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Canadian Best Practice Recommendations for Stroke Care

(updated 2008)

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Canadian best practice recommendations for stroke care (updated 2008)

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What's new in 2008? Updates to the 2006 Canadian Best Practice Recommendations for Stroke Care

Overall enhancements

- Recommendations reorganized to flow across the continuum of stroke care and to incorporate new statements
- Recommendations integrate an emphasis on ideal discharge planning at all transitions
- Acknowledgement of specific issues in pediatric stroke integrated throughout document

Specific changes to recommendations

- Updated evidence reviews and minor wording changes to 21 of the original 24 best practice recommendations made in 2006
- 2006 recommendation about community rehabilitation expanded to encompass both community and outpatient rehabilitation services
- Two recommendations from 2006 — those regarding computed tomography scans and carotid imaging — combined into a new, broader recommendation on neurovascular imaging
- New recommendation developed on emergency medical services care of stroke patients before hospital arrival, including the need to recognize stroke as a priority dispatch for emergency medical services, direct transport protocols, training in and use of stroke screening tools for patients with suspected stroke, prenotifcation protocols and communication between emergency medical services and receiving hospitals
- New recommendation on acute management of transient ischemic attack and minor stroke that focuses on timely and comprehensive assessments, for outpatients or patients in hospital, and implementation of appropriate therapeutic interventions and therapies
- New recommendation on components of acute inpatient care with the goal of minimizing stroke-related complications during hospitalization, including the specific areas of venous thromboembolism prophylaxis, temperature management, early mobilization, continence management, nutrition, oral care and early discharge planning
- New recommendation on vascular cognitive impairment and dementia for patients who have experienced a stroke, with guidance on screening and assessment for vascular cognitive impairment, appropriate timing for assessments, pharmacotherapy and nonpharmacologic management

Focus on implementation

- Strategic initiatives related to implementation are under way
- Point-of-care tools have been developed and made available to support implementation of the best practice recommendations

Overview

The Canadian Stroke Strategy was initiated under the leadership of the Canadian Stroke Network and the Heart and Stroke Foundation of Canada. It brings together a multitude of stakeholders and partners to work toward the common goal of developing and implementing a coordinated and integrated approach to stroke prevention, treatment, rehabilitation and community reintegration in every province and territory in Canada. Enhanced access for all Canadians to integrated, high-quality and efficient stroke services will establish the Canadian Stroke Strategy as a model for innovative health system reform in Canada and internationally.

The Canadian Stroke Strategy provides a framework to facilitate the widespread adoption of evidence-based best practices across the continuum of stroke care, focusing at 2 levels:

- the national level, where the creation of working groups to address priority initiatives supports provincial and territorial work through coordination, content development and communication;
- the provincial/territorial level, where implementation of best practices in stroke prevention, treatment, rehabilitation and community reintegration occurs at the front lines of health care.

Best Practices and Standards represent 1 of 5 Canadian Stroke Strategy national priority platforms. The goal of the Best Practices and Standards platform is to transform stroke prevention and care, ensuring that evidence-based best practices are integrated into the Canadian health system. The development and dissemination of the Canadian Best Practice Recommendations for Stroke Care begins to address this goal.

The Best Practices and Standards Working Group was established in response to the observation that stroke research findings do not always reach health care professionals, hospital administrators, health ministries and, most importantly, persons with stroke. Thus, best practices are not consistently applied, leaving a significant gap in the quality of stroke care between what should be done and what is being done. The primary goal of the Canadian Stroke Strategy is to help close this gap. The membership list for the Best Practices and Standards Working Group is provided in Appendix 1.

The first edition of the Canadian Best Practice Recommendations for Stroke Care, released in 2006,[1] included an ongoing plan to formally update the recommendations every

*See Appendix 1, Appendix 2, Appendix 3 and Appendix 4 for affiliations of the writing group and a complete list of committees and other contributors to this work.

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2 years to ensure that the best practice recommendations remain current and are coordinated with other similar initiatives nationally and internationally. The 2008 update includes both revisions to the 24 best practice recommendations released in 2006 and the addition of 4 new recommendations addressing emergency medical services, management of transient ischemic attack and minor stroke, acute inpatient care and vascular cognitive impairment.

Scope, purpose and target audience

The Canadian Best Practice Recommendations for Stroke Care are the result of an extensive review of international stroke research and published evidence-based best practice recommendations or guidelines related to stroke. The document provides a synthesis of best practices in stroke care across the continuum of care and serves as a framework for provinces and territories as they develop and implement stroke strategies. For the purpose of this document, the "continuum of stroke care" is defined as having the following components:

- 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

The Canadian Best Practice Recommendations for Stroke Care, 2008 update, reflect the most critical topics in effective stroke care, are evidence-based and/or key health system drivers and are relevant in the Canadian context. They are for use by health professionals throughout the health care system who care for those affected by stroke, as well as health system policy-makers, planners, funders and administrators. Each recommendation is accompanied by information to support uptake and implementation, as follows:

- The *best practice recommendation* provides direction for front-line staff and caregivers on optimal stroke care based on current evidence.
- 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 s*ystem implications* provide system leaders, administrators and funders with information on what needs to be in place for the specific recommendation to be most effectively implemented. These are the mechanisms and structures that should be developed and/or put in place if front-line staff and caregivers are to successfully implement the recommendations and achieve optimal levels of care for stroke patients.
- The *performance measures* provide managers and administrators with a standardized and validated mechanism for consistently monitoring the quality of stroke care and the impact of implementing the best practice recommendations. The most important performance measures are **highlighted in bold type**. The others, while important, are for those able to conduct a more extensive evaluation of stroke practice in their region. Performance measures that are part of the Canadian Stroke Strategy core indictaor set, identified through a consensus panel, are indicated with the parenthetical term "core."
- The *summary of the evidence* summarizes the most compelling and strongest evidence related to the recommendation.

Where Canadian guidelines for specific components of stroke care already existed elsewhere — for example, rehabilitation guidelines available in the Stroke Canada Optimization of Rehabilitation through Evidence (SCORE) project — the detailed recommendations in those documents are not repeated here. Rather, readers are referred to the original document for the specific recommendation (such as care of a hemiplegic arm or leg as presented in the Stroke Canada Optimization of Rehabilitation through Evidence project[2]), while the Canadian Best Practice Recommendations for Stroke Care address related structure and process issues, such as "components of inpatient rehabilitation."

Within the health care system, there are generally 3 levels of facilities that provide stroke services: comprehensive stroke centres, centres providing an intermediate level of stroke services and centres lacking necessary stroke resources. These types of facilities are described below (other stroke-related terms are defined in a glossary of terms appearing in Appendix 5.

Comprehensive stroke centres are 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 stroke 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.

Hospitals with intermediate stroke services are facilities with clinicians who have stroke expertise; written stroke protocols for emergency services, acute care and/or rehabilitation; 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 (e.g., telemedicine); and coordinated processes for patient transition to ongoing rehabilitation and secondary prevention services.

Hospitals without specialized stroke resources are centres that do not have in-hospital resources such as clinicians with stroke expertise or neuroimaging. These centres should have written agreements in place to facilitate timely transfer of stroke patients to higher levels of care as appropriate.

It is recognized that resource issues (human, financial and system) may make it difficult to implement every

recommendation and performance measure in this document. However, they are presented as "gold standard" benchmarks toward which all organizations and systems managing stroke patients should be striving. Additionally, they are valuable tools that can be used by those advocating for improved stroke care services.

Updates and revisions

The first edition of the Canadian Best Practice Recommendations for Stroke Care was released in 2006, with a commitment to conduct a formal review and update every 2 years. In addition, interim bulletins would be issued as required to address emerging evidence that may alter an existing recommendation. This update was prepared between September 2007 and November 2008.

Method: development and update process

The conceptual framework used to guide the identification, selection, development and updating of the Canadian best practice recommendations was the Practice Guideline Evaluation and Adaptation Cycle of Graham and colleagues.[3] This cycle involves a number of steps that are integral to the guideline development process:

1. Establishing an interdisciplinary 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 Canadian Best Practice Recommendations for Stroke Care developed in 2006 was based on this framework, and it continues to be followed, with additional enhancements, for subsequent updates. The key activities undertaken in the guideline development process are highlighted below.

Leadership

The guideline development process was led by a subgroup of the Best Practices and Standards Working Group and managed by the performance and standards specialist from the Canadian Stroke Network (P.L). An interprofessional group of experts in stroke care was identified to participate on task groups convened specifically to draft the Canadian recommendation statements for each segment of the continuum of stroke care. Task groups included members of the Best Practices and Standards Working Group and other recognized experts from across Canada, including stroke neurologists, physiatrists, nurses, emergency physicians, paramedics, physiotherapists, occupational therapists, dietitians, speech–language pathologists, pharmacists, stroke survivors, education experts and professionals from other disciplines as required to ensure that all relevant health disciplines for a particular topic area were represented in the development of the recommendations. A national consensus panel was convened to provide further input into the recommendations. An external group of stroke and methods experts conducted a final review of the recommendations before release.

Participants in the guideline development and review process were asked to declare all potential conflicts of interest in writing. Sixteen people had received honoraria to speak about stroke. None of these conflicts were deemed to prevent unbiased participation in the guideline process. This project was funded in its entirety by the Canadian Stroke Strategy, a partnership of the Canadian Stroke Network and the Heart and Stroke Foundation of Canada (both nonprofit organizations). The recommendations were achieved by consensus of independent experts and stakeholders through a rigorous process, and the views and interests of the funding body have not influenced the final recommendations.

Identification of key topics and core reference guidelines

Criteria were established to guide the selection of best practice recommendations for the Canadian stroke guideline. These were applied to the original recommendations and all updates. It was determined that, to be considered for inclusion, recommendations had to meet the following criteria:

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

It was agreed that all recommendations would be accompanied by specific information to support implementation, i.e., the rationale for the recommendation, key health system implications, standardized performance measures to evaluate implementation and a summary of the supporting evidence.

Initially, the scope and content of the project was defined by evaluating existing national and international stroke guidelines and recommendations to determine which topics should be considered for inclusi on in the Canadian stroke best practice recommendations.[1,2,4–38] Two comprehensive Canadian stroke care guideline reviews that were already available, the Canadian Stroke Quality of Care Study (CSQCS),[18–21] which focused on acute care, telestroke and secondary prevention, and the Stroke Canada Optimization of Rehabilitation through Evidence project (SCORE),[2] which focused on specific rehabilitation components, were used as a starting point. These studies of best practices and performance measurement in stroke care flowed from 5 Canadian consensus panels (3 for the Canadian Stroke Quality of Care Study, 1 for the Stroke Canada Optimization of Rehabilitation through Evidence project and 1 joint) conducted from 2004 to 2006. The rigorous methodology and detailed findings of these 2 projects formed the foundation for the initial phase of development of the stroke best practices recommendations.

