognitive abilities, as identified through in-depth assessment and developed in relation to patients’ and caregivers’ needs and goals [Evidence Level B].

v. Strategy training provides individuals who have limitations in activities of daily living with compensatory strategies to promote independence and should be offered to patients with cognitive challenges. [Evidence Level B]. The evidence for the effectiveness of specific interventions for cognitive impairment in stroke is limited and requires more research.

   a. Attention training may have a positive effect on specific, targeted outcomes and should be implemented with appropriate patients [Evidence Level C].

   b. Compensatory strategies can be used to improve memory outcomes [Evidence Level B]

vi. Patients with evidence of depression or anxiety on screening should be referred and managed by an appropriate health professional [Evidence Level C].

   Refer to recommendation 6.2 for additional information.

vii. Pharmacotherapy

   a. Patients with evidence of vascular cognitive impairment should be referred to a physician with expertise in vascular cognitive impairment for further assessment and recommendations regarding pharmacotherapy [Evidence Level C].

   b. Cholinesterase inhibitors should be considered for management of vascular cognitive impairment diagnosed using the National Institute of Neurological Disorders and Stroke (NINDS) – Association Internationale pour la Recherche et l’Enseignement en Nerosciences (AIREN) diagnostic criteria [Evidence Level B].

   c. There is fair evidence of small magnitude benefits for galantamine on cognition function and behaviour in mixed Alzheimer and cerebrovascular disease. Galantamine can be considered a treatment option for mixed Alzheimer and cerebrovascular disease [Evidence Level B].
d. There is fair evidence of small magnitude benefits for donepezil in cognitive and global outcomes, with less robust benefits on functional measures. Donepezil can be considered a treatment option for vascular dementia [Evidence Level B].

**Rationale**

Vascular cognitive impairment affects up to 60 percent of stroke survivors and is associated with decreased function in activities of daily living and instrumental activities of daily living. Patients may require long-term, ongoing intervention and/or rehabilitation.²⁸, ⁵⁷⁶ It has been suggested that cognitive abilities such as abstract thinking, judgment, short-term memory, comprehension and orientation are important in predicting functional status at discharge.²⁸ In addition, cognitive impairment can be chronic and progressive after stroke; post-stroke dementia is estimated to occur in 26 percent of stroke patients by three months (95% CI 3% in age-matched controls) and adversely affects recovery. Cognitive impairment increases long-term dependence and is associated with higher mortality (61 percent versus 25 percent).⁵⁷⁶

Cognitive impairment due to covert vascular pathology is also increasing. Covert strokes, usually lacunes, are common (23 percent of community elderly) and are associated with cognitive decline, dementia, and stroke.⁵⁷⁶ Evidence is emerging that demonstrates that for every clinically evident stroke, there are six to nine so-called “covert” strokes. Signs of covert stroke are often manifested as cognitive impairment signs and symptoms.²⁸ Intracerebral small-vessel disease is a significant issue that is on the rise with the aging of the population, leading to an increase in the need for long-term care support services.

In most population studies, vascular dementia is the second most common cause of dementia, after Alzheimer disease.⁵⁷⁶ The combination of Alzheimer disease and vascular disease results in the commonest substrate of dementia in the elderly. A single macroscopic hemispheric infarct is sufficient to cause dementia in people with intermediate Alzheimer pathology.

**System Implications**

- Education of the public on adding cognitive changes to the signs and symptoms of stroke.
- Professional education across specialties (e.g., nephrology, ophthalmology) to increase awareness that patients with small-vessel disease should be investigated for stroke risk factors and cognitive impairment.
- Ongoing professional education to ensure proficiency in assessment administration, interpretation and management of cognitive impairment.
- Increased awareness among family physicians that patients with vascular risk factors, if not treated, will be at high risk for cognitive deficits.
- Increased professional education and awareness for primary care practitioners regarding small-vessel disease and vascular cognitive impairment.
- Increased public awareness programs focused on untreated hypertension and other vascular risk factors and their relationship to dementia.

**Performance Measures**

1. Percentage of patients with stroke who undergo a brief cognitive screening at each transition point along the continuum of stroke care (i.e., acute inpatient care, inpatient rehabilitation, outpatient and ambulatory clinics, and stroke prevention clinics) in the community following inpatient discharge and at any time when there is a suspected change in the patient’s...
cognitive status.

2. Percentage of patients with stroke who are referred for more in-depth cognitive or neuropsychologic assessment during inpatient care, inpatient rehabilitation, outpatient and ambulatory clinics (stroke prevention clinics) and/or following inpatient discharge to the community.

3. Percentage improvement in control of high blood pressure and other vascular risk factors in patients with vascular cognitive impairment.

**Measurement Notes**

- This is a new area and will require a great deal of education for healthcare professionals especially in the area of documentation.

**Implementation Resources and Knowledge Transfer Tools**

- Montreal Cognitive Assessment (MoCA)
- Mini Mental State Examination (MMSE)
- Vascular Harmonization Guidelines Test
- StrokEngine

**Summary of the Evidence**

Vascular cognitive impairment represents a spectrum of cognitive disorders associated with stroke and cerebrovascular disease ranging in severity from vascular cognitive impairment without dementia to vascular dementia. As noted in the Evidence-Based Review of Stroke Rehabilitation, as many as two-thirds of patients experience cognitive impairment or decline following stroke and approximately one-quarter to one-third develop dementia. Nyenhuis and Gorelick reported that more than 700,000 strokes occur annually in the United States. Vascular cognitive impairment affects up to half of stroke survivors and represents a substantial public health burden, with 1998 per-patient care costs estimated to be US$9313 for persons with mild disease and US$21,399 for persons with severe disease. Vascular cognitive impairment is also associated with reduced life expectancy and impaired daily functional abilities. For instance, Teasell and collaborators further noted that mortality rates among stroke patients with dementia were two to six times greater than among patients without dementia. In terms of factors affecting recovery, Newman and associates conducted a post hoc analysis of longitudinal data (n = 3680) and found that diabetes, HDL and homocysteine predicted poorer cognitive function and greater disability after stroke for this sample population.

Pendlebury and Rothwell conducted a systematic review of the prevalence, incidence and associated factors for pre-stroke and post-stroke dementia. The review included 22 hospital-based and eight population-based eligible cohorts (7511 patients) described in 73 papers. The pooled prevalence of pre-stroke dementia was higher (14.4%, 95% CI 12.0—16.8) in hospital-based studies than in population-based studies (9.1%, 6.9—11.3). Although post-stroke (<1 year) dementia rates were heterogeneous overall, the rates ranged from 7.4% (4.8—10.0) in population-based studies of first-ever stroke in which pre-stroke dementia was excluded to 41.3% (29.6—53.1) in hospital-based studies of recurrent stroke in which pre-stroke dementia was included. The cumulative incidence of dementia after the first year was little greater (3.0%, 1.3–4.7) per year in hospital-based studies than expected on the basis of recurrent stroke alone. Medial temporal lobe atrophy, female sex, and a family history of dementia were strongly associated with pre-stroke dementia, whereas the characteristics and complications of the stroke and the presence of multiple lesions in time and place were more strongly associated with post-stroke dementia. They report that the estimates of the prevalence of dementia are consistent: 10 percent of patients had dementia before first stroke, 10 percent developed new dementia soon after first stroke, and more than a third had dementia after recurrent stroke. Further, the strong association of post-stroke dementia with multiple strokes and the prognostic value of other stroke characteristics highlight the central causal role of stroke itself as opposed to the underlying vascular risk factors. Therefore, they conclude that there is a likely effect of optimum acute stroke care and secondary prevention in reducing the burden of dementia.
After stroke, vascular cognitive impairment can be found in many cognitive domains. Common deficits are seen in attention, memory, executive function, language, visuospatial processing and speed of processing in both the acute and rehabilitation phases.\textsuperscript{80, 81} and can remain chronic in the long-term.\textsuperscript{582-586} Hoffmann reported that the frequency of higher cortical function abnormality (aphasia, apraxia, amnesia and executive dysfunction) based on bedside neurologic testing was 63.5 percent in 1000 patients within the first month after stroke.\textsuperscript{587} High rates have been found in other studies using neuropsychologic testing two–three months after stroke as well.\textsuperscript{575, 588} These deficits persist in the chronic phase after stroke; in one study examining cognitive recovery from three to 27.7 months, most patients showed no improvement or declined.\textsuperscript{306} Likewise, Tatemi and coworkers found that 35 percent of a group of 227 patients showed cognitive impairment on multiple tests at 3 months after stroke, with improvement seen in only 12 percent of patients in memory, orientation, visuospatial function and attention in yearly follow-ups.\textsuperscript{589}

More information about cognitive deficits in the early phase after stroke is needed, however, to accurately estimate early cognitive recovery. The degree of cognitive recovery after stroke may be underestimated when the baseline examination is performed at three months after stroke (after spontaneous recovery has already occurred).\textsuperscript{590} Van Zandvoort and associates attempted to describe the feasibility and validity of neuropsychologic evaluation in the early stage following a stroke event, examining consecutive stroke patients four to 20 days following their first ischemic stroke ($n = 57$).\textsuperscript{591} At the early stage of evaluation, 77 percent of patients were able to successfully complete 82 percent of the tasks required of them. Cognitive impairment in many stroke survivors remains evident in the chronic phase and constitutes a significant issue for rehabilitation and long-term management.