Key activities undertaken:

- Since the release of the 2006 edition of the stroke guidelines, a literature scan has been conducted every 2 to 3 months to review emerging evidence and new or updated guidelines.
- An extensive literature scan of primary research evidence was conducted, followed by an evaluation of the strength of the evidence for each relevant paper found. The levels of evidence across all papers selected for a given topic often varied depending on the nature of the research. The sum of the papers for each topic provided a comprehensive understanding of the strength of the evidence, the state of the research and gaps for future inquiry.
- A detailed literature search for existing international stroke-related guidelines was also undertaken. The Appraisal of Guidelines Research and Evaluation (AGREE) tool was used to appraise the quality of stroke-related guidelines identified. The Appraisal of Guidelines Research and Evaluation tool (www.agreetrust.org) is a guideline appraisal instrument that assesses the process of guideline development according to 6 domains: identification of a clinical area to promote best practice, stakeholder involvement, rigour of development, clarity and presentation, applicability and editorial independence. Guidelines identified and appraised as part of the Canadian Stroke Quality of Care Study (CSQCS) and the Stroke Canada Optimization of Rehabilitation through Evidence (SCORE) project were not reappraised; rather than duplicate the work of those 2 projects, the already-established scores were accepted for this process.
- A set of high-quality stroke-related guidelines was selected to serve as core reference guidelines, on the basis of their ratings from the Appraisal of Guidelines Research and Evaluation tool, particularly the "rigour of development" domain score, and their relevance to the Canadian context.
- A content review of the core reference guidelines was conducted to identify a list of stroke topic areas that were addressed in these guidelines and were supported by the highest levels of evidence. A secondary list of stroke topic areas that had lower levels of evidence but that were considered to be key system drivers (such as acute diagnostic imaging with computed tomography [CT] scans) was also identified. The findings were compiled into a matrix to allow easy comparison of international recommendations by topic.
- The stroke topic areas and levels of supporting evidence were reviewed and debated by the working group. A final list of stroke topic areas that were considered most relevant to optimal stroke care in Canada was developed, using a consensus model.
- For each topic area across the continuum of stroke care, a Stroke Recommendation Matrix was generated, showing all recommendations drawn from the core reference guidelines related to that topic area and their corresponding levels of evidence. This matrix allowed for quick comparison between recommendations.
- The project manager (C.H.) conducted structured literature reviews for each stroke topic area, focusing on meta-analyses, systematic reviews, randomized trials, quasi-experimental studies, other related guidelines and reports, and Canadian consensus statements by health care professional groups. The strength of the available evidence was then graded using a standardized scoring system. See Appendix 6 for the evidence grading system used in these guidelines. Each guideline group applied a validated grading system for determining the strength of the evidence used to develop the guideline, and overall, several different grading systems were used. The level of evidence for each recommendation in the Canadian Best Practice Recommendations for Stroke Care appears at the end of the recommendation statement.

Synthesis of best practice recommendations

For each segment of the continuum of stroke care (prevention, hyperacute and acute care, rehabilitation and community care), expert task groups were convened to select relevant recommendations from the matrix or, if necessary, draft new recommendations based on the literature reviews. 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 taken as direct statements from other existing guidelines, adapted from one or more guidelines, or written by the task group. See Appendix 2 for task group participant lists. At the end of each recommendation statement, we have listed other guidelines with which these recommendations are most strongly aligned, where appropriate and relevant (see Table 1 for the abbreviations of guideline titles or developers used in these lists).

Most of the task group work was done by teleconference, with the project leader and/or the project manager joining all teleconferences to ensure consistency, standardization and rigour of development across groups.

The task groups:

- reviewed the Stroke Recommendation Matrix and supporting documentation for their segment of the continuum
- reviewed structured literature reviews and the primary evidence for each stroke topic area
- considered additional topics that had high levels of supporting evidence but that did not appear on the original topic list identified by the working group
- wrote the first draft of the recommendations for their segment of the continuum by selecting from existing guidelines or crafting them to fit new evidence
- provided references for each recommendation, including the core reference guideline(s) that were adapted or that contributed most to the wording of the recommendation
- provided a rationale for each recommendation that stated its relevance to stroke care delivery
- identified the implications of implementing the recommendations for the Canadian health care system
- provided summaries of the primary research evidence underpinning the recommendations

National expert consensus panel review of recommendations

After the task groups completed their work, the draft recommendations and supporting information were presented for

Table 1: Abbreviations used for citing other guidelines and clinical trials with which current recommendations are aligned*

Abbreviation	Definition
AAN	American Academy of Neurology: Report of the Therapeutics and Technology Assessment Subcommittee[39]
ACCP	American College of Chest Physicians: Evidence-based clinical practice guidelines (8th ed.)[10]
AHA-P	American Heart Association: Management of stroke in infants and children[9]
ASA	American Stroke Association[4–8]
AU	National Stroke Foundation, Australia: Clinical guidelines for acute stroke management[12]
AU-R	National Stroke Foundation, Australia: Clinical guidelines for stroke rehabilitation and recovery[13]
AVERT	A Very Early Rehabilitation Trial for stroke[40,41]
CAST/IST	Chinese Acute Stroke Trial/International Stroke Trial[42]
CCCDTD	Canadian Consensus Conference of the Diagnosis and Treatment of Dementia[14]
CCF	Canadian Continence Foundation[43]
CDA	Canadian Diabetes Association: Canadian Diabetes Association 2008 clinical practice guidelines for the prevention and management of diabetes in Canada[15]
CHARISMA	Clopidogrel for High Atherothrombotic Risk and Ischemic Stabilization, Management, and Avoidance[44]
CHEP	Canadian Hypertension Education Program[17]
Cochrane	Cochrane Database of Systematic Reviews: Thrombolysis for acute ischaemic stroke[45]
CSQCS	Canadian Stroke Quality of Care Study[18–21]
EBRSR	Evidence-Based Review of Stroke Rehabilitation[25]
ECASS III	European Cooperative Acute Stroke Study III: Thrombolysis with alteplase 3 to 4.5 hours after acute ischemic stroke[46]
ESO	European Stroke Organization: Guidelines for the management of ischaemic stroke and transient ischaemic attack[26]
EXPRESS	Early use of Existing Preventive Strategies for Stroke[47]
HSFO	Heart and Stroke Foundation of Ontario: Consensus Panel on the Stroke Rehabilitation System[48]
MATCH	Management of Atherothrombosis with Clopidogrel in High-risk patients with recent TIA or ischemic stroke[49]
NAEMSP	National Association of EMS Physicians[50]
NICE	National Institute for Health and Clinical Excellence[32]
NOCP	Paramedic Association of Canada: National occupational competency profiles for paramedic practitioners[51]
NZ	Stroke Foundation, New Zealand: New Zealand guideline for management of stroke[27]
OCCPG	Obesity Canada clinical practice guidelines[52]
Ottawa Panel	Evidence-based clinical practice guidelines for post-stroke rehabilitation[24]
PROGRESS	PROGRESS Collaborative Group: Randomised trial of a perindopril-based blood-pressure-lowering regimen[53]
RCP	Royal College of Physicians: National clinical guidelines for stroke[36]
RCP-P	Royal College of Physicians: Stroke in childhood[38]
RNAO	Registered Nurses Association of Ontario: Nurses best practice guideline (continence)[23]
SCORE	Stroke Canada Optimization of Rehabilitation through Evidence[2]
SIGN	Scottish Intercollegiate Guidelines Network: Management of patients with stroke[28–31]
SIGN 13	Scottish Intercollegiate Guidelines Network: Management of patients with stroke I: assessment, investigation, immediate management and secondary prevention[28]
SIGN 14	Scottish Intercollegiate Guidelines Network: Management of patients with stroke II: management of carotid stenosis and carotid endarterectomy[29]
SIGN 64	Scottish Intercollegiate Guidelines Network: Management of patients with stroke IV: rehabilitation, prevention and management of complications and discharge planning[31]
SIGN 78	Scottish Intercollegiate Guidelines Network: Management of patients with stroke III: identification and management of dysphagia[30]
VA/DoD	US Veterans Affairs/Department of Defense: Clinical practice guideline for the management of stroke rehabilitation[11]

*In many instances, the best practice recommendations were adapted from or aligned with other existing guidelines. These are identified at the end of each recommendation statement, as appropriate, using the abbreviations listed here.

discussion and decision-making to a broad group of stakeholders at a national consensus panel meeting. Panel participants included task group members, health care professionals from across disciplines and across the health care continuum who were external to the guideline development process, key opinion leaders and stroke survivors. The objectives of the consensus panel meeting were the following:

- to discuss and, where necessary, modify the proposed updates to existing recommendations, the inclusion of new recommendations and other suggested changes to the document
- to reach consensus and vote on the complete set of recommendations
- to discuss and propose ongoing implementation strategies
- to prioritize the best practice recommendations to identify foci for existing implementation resources, while maintaining an emphasis on the importance of all of the recommendations to an integrated and coordinated stroke care system

Panel members received the draft recommendations and updates in advance of the panel meeting and were asked, before the meeting, to review the recommendations, provide feedback and indicate their degree of support for each recommendation. Through breakout sessions and full panel meetings, discussion and debate took place with respect to relevance, current evidence and practice, and barriers to uptake and implementation of each proposed recommendation. Finally, a decision was made for each recommendation as to whether to approve it, reject it or defer it for further investigation by the task groups.

The first best practices and standards national consensus panel meeting was held in Halifax in April 2006 with 40 participants. The second was held in Toronto in April 2008 and was attended by 49 of the 55 members of the consensus panel. See Appendix 3 for the participant list.

Development of performance measures

The Canadian Stroke Strategy Information and Evaluation Working Group (see Appendix 1) was established to develop a framework to measure the quality and consistency of care across the continuum of stroke care delivery. Members of the working group were drawn from across the continuum of stroke care.

As part of its mandate, the Information and Evaluation Working Group reviewed each final recommendation and developed a set of performance measures 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," which 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 19 core performance measures for stroke established at a Canadian Stroke Strategy performance measurement consensus conference in 2005. Additional validated performance measures for the recommendations were developed for each recommendation. The Information and Evaluation Working Group has created the comprehensive *Canadian Stroke Strategy Performance Measurement Manual* as a supplement to the best practice recommendations. It includes all the performance measures identified throughout the best practices recommendations, as well as additional measures for those who would like to conduct more in-depth evaluation of the implementation and outcomes for specific recommendations. This manual provides detailed definitions and formulas to calculate each performance measure, which will lead to increased consistency and standardization of measuring stroke care performance across Canada. This standardization 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 initiatives are under way nationally and internationally to establish validated benchmarks for stroke performance measures. (To access the *Canadian Stroke Strategy Performance Measurement Manual*, see www.canadianstrokestrategy.ca.)

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. Several collaborators with the Canadian Stroke Strategy, such as research investigators with the Canadian Stroke Network, have developed audit tools and data collection mechanisms that have been made available nationally to support the collection of vital stroke data. As with implementation of the best practice recommendations themselves, it is not expected that users will be able to collect and document all performance measures included with the best practice recommendations. Therefore, the most significant measures have been highlighted for easy identification, with the remaining measures provided for those who are able to conduct a more extensive evaluation of stroke practice in their region.

Areas of controversy in stroke management

Several areas across the continuum of stroke care could be considered controversial — some of the controversy being based on expert opinion and some on conflicting or insufficient research evidence. Specific issues have been highlighted throughout the document within the evidence summaries for relevant recommendations. The 6 most controversial of these areas are the following:

- long-term combined antiplatelet therapy in persons with both coronary artery and cerebrovascular disease
- carotid stenting
- intra-arterial thrombolysis
- superiority of low molecular weight heparin over heparin for venous thromboembolism prophylaxis
- risks and benefits of statin agents in hemorrhagic stroke
- optimal timing, duration and intensity of inpatient and outpatient rehabilitation

This is not a finite list, but rather some examples of issues raised throughout the recommendations. Please refer to individual recommendations for further information.

Levels of evidence for stroke recommendations

Recommendations supported by evidence level A resulted when there was strong research evidence from randomized

clinical trials and/or meta-analyses in accordance with the grading system selected to guide the primary research reviews.[54] Areas where there was weaker evidence (e.g., isolated or nonrandomized trials) were rated as level B recommendations, and level C indicates that there was consensus of experts with only weak or inconsistent evidence. The 27 topics included in the Canadian Best Practice Recommendations for Stroke Care address 47 main components, of which 25 were rated level A, 15 were considered level B, and 7 had level C evidence (Table 2).

Limitations of the Canadian Best Practice Recommendations for Stroke Care

Limitations of the Canadian Best Practice Recommendations for Stroke Care may arise from bias in the choice of topics for recommendations, challenges in addressing late-breaking evidence, bias in the consensus panel process, problems with generalizability outside the Canadian context and inadequate recognition of the barriers to implementation of the recommendations.

A thorough literature review and consultation process was undertaken to identify topics that met our criteria of strongest evidence or key health system drivers; however, some important topics may not be addressed in these guidelines. These include such topics as use of telemedicine in stroke and the optimal treatment of patients with communicative disorders. The task groups considered these and concluded that they did not meet our criteria at this time. Some of these topics will be explored for inclusion in future updates. Similarly, topics covered in detail in other current Canadian stroke-related guidelines, for example, the Stroke Canada Optimization of Rehabilitation through Evidence (SCORE) rehabilitation guidelines,[2] were not repeated in these guidelines; rather, complete references are provided, and readers are referred to the relevant works and web links.

A final literature review date of June 30, 2008, was set to enable completion of the recommendation development process. It was not feasible or appropriate to present the expert panel with all available evidence, and therefore the primary evidence was initially screened and evaluated by the task groups. Some appropriate research papers were not included in our deliberations (Appendix 7 provides a brief list of relevant evidence not considered during the consensus process). In addition, research in stroke care interventions is emerging rapidly, and some evidence has emerged since the consensus panel concluded its work. Wherever possible, late-breaking new evidence was reviewed by the task group leaders to identify areas where the evidence might significantly alter our current recommendations. This occurred for the recommendation on acute thrombolytics, and an ad hoc task group was convened before publication to review the recommendation in light of the new evidence, followed by review and input from the consensus panel.

Bias could have been introduced through the selection of consensus panel members. A conscientious effort was undertaken to ensure broad representation of important stakeholders; however, some relevant groups might have been underrepresented.

One of our criteria at the outset was that the recommendations be relevant to the Canadian context. This may in part limit their generalizability to jurisdictions outside Canada, given our unique setting and health care funding model. The Canadian relevance was more apparent in the "Systems implications" sections of the guidelines, and the evidence on which the recommendations are based has been derived internationally, so others may adapt or adopt the recommendations as appropriate within their own settings. Much effort has been made over the past 2 years for Canada to work with stroke guideline developers internationally to increase alignment and relevance outside Canada. Finally, the research evidence on the most effective strategies for implementation and uptake of clinical practice guidelines and the data on the impact of implementing stroke guidelines on improving patient outcomes are both in their early stages. We are developing evaluation strategies to more fully understand both these issues, which will inform our ongoing efforts to improve stroke care and outcomes.

Release of best practice recommendations

Following the consensus panel meeting, the task groups reconvened to review the consensus panel feedback, address suggested revisions and propose final wording for the recommendations. Once that process was completed, the following steps were undertaken:

- The recommendations and supporting documentation were reviewed externally by a range of Canadian stroke experts and system leaders who had not participated in any previous step of the guideline development process. (In addition, the comments of *CMAJ* editors and peer reviewers, accompanied by the authors' responses, appear in Appendix 8, available at www.cmaj.ca/cgi/content/full/179/12/E1/DC2.)
- The document was translated into French and the translation was verified by bilingual stroke neurologists and stroke nurses.
- Monitoring and feedback mechanisms were put in place to continue preparation for the next update.

Highlights of the 2008 update

Following the release of the 2006 best practice recommendations, an extensive national consultation was undertaken and valuable feedback was received from front-line staff directly involved in implementing the recommendations and from health system leaders in institutions, regional health authorities and government. All feedback and suggestions were considered by the Canadian Stroke Strategy and by the task groups during the development of the 2008 update. The consensus panel provided further direction and feedback. Ultimately, after the suggested changes were made, the consensus panel voted and developed essentially unanimous agreement to the following enhancements.

Revisions to existing best practice recommendations

- Updates and minor edits were proposed and approved for 21 of the original 24 best practice recommendations.

Table 2: Canadian best practice recommendations for management of stroke across the continuum of care: strength of available evidence (part 1)

Recommendation no.	Topic	Level of evidence* (as of June 2008)
1: Public awareness and patient education		
1.1	Public awareness and responsiveness	B
1.2	Patient and family education	A
2: Prevention of stroke		
2.1	Lifestyle and risk factor management	
	• Healthy balanced diet	B
	• Sodium	B
	• Exercise	A
	• Weight	B
	• Smoking	A
	• Alcohol consumption	C
2.2	Blood pressure management	
	2.2a Blood pressure assessment	A
	2.2b Blood pressure management	A
2.3	Lipid management	
	2.3a Lipid assessment	C
	2.3b Lipid management	A
2.4	Diabetes management	
	2.4a Diabetes assessment	C
	2.4b Diabetes management	A
2.5	Antiplatelet therapy	A
2.6	Antithrombotic therapy in atrial fibrillation	A
2.7	Carotid intervention	
	2.7a Symptomatic carotid stenosis	A
	2.7b Asymptomatic carotid stenosis	A
3: Hyperacute stroke management		
3.1	Emergency medical services management of acute stroke patients *(new for 2008)*	B–C
3.2	Acute management of transient ischemic attack and minor stroke *(new for 2008)*	
	3.2a Assessment	B
	3.2b Management	A
3.3	Neurovascular imaging	B
3.4	Blood glucose abnormalities	B
3.5	Acute thrombolytic therapy	A
3.6	Acute acetylsalicylic acid (ASA) therapy	A
3.7	Management of subarachnoid and intracerebral hemorrhage	B
4: Acute inpatient stroke care		
4.1	Stroke unit care	A
4.2	Components of acute inpatient care *(new for 2008)*	
	• Venous thrombo-embolism prophylaxis	A
	• Temperature	C
	• Mobilization	B

Table 2: Canadian best practice recommendations for management of stroke across the continuum of care: strength of available evidence (part 2)

Recommendation no.	Topic	Level of evidence* (as of June 2008)
4: Acute inpatient stroke care (con't)		
(4.2 con't)	• Bladder continence and management	C
	• Bowel management program	A
	• Nutrition	B
	• Oral care	C
	• Discharge planning	B
5: Stroke rehabilitation and community reintegration		
5.1	Initial stroke rehabilitation assessment	A
5.2	Provision of inpatient stroke rehabilitation (Stroke unit)	A
5.3	Components of inpatient stroke rehabilitation	A
5.4	Outpatient and community-based rehabilitation (expanded since 2006)	A
5.5	Follow-up and community reintegration	A
6: Selected topics in stroke management		
6.1	Dysphagia screening	B
	Full assessment	A
6.2	Identification and management of post-stroke depression	A
6.3	Vascular cognitive impairment and dementia *(new for 2008)*	
	6.3a Assessment	B
	6.3b Timing	C
	6.3c Management	B
6.4	Shoulder pain assessment and treatment	A

*These are summary ratings based on the strength of evidence for the key recommendation statements within each topic. See individual sections for complete information about the strength of evidence for individual recommendations.

- The recommendations on CT scanning and carotid imaging were combined into 1 recommendation on neurovascular imaging.
- The recommendation on acute thrombolysis was substantially revised in light of late-breaking evidence.
- The recommendation addressing community rehabilitation was refocused to include both outpatient and community rehabilitation services.

Additional amendments

- *Discharge planning:* Discharge planning should begin soon after the patient presents to the health care system, and should be reviewed and updated as required at each transition point. For 2008, amendments were made to some of the existing recommendations, where appropriate, to emphasize the importance of discharge planning.
- *Pediatric stroke:* Stroke may occur at any age. Although stroke is uncommon in children, it can result in significant long-term issues for the survivor. Many of the recommendations in this document apply across the lifespan, as well as across the continuum of stroke care. The Canadian Best Practice Recommendations for Stroke Care are not intended as comprehensive guidelines for the management of pediatric patients. Rather, some evidence-based additions have been made to highlight specific issues in pediatric stroke care. References for current detailed guidelines in pediatric stroke are included at the end of this document.[9,38]

Approval of 4 new recommendations

Four recommendations were approved by the consensus panel, addressing the following topics:

- emergency medical services care of stroke patients before hospital arrival or during transport between hospitals
- acute management of transient ischemic attack and minor stroke, especially for patients managed in the community or discharged home from the emergency department
- components of acute stroke management, to minimize the risk of complications
- vascular cognitive impairment and dementia as manifestations of stroke, to emphasize that those symptoms of vascular cognitive impairment should trigger aggressive secondary prevention therapy

Identification of implementation barriers and facilitators

A considerable amount of time was spent during the 2008

consensus panel meeting discussing the challenges to and strategies for implementation of the best practice recommendations. Panel members were divided into 4 groups: acute care; prevention; rehabilitation and recovery; and a broader systems group that included leaders from hospitals and health regions, stroke program administrators, government representatives and other stakeholder groups.

Among the factors identified for successful implementation were the following:

- well-resourced stroke coordinators hired to manage implementation
- government support and funding
- identification and participation of key stroke champions
- integration of stroke programs and services into regional and hospital strategic and operational plans
- demonstration of the economic impact of providing coordinated stroke care and implementing best practice recommendations.

The major barriers to implementation of best practices for stroke were identified as (1) competing priorities within health care systems, regions and institutions and (2) limited human, financial and equipment resources. These factors were incorporated into the "Systems implications" sections of several recommendations as appropriate.

Priorities for implementation

As the final task of the 2008 consensus panel meeting, members were asked to participate in an exercise to prioritize the recommendations for implementation. The intent was to provide guidance for the allocation of limited local, regional and national resources in stroke care; however, the consensus of the group was that effective stroke care for all Canadians depends on coordinated and integrated systems of care, which will require implementation of all of the best practice recommendations in this document.

At the end of the afternoon breakout session, all consensus panel participants were asked the question, "Keeping in mind that all of the recommendations in the Canadian Best Practice Recommendations for Stroke Care (2008) are both important and necessary, which ones, if implemented immediately, would have the greatest impact on stroke care in Canada?" Each recommendation was written on a large piece of paper, and the pages were posted around the meeting room. Panel members were each given 5 voting tabs and were asked to place them on the pages for recommendations they considered the highest priority in response to the question posed. The following top 10 priorities emerged (in descending order of priority), based on the highest number of votes by panel members:

1. Management of transient ischemic attack and minor stroke
2. Outpatient and community rehabilitation
3. Development of stroke units
4. Management of stroke by emergency medical services
5. Initial assessments for rehabilitation
6. Blood pressure management
7. Provision of inpatient rehabilitation
8. Management of post-stroke depression
9. Carotid artery interventions
10. Anticoagulation in stroke patients with atrial fibrillation

Dissemination and implementation

Networking

Several dissemination strategies for the best practice recommendations were identified and implemented following the initial release in 2006. Many of these are ongoing.