The impact of cognitive impairment on rehabilitation and long-term functional outcome has been documented widely. The presence of cognitive impairment in general is associated with increased functional disability and poor outcome.\textsuperscript{589, 592, 593} Poor outcome has been specifically associated with spatial neglect and related symptoms, such as anosognosia.\textsuperscript{584-598} Attention and memory deficits also affect outcome, as well as executive dysfunction.\textsuperscript{583, 599-604} Cognitive deficits may also adversely affect physical disability via reduced skill reacquisition in physical rehabilitation.\textsuperscript{601, 605, 606}

One-quarter to one-third of stroke patients develop dementia. In a UK-based population study of 4075 individuals aged 65 and over (Medical Research Council Cognitive Function and Ageing Study),\textsuperscript{607} stroke was significantly associated with an increasing risk for the development of dementia, and Kalaria and Ballard found that post-stroke dementia occurs in up to 30 percent of stroke patients.\textsuperscript{608} The risk for developing dementia may be up to 10 times greater among individuals with stroke than for those without.\textsuperscript{608} Independent risk factors for poorer recovery and the development of dementia following stroke include increasing age, lower levels of formal education and nonwhite race.

While the risk of vascular cognitive impairment is high in stroke populations, vascular cognitive impairment is also frequent in the general elderly population. According to the Canadian Study of Health and Aging (CSHA), it is estimated that five percent of all people over the age of 65 years have evidence of vascular cognitive impairment (using the inclusive concept of vascular cognitive impairment, no dementia; vascular dementia; and mixed Alzheimer and cerebrovascular disease).\textsuperscript{609} In forty-four percent of the subgroup with vascular cognitive impairment, no dementia developed dementia over a five-year period.\textsuperscript{610} The underlying causal factors for development of dementia are mixed. Elderly people with silent brain infarcts and white matter lesions are at a strongly increased risk of stroke, which cannot be explained by the major stroke risk factors.\textsuperscript{611} Vascular dementia is the second most common cause of dementia after Alzheimer disease, in the order of 20 percent. Population autopsy studies, however, suggest that while pure vascular dementia is less frequent (<10 percent of cases), combined cerebrovascular disease and Alzheimer disease is the most common neuropathologic finding.\textsuperscript{576, 612} Vascular dementia may be the second leading cause of late-life dementia in the United States and Europe, and is a leading cause of dementia in countries where stroke rates are high, such as Japan and other countries in the Far East.\textsuperscript{613}

Thus, there is increasing recognition of the impact of vascular disease on cognitive impairment and the need for assessment and management. In the National Institute of Neurological Disorders and Stroke – Canadian Stroke Network Vascular Cognitive Impairment Harmonization Standards, Hachinski and colleagues made recommendations for an abbreviated clinical examination focusing on vascular impairment. It was advised that this evaluation should include an assessment with respect to cognitive impairment and vascular contribution.\textsuperscript{614}
Instruments are needed that are reliable at detecting changes in cognitive function following stroke. The Mini Mental State Examination (MMSE) and the Montreal Cognitive Assessment (MoCA) are both frequently used in clinical practice. Pendlebury and colleagues conducted a study comparing these two measurement tools during the six month and five year follow-up visits as part of the Oxford Vascular Study. Of 493 patients seen in follow-up, 413 (84%) were testable. Untestable patients were older (75.5 versus 69.9 years, \( P < 0.001 \)) and often had dysphasia (24%) or dementia (15%). Although MMSE and MoCA scores were highly correlated (\( r^2 = 0.80, P < 0.001 \)), MMSE scores were skewed toward higher values, whereas MoCA scores were normally distributed: median and interquartile range 28 (26 to 29) and 23 (20 to 26), respectively. Two hundred ninety-one of 413 (70%) patients had a MoCA score <26 of whom 162 had MMSE \( \geq 27 \), whereas only 5 patients had MoCA \( \geq 26 \) and MMSE < 27 (\( P < 0.0001 \)). In patients with MMSE \( \geq 27 \), MoCA <26 was associated with higher Rankin scores (\( P < 0.0003 \)) and deficits in delayed recall, abstraction, visuospatial/executive function, and sustained attention. The authors concluded that the MoCA picked up substantially more cognitive abnormalities after transient ischemic attack and stroke than the MMSE, demonstrating deficits in executive function, attention, and delayed recall.
Best Practice Recommendation 7.5  
Falls Prevention and Management  

All patients post stroke should be screened for risk of falls by an experienced clinician at admission, whenever there is a change in patient health status, and at transition points [Evidence Level C].

i. Screening for risk of falls should include identification of medical, functional, cognitive, and environmental factors associated with potential falls and fall injuries [Evidence Level B].

ii. Those found to be at risk for falls should undergo a comprehensive interprofessional falls assessment that includes medical and functional history, and examination of mobility, vision, perception, cognition, and cardiovascular status [Evidence Level C].

iii. Based on the risk assessment findings, an individualized falls prevention plan should be implemented for each patient [Evidence Level C].
   a. Patients should be educated regarding their risk for falls and precautions to take to reduce their risk [Evidence Level B].
   b. Families and caregivers should be provided with education and skills training for transferring and mobilizing the stroke patient [Evidence Level B].
   c. Topics addressed in patient, family, and caregiver education should include footwear, direction of transfer, gait aids, transfer belt use, seatbelt use, arm support devices, foot rests, and brakes [Evidence Level B].

iv. All patients who fall post-stroke should have an assessment of the circumstances surrounding the fall to identify precipitating factors, and the falls prevention plan should be modified to reduce the risk of further falls [Evidence Level C].

Rationale

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

System Implications

• Regular and ongoing education for staff in all hospital settings about risk assessment and prevention strategies related to falls, including transfer and mobilization training.
• Patient transferring and mobilization instructions provided by physical therapists and occupational therapists.
• Standardized falls risk assessment process that addresses timing, components, and the need for documentation.
• Universal falls precautions in all environments where stroke patients receive care.

Performance Measures

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

Measurement Notes

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

**Implementation Resources and Knowledge Transfer Tools**

- RNAO Prevention of Falls and Fall Injuries in the Older Adult Best Practice Guideline: [www.rnao.org](http://www.rnao.org)

**Summary of the Evidence**

Teasell and collaborators indicate that stroke rehabilitation patients are at high risk of falling, with one third of patients on a stroke rehabilitation unit sustaining at least one fall. However, the incidence of a serious injury caused by a fall was very small. 617 All measures of functional impairment including three components of the CM scores, the BBS scores, and the FIM were significantly lower when fallers and nonfallers were compared. Additionally, fallers were more frequently documented as apraxic and demonstrated cognitive deficits when compared with nonfallers. A total of 180 falls were reported over the study period. Eighty-eight patients (37%) experienced at least one fall. Injuries were reported in 22 percent (39/180) of the falls. The average length of time from stroke onset to rehabilitation admission and rehabilitation stay for all patients were 24.5 ±25.9 and 42.8 ±33.7 days, respectively. There were no differences in stroke type (P =0.393), stroke location (P =0.926), or gender (P =0.741) between fallers and nonfallers. However, there were differences in the scores of all functional measurement scores between fallers and nonfallers. The arm, leg, and foot components of the admission CM scores were significantly lower for fallers when compared with nonfallers (P <0.05). Admission BBS scores were significantly lower in fallers when compared with nonfallers (19.0 ± 13.9 vs 30.7 ± 16.6, P <0.001). FIM scores of nonfallers were greater than the scores of fallers (P <0.001). There was also a direct, inverse relationship between admission FIM scores and the number of falls. The average admission FIM score for one-time fallers was 72.4 ±19.1 but declined to 43.6 ±22.9 for those who had experienced four or more falls (P <0.001).

When functional deficits between the two groups were compared fallers were more likely to be apraxic (P =0.014) and have cognitive deficits (P =0.010).