- Consultation with research experts in the field of knowledge translation and guideline implementation across Canada and internationally to identify and utilize evidence-based implementation strategies.
- Sharing progress with all Canadian Stroke Strategy working groups to ensure alignment and collaboration in dissemination.
- Presentation to and discussion with provincial stroke champions during draft stages of development and preparation of final content.
- Consultation with other national guideline groups in related fields (e.g., hypertension, dyslipidemia, diabetes).
- Presentation for discussion at meetings of health care professionals across health care disciplines and across the continuum of stroke care, at the national, provincial and regional levels.
- Presentation to front-line health care 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.
- Posting the recommendations on the Canadian Stroke Strategy website, as well as other central guideline repository websites.
- Direct mail-out to key stakeholders and front-line health care professionals working with persons with stroke and their families along the continuum of care.
- Highlights of individual recommendations in stroke-related newsletters, such as the National Stroke Nursing Council's newsletter.
- Structured feedback mechanism included in mailings and on the Canadian Stroke Strategy website.

Tools to support implementation of best practice recommendations

The national professional development and training platform of the Canadian Stroke Strategy focuses on implementation of a professional development and training plan for health professionals caring for stroke patients. The Professional Development and Training Working Group has developed a 3-pronged approach encompassing pre-professional education, professional development and systems change. This working group conducted a national needs assessment and identified a need for point-of-care tools to facilitate knowledge transfer of stroke best practice recommendations to and within the clinical setting.

The Professional Development and Training Working Group has developed several point-of-care tools that are now available through the websites of the Canadian Stroke

Strategy and the Heart and Stroke Foundation of Canada:

- Acute stroke management resource
- Toolkit for the Canadian Best Practice Recommendations for Stroke Care (2006)
- Pocket reference cards: Cranial Nerves, Common Stroke Presentations, Functions of the Brain, National Institutes of Health Stroke Scale, Canadian Neurological Scale, Stroke Prevention
- *FAAST FAQs for Nurses*
- *National Professional Education Atlas*

Professional development and training resources for stroke will continue to be an important part of the implementation strategy for the Canadian Best Practice Recommendations for Stroke Care. The Heart and Stroke Foundation is leading the ongoing prioritization and development of professional development resources in partnership with the Canadian Stroke Strategy.

Professional development information is also available at the following websites: Canadian Stroke Strategy (www.canadianstrokestrategy.ca) and the Heart and Stroke Foundation professional education website (http://profed.heartandstroke.ca/).

Ongoing development

Work in progress

Throughout the review process for the 2008 best practices update, additional emerging topics have been suggested by stakeholders and reviewers that are considered relevant to stroke care and within the scope of these guidelines. A comprehensive literature review will be undertaken for recommendation topics that have been suggested, and, on the basis of the review findings and analysis, they will be presented to the Best Practices and Standards Working Group for consideration in future updates of the Canadian Best Practice Recommendations for Stroke Care.

The following topics are among those currently under review for future consideration:

- Family and caregiver support
- Management of post-stroke seizures
- Discharge planning for stroke patients
- Care of younger adult stroke patients (20–60 year age range)
- Management of patients who experience a stroke while in hospital for other conditions
- Use of telemedicine for stroke management and recovery
- Primary management of atrial fibrillation in patients who have not experienced a stroke
- Patients with communicative disorders resulting from stroke
- Recommendations specific to targeted populations such as Aboriginal groups and people suffering from significant visual impairment following stroke
- Stenting and mechanical thrombolysis

Recommendations

1: Public awareness and patient education

Best practice recommendation 1.1: Public awareness and responsiveness

All members of the public should be able to recognize and identify the signs and symptoms of stroke, which include sudden weakness, sudden trouble speaking, sudden vision problems, sudden headache, sudden dizziness (Box 1).

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 to take the appropriate actions — that is, to call 9-1-1 or their local emergency number [Evidence Level B] (CSQCS, ESO).
ii. Public education should include information that stroke can affect persons of any age — from newborn and children to adults [Evidence Level C] (RCP-P).

Rationale

Stroke is a medical emergency. Many people of all ages do not recognize the 5 main symptoms of stroke and therefore do not seek urgent 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 at least within an hour of symptom onset, 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. Earlier detection results in timelier treatment and better outcomes.

System implications

- Health promotion efforts that contribute to the primary prevention of stroke in all communities (integrated with existing chronic disease prevention initiatives).
- Public awareness initiatives focusing on the signs and symptoms of stroke and the sudden nature of the onset of these signs and symptoms.
- Enhanced public education on the warning signs of stroke with a stronger emphasis on the appropriate response when the signs and symptoms of stroke are recognized.

Box 1: Warning signs of stroke*

- 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

*Heart and Stroke Foundation of Canada: www.heartandstroke.ca

- 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 that can name 2 or more stroke symptoms (core).**
2. **Proportion of the population that can name the 3 dominant stroke symptoms — sudden weakness, trouble speaking, vision problems (core).**
3. **Median time from stroke symptom onset to presentation at an emergency department (core).**
4. Proportion of patients who seek medical attention within 4 hours of stroke symptom onset.
5. Proportion of emergency medical service providers trained in stroke recognition and 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 who can name 2 or more signs and symptoms of stroke.

Measurement notes

- Data for performance measures 1 and 2 may come from Heart and Stroke Foundation public polls.
- Data for performance measure 3 would be obtained from chart audit data.
- For performance measure 4, the unit of analysis may vary depending on the model for emergency health services management within each province/territory.
- 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 wakening. It is important to record whether the time of onset was estimated or exact when measuring this indicator. The time would qualify 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.
- Data sources for these performance measures include emergency department triage sheet or admission note, history and physical examination, consultant's notes, emergency medical services ambulance records.

Summary of the evidence

Stroke is a medical and occasionally also a surgical emergency. Successful care of the acute stroke victim begins with the recognition both by the public and the health professional that stroke is an emergency, like acute myocardial infarction and trauma.[26] Interventions such as acute thrombolysis are time sensitive, with the current treatment window being within 4.5 hours after symptom onset.[46] The majority of stroke patients do not receive adequate therapy, which could potentially reduce the impact of stroke because they do not reach the hospital soon enough.[46,55]

Successful care of the acute stroke victim as an emergency depends on a 4-step chain:

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

Failure to recognize stroke symptoms and to consult a primary physician delays the interval between stroke onset and hospital arrival.[56–61] The importance of promoting early recognition of stroke as a medical emergency was recommended by Australia's National Stroke Foundation and is now included in its recently updated Clinical Guidelines for Acute Stroke Management.[12]

A recent retrospective study by Hodgson and colleagues[62] 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 2 correct warning signs of stroke, from 52% in 2003 to 72% 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 visits for stroke across the study period was reported. This effect was not sustained after the campaign, and the rate of emergency department visits decreased following a 5-month advertising blackout. Also reported was a campaign effect (independent of year) for total presentations, presentation within 5 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 may be an important correlation between the advertising and emergency department presentations, particularly for transient ischemic attacks.

Mosley and associates[63] examined prehospital delays after stroke symptom onset in an attempt to determine patient factors associated with stroke recognition, as well as factors associated with a call for ambulance assistance within 1 hour of symptom onset. Of 198 patients included in the study, stroke was reported in 44% of cases. More than half of the calls were made within 1 hour of symptom onset, and only 43% 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 call for ambulance assistance within 1 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 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 patients.[64] This statement pushed for changes in current 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.

Kleindorfer and coworkers[65] examined the effectiveness of the FAST mnemonic (face, arm, speech, time) for identifying

stroke and transient ischemic attacks. The FAST mnemonic identified 88.9% of cases of stroke or transient ischemic attack, performing better for patients with ischemic stroke than for those with hemorrhagic stroke. It is not known at this time whether the FAST mnemonic provides a message that is easier to recall than the current American Heart Association 5 warning signs for stroke.

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.[66] Of crucial concern for pediatric stroke patients is the burden of illness caused by developmental and motor impairments that may last throughout the lifetime.[67] Neurologic deficits in this population have been indicated in over 60% of older infants and children following a stroke event. The risk of recurrence is between 10% and 25%.[68] Recognition of stroke may be difficult, especially for infants and younger children.[38]

Best practice recommendation 1.2: Patient and family education

Note: Patient, family and caregiver education is an integral part of stroke care that should be addressed at *all stages across the continuum of stroke care* for both adult and pediatric patients. Education includes the transfer of information and skills, and may include additional training components as required to transfer skills for self/patient management for both adult and pediatric stroke patients and their families.

Education that is integrated and coordinated should be provided in a timely manner across the continuum of stroke care for all patients with stroke or at risk for stroke, as well as their families and caregivers.

i. Educational content should be specific to the phase of care or recovery across the continuum of stroke care and appropriate to patient, family and caregiver readiness and needs [Evidence Level B].[69]
ii. The scope of the educational content should cover all aspects of care and recovery, including the nature of stroke and its manifestations, signs and symptoms; impairments and their impact and management, including caregiver training; risk factors; post-stroke depression; cognitive impairment, discharge planning and decision-making; community resources, services, and support programs; and environmental adaptations and benefits [Evidence Level A] (AU, CSQCS, Hare et al.,[70] NZ, RCP).
iii. Education should be interactive, timely, up to date, provided in a variety of languages and formats (written, oral, aphasia friendly, group counselling approach), and specific to patient, family and caregiver needs and impairments. The provision of education should ensure communicative accessibility for stroke survivors [Evidence Level B] (AU, CSQCS, NZ, RCP).
iv. Clinicians and/or teams should develop processes for routine patient, caregiver and family education in which designated team members are responsible for provision and documentation of education [Evidence Level C] (ASA).

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 their 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, and therefore the delivery should be interactive in nature. The delivery of education should also be 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 health care 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 and ethnically appropriate, available in languages other than English and French where possible, and that address the needs of patients with aphasia.

Performance measures

1. **Proportion of stroke patients with documentation of education provided for patient, family and/or caregivers at each stage throughout the continuum of stroke management and recovery.**
2. Total time spent on patient/family education during a health care encounter for stroke.

Measurement notes

- Quantity and method of patient education are very important elements of this recommendation. Measurement for patient and family education should be expanded when feasible to measure these aspects.
- Data sources include all documents, charts and records related to patient care across the health care system (primary care, acute care, follow-up clinics, inpatient and outpatient

rehabilitation programs, community programs and services) and would be obtained through primary chart audit or review, and various logging and audit practices of individual groups.
- Documentation quality by health care professionals involved in the patient's care may affect ability to monitor this indicator reliably.

Summary of the evidence

Information for patients and their families following stroke can be offered in a variety of formats. Patient information booklets are published and available on the web. Patient organizations have a variety of leaflets and web-based materials on stroke. However, research demonstrates that it is difficult to give information effectively, and that failure to provide relevant information is one of the commonest patient complaints received by staff.

Clinical practice guidelines offer strong consensus to provide patient 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 systematic review of 19 trials of organized inpatient stroke care identified several features that characterized the stroke units in these trials and distinguished them from conventional care. Some of those features were routine involvement of caregivers in rehabilitation and in interdisciplinary team meetings, and routine provision of information to caregivers ($p < 0.01$ for all comparisons of stroke unit verus conventional care). While the unique impact of these features of stroke units in the improved patient outcomes associated with organized inpatient stroke care cannot be ascertained with certainty, these findings provide some additional evidence supporting the benefit of patient and caregiver education and support during hospitalization for acute stroke.[71]

A conceptual review was conducted by Cameron and Gignac[69] to highlight the changing needs for education and support across the continuum of stroke care for family caregivers of stroke survivors. 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 5 phases of caregiver support: (1) event and diagnosis, (2) stabilization, (3) preparation, (4) implementation and (5) adaptation. The first 2 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 health care professionals to provide more timely and appropriate support.

Desrosiers and colleagues[72] 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.[73] 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% or fewer of stroke patients, and 90% 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[74] 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% 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% of patients reported medication nonadherence, 26% had not seen their primary care physician in the preceding year, and fewer than 40% of patients with diabetes mellitus or hypertension reported dietary adherence. From these findings, it appears that stroke patients in this sample and their caregivers had large gaps in stroke knowledge and suboptimal personal health behaviours, thereby putting the patients at high risk for recurrent stroke. There is a need to develop stroke education programs for rehabilitating patients that are effective in closing these gaps in knowledge.

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,[75] as discussed in the Evidence-Based Review of Stroke Rehabilitation (EBRSR), 10th edition.[25] The researchers sampled

93 caregivers over a period of 2 years following stroke. Caregivers reported that preparation for caregiving was an unmet need upon discharge. Similarly, Grant[76] 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 3-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 3 months. At 2 and 5 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 2 and 5 weeks but not at 13 weeks. Lower levels of caregiver preparedness were demonstrated to be significantly associated with positive perceptions of preparedness at the 2-week and 5-week assessments ($p < 0.05$).

Also discussed in the Evidence-Based Review of Stroke Rehabilitation[25] was a study by Kalra and collaborators[77] that 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 options. They were also included in goal-setting for rehabilitation and discharge planning, and 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. Caregivers received 3 to 5 sessions, approximately 30 to 45 minutes in length, dependent on needs. Outcomes assessed included cost to health and social services systems, caregiving burden, functional status of patient and caregiver, psychologic state, quality of life and patient's institutionalization or death at 1 year after the stroke. 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.[78]

The Evidence-Based Review of Stroke Rehabilitation concluded that "there is strong (Level 1a) evidence that skills training is associated with a reduction in depression. There is moderate (Level 1b) evidence that training in basic nursing skills improves outcomes of depression, anxiety and quality of life for both caregiver and the stroke patient."[25]

Hare and colleagues[70] 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 6 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 psychologic 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 psychologic needs are required. Primary care could be a key setting for helping to provide more inclusive services for both patient and carer.

2: Prevention of stroke (see Box 2)

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 counselling about possible strategies to modify their lifestyle and risk factors [Evidence Level B] (AU, NZ, RCP, VA/DoD).

Lifestyle and risk factor interventions should include:

i. *Healthy balanced 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 (Table 3) [Evidence Level B] (ASA, CHEP, RCP).
ii. Sodium: The recommended daily sodium intake from all sources is the Adequate Intake by age. For persons 9–50 years, the Adequate Intake is 1500 mg. Adequate Intake decreases to 1300 mg for persons 50–70 years and to 1200 mg for persons > 70 years. A daily upper consumption limit of 2300 mg should not be exceeded by any age group [Evidence Level B]. See Table 4, Table 5 and www.sodium101.ca for sodium intake guidelines.
iii. *Exercise:* Moderate exercise (an accumulation of 30 to 60 minutes) of walking (ideally brisk walking), jogging, cycling, swimming or other dynamic exercise 4 to 7 days

Box 2: Definitions of prevention for the Canadian Best Practice Recommendations for Stroke Care

- **Primary prevention:** Primary prevention is an individually based clinical approach to disease prevention. It is directed toward preventing the initial occurrence of a disorder in otherwise healthy individuals.[79,80] 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 and diabetes management) 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 the main purposes of the current 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:** Secondary stroke prevention is an individually based clinical approach to reducing the risk of 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."[80] 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 provided in this section 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 issues should be addressed at all appropriate health care encounters on an ongoing basis following a stroke or transient ischemic attack.
- Please also refer to recommendation 3.2, "Acute management of transient ischemic attack and minor stroke," for further guidance on assessing stroke risk (defined in Tables 6 and 7).

Table 3: Canada's Food Guide to Healthy Eating: recommended daily servings of each food group by age and gender

	Children			Teens		Adults			
Age in years	2–3	4–8	9–13	14–18		19–50		51 +	
Sex	Girls and boys			Females	Males	Females	Males	Females	Males
Vegetables and fruit (e.g., 1 medium sized fruit, ½ cup juice, ½ cup frozen vegetables)	4	5	6	7	8	7–8	8–10	7	7
Grain products (e.g., 1 slice bread, ½ cup pasta or rice)	3	4	6	6	7	6-7	8	6	7
Milk and alternatives (e.g., 1 cup milk, ¾ cup yoghurt, 50 grams cheese)	2	2	3–4	3–4	3–4	2	2	3	3
Meat and alternatives (e.g., 1–2 eggs; 50–100 grams fish, poultry, meat; 1/3 cup tofu)	1	1	1–2	2	3	2	3	2	3

each week in addition to routine activities of daily living [Evidence Level A]. Medically supervised exercise programs are recommended for high-risk patients (e.g., those with cardiac disease) (ASA, CHEP, EBRSR, NZ).

iv. *Weight:* Maintain goal of a body mass index (BMI) of 18.5 to 24.9 kg/m^2 and a waist circumference of < 88 cm for women and < 102 cm for men [Evidence Level B] (ASA, CHEP, OCCPG).

v. *Smoking:* Smoking cessation and a smoke-free environment; nicotine replacement therapy and behavioural therapy [Evidence Level B] (ASA, CHEP, CSQCS, RCP). For nicotine replacement therapy, nortriptyline therapy, nicotine receptor partial agonist therapy and/or behavioural therapy should be considered [Evidence Level A] (ASA, AU).

vi. *Alcohol consumption:* Two or fewer standard drinks per day; and fewer than 14 drinks per week for men; and fewer than 9 drinks per week for women [Evidence Level C] (ASA, AU, CHEP).

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 salt (sodium) in foods would abolish high blood pressure for almost 1 in 3 Canadians. Furthermore, this evidence suggests that lowering sodium consumption to adequate intake levels (see Table 4) could reduce the incidence of stroke and heart disease by as much as 30%. Regular exercise also reduces the risk of stroke. Smoking is also a significant risk factor, as smokers have up to 4 times the risk of stroke of nonsmokers.

System implications

- Health promotion efforts that contribute to the primary 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 health care professionals throughout the continuum of care.
- 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 health care 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), 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 health care 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, that are available in multiple languages and that address the needs of patients with aphasia.

Performance measures

1. **The 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. Percentage of the population who can identify the major risks for stroke, including hypertension, sodium intake, diet, weight, exercise, smoking and alcohol intake.
3. Percentage of people who are aware of the healthy targets for each stroke risk factor.
4. **The annual occurrence of stroke in each province and territory by stroke type (core).**
5. Stroke mortality rates across provinces and territories, including in-hospital or 30-day rate and 1-year rate (core).

Table 4: Recommendations for adequate sodium intake by age*

Age	Adequate sodium intake (mg/ day)
0–6 mo	120
7–12 mo	370
1–3 yr	1000
4–8 yr	1200
9–50 yr	1500
50–70 yr	1300
> 70 yr	1200

*Source: Standing Committee on the Scientific Evaluation of Dietary Reference Intakes, Panel on Dietary Reference Intakes for Electrolytes and Water.[81]

Table 5: Equivalent measurements of sodium and salt*

Sodium (mg)	Sodium (mmol)	Salt (g)
500	22	1.25
1500	65	3.75
2000	87	5.0
2300†	100	5.8
2400	104	6.0
3000	130	7.5
4000	174	10

*Source: Standing Committee on the Scientific Evaluation of Dietary Reference Intakes, Panel on Dietary Reference Intakes for Electrolytes and Water.[81] Additional resource on sodium by the Canadian Stroke Network: *Sodium 101* (www.sodium101.ca).
†One teaspoon of salt contains approximately 2300 mg or 100 mmol of sodium. This is considered the upper limit for daily sodium intake.

Measurement notes

- For performance measures 1, 2 and 3, data will need to be extracted from provincial and national health surveys.
- For 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.

Summary of the evidence

Diet and sodium

Gillman and associates[82] 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 3 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 8 studies and 257 551 individuals over a 13-year follow-up period, showed that consumption of 5 or more servings of fruits and vegetables per day is associated with a lower risk of stroke.[83] Compared with individuals who had fewer than 3 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 3 to 5 servings per day, and 0.74 (95% CI 0.69–0.79) for those with more than 5 servings per day.[83]

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.[84,85] In an analysis of combined data from the Nurses' Health Study and the Health Professionals Follow-up Study, Joshipura and associates[84] found that an increase of 1 serving per day of fruits or vegetables was associated with a reduction of risk of 6% and that cruciferous vegetables, leafy green vegetables and citrus fruit (including juice) contributed most to this effect. Liu and colleagues[85] 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.[85]

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.[86] 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."[86]

Physical activity

Lee and collaborators[87] published a meta-analysis of 23 studies published between 1983 and 2002 examining the association between physical activity and stroke incidence or mortality. 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% 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[87] 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. The question of what type or quantity of activity is required to reach a moderate level and so to benefit from a 20% reduction in the risk of stroke is one that needs to be investigated by means of a randomized controlled trial.

Smoking

The World Health Organization has recently released its "M-Power" report, which describes smoking as a global tobacco epidemic.[88] 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.

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.[89–92] Overall, given that an estimated 25% of adults are active smokers, approximately 18% of strokes may be attributed to active smoking.[93]

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.[89,92,94,95] 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.[96,97]

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.[96,97] 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.[96]

Risk associated with current cigarette smoking is greatest

in the middle years and declines with age.[94] 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.[98] Mortality was particularly high among current smokers who had been smoking for 40 or more years (7.2% v. 1.8% for nonsmokers, $p < 0.01$).[98]

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.[99] 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.[99] 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.[100]

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.[101] 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[102] and Sacco[103] 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 in all persons at risk for stroke.

2.2a. Blood pressure assessment

i. All persons at risk of stroke should have their blood pressure measured at each health care encounter, but no less than once annually [Evidence Level C] (CHEP, NICE, RCP).
ii. Proper standardized techniques, as described by the Canadian Hypertension Education Program, should be followed for blood pressure measurement (CHEP).
iii. 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] (ASA, CHEP, RCP).
iv. Patients with hypertension or at risk for hypertension should be advised on lifestyle modifications [Evidence Level C]. Refer to recommendation 2.1, "Lifestyle and risk factor management," for details on lifestyle modifications.

2.2b. Blood pressure management

i. The Canadian Stroke Strategy recommends target blood pressure levels as defined by the Canadian Hypertension Education Program (CHEP) guidelines for prevention of first stroke, recurrent stroke, and other vascular events. See "Rationale," below, for additional information.