Czernuszenko and Czlonkowska assessed the incidence and circumstances of falls in stroke patients during inpatient rehabilitation, the frequency of fall-related fractures and identified the risk factors for single and repeated falls. 618 Two hundred fifty-two falls were reported in 189 (16.3%) patients during the observation period. The incidence rate for any fall was 7.6 per 1000 patient-days (95% CI 6.6–8.5). For the first fall, the ratio is 6.5 per 1000 patient-days (95% CI 5.6–7.4), subsequent falls were much higher at 14.5 per 1000 patient-days (95% CI 11–18.1; <0.0001). Almost two-thirds (65%; n=163) of falls occurred in the first two weeks after admission. The fall rates changed over the observation time. The incidence rate for a first fall reached its highest value in the first week, at 13.33 (95% CI 10.7–15.9) per 1000 patient-days and in the ninth week at 14.7 per 1000 patient-days (95% CI 0.4–79). Most falls (n=207; 82%) occurred during the day between the hours of 6 am and 8 pm with a peak incidence between 11 am–1 pm. Patients fell during activities that included transfers (34%; n=85), while sitting (21%; n=54) and during position changes such as going from a sitting to standing or standing to sitting position (13%; n=32). Falls from bed accounted for 10 percent (n=24) of the events n=24) of the events. In 24 cases, falls resulted from inadequate or insufficient staff assistance (5 falls from bed, 19 falls from a wheelchair or toilet bowl). In three cases, patients slid on a wet floor, and falls occurred in three cases due to inadequate assistance by visitors. Seventy-two per cent (n=182) of falls resulted in no injury; 27 percent (n=67) resulted in bruises, grazes or lacerations; and 1.2 percent (n=3) resulted in fractures (proximal femur, humeral bone and pelvis).

Pouwels and coworkers evaluated the association between stroke and the risk of hip/femur fracture. 619 An increased risk of hip/femur fracture was observed in patients who experienced a stroke at any time before the index date (adjusted OR, 1.96; 95% CI, 1.65–2.33). The fracture risk was highest among patients who sustained a stroke within 3 months before the index date (adjusted OR, 3.35; 95% CI, 1.87–5.97) and among female patients (adjusted OR, 2.12; 95% CI, 1.73–2.59). The risk further increased among patients younger than 71 years (adjusted OR, 5.12; 95% CI, 3.00–8.75). Patients who had experienced a hemorrhagic stroke tended to be at a higher hip/femur fracture risk compared with those who had experienced an ischemic stroke. It was found that stroke was associated with a 2.0-fold increased risk of hip/femur fracture. Findings from this study imply that it is important to conduct fracture risk assessment immediately after a patient is hospitalized for stroke. Severity of stroke (ie, the degree of paresis or immobility), being female, and age of 70 years or younger are important risk factors to take into account. Fall prevention programs, BMD measurements, and use of bisphosphonates may be necessary to minimize hip fractures in the elderly during and after

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December 8, 2010
stroke rehabilitation.

Maeda and coworkers determined that fallers (occasional and repeat fallers) comprised 27/72 (38%) of the stroke patients.\(^6\) Age and length of stay (LOS) in hospital were significantly higher in the faller group compared with the non-faller group \((P=0.001\) and 0.003, respectively), while significantly lower values were recorded in the faller group compared with the non-faller group for time from stroke onset \((P=0.018)\), total Functional Independence Measure (FIM \(^6\) Instrument) on admission and discharge \((both\ P<0.001)\), Berg Balance Scale on admission \((P<0.001)\) and Mini-Mental State Examination (MMSE) \((P=0.003)\). The Pearson correlation coefficients for the variables show a strong correlation between BBS on admission and total and motor FIM on admission and discharge \((P<0.05\) - \(P<0.01)\). BBS on admission was found to be significantly related to falls \((P<0.01)\). A logistic model for predicting falls showed that BBS at admission was significantly related to falls, with fallers having lower BBS scores at admission \((cut-off \leq 29;\ sensitivity 80\%;\ specificity 78\%)\). These data suggest BBS is a sensitive and specific measure for identifying stroke patients at risk of falling.

Andersson and coworkers also examined the usefulness of the Berg Balance Scale in predicting patients at high risk for falls.\(^6\) Sixty-eight \((43\%)\) of the 159 patients fell at least once during the time from discharge from the stroke unit to the follow-up and 91 \((57\%)\) patients did not fall. At the follow-up at 6 months 23 of 66 patients \((35\%)\) had fallen, and 45 of 93 patients \((48\%)\) had fallen at 12 months. Forty-one \((60\%)\) of the fallers were repeat fallers. The prevalence of fallers did not differ between the patients followed-up at 6 and 12 months. The prevalence of fallers was highest in patients who were able to perform BBS and in patients who were able to perform SWWT. Therefore calculations of the accuracy of the fall risk prediction was made for the combinations of the tests, that is patients obtaining positive or negative test results in both of them. The post-test probability for the combination BBS+SWWT was 0.86. If patients were able to perform both BBS and SWWT the combined results increase the possibility of identifying fallers.

Three different patient populations hospitalized for stroke rehabilitation were investigated by Aizen and coworkers to analyze the incidence and characteristics of falls, risk factors for falls, and the frequency and nature of associated injuries.\(^6\) Variables in each group of fallers were compared to its control group. As well, comparisons were made between the three different patient populations. A total of 100 falls were reported over the study period. Overall 84 fallers and 84 control patients were recruited to the trial. Of these, 69 had only one fall, 14 had two falls, and one had three falls. Forty one \((15.6\%)\) of the stroke patients experienced a fall, 20 \((13.7\%)\) of the hip fractured patients and 23 \((13.3\%)\) of the deconditioning patients also fell. 50 percent \((42 of 84)\) of all fallers fell from their wheelchairs. Falling from the wheelchair was especially common among patients hospitalized for stroke rehabilitation \((61\%, 25 of 41 falls)\), Patients fell more frequently forward or to the oblique forward direction \((42.9\%, 36 of 84)\), and most patients \((70.2\%, 59 of 84)\) managed to break the fall. Most falls occurred beside the bed \((44\%),\) or in the toilets \((17.9\%)\) and corridors \((17.9\%)\). Falls were least likely to occur during the first hospitalization week \((11.9\%)\), with a peak incidence in the second \((46.4\%)\) and third week \((41.7\%)\) of hospitalization.
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APPENDICES

Appendix One  Membership List for the Best Practices and Standards Working Group and the Information and Evaluation Working Group

Appendix Two  Membership List for Task Groups

Appendix Three  2010 Consensus Meeting Participants

Appendix Four  2010 External Reviewers

Appendix Five  Glossary of Terms

Appendix Six  List of Clinical Trials and International Stroke Guidelines referenced in this document

Appendix Seven  Evaluation of Levels of Evidence Table

Appendix Eight  CSS Core Performance Indicators 2010

Appendix Nine  Professional Development Resources that Support implementation and Uptake of Best Practices
The development of these guidelines has been funded in their entirety by the Canadian Stroke Strategy, a joint initiative of the Canadian Stroke Network and the Heart and Stroke Foundation of Canada. Funds are received primarily from the Canadian Stroke Network, who is in turn funded by the National Centres of Excellence program. No funds for these guidelines have come from commercial interests, including pharmaceutical companies.

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APPENDIX TWO
MEMBERSHIP LIST FOR THE CANADIAN BEST PRACTICE RECOMMENDATIONS FOR STROKE CARE 2010 TASK GROUPS with CONFLICT OF INTEREST DECLARATIONS

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Neuroscience | Health Region

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### Paediatric Stroke Care Task Group

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**Pre-Hospital Task Group**

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<td>Gladstone, David</td>
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<td>Sunnybrook Health Sciences Centre, University of Toronto</td>
<td>Ontario</td>
<td>PI of the EMBRACE trial that received operating grant funding from CSN. Receipt of honoraria from Boehringer Ingleheim, Bayer, Sanofi Aventis and Bristol Myers Squibb (speaker's fee for CME</td>
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December 8, 2010
### Stroke Rehabilitation Care Task Group

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### SCORE Task Group

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**Rural, Remote and Northern Stroke Care Task Group**

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<td>Sanguins, Julianne</td>
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### Transition Management Task Group

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<td>Bagg, Stephen</td>
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<td>Bell, Allan</td>
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<td>Toronto</td>
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<td>Received research, travel or speaking grants from the following commercial organizations: Sanofi Aventis, BMS, AstraZeneca and Lilly.</td>
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<td>Cameron, Jill</td>
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### SCORE Task Group

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**APPENDIX Three**

PARTICIPANTS FOR 2010 CANADIAN STROKE BEST PRACTICES CONSENSUS MEETING with CONFLICT OF INTEREST DECLARATIONS
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<td>Queen Elizabeth II Health Sciences Centre</td>
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<td>Toronto Rehabilitation Institute</td>
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<td>Gubitz, Gord</td>
<td>Co-Chair Best Practices Update 2010; Neurologist, Acute Stroke Unit &amp; Outpatient Neurovascular Clinic</td>
<td>Queen Elizabeth II Health Sciences Centre</td>
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December 8, 2010
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# APPENDIX FOUR

EXTERNAL REVIEWERS FOR 2010 CANADIAN BEST PRACTICES UPDATE
with CONFLICT OF INTEREST DECLARATIONS

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<td>Boulanger, Jean-Martin</td>
<td>Professor Adjoint, Departement de Biochimie, Faculté de médecine et des sciences de la santé</td>
<td>Université de Sherbrooke, Hôpital Charles LeMoyne</td>
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<td>Cooper, Mary Elizabeth</td>
<td>Acute Care Nurse Practitioner</td>
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<tr>
<td>O’Donnel, Martin</td>
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</table>
APPENDIX FIVE: GLOSSARY OF TERMS

Activities of daily living: The basic elements of personal care such as eating, washing and showering, grooming, walking, standing up from a chair and using the toilet.