CHEP 2008 recommendations for management of blood pressure (excerpts used with permission; see www.hypertension.ca/chep for detailed information[17]):

- For the prevention of first stroke in the general population the systolic blood pressure treatment goal is a pressure level of less than 140 mm Hg [Evidence Level C]. The diastolic blood pressure treatment goal is a pressure level of less than 90 mm Hg [Evidence Level A].
- Blood pressure lowering treatment is recommended for patients who have had a stroke or transient ischemic attack to a target of less than 140/90 mm Hg [Evidence Level C].
- In patients who have had a stroke, treatment with an angiotensin-converting enzyme (ACE) inhibitor or diuretic is preferred [Evidence Level B].
- Blood pressure lowering treatment is recommended for the prevention of first or recurrent stroke in patients with diabetes to attain systolic blood pressures of less than 130 mm Hg [Evidence Level C] and diastolic blood pressures of less than 80 mm Hg [Evidence Level A].
- Blood pressure lowering treatment is recommended for the prevention of first or recurrent stroke in patients with nondiabetic chronic kidney disease to attain a blood pressure of less than 130/80 mm Hg [Evidence Level C].

ii. Randomized controlled trials have not defined the optimal time to initiate blood pressure lowering therapy after stroke or transient ischemic attack. It is recommended that blood pressure lowering treatment be initiated (or modified) before discharge from hospital. For patients with nondisabling stroke or transient ischemic attack not requiring hospitalization, it is recommended that blood pressure lowering treatment be initiated (or modified) at the time of the first medical assessment [Evidence Level B] (EXPRESS, PROGRESS).
iii. For recommendations on specific agents and sequence of agents, please refer to the current Canadian Hypertension Education Program guidelines.[17]

Rationale

Elevated blood pressure is the single most important risk factor for stroke. One in 5 adult Canadians has blood pressure in

the range of 130–139/85–89 mm Hg, and up to 60% of these will develop hypertension within 4 years. Among persons aged 55 with normal blood pressure, 90% will develop hypertension if they live to an average age. All adults require ongoing assessment of blood pressure throughout their lives.[17] Each 1 mm Hg increase in blood pressure, over time, increases the risk of poor late-life cognitive function by approximately 1%.[104] 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% of the population-attributable risk for cerebrovascular disease. A number of trials have shown a 28% 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 less than 140/90 mm Hg for people who have had a cerebrovascular event. The PROGRESS trial demonstrated that lowering blood pressure with an ACE inhibitor and diuretic prevented recurrent stroke in both normotensive and hypertensive patients.[53] Epidemiologic data have shown that those with a response to treatment with lower pressures have better outcomes, yet treatment trials published to date have not proven that a lower target is better.

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.

Performance measures

1. **Proportion of persons at risk for stroke who had their blood pressure measured at their last health care encounter.**
2. Proportion of the population who are aware of hypertension and the risks of high blood pressure.
3. Proportion of the population who report having hypertension.
4. **Proportion of the population who have diagnosed elevated blood pressure (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

- Data for performance measures 1 through 4 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.
- Data for performance measures 5 and 6 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.
- For performance measures 7 and 8 prescriptions for blood pressure lowering agents may occur 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.[105]

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 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.[106]

A continuous and linear relationship between blood pressure and risk of stroke has been reported, which holds even in individuals with normal blood pressure. Weber[107] 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 recent 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% reduction in mortality from ischemic heart disease and a 10% reduction in mortality from stroke.[108]

Du and associates[109] reported that some 20%–30% of adult populations are affected, as are over 60% of people over 65 years and about 70% 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.[109] At least three-quarters of strokes in hypertensive patients are preventable by treatment. 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.

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).[110] 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% reduction in the rate of fatal or nonfatal stroke (95% CI –1% to 51%, $p = 0.06$), a 39% reduction in the rate of death from stroke (95% CI 1% to 62%, $p = 0.05$), a 21% reduction in the rate of death from all causes (95% CI 4% to 35%, $p = 0.02$) and a 23% reduction in the rate of death from cardiovascular causes (95% CI –1% to 40%, $p = 0.06$).[110] 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 collaborative meta-analysis was conducted to assess the age-specific relevance of blood pressure to cause-specific mortality.[108] 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 2-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.

The relationship between blood pressure and cardiovascular risk is "continuous, consistent, and independent of other risk factors."[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.[6] 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[111] 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. 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.[108,112] 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],[113] PROGRESS[53]). Blood pressure lowering therapy reduces the risk of vascular events across a wide spectrum of initial blood pressures.[53,113]

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),[114] the Acute Candesartan Cilexetil Therapy in Stroke Survivors Study (ACCESS),[115] and the Study on Cognition and Prognosis in the Elderly (SCOPE).[116] All 3 trials demonstrated consistent relative risk reductions for stroke in the range of 24% to 34%, 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.[117] 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[104] 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% (95% CI 3%–11%) and for poor cognitive function of 9% (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

Lipid levels should be monitored in all persons at risk for stroke.

2.3a. Lipid assessment

i. Fasting lipid levels (total cholesterol, total glycerides, low-density-lipoprotein [LDL] cholesterol, high-density-lipoprotein [HDL] cholesterol) should be measured every 1 to 3 years for all men 40 years or older and for women who are postmenopausal and/or 50 years or older [Evidence Level C] (McPherson et al.,[16] VA/DoD). 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 C] (McPherson et al.[16]).

2.3b. Lipid management

i. Ischemic stroke patients with LDL cholesterol of > 2.0 mmol/ L should be managed with lifestyle modification and dietary guidelines [Evidence Level A] (AU, CSQCS, McPherson et al.,[16] VA/DoD).

ii. 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] (AU, CSQCS, McPherson et al.,[16] VA/DoD).

Rationale

High cholesterol and lipids in the blood are associated with a higher risk of both stroke and heart attacks. People who have already have had an ischemic stroke or transient ischemic attack will benefit from cholesterol-lowering medications with a statin type drug. Aggressive reduction of LDL cholesterol is likely to yield greater benefit than more modest reductions. A 20%–30% 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.

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.

Performance measures

1. Proportion of the population who report that they have elevated lipid levels, especially LDL.
2. **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.**
3. Proportion of stroke patients with an LDL cholesterol between 1.8 and 2.5 mmol/L at 3 months following the stroke event.

Measurement notes

- Data for performance measures 1 and 2 may be available through the Canadian Community Health Survey.
- Prescription for lipid-lowering agents may occur 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.
- Data sources for performance measure 2 may include physician order sheets, physicians' and nurses' notes, discharge summaries or copies of prescriptions given to patients.
- Prescriptions given to a patient do not imply compliance.
- Blood values for measure 3 should be taken from official laboratory reports where possible.

Summary of the evidence

The causal relationship between dyslipidemia and atherosclerosis is well documented. Screening and appropriate management of dyslipidemia by health care providers is imperative in both primary and secondary prevention of coronary artery disease, peripheral vascular disease and stroke.[118]

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%, (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[119] 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% 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 nonhemorrhagic 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).[119] Only one trial reported on statin therapy for secondary prevention. Statin therapy provides high levels of protection for all-cause mortality and nonhemorrhagic 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% (95% CI 14%–36%) for secondary prevention.[120] 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 7% (RR 0.93, 95% CI 0.79–1.08).

The Heart Protection Study[121] 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 5 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%; 95% CI 15%–44%), irrespective of the patient's age, sex or blood lipid concentrations when treatment was initiated.[121] 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 had a stroke or transient ischemic attack within 1 to 6 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.[122] 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%; 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 5-year absolute reduction in risk of major cardiovascular events was 3.5% (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.[123]

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.[124] 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, 2% had hemorrhagic strokes as entry events.[124] 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 2.82–11.30; $p < 0.001$), 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

2.4a. Diabetes assessment

i. All individuals in the general population should be evaluated annually for type 2 diabetes risk on the basis of demographic and clinical criteria [Evidence Level C] (CDA).

ii. A fasting plasma glucose should be performed every 3 years in individuals > 40 years of age to screen for diabetes [Evidence Level C] (CDA). More frequent and/or earlier testing with either a fasting plasma glucose or plasma glucose sample drawn 2 hours after a 75-g oral glucose load should be considered in people with additional risk factors for diabetes [Evidence Level C] (CDA). Some of these risk factors include family history, high-risk population, vascular disease, history of gestational diabetes, hypertension, dyslipidemia, overweight, abdominal obesity, polycystic ovary syndrome.

iii. In adults, fasting lipid levels (total cholesterol, HDL cholesterol, total glycerides and calculated LDL cholesterol) should be measured at the time of diagnosis of diabetes and then every 1 to 3 years as clinically indicated.

More frequent testing should be performed if treatment for dyslipidemia is initiated [Evidence Level C] (CDA).

iv. Blood pressure should be measured at every diabetes visit [Evidence Level C] (CDA).

2.4b. 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 (Hb_{A1c}) level ≤ 7.0% in order to reduce the risk of microvascular complications [Evidence Level A] (CDA) and, in individuals with type 1 diabetes, macrovascular complications [Evidence Level C] (CDA).

ii. To achieve an Hb_{A1c} ≤ 7.0%, patients with type 1 or type 2 diabetes should aim for a fasting plasma glucose or preprandial plasma glucose targets of 4.0 to 7.0 mmol/L [Evidence Level B] (CDA).

iii. The 2-hour postprandial plasma glucose target is 5.0–10.0 mmol/L [Evidence Level B]. If Hb_{A1c} targets cannot be achieved with a postprandial target of 5.0–10.0 mmol/L, further postprandial blood glucose lowering, to 5.0–8.0 mmol/L, can be considered [Evidence Level C] (CDA).

iv. Adults at high risk of a vascular event should be treated with a statin to achieve an LDL cholesterol ≤ 2.0 mmol/L [Evidence Level A] (CDA).

v. Unless contraindicated, low dose acetylsalicylic acid (ASA) 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] (CDA).

Rationale

Diabetes (raised blood glucose) is a major risk factor for cardiovascular disease and is recognized as an independent risk factor for ischemic stroke.[26] 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.
- Definition, dissemination and implementation of best practices for diabetes management.
- Mechanisms for ongoing monitoring and evaluation, with a feedback loop for interpretation of findings and opportunities for quality improvement.

Performance measures

1. Proportion of the population with a confirmed diagnosis of diabetes (type 1 and type 2).
2. **Proportion of persons with diabetes presenting to hospital with a new stroke event.**
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.
- Monitoring and tracking of trends and benchmarks through the National Diabetes Surveillance System data.

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[125] 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 3-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.[125]

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[126] 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 2-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 cerebro- and cardiovascular risk.

Lehto and coworkers[127] conducted a 7-year follow-up study on diabetic patients and nondiabetic controls to assess risk for stroke. They found diabetic men had a 2- to 3-fold higher risk, and diabetic women a 5-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).[127] 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 Hb_{A1c}, which reflects hyperglycemia during the preceding 2 months. There was a dose–response relationship between Hb_{A1c} 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.[128] 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% compared with atorvastatin 10 mg.

The Action to Control Cardiovascular Risk in Diabetes Study investigators assessed whether intensive therapy to target normal Hb_{A1c} levels would reduce cardiovascular events in patients with type 2 diabetes who had either established cardiovascular disease or additional cardiovascular risk factors.[129] Patients (n = 10 251) with a median Hb_{A1c} level of 8.1% were randomly assigned to receive intensive therapy (targeting an Hb_{A1c} level below 6.0%) or standard therapy (targeting a level from 7.0% to 7.9%). 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).[129] 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 Hb_{A1c} value of 6.5% or less.[130] 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] (ASA, AU, CSQCS, ESO, NZ, RCP, VA/DoD).

i. ASA, combined ASA (25 mg) and extended-release dipyridamole (200 mg), or clopidogrel may be used depending on the clinical circumstances [Evidence Level A].
ii. For adult patients on ASA, the usual maintenance dosage is 80 to 325 mg per day [Evidence Level A] (CSQCS, VA/DoD), and in children with stroke the usual maintenance dosage of ASA is 3 to 5 mg/kg per day for the prevention of recurrent stroke [Evidence Level C] (AHA-P).
iii. Long-term combinations of ASA and clopidogrel are not recommended for secondary stroke prevention [Evidence Level B] (CHARISMA, MATCH).