Activity: The execution of a task or action by an individual. Activity limitations are difficulties that an individual may have in executing activities.

Agnosia: The inability to recognize sounds, smells, objects or body parts (other people’s or one’s own) despite having no primary sensory deficits.

Alternate level of care: A patient receiving an alternate level of care is one who has finished the acute care phase of treatment but remains in an acute care bed, awaiting placement in an alternate care setting (chronic care unit, home for the aged, nursing home, home care program, etc.). This classification occurs when the patient is admitted as a patient’s physician gives an order to change the level of care from acute care and requests a transfer for the patient. Sometimes a patient is admitted as a patient requiring an alternate level of care because alternate care is not available (Canadian Institute for Health Information Discharge Abstract Antiplatelet agents: Agents that inhibit platelet aggregation. These agents are used in the prevention of ischemic stroke in high-risk patients.

Aphasia: Loss of the inability to produce or comprehend language as a result of injury to specialized areas in the brain related to these functions, affecting the ability to speak, understand, or read and write.

Apraxia: Impaired planning and sequencing of movement that is not due to weakness, incoordination or sensory loss.

Assistive technology: Technology designed to help a patient with limitations to perform daily activities and social roles.

Atrial fibrillation: Rapid, irregular beating of the heart.

Balance: Acquisition and maintenance of postural stability at rest or during activities.

Balance training: Sensory motor and cognitive intervention to promote postural stability.

Biofeedback: A technique monitoring physiological functions and providing extrinsic feedback, which may include somatosensory, visual and auditory input.

Canadian Institute for Health Information: An independent, not-for-profit organization that provides essential data and analysis on Canada’s health system and the health of Canadians. This organization tracks data in many areas, using information supplied by hospitals, regional health authorities, medical practitioners, governments and other sources.

Canadian Stroke Strategy: A joint initiative of the Canadian Stroke Network and the Heart and Stroke Foundation of Canada. It brings together a multitude of stakeholders and partners with the common vision that “All Canadians have optimal access to the integrated high quality, and efficient services in stroke prevention, treatment, rehabilitation and community reintegration”.

Cardio Respiratory Fitness: Related to the ability to perform large muscle, dynamic, moderate-to-high intensity exercise for prolonged periods. Improvements in cardiorespiratory fitness result in improvements of the heart to deliver oxygen to the working muscles and in the muscle’s ability to generate energy with oxygen and result in better endurance performance. (America College of Sports Medicine Guidelines, 2000)

Carotid endarterectomy: Surgical opening in one of the main neck arteries (the carotid arteries) performed when the artery is partially blocked by plaque (the buildup of fatty materials, calcium and scar
tissue that narrows the artery). The procedure helps prevent a first stroke or reduces the risk of further strokes. It works best for people whose artery is narrowed but not completely blocked. (Heart and Stroke Foundation)

**Cognitive:** Relating to the ability to think, remember and solve problems.

**Community-based rehabilitation therapy:** Rehabilitation provided in the home or community-based organizations.

**Community reintegration:** A return to participation in desired and meaningful activities of daily living, community interests and life roles following a stroke event. The term encompasses the return to mainstream family and active community living and continuing to contribute to one’s social groups and family life. Community reintegration is a component in the continuum of care after stroke; rehabilitation helps clients identify meaningful goals for community reintegration and, though structured interventions, facilitates resumption of these activities to the best of their abilities. The stroke survivor, family, friends, stroke recovery associations, rehabilitation programs and the community at large are all integral to successful community reintegration.

**Comorbid condition:** Relates to the effect of all other diseases or conditions a patient may have in addition to the primary disease of interest

**Compensatory therapy:** Adaptive therapeutic interventions designed to enhance activity and participation (the focus is on function and not impairment).

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

**Computed tomography scan:** Radiographic images of the head, appearing as a series of thin slices showing details of the brain’s anatomy. In some cases, a contrast dye may be injected to better define tissues and blood vessels and enhance the images. These images can show whether a stroke was due to a blood clot (an ischemic stroke) or uncontrolled bleeding (a hemorrhagic stroke). This is often one of the first tests scheduled for someone who has had a stroke.

**Constraint induced therapy:** Intervention designed to enhance recovery of function or a body part by restraining a less affected function or body part.

**Continuing Care Reporting System:** Contains standardized clinical and administrative information on continuing care in Canada, which includes detailed clinical, functional and service information (e.g., residents’ preferences, needs and strengths) and provides a snapshot of the services they use. Two types of facilities are included: hospitals that have beds designated and funded as continuing care beds, commonly known as extended, auxiliary, chronic or complex beds; and residential care facilities, commonly known as nursing homes, personal care homes or long-term care facilities. The data are collected using the Resident Assessment Instrument (RAI) Minimum Data Set (MDS 2.0).

**Conventional therapy:** The usual care offered in a particular setting and must be defined in terms of their intensity, frequency, and duration.
Day hospital: A defined geographic outpatient unit dedicated to interdisciplinary care and rehabilitation of an individual.

Deep vein thrombosis: Thrombosis (a clot of blood) in the deep veins of the leg, arm or abdomen.

Disability: A defect in performing a normal activity or action (e.g., inability to dress or walk).

Discharge Abstract Database: Database of information related to acute care hospital discharges across Canada. The database is maintained by the Canadian Institute for Health Information, which receives data directly from all hospitals in every province and territory except Quebec. The database contains demographic, administrative and clinical data for hospital discharges (inpatient acute, chronic, rehabilitation) and day surgeries in Canada.

Discharge disposition: A patient’s destination following a visit to the emergency department or following a stay in hospital. A patient’s discharge disposition may or may not be the same location as before their visit to hospital.

Dysarthria: Impaired ability to produce clear speech due to the impaired function of the speech muscles

Dysphagia: An impairment of swallowing that may occur following a stroke.

Early supported discharge: Early supported discharge services aim to move forward the time of discharge from hospital, as well as to provide a more continuous process of rehabilitation spanning both the period in hospital and the first few weeks at home. In these two ways, early supported discharge alters the conventional pathway of care to ensure more amenable services for patients undertaking rehabilitation.

Emergency department: A hospital or primary care department that provides initial treatment to patients with a broad spectrum of illnesses and injuries, some of which may be life-threatening and require immediate attention.

Emergency medical services: Provide out-of-hospital acute care and transport to definitive care for patients with illnesses and injuries that the patient believes constitute a medical emergency. The most common and recognized type of emergency medical service is an ambulance or paramedic organization.

Enteral tube: Delivery of nutrients directly into the digestive system via a tube.

Executive function: Cognitive functions usually associated with the frontal lobes, including planning, reasoning, time perception, complex goal-directed behaviour, decision-making and working memory.

Exercise therapy: Intervention directed towards optimizing physical capacity.

Functional independence measure: An 18-item, 7-level ordinal scale. It is the product of an effort to resolve the long-standing problem of lack of uniform measurement and data on disability and rehabilitation outcomes.

Gait: The pattern of walking, which is often characterized by elements of progression, efficiency, stability and safety.

Hemiparesis: Weakness involving one side of the body (of mild, moderate or severe degree) that may be caused by stroke, and can be accompanied by sensory or other neurological deficits.

Hemiplegia: Refers to a complete paralysis. Complete loss of motor function on one side of body that may be caused by stroke localized to the cerebral hemisphere opposite to the side of weakness.

Hemorrhagic stroke: A stroke caused by the rupture of a blood vessel within the brain, usually an artery.

Hyperacute period: The time frame from the initial onset of stroke symptoms and engagement of
emergency medical services though interaction with paramedics and within the emergency departments of acute care hospitals.

**Hypertension**: High blood pressure, defined as a repeatedly elevated blood pressure exceeding 140/90 mm Hg. Hypertension is a risk factor for stroke or transient ischemic attack and is managed with regular aerobic exercise, weight reduction (if overweight), salt reduction and medications.

**Hypertonia**: Abnormal increase in resistance while externally imposing movement about a joint.

**Impairment**: A problem in the structure of the body (e.g., loss of a limb) or the way the body of a body part functions (e.g., hemiplegia).

**Infarction**: Death of cells in an organ (e.g., the brain or heart) due to lack of blood.

**Integration**: An integrated health system would result in coordinated health services that both improve accessibility and allow people to move more easily through the care and treatment continuum of the care health system and would provide appropriate, effective and efficient health services.

**Intensity**: The level of effort demanded or required of the individual in relation to their current capacity (physical and mental)

**Interdisciplinary stroke team**: A comprehensive team of healthcare professionals who are dedicated to the care of stroke patients within a unit. An interdisciplinary stroke team may include persons who have experienced a stroke, family and caregivers, neurologists and other physicians with expertise in stroke management, physiatrists, nurses, primary care practitioners, physical therapists, occupational therapists, speech language pathologists, social workers, dieticians, pharmacists, psychologists, rehabilitation assistants and pastoral care workers.

**International normalized ratio**: Used to evaluate the ability of blood to clot properly, this ratio can be used to assess both bleeding and clotting tendencies. One common use is to monitor the effectiveness of anticoagulants such as warfarin.

**Ischemia**: An inadequate flow of blood to part of the body because of blockage or constriction of the arteries that supply it.

**Last seen normal**: The date and time a patient was last known to be normal before the onset of symptoms of stroke or transient ischemic attack.

**Lack of stay**: A measure of the duration of a single hospitalization.

**Length of stay**: A measure of the duration of a single hospitalization.

**Long-term care home**: A facility that provides rehabilitative, restorative or ongoing skilled nursing care to residents in need of assistance with activities of daily living.

**Low-density lipoprotein**: A compound that regulates cholesterol synthesis from the liver to the peripheral tissues. Sometimes referred to as "bad cholesterol," LDL may put an individual at risk for cerebrovascular disease if it occurs at high levels.

**Mean**: Simple average, equal to the sum of all values divided by the number of values.

**Median**: The value that has 50 percent of the data points above it and 50 percent below it.

**Medical redirect bypass**: Following predefined medical criteria and a written agreement between physicians, hospitals, dispatch and ambulance service, a closer hospital may be bypassed for medical reasons to redirect the person exhibiting signs and symptoms of stroke to a stroke centre that can provide expert timely assessment and treatment.
Muscular endurance: Ability of a muscle or muscle group to perform repeated muscle contractions over a period of sufficient to cause muscular fatigue, or to maintain a specific percentage of the maximum voluntary contraction for a prolonged period of time (ACSM, 2001)

Muscle strength: Maximal force that can be generated by a specific muscle or muscle group. (ACSM, 2000)

National Ambulatory Care Reporting System: Includes data for all hospital-based ambulatory care provided departments. Client visit data are collected at the time of service in participating facilities. Currently, data submission to the National Ambulatory Care Reporting System has been mandated in Ontario for emergency departments, day surgery units, dialysis units, cardiac catheterization suites and oncology units (including all regional cancer centres). Data elements include demographic data, clinical data, administrative data, financial data and service-specific data elements for day surgery and emergency.

National Rehabilitation Reporting System: Includes client data collected from participating adult inpatient rehabilitation facilities and programs across Canada. Data are collected at time of admission and discharge by service providers in participating facilities. There is also an optional postdischarge follow-up data collection process. The National Rehabilitation Reporting System data elements are organized under the following categories: socio-demographic information, administrative data (e.g., referral, admission and discharge), health characteristics, activities and participation (e.g., activities of daily living, communication, social interaction), interventions. These elements are used to calculate a variety of indicators including wait times and client outcomes.

Neglect: The failure to attend or respond to or make movements toward one side of the environment.

Outpatient rehabilitation: Includes day hospital, outpatient ambulatory care and home-based rehabilitation. Outpatient therapy in the subacute phase of stroke (4 to 8 weeks after stroke) is often prescribed following discharge from outpatient stroke rehabilitation units. (Evidence-Based Review of Stroke Rehabilitation, 10th edition)

Outpatient Therapy: In the subacute phases of stroke (4-8 weeks after stroke) outpatient rehabilitation therapy in an outpatient clinic affiliated with an acute care or inpatient rehabilitation facility may be prescribed upon discharge from acute inpatient care or inpatient rehabilitation.

Percutaneous endoscopic gastrostomy: A form of enteral feeding in which nutrition is delivered via a tube that has been surgically inserted into the stomach through the skin.

Performance measure: A quantifiable measure of outcomes, outputs, efficiency, access and other dimensions of quality of care.

Pulmonary embolism: Blockage of the pulmonary artery (which carries blood from the heart to the lungs) with a solid material, usually a blood clot or fat, that has travelled there via the circulatory system.

Rankin Scale (modified): An outcomes scale used to measure disability or dependence in activities of daily living in stroke victims.

Recovery: The process whereby the person regains body structure, function, activity and participation. (Not time limited)

Registry of the Canadian Stroke Network: A clinical database that collects data from prehospital stroke onset to discharge from acute care, following a stroke or transient ischemic attack. Information is collected on risk factors, presentation, acute investigations and interventions, inpatient management, complication, discharge disposition, length of stay and mortality. Note: During the data collection period for the 2006 report of the Stroke Evaluation Advisory Committee, only 10 regional stroke centres were
participating in the Registry of the Canadian Stroke Network (Central South/Royal Victoria Hospital was not yet part of the network). Data collection began July 1, 2003, so the fiscal year 2003-04 included only 9 months of data, which means that volumes and counts are underestimated for that year.

**Rehabilitation:** Restoration of a disabled person to optimal physical and psychological functional independence.

**Restorative (remedial) therapy:** Therapeutic interventions designed to restore body structure and function by targeting the underlying impairment to enhance recovery.

**Risk factor:** A characteristic of a person (or group of people) that is positively associated with a particular disease of condition.

**Spasticity:** Velocity-dependent increase in muscle tone that often occurs in stroke.

**Stroke:** Rapidly developing clinical signs of focal (at times global) disturbance of cerebral function, lasting more than 24 hours or leading to death, with no apparent cause other than that of vascular origin.

**Stroke prevention clinic:** A clinic providing comprehensive stroke prevention services to patients who are not admitted to the hospital at the time of their emergency department visit. Prevention clinics offer an interdisciplinary team approach and are typically funded for an advanced practice nurse, a medical secretary and a behavioural psychologist or occupational therapist.

**Stroke unit:** A specialized, geographically located hospital unit with a dedicated stroke team and stroke resources (e.g., care pathway, educational material, monitored beds). The unit does not need to have all of these resources, nor does it have to be exclusive for stroke patients, but it must be in one location.

**Subarachnoid hemorrhage:** Occurs when a blood vessel just outside the brain ruptures and blood fills the subarachnoid space surrounding the brain. Symptoms may include a sudden, intense headache, neck pain, and nausea or vomiting,

**Task-specific training:** Training that involves repetition of a functional task or part of the task.

**Telemedicine/telestroke:** Use of electronic communication to exchange medical information from one site to another to educate the patient or the healthcare provider, and to improve patient care and health.

**Thrombolytics:** An agent (medication) that dissolves or splits up a blood clot.

**Tissue plasminogen activator:** A clot-busting drug used to treat heart attack and ischemic stroke.

**Tone:** Resistance to passive stretch while the patient is attempting to maintain a relaxed state of muscle activity.

**Transient Ischemic attack:** An episode of temporary and focal cerebral dysfunction of vascular origin, variable in duration, commonly lasting from 2 to 15 minutes, but occasionally lasting as long as a day (24 hours), which leaves no persistent neurological deficit.