Rationale

Several clinical trials have shown that antiplatelet medications (like ASA) reduce the risk of further vascular events after transient ischemic attack or ischemic stroke (25% relative risk reduction).[131] 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.
- Definition, dissemination and implementation of best practices throughout the health care system.
- 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.
- Mechanisms for ongoing monitoring and evaluation, with a feedback loop for interpretation of findings and opportunities for quality improvement.

Performance measures

1. **Proportion of patients with stroke or transient ischemic attack prescribed antiplatelet therapy on discharge from acute care (core).**
2. **Proportion of patients with 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.
- 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 ASA, clopidogrel and the combination of ASA and extended-release dipyridamole.[132] 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 recent critical review, 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.[133] 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 9%. 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% (OR 0.82, 95% CI 0.74–0.91) compared with ASA alone, without causing more bleeding.[133]

Verro and associates[134] 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 2 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.[134] 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 recent 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.[135] 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% with ASA, 13% with dipyridamole (95% CI 4% to 21%; $p = 0.046$) and 34% with combination ASA and dipyridamole. Compared with ASA, the relative risk of recurrent stroke and other serious vascular events was reduced by 7.3% with clopidogrel (95% CI –5.7% to 18.7%) and 18% 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.

A recent 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.[136] The review included randomized long-term secondary prevention trials with concealed treatment allocation, treatment for more than 1 month, starting within 6 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 [ESPS2])[137] in patients presenting with cerebral ischemia. 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.[131] 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 2 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[138] 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. Four high-quality and comparable trials, including 22 656 patients at high risk for adverse vascular events, were identified (3 compared ASA to ticlopidine and 1 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 2 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 2 years.[138]

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.[139] Patients participating in the trial ($n = 20\,332$ across 35 countries) were followed for a period of 4 years. Stroke recurrence rates were similar in both arms of the trial (9.0% among patients assigned to receive ASA plus extended-release dipyridamole and 8.8% 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 6 months of a transient ischemic attack or minor stroke of presumed arterial origin.[140] 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% (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).[140] 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.[44] The primary efficacy end point, a composite of nonfatal stroke, nonfatal myocardial infarction or vascular death, was reached by 6.8% of patients assigned to receive clopidogrel plus ASA and 7.3% 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% and 17.9% (RR 0.92. 95% CI 0.86–0.995; p = 0.04). Severe bleeding occurred in 1.7% 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).[44] Among patients with multiple risk factors, the primary end point was reached by 6.6% of the clopidogrel plus ASA group and 5.5% 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% 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% with clopidogrel and 7.9% 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.[49] 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).[141] An 8.7% (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.[142]

Pediatrics

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 pediatric stroke patients are not yet available,[38] but it is clear that no treatment is associated with increased risk of recurrent stroke.[143] 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.[9]

Best practice recommendation 2.6: Antithrombotic therapy in atrial fibrillation

Patients with stroke and atrial fibrillation should be treated with warfarin at a target international normalized ratio of 2.5, range 2.0 to 3.0 (target international normalized ratio of 3.0 for mechanical cardiac valves, range 2.5 to 3.5) [Evidence Level A], if they are likely to be compliant with the required monitoring and are not at high risk for bleeding complications (ASA, AU, CSQCS, ESO, SIGN, VA/DoD).

Rationale

Atrial fibrillation is a significant risk factor for stroke, with 1 in 6 patients with atrial fibrillation experiencing a stroke in their lifetime.[144] Stroke caused by atrial fibrillation is highly preventable if patients are treated with anticoagulants (blood-thinning medications). These medications require regular monitoring of blood levels to ensure they are within target ranges. A 68% relative risk reduction and a 33% absolute risk reduction in recurrent stroke has been found for patients who receive anticoagulation with adjusted-dose warfarin.[145,146]

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 in place for appropriate outpatient monitoring of patients' international normalized ratio levels 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.

Performance measures

1. **Proportion of eligible stroke and transient ischemic attack patients with atrial fibrillation prescribed anticoagulant therapy on discharge from acute care (core).**
2. **Proportion of stroke and transient ischemic attack patients with atrial fibrillation prescribed anticoagulant therapy after a visit to a secondary prevention clinic (core).**
3. Proportion of patients with stroke and atrial fibrillation on ASA and not prescribed anticoagulant agents (include defining reasons why prescriptions not given).
4. Proportion of patients continuing to comply with warfarin therapy at 3 months, 6 months and 1 year following initiation of therapy.
5. Proportion of patients on warfarin with international normalized ratio in therapeutic range at 3 months, 6 months and 1 year following index stroke event.

Measurement notes

- 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.
- It is important to note that providing a prescription does not ensure patient compliance with medication administration. Compliance can be determined through patient self-report and through international normalized ratio measurements over time.
- For 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.

Summary of the evidence

There is general agreement that all patients with atrial fibrillation should be considered for treatment with warfarin or ASA for the primary prevention of stroke, with strong evidence for warfarin in patients at high risk for stroke. Also, for patients with atrial fibrillation and recent cerebral ischemia, warfarin is indicated over ASA for secondary stroke prevention.[145,147] The optimal time to initiate warfarin therapy after a stroke or transient ischemic attack is unclear.

A stroke risk scoring system based on the presence of congestive heart failure, hypertension, age, diabetes and stroke (doubled), commonly abbreviated as CHADS2, may be used to assess the risk of stroke for a patient with atrial fibrillation, and to help determine whether to treat the patient with ASA or warfarin.[10] This scoring system is mainly intended to guide management of a patient who has not had a stroke or transient ischemic attack.

The Eighth American College of Chest Physicians Conference on Antithrombotic and Thrombolytic Therapy reviewed the clinical trials and pooled analyses that included patients with chronic persistent atrial fibrillation (also known as "sustained" and including the category "permanent") or, less commonly, paroxysmal atrial fibrillation (or intermittent atrial fibrillation), the majority of whom had not experienced stroke or transient ischemic attack. In most instances, atrial fibrillation had been present for many months to years.[10] Each of these trials stopped early because of the large effect of oral anticoagulants in preventing ischemic stroke and systemic embolism (the Canadian Atrial Fibrillation Anticoagulation trial was stopped early because of the superiority of anticoagulation seen in other trials). Because of this, the number of outcome events observed was relatively small, resulting in fairly wide confidence limits around estimates of efficacy. The

intention-to-treat analysis of these pooled data revealed a reduction in annual stroke rate from 4.5% for the control patients to 1.4% for the patients assigned to adjusted-dose warfarin. The efficacy of warfarin was consistent across studies, with an overall relative risk reduction of 68% (95% CI, 50%–79%). The absolute risk reduction implies that 31 ischemic strokes will be prevented each year for every 1000 patients treated (or number needed to treat [NNT] for 1 year to prevent 1 stroke = 32).

A meta-analysis by Hart and associates[148] reported that adjusted-dose warfarin and antiplatelet agents reduced stroke by approximately 60% and by approximately 20%, respectively, in patients who had atrial fibrillation. Warfarin was substantially more efficacious (by approximately 40%) than antiplatelet therapy. Absolute increases in major extracranial hemorrhage associated with antithrombotic therapy in participants from the trials included in this meta-analysis were less than the absolute reductions in stroke; however, it is important to note that methodologic features and quality varied substantially across studies and often were incompletely reported.

The Birmingham Atrial Fibrillation Treatment of the Aged (BAFTA) Study specifically examined warfarin anticoagulation in elderly people.[149] Men and women over the age of 75 with atrial fibrillation (n = 973) (13% of whom had a history of transient ischemic attack or stroke) were randomly assigned to treatment with either warfarin (target international normalized ratio 2.0 to 3.0) or ASA (75 mg). There were fewer primary events among patients assigned to warfarin than among those assigned to ASA (24, 1.8% per year v. 48, 3.8% per year; RR 0.48, 95% CI 0.28–0.80). The number needed to treat was calculated as 50 for 1 year to prevent 1 primary event. Risk of stroke rose with age and was particularly high in people who had already had a stroke or transient ischemic attack, was higher in people already known to have atrial fibrillation than in those identified by opportunistic screening and was higher in people on warfarin before study entry than in those new to this treatment. These findings supported the use of anticoagulation therapy for people aged over 75 who have atrial fibrillation unless there are contraindications or the patient decides that the benefits are not worth the inconvenience. These findings were reinforced in a follow-up letter published in 2007.[150]

Two trials have specifically examined warfarin anticoagulation *after* a recent transient ischemic attack or ischemic stroke.[145] The European Atrial Fibrillation Trial involved 455 patients, who received either anticoagulants (international normalized ratio 2.5 to 4.0) or ASA (300 mg/day).[147] Patients joined the trial within 3 months of transient ischemic attack or minor stroke. The mean follow up was 2.3 years. In the Studio Italiano Fibrillazione Atriale trial, 916 patients with nonrheumatic atrial fibrillation and a transient ischemic attack or minor stroke within the previous 15 days were randomized to open-label anticoagulants (international normalized ratio 2.0 to 3.5) or indobufen (a reversible platelet cyclooxygenase inhibitor, 100 or 200 mg twice a day).[151] The follow-up period was 1 year. The combined results showed that anticoagulants were significantly more effective than antiplatelet therapy for the prevention of all ischemic vascular events (OR 0.67, 95% CI 0.50–0.91) and for the prevention of stroke recurrence (OR 0.49, 95% CI 0.33–0.72). Major extracranial bleeding complications occurred more often in patients on anticoagulants (OR 5.16, 95% CI 2.08–12.83), but the absolute difference was small (2.8% per year v. 0.9% per year in the European Atrial Fibrillation Trial[147] and 0.9% per year v. 0% in the Studio Italiano Fibrillazione Atriale[151]). Warfarin did not significantly increase the frequency of intracranial bleeding. The evidence from these 2 trials suggests that anticoagulant therapy is superior to antiplatelet therapy for the prevention of stroke in people with non-rheumatic atrial fibrillation and recent minor (nondisabling stroke) or transient ischemic attack; however, the risk of extracranial bleeding was higher with anticoagulant therapy than with antiplatelet therapy.

The Atrial fibrillation Clopidogrel Trial with Irbesartan for prevention of Vascular Events (ACTIVE) investigators assessed whether clopidogrel plus ASA was noninferior to oral anticoagulation therapy for prevention of vascular events.[152] Patients with atrial fibrillation and 1 or more risk factors for stroke were randomly assigned to receive oral anticoagulation therapy (target international normalized ratio of 2.0–3.0; n = 3371) or clopidogrel (75 mg per day) plus ASA (75–100 mg per day recommended; n = 3335). The study was stopped prematurely because of clear evidence of superiority of oral anticoagulation therapy. There were 165 primary events among patients on oral anticoagulation therapy (annual risk 3.93%) and 234 among those on clopidogrel plus ASA (annual risk 5.60%; RR 1.44, 95% CI 1.18–1.76; p = 0.0003). Patients on oral anticoagulation therapy who were already receiving this treatment at study entry had a trend toward a greater reduction in vascular events (RR 1.50, 95% CI 1.19–1.89) and a significantly (p = 0.03 for interaction) lower risk of major bleeding with oral anticoagulation therapy (RR 1.30, 95% CI 0.94–1.79) than patients not on this treatment at study entry (RR 1.27, 95% CI 0.85–1.89 and RR 0.59, 95% CI 0.32–1.08, respectively).