**Vascular cognitive impairment:** A common form of dementia that is due to cerebrovascular disease. Symptoms include confusion, memory problems, loss of bladder or bowel control (incontinence), emotional problems such as inappropriate laughing or crying, difficulty following instructions and problems with daily activities such as handling money.
## Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAC</td>
<td>Augmentative and alternative communication</td>
</tr>
<tr>
<td>ADL</td>
<td>Activities of daily living</td>
</tr>
<tr>
<td>AF</td>
<td>Atrial fibrillation</td>
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<tr>
<td>ASA</td>
<td>Acetylsalicylic Acid (aspirin)</td>
</tr>
<tr>
<td>CEA</td>
<td>Carotidendarterectomy</td>
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<tr>
<td>CEMRA</td>
<td>Contrast enhanced magnetic resonance angiography</td>
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<td>CHEP</td>
<td>Canadian Hypertension Education Program</td>
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<td>CSN</td>
<td>Canadian Stroke Network</td>
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<td>CSS</td>
<td>Canadian Stroke Strategy</td>
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<td>CT</td>
<td>Computed tomography</td>
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<tr>
<td>DBP</td>
<td>Diastolic Blood Pressure</td>
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<td>DM</td>
<td>Diabetes Mellitus</td>
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<td>DVT</td>
<td>Deep vein thrombosis</td>
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<td>EBRSR</td>
<td>Evidence-Based Review of Stroke Rehabilitation</td>
</tr>
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<td>ED</td>
<td>Emergency Department</td>
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<tr>
<td>ECG/EKG</td>
<td>Electrocardiogram</td>
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<td>EMS</td>
<td>Emergency Medical Services</td>
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<td>ESD</td>
<td>Early supported discharge</td>
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<td>EWG</td>
<td>Expert Working Group</td>
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<tr>
<td>GP</td>
<td>General Practitioner</td>
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<td>ICH</td>
<td>Intracranial hemorrhage</td>
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<td>ICU</td>
<td>Intensive care unit</td>
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<td>INR</td>
<td>International normalized ratio</td>
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<tr>
<td>IPC</td>
<td>Intermittent pneumatic compression</td>
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<td>IV</td>
<td>Intravenous</td>
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<td>LDL</td>
<td>Low-density Lipoprotein</td>
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<td>LMWH</td>
<td>Low molecular weight heparin</td>
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<td>MCA</td>
<td>Middle cerebral artery</td>
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<td>MI</td>
<td>Myocardial Infarction</td>
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<tr>
<td>MR-DWI</td>
<td>Magnetic resonance diffusion weighted imaging</td>
</tr>
<tr>
<td>MRI</td>
<td>Magnetic Resonance Imaging</td>
</tr>
<tr>
<td>NINDS</td>
<td>National Institute of Neurological Disorders and Stroke</td>
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<tr>
<td>NNT</td>
<td>Numbers needed to treat</td>
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<tr>
<td>OBS</td>
<td>Observational study</td>
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<td>OT</td>
<td>Occupational therapist</td>
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<td>PE</td>
<td>Pulmonary embolism</td>
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<tr>
<td>PEG</td>
<td>Percutaneous endoscopic gastrostomy</td>
</tr>
<tr>
<td>PT</td>
<td>Physical therapist or Physiotherapy</td>
</tr>
<tr>
<td>RCT</td>
<td>Randomized controlled trial</td>
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<tr>
<td>rFVIIa</td>
<td>recombinant activated factor VII</td>
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<tr>
<td>rt-PA</td>
<td>Recombinant tissue plasminogen activator</td>
</tr>
<tr>
<td>Abbreviation</td>
<td>Definition</td>
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<tr>
<td>RN</td>
<td>Registered nurse</td>
</tr>
<tr>
<td>RRR</td>
<td>Relative risk reduction</td>
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<td>SAH</td>
<td>Subarachnoid Hemorrhage</td>
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<tr>
<td>SCORE</td>
<td>Stroke Canada Optimization of Rehabilitation through Evidence</td>
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<tr>
<td>SBP</td>
<td>Systolic Blood Pressure</td>
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<tr>
<td>SLP</td>
<td>Speech Language Pathologist</td>
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<tr>
<td>SR</td>
<td>Systematic review</td>
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<tr>
<td>STAIR</td>
<td>Stroke transition after inpatient care</td>
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<tr>
<td>STEP</td>
<td>Stroke Therapy Evaluation Program</td>
</tr>
<tr>
<td>SU</td>
<td>Stroke Unit</td>
</tr>
<tr>
<td>SW</td>
<td>Social work or Social worker</td>
</tr>
<tr>
<td>TIA</td>
<td>Transient ischemic attack</td>
</tr>
<tr>
<td>tPA</td>
<td>Tissue plasminogen activator</td>
</tr>
<tr>
<td>TTE</td>
<td>Transthoracic echocardiography</td>
</tr>
<tr>
<td>TEE</td>
<td>Transesophageal echocardiography</td>
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<tr>
<td>UK</td>
<td>United Kingdom</td>
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<tr>
<td>UFH</td>
<td>Unfractionated heparin</td>
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<tr>
<td>VTE</td>
<td>Venous Thrombus Embolism</td>
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APPENDIX SIX: Levels of Evidence Grading System

Each recommendation in the 2008 update of the Canadian Best Practice Recommendations for Stroke Care was evaluated against several criteria: the strength of the available research evidence to support the recommendation, the degree to which the recommendation drives system change or processes of care delivery, and the overall validity and relevance as a core recommendation for stroke care across the continuum.

The levels of evidence were determined through a structured ranking system that measured the strength of the results in a clinical trial or research study. The design of the study (such as a case report for an individual patient or a randomized double-blind controlled clinical trial) and the end points measured (such as survival or quality of life) affect the strength of the evidence.

The various types of study designs, in descending order of strength, include the following:
- Randomized controlled clinical trials (double-blinded or non-blinded): This is considered the gold standard of study design.
- Meta-analyses of randomized studies: Such analyses offer a quantitative synthesis of previously conducted studies. The strength of evidence from a meta-analysis is based on the quality of the conduct of individual studies. Meta-analyses of randomized studies are placed in the same category of strength of evidence as are randomized studies.
- Nonrandomized controlled clinical trials.
- Case series: Population-based, consecutive series, consecutive cases (not population-based) or nonconsecutive cases.

These clinical experiences are the weakest form of study design, but often they are the only information available. Several rating systems have been used by guideline developers internationally to evaluate the strength of the evidence for their recommendations. These systems vary in the nomenclature used (alphabetical versus numeric), but there is usually reasonable equivalence in the definitions across the levels of evidence. Each best practice recommendation included in this document provides the level of evidence for the recommendation, and cites the core reference guideline(s) that was adapted or that contributed most to the wording of the recommendation (see Table 1 of the main document for definitions of abbreviations used for this purpose). Refer to the master reference list for a detailed list, including website addresses, of the core reference guidelines.

Evidence table: Summary of definitions for levels of evidence reported in this document*

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<th>Grade</th>
<th>Criteria</th>
</tr>
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<tbody>
<tr>
<td>A</td>
<td>Strong recommendation. Evidence from randomized controlled trials or meta-analyses of randomized controlled trials. Desirable effects clearly outweigh undesirable effects, or vice versa.</td>
</tr>
<tr>
<td>B</td>
<td>Single randomized controlled trial or well-designed observational study with strong evidence; or well-designed cohort or case–control analytic study; or multiple time series or dramatic results of uncontrolled experiment. Desirable effects closely balanced with undesirable effects.</td>
</tr>
<tr>
<td>C</td>
<td>At least one well-designed, nonexperimental descriptive study (e.g., comparative studies, correlation studies, case studies) or expert committee reports, opinions and/or experience of respected authorities, including consensus from development and/or reviewer groups.</td>
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**APPENDIX SEVEN: List of Clinical Trials and International Stroke Guidelines referenced in this document**

**Clinical Trials**

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<tr>
<th>Trial</th>
<th>Description</th>
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<tr>
<td>ACST</td>
<td>Asymptomatic Carotid Surgery Trial</td>
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<tr>
<td>ACTIVE</td>
<td>Atrial Fibrillation Clopidogrel Trial with Irbesartan for prevention of Vascular Events (ACTIVE W)</td>
</tr>
<tr>
<td>ADVANCE</td>
<td>Action in Diabetes and Vascular Disease: PreterAx and DiamicroN Modified-Release Controlled Evaluation</td>
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<td>ATACH</td>
<td>Antihypertensive Treatment of Acute Cerebral Hemorrhage</td>
</tr>
<tr>
<td>AVERT</td>
<td>A Very Early Rehabilitation Trial</td>
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<tr>
<td>BAFTA</td>
<td>Birmingham Atrial Fibrillation Treatment of the Aged study</td>
</tr>
<tr>
<td>CAPRIE</td>
<td>the Clopidogrel versus Aspirin in Patients at Risk of Ischemic Events trial</td>
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<td>CASES</td>
<td>Canadian Alteplase for Stroke Effectiveness Study</td>
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<tr>
<td>CAST/IST</td>
<td>Chinese Acute Stroke Trial/International Stroke Trial</td>
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<tr>
<td>CHARISMA</td>
<td>Clopidogrel for High Atherothrombotic Risk and Ischemic Stabilization, Management, and Avoidance</td>
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<td>CLOTS</td>
<td>Effectiveness of thigh-length graduated compression stockings to reduce the risk of deep vein thrombosis after stroke</td>
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<td>CREST</td>
<td>Carotid Revascularization Endarterectomy vs Stenting Trial</td>
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<td>EAFT</td>
<td>European Atrial Fibrillation Trial</td>
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<td>ECASS III</td>
<td>European Cooperative Acute Stroke Study III</td>
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<td>ESPRIT</td>
<td>the European/Australian Stroke Prevention Reversible Ischemia Trial group</td>
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<td>EXPRESS</td>
<td>Effect of urgent treatment of transient ischemic attack and minor stroke on early Recurrent Stroke Study</td>
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<td>FAST</td>
<td>Factor Seven for Acute Hemorrhagic Stroke (FAST)</td>
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<td>FASTER</td>
<td>Fast Assessment of Stroke and transient ischemic attack to prevent Early Recurrence</td>
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<td>Glucose in Stroke Trial</td>
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<tr>
<td>GRASP</td>
<td>Graded repetitive arm supplementary program</td>
</tr>
<tr>
<td>ICSS</td>
<td>International Carotid Stenting Study</td>
</tr>
<tr>
<td>INTERACT</td>
<td>The Intensive Blood Pressure Reduction in Acute Cerebral Haemorrhage Trial</td>
</tr>
<tr>
<td>ISAT</td>
<td>International Subarachnoid Aneurysm Trial</td>
</tr>
<tr>
<td>LIFE</td>
<td>Losartan Intervention For Endpoint Reduction Study</td>
</tr>
<tr>
<td>MATCH</td>
<td>Aspirin and clopidogrel compared with clopidogrel alone after recent ischaemic stroke or transient ischaemic attack in high-risk patients</td>
</tr>
<tr>
<td>NASCET</td>
<td>North American Symptomatic Carotid Endarterectomy Trial</td>
</tr>
<tr>
<td>ONTARGET/</td>
<td></td>
</tr>
<tr>
<td>TRANSCEND</td>
<td>ONgoingTelmisartan Alone and in Combination with Ramipril Global Endpoint Trial/Telmisartan Randomized AssessmeNT Study in ACE-INtolerant Subjects with Cardiovascular Disease</td>
</tr>
<tr>
<td>Acronym</td>
<td>Description</td>
</tr>
<tr>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td>OXVASC</td>
<td>Oxford Vascular study</td>
</tr>
<tr>
<td>PREVAIL</td>
<td>The efficacy and safety of enoxaparin versus unfractionated heparin for the prevention of venous thromboembolism after acute ischaemic stroke</td>
</tr>
<tr>
<td>PrOFESS</td>
<td>Prevention Regimen For Effectively avoiding Second Stroke</td>
</tr>
<tr>
<td>PROGRESS</td>
<td>The perindopril protection against recurrent stroke study</td>
</tr>
<tr>
<td>RE-LY</td>
<td>Randomized Evaluation of Long term anticoagulant therapy</td>
</tr>
<tr>
<td>SCOPE</td>
<td>The Study on Cognition and Prognosis in the Elderly</td>
</tr>
<tr>
<td>SPARCL</td>
<td>Stroke Prevention by Aggressive Reduction in Cholesterol Levels trial</td>
</tr>
<tr>
<td>STITCH</td>
<td>International Surgical Trial in Intracerebral Haemorrhage</td>
</tr>
</tbody>
</table>
## APPENDIX EIGHT  CSS Core Performance Indicators 2010

### Canadian Stroke Strategy Core System Indicators 2010

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Proportion of the population aware of 2 or more signs of stroke.</td>
</tr>
<tr>
<td>2.</td>
<td>The proportion of patients in the population that has any identified risk factors for stroke including: hypertension, obesity, smoking history, low physical activity, hyperlipidemia, diabetes, atrial fibrillation and carotid artery disease.</td>
</tr>
<tr>
<td>3.</td>
<td>The emergency department admission volumes for patients with ischemic stroke, intracerebral hemorrhagic stroke, subarachnoid hemorrhage, and transient ischemic attack. The hospital inpatient admission volumes for patients with ischemic stroke, intracerebral hemorrhagic stroke, subarachnoid hemorrhage, and transient ischemic attack.</td>
</tr>
<tr>
<td>4.</td>
<td>Total acute inpatient hospital length of stay (active LOS + ALC = total). Total inpatient rehabilitation hospital length of stay (active LOS + days waiting – service interruptions = total).</td>
</tr>
<tr>
<td>5.</td>
<td>Stroke death rates for 7-day in-hospital stroke fatality; 30 day all cause mortality; one-year all cause mortality, for patients with ischemic stroke, intracerebral hemorrhagic stroke, subarachnoid hemorrhage, and transient ischemic attack.</td>
</tr>
<tr>
<td>6.</td>
<td>Proportion of acute stroke and TIA patients that are discharged alive that are then readmitted to hospital with a new stroke or TIA diagnosis within 90 days of index acute care discharge.</td>
</tr>
</tbody>
</table>

### Canadian Stroke Strategy Core Clinical Indicators 2010

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.</td>
<td>Proportion of acute ischemic stroke patients who arrive at hospital within 3.5 hours of stroke symptom onset.</td>
</tr>
<tr>
<td>8.</td>
<td>Proportion of all ischemic stroke patients who receive acute thrombolytic therapy.</td>
</tr>
<tr>
<td>9.</td>
<td>Proportion of all thrombolized ischemic stroke patients who receive acute thrombolytic therapy within one hour of hospital arrival.</td>
</tr>
<tr>
<td>10.</td>
<td>The proportion of all acute stroke patients who are managed on a designated geographically defined integrated, acute, and/or rehabilitation stroke unit at any point during hospitalization. Median total time spent on a stroke unit for each patient during inpatient stay.</td>
</tr>
<tr>
<td>11.</td>
<td>Proportion of stroke patients who receive a brain CT/MRI within 24 hours of hospital arrival.</td>
</tr>
<tr>
<td>12.</td>
<td>Proportion of patients with documentation of an initial dysphagia screening during admission to ED or acute inpatient care or inpatient rehabilitation.</td>
</tr>
<tr>
<td></td>
<td>Proportion of acute ischemic stroke and TIA patients who receive acute antiplatelet therapy within the first 48 hours of hospital arrival. ^+</td>
</tr>
<tr>
<td>---</td>
<td>----------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>13.</td>
<td>Proportion of stroke patients with a rehabilitation assessment within 48 hours of hospital admission for acute ischemic stroke and within 5 days of admission for hemorrhagic stroke. +</td>
</tr>
<tr>
<td>14.</td>
<td>Proportion of acute ischemic stroke patients discharged on antithrombotic therapy unless contraindicated. *</td>
</tr>
<tr>
<td>15.</td>
<td>Proportion of acute ischemic stroke patients with atrial fibrillation who are treated with anti-coagulant therapy unless contraindicated. +</td>
</tr>
<tr>
<td>16.</td>
<td>Proportion of patients with TIA who are investigated and discharged from the emergency department who are referred to organized secondary stroke prevention services. *</td>
</tr>
<tr>
<td>17.</td>
<td>Percentage of patients referred to organized secondary stroke prevention services who are seen within 72 hours</td>
</tr>
<tr>
<td>18.</td>
<td>Wait time from ischemic stroke or TIA symptom onset to carotid revascularization. *</td>
</tr>
<tr>
<td>19.</td>
<td>Distribution of discharge locations (dispositions) for acute stroke patients from acute inpatient care to: home (with and without services); inpatient rehabilitation (General or specialized); long term care; and to palliative care (each stratified by stroke type and severity). *</td>
</tr>
<tr>
<td>20.</td>
<td>Wait times for inpatient stroke rehabilitation services from stroke onset to rehabilitation admission. *</td>
</tr>
<tr>
<td>21.</td>
<td>Distribution of discharge locations (dispositions) from inpatient rehabilitation to: home (with and without services); acute care (for acute medical issues or as repatriation to home community); and to long term care (each stratified by stroke type and severity).</td>
</tr>
<tr>
<td>i</td>
<td>Proportion of all stroke patients with documentation of education provided for patient, family and/or caregivers during acute inpatient care or inpatient rehabilitation stay. ^+</td>
</tr>
</tbody>
</table>

^ New core indicator – previously part of larger set of CSS best practice indicators, and/or part of Accreditation indicator set and elevated to core indicator for 2010

* CSS core indicators that are also mandatory indicators for the Accreditation Canada Stroke Distinction Program

+ CSS core indicators that are also optional indicators for the Accreditation Canada Stroke Distinction Program

! Indicator on documentation of patient education is considered a developmental indicator that will be monitored closely for data quality and validity prior to being considered as a part of the CSS core indicator set.

For additional indicators associated with each stroke best practice recommendation, please refer to the CSS Performance Measurement Manual, found at www.canadianstrokestrategy.com
## APPENDIX NINE  Implementation Resources that Support Uptake of Best Practices

<table>
<thead>
<tr>
<th>Resource</th>
<th>Description</th>
<th>Access</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Professional Development Resources</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Canadian Best Practice Recommendations for Stroke Care: 2008 Toolkit</strong>&lt;br&gt;<em>2010 edition in development</em></td>
<td><strong>Purpose:</strong> To introduce and provide an overview of the current stroke best practice recommendations.&lt;br&gt;<strong>Target Audience:</strong> Front line interprofessional staff, managers and system leaders involved in stroke care delivery.&lt;br&gt;<strong>Resource Description:</strong> A series of educational modules that includes a review of the recommendations for each part of the care continuum, and provides additional information, evidence and examples of their application.&lt;br&gt;<strong>Delivery format:</strong> PowerPoint presentations that could be delivered during in-person workshops or self-directed learning.</td>
<td><a href="http://www.heartandstroke.on.ca/site/c.pvI3IeNWJwE/b.5398033/k.2C15/Canadian_Best_Practices_Workshop.html">http://www.heartandstroke.on.ca/site/c.pvI3IeNWJwE/b.5398033/k.2C15/Canadian_Best_Practices_Workshop.html</a></td>
</tr>
<tr>
<td><strong>Emergency Medical Services Management of Suspected Stroke Patients (2010)</strong></td>
<td><strong>Purpose:</strong> To increase consistency and standardization for emergency medical system (EMS) personnel’s assessment and management of suspected stroke patients.&lt;br&gt;<strong>Target Audience:</strong> Experienced EMS providers and new trainees. EMS dispatch, emergency department staff.&lt;br&gt;<strong>Resource Description:</strong> Two parts: (i) a standard template with core content for assessment and management of suspected stroke patients on scene; (ii) in-depth educational workshop that provides in-depth explanations of each component of the assessment and management tool.&lt;br&gt;<strong>Delivery format:</strong> The template is in the form of stroke pocket cards and a written document. The educational workshop can be delivered as an in-person workshop, or as an online self-directed learning module.</td>
<td><a href="http://canadianstrokestrategy.ca/eng/professional/tools.html">http://canadianstrokestrategy.ca/eng/professional/tools.html</a></td>
</tr>
<tr>
<td><strong>Secondary Prevention Best</strong></td>
<td><strong>Purpose:</strong> To support the interprofessional healthcare team in the</td>
<td><a href="http://www.heartandstroke.on.ca/site">http://www.heartandstroke.on.ca/site</a></td>
</tr>
<tr>
<td>Resource</td>
<td>Description</td>
<td>Access</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Practices Workshop Toolkit: Preventing Stroke One at a Time*</td>
<td>implementation of recommendations for the secondary prevention of stroke.</td>
<td>/c.pvl3IeNWJwE/b.5882219/k.48F5/Secondary_Prevention_Tool_Kit.htm</td>
</tr>
<tr>
<td>Target Audience: Front line interprofessional healthcare providers,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>staff and patient educators, managers and system leaders involved in</td>
<td></td>
<td></td>
</tr>
<tr>
<td>stroke care delivery.</td>
<td></td>
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<tr>
<td>Resource Description: A comprehensive set of learning materials</td>
<td></td>
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<tr>
<td>that address the evaluation of stroke, acute interventions, lifestyle,</td>
<td></td>
<td></td>
</tr>
<tr>
<td>and risk factor management issues.</td>
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<td></td>
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<tr>
<td>Delivery format: This includes eight slide presentations with</td>
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<tr>
<td>speakers’ notes on a range of stroke prevention topics, as well as</td>
<td></td>
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<tr>
<td>handouts and templates for organizing and delivering workshops and</td>
<td></td>
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</tr>
<tr>
<td>educational sessions on secondary stroke prevention.</td>
<td></td>
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</tr>
<tr>
<td>A Guide to the Implementation of Stroke Unit Care (2009)</td>
<td><strong>Purpose:</strong> To provide a systematic and comprehensive approach to guide the establishment of new stroke units and the enhancement of existing stroke units to provide optimal services and processes of care for stroke patients.</td>
<td><a href="http://canadianstrokestrategy.com/wp-content/uploads/2010/07/CSSStrokeUnitResource_EN.pdf">http://canadianstrokestrategy.com/wp-content/uploads/2010/07/CSSStrokeUnitResource_EN.pdf</a></td>
</tr>
<tr>
<td><strong>Target Audience:</strong> Hospital/regional funders, senior administrators,</td>
<td></td>
<td></td>
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<tr>
<td>program managers, front-line staff caring for stroke patients.</td>
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<tr>
<td>Resource Description: Written reference material that addresses</td>
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<tr>
<td>the current stroke unit recommendations, operational definitions and</td>
<td></td>
<td></td>
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<tr>
<td>key components of stroke units, key steps and staffing models to set-up</td>
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<td></td>
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<tr>
<td>a stroke unit, quality of care evaluation indicators.</td>
<td></td>
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<tr>
<td>Delivery format: Reference booklet, available in hard copy and as a</td>
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<tr>
<td>web-based document for download.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Add second nursing resource</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Target Audience:</strong> Front line and advanced practice nurses.</td>
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<td></td>
</tr>
<tr>
<td>Resource Description: A series of educational modules and resources</td>
<td></td>
<td></td>
</tr>
<tr>
<td>that review recommendations for each part of the care.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resource</td>
<td>Description</td>
<td>Access</td>
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<tr>
<td>----------</td>
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<td>--------</td>
</tr>
</tbody>
</table>
| **Stroke Pocket Cards (2005)** | **Purpose:** To provide quick and convenient reference information for the assessment of stroke severity and neurological function.  
**Target Audience:** Front line interprofessional healthcare providers who care for stroke patients across the continuum.  
**Resource Description:** A package of five quick reference pocket cards including Stroke Symptoms, Functions of the Brain, Cranial Nerves, Canadian Neurological Scale and National Institute of Health Stroke Scale.  
**Delivery format:** These pocket cards come as a set of five, and can be ordered online. | www.heartandstroke.on.ca/site/c.pvI3leNWJwE/b.5852913/k.AC4B/Order_Resources/apps/ka/ct/contactcustom.asp |
| **Patient’s Guide to Canadian Best Practices Recommendations for Stroke Care*  
*2010 edition in development** | **Purpose:** To educate patients and families about best practices in stroke care and encourage their active participation in stroke care and recovery.  
**Target Audience:** Stroke patients, family members, caregivers, lay public.  
**Resource Description:** Booklet with lay terminology describing the best practice recommendations for stroke care across the continuum of care  
| **Performance Measurement and Evaluation Resources** | **Purpose:** To provide a standardized set of case definitions and | http://canadianstrokestrategy.com/w |

*2010 edition in development*
<table>
<thead>
<tr>
<th>Resource</th>
<th>Description</th>
<th>Access</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Target Audience:</strong> Interprofessional stroke teams, stroke evaluation specialists, epidemiologists, stroke researchers.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Resource Description:</strong> This resource includes a comprehensive list of International Classification of Diseases, 10th Edition (ICD_10) codes to describe acute stroke and stroke subtypes. It also includes a list of the 21 core stroke evaluation indicators that span the stroke care continuum, which have been identified through a structured consensus process.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Delivery format:</strong> Documents available electronically and in downloadable format for printing.</td>
<td></td>
</tr>
<tr>
<td>*2010 edition in development</td>
<td><strong>Target Audience:</strong> Interprofessional stroke teams, stroke evaluation specialists, epidemiologists, stroke researchers.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Resource Description:</strong> A comprehensive data dictionary that provides a detailed description of operational definition, numerator, denominator and inclusion criteria for each performance measure included in the stroke best practice recommendations.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Delivery format:</strong> This is presented as a manual in electronic form that is available for download and printing.</td>
<td></td>
</tr>
<tr>
<td>Canadian Stroke Strategy Guide to CIHI Stroke Special Project #340</td>
<td><strong>Purpose:</strong> To provide an overview of the performance measurement elements contained in the Canadian Institute for Health Information’s Special Project #340.</td>
<td>TBD</td>
</tr>
<tr>
<td></td>
<td><strong>Target Audience:</strong> Health Information Management specialists, hospital records coders and archivists, stroke evaluation specialists, epidemiologists, stroke researchers.</td>
<td></td>
</tr>
<tr>
<td>Resource Description: A slide presentation that provides an overview of CIHI Stroke Special Project #340, and detailed information regarding each data element included for data collection. <strong>Delivery format:</strong> Slide presentation for delivery as an in-person workshop.</td>
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</tr>
<tr>
<td><strong>Accreditation Canada Stroke Distinction Program</strong></td>
<td></td>
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</tr>
<tr>
<td><strong>Accreditation Stroke Distinction Award</strong></td>
<td></td>
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</tr>
<tr>
<td><strong>Purpose:</strong> To provide a mechanism to recognize organizations that demonstrate clinical excellence and an outstanding commitment to leadership in stroke care. <strong>Target Audience:</strong> Organized stroke programs and interprofessional stroke teams, regional health authorities, organization leaders and administrators. <strong>Resource Description:</strong> A highly specialized standards of excellence that are closely based on the <em>Canadian Best Practice Recommendations for Stroke Care</em>, addressing acute stroke services, inpatient rehabilitation stroke services, and comprehensive stroke services (for use in a regional setting). The distinction award also includes a set of performance measures that each participating organization is required to submit to Accreditation Canada. <strong>Delivery format:</strong> This program includes a set of standards and protocols, the ongoing submission of data related to a core set of stroke quality indicators, and an on-site visit by expert evaluators with wide-ranging experience in the stroke care field.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Access:</strong> <a href="http://www.accreditation.ca/accreditation-programs/distinction/stroke-services/">http://www.accreditation.ca/accreditation-programs/distinction/stroke-services/</a></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>