Best practice recommendation 2.7: Carotid intervention

2.7a Symptomatic carotid stenosis

Patients with transient ischemic attack or nondisabling stroke and ipsilateral 70%–99% internal carotid artery stenosis (measured on a catheter angiogram or by 2concordant noninvasive imaging modalities) should be offered carotid endarterectomy within 2 weeks of the incident transient ischemic attack or stroke unless contraindicated [Evidence Level A] (ASA, AU, CSQCS, ESO, NZ, SIGN 14).

i. Carotid endartarectomy is recommended for selected patients with moderate (50%–69%) symptomatic stenosis, and these patients should be evaluated by a physician with expertise in stroke management [Evidence Level A] (ASA, AU, CSQCS, NZ, SIGN 14).
ii. Carotid endarterectomy should be performed by a surgeon with a known perioperative morbidity and mortality of < 6% [Evidence Level A] (ASA, CSQCS, ESO, NZ).
iii. Carotid stenting may be considered for patients who are

not operative candidates for technical, anatomic or medical reasons [Evidence Level C].

iv. Carotid endarterectomy is contraindicated for patients with mild (< 50%) stenosis [Evidence Level A] (ASA, CSQCS, SIGN 14).

2.7b Asymptomatic carotid stenosis

Carotid endarterectomy may be considered for selected patients with asymptomatic 60%–99% carotid stenosis.

i. Patients should be less than 75 years old with a surgical risk of < 3%, a life expectancy of > 5 years and be evaluated by a physician with expertise in stroke management [Evidence Level A] (AAN, AHA, AU, CSQCS).

Rationale

Carotid endarterectomy is a surgical procedure that removes the inside lining of a narrowed 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 a high-grade stenosis (narrowing) of the proximal internal carotid artery. For selected patients with asymptomatic carotid stenosis, carotid endarterectomy roughly halves the risk of stroke.

System implications

- Initial assessment performed by clinicians experienced in stroke who are able to determine carotid territory involvement.
- Timely access to diagnostic services for evaluating carotid arteries.
- Timely access to surgical consults, including a mechanism in place for expedited referrals as required.

Performance measures

1. **Proportion of stroke patients with moderate to severe (70%–99%) carotid artery stenosis who undergo a carotid intervention procedure following an index stroke event.**
2. **Median time from stroke symptom onset to carotid endartarectomy surgery (core).**
3. **Proportion of stroke patients requiring carotid intervention who undergo the procedure within 2 weeks of the index stroke event.**
4. Proportion of stroke patients with moderate carotid stenosis (50%–69%) who undergo carotid intervention procedure following the index stroke event.
5. Proportion of stroke patients with mild carotid stenosis (< 50%) who undergo carotid intervention procedure following the index 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 2 weeks, between 2 and 4 weeks, between 2 weeks and 3 months, and between 3 and 6 months of stroke onset.
9. Proportion of patients who wait > 3 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 time documented as the actual surgical date.
- 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 endartarectomy, 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 previously 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.

Summary of the evidence

It has been well established that carotid endarterectomy is beneficial for stroke prevention in appropriate patients. There are 3 large trials of endarterectomy for symptomatic stenosis: the North American Symptomatic Carotid Endarterectomy Trial (NASCET),[153] the European Carotid Surgery Trial (ECST)[154] and the Veterans Affairs 309 Trial.[155] According to a pooled analysis of these trials, endarterectomy is highly beneficial in symptomatic patients with severe (70%–99%) angiographic stenosis (NNT = 6 to prevent 1 stroke over 5 years), moderately beneficial for symptomatic patients with moderate (50%–69%) stenosis (NNT = 22 to prevent 1 stroke over 5 years) and not beneficial for mild (< 50%) stenosis.[156] Guidelines on carotid endarterectomy from the American Heart Association[157] and the Canadian Neurosurgical Society[158] 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.[159] 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.

Endarterectomy for symptomatic patients should be performed with a maximum combined perioperative stroke and death rate of 6%, according to the American Academy of Neurology guidelines[39] and the Canadian Neurosurgical Society guidelines;[158] the American Heart Association guidelines recommend a 5% rate for patients with transient ischemic attack and 7% 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,[160] or when performed after greater than 2 weeks for symptomatic, high-grade (70%–99%) stenosis).[161] All of these guidelines recommend that endarterectomy for asymptomatic patients be performed with a maximum combined perioperative stroke and death rate of < 3%, although doubt persists whether carotid endarterectomy is beneficial in most women with asymptomatic stenosis.[161]

For the Carotid Endarterectomy Trialists' Collaboration, Rothwell and associates[161] 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%), surgery was most effective when performed within 2 weeks of the index transient ischemic attack or stroke (NNT = 3 to prevent 1 stroke in 5 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 2 weeks of the ischemic event was beneficial, but the benefit was lost (and there was net harm) when surgery was delayed more than 3 months. Therefore, the Carotid Endarterectomy Trialists' Collaboration recommended that carotid endarterectomy should be done within 2 weeks of the patient's last symptoms.

Carotid endartarectomy 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% or greater reduction in diameter to receive carotid endarterectomy, with daily ASA administration and medical risk factor management for all patients.[162] After a median follow-up of 2.7 years, the absolute risk reduction for ipsilateral stroke was 3.0% 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 1 month, 88% by 1 year) and indefinite deferral of any carotid endarterectomy (only 4% per year received carotid endarterectomy) over a 10-year period.[163] Patients were followed for up to 5 years (mean 3.4 years). The absolute risk reduction for ipsilateral stroke was 3.1%. 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% 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 5 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.[164] Overall, the absolute risk reduction with carotid endarterectomy is small (3.0%), translating into a number needed to treat of about 33. Gladstone and Sahlas[165] recommended that carotid endarterectomy should be considered only for carefully selected patients with carotid artery stenosis of at least 60% 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.[39] They 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% 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% (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)."[4]

Rothwell asserted the importance of ensuring that we have reliable evidence of benefit in relevant subgroups before otherwise healthy asymptomatic individuals are persuaded to submit themselves to surgery.[166] His concern is that readers could easily have misinterpreted the Asymptomatic Carotid Surgery Trial subgroup analyses and conclusions, and gained the mistaken impression that the trial showed that endarterectomy was beneficial in men and women. In fact, the analysis of treatment effect by sex was based only on the risk of stroke, excluding operative strokes and deaths. The effect of sex on the operative risk of stroke and death was reported separately, and the overall balance of hazard and benefit, which is of most interest to patients and clinicians, was not reported. The results of the subgroup analysis in the 2 trials, the Asymptomatic Carotid Surgery Trial (ACST) and the Asymptomatic Carotid Atherosclerosis Study (ACAS), showed clear benefit from endarterectomy in men and considerable uncertainty in women. Although this crude analysis will underestimate the absolute benefit of surgery at 5 years' follow-up in both subgroups, the subgroup–treatment effect interactions are unlikely to be biased and they suggest that the sex-difference in the overall effect of surgery is not due to chance (Breslow-Day test: ACST $p = 0.059$, ACAS $p = 0.07$, pooled $p = 0.01$). However, underpowered subgroup analyses can be misleading, and apparent sex differences in trials of stroke prevention have been wrong in the past. Overall benefit from surgery could certainly accrue in women with longer follow-up. Until further follow-

up analyses are available, perhaps the most important implication of the interim results of the Asymptomatic Carotid Surgery Trial is that continued high rates of endarterectomy for asymptomatic carotid stenosis in women in the United States and some other countries might not be justified.

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.[167] In an Oxfordshire, United Kingdom, population-based study of transient ischemic attack and stroke patients referred for endarterectomy for > 50% stenosis, only 6% had surgery within 2 weeks of their ischemic event and only 43% within 3 months; 32% of patients had a recurrent stroke while awaiting endarterectomy.[168] 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.

3: Hyperacute stroke management

Within this section of the recommendations, hyperacute stroke care is defined as the health care activities that take place from the time of first contact between a patient with potential stroke and medical care until the patient is either admitted to hospital or discharged back into the community.

Best practice recommendation 3.1: Emergency medical services management of acute stroke patients (new for 2008)

This recommendation covers management of patients with suspected stroke from the time of first contact with the local emergency medical services to transfer to hospital personnel, as well as care of suspected or confirmed stroke patients who are being transferred between health care 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 received the appropriate training to screen for stroke and manage potential stroke patients during transfer.

Patients who show signs and symptoms of hyperacute stroke, usually defined as symptom onset within the previous 4.5 hours, must be treated as time-sensitive emergency cases and should be transported without delay to the closest institution that provides emergency stroke care [Evidence Level C] (ASA, AU, ESO, RCP).

i. Immediate contact with emergency medical services (e.g., 9-1-1) by patients or other members of the public is strongly recommended because it reduces time to treatment for acute stroke [Evidence Level C] (ASA, ESO).
ii. Emergency medical services dispatchers must triage patients exhibiting signs and symptoms of a hyperacute stroke as a priority dispatch [Evidence Level C] (ASA, AU, ESO, NAEMSP, RCP).
iii. A standardized acute stroke diagnostic screening tool should be used by paramedics (as per the National Occupational Competency Profile [NOCP][51]) [Evidence Level B] (ASA, AU, ESO).
iv. Out-of-hospital patient management should be optimized to meet the needs of suspected acute stroke patients [Evidence Level A] (ASA, RCP).
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] (AU, ESO).
vi. Direct transport protocol criteria must be based on (1) both symptom duration and anticipated transport duration being less than the therapeutic window and/or (2) other acute care needs of the patient [Evidence Level B] (ASA).
vii. History of event, including time of onset, signs and symptoms, and previous medical and drug history, must be obtained from the patient if able and/or informant when available [Evidence Level C] (RCP).
viii. Paramedics must notify the receiving facility of a suspected acute stroke patient in order for the facility to prepare for patient arrival [Evidence Level C] (ASA, ESO, NAEMSP, RCP).
ix. Transfer of care from paramedics to receiving facility personnel must occur without delay [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 (prehospital) assessment and management of patients with suspected stroke. Acute interventions such as reperfusion therapies (clot-busting drugs) are time-sensitive, and therefore strategies such as redirecting ambulances to stroke centres facilitates earlier assessment, diagnosis and treatment, and may result in better outcomes.

System implications

- Scope of out-of-hospital care is from first patient contact with emergency medical services (e.g., 9-1-1 or local emergency number) to the transfer of care to the receiving facility (e.g., emergency department).
- Emergency medical service dispatchers who are trained to screen for stroke-related symptoms.
- Paramedic education that includes recognition of the signs and symptoms of acute stroke and the need to provide appropriate out-of-hospital treatment.
- Paramedics educated in the use of validated, rapid out-of-hospital stroke screening tools and able to incorporate such protocols into all prehospital assessments of suspected stroke patients.[10]
- Direct transport agreements (bypass or redirect) between emergency medical service providers and regional health authorities and/or receiving facilities.

- Emergency medical service providers who provide coordinated, seamless transport and disposition (land, water and air) of care for acute stroke patients.
- Communication systems available to support access to specialized stroke services (such as telemedicine) (Evidence Level B).

Performance measures

1. **Percentage of (suspected) stroke patients arriving in the emergency department who were transported by emergency medical services.**
2. **Time from initial call received by emergency dispatch centre to emergency medical services arrival on patient scene.**
3. **Time from emergency medical services arrival on patient scene to arrival at *appropriate* emergency department.**
4. Percentage of potential stroke patients transported by emergency medical services who received a final diagnosis of stroke or transient ischemic attack during hospital stay (in the emergency department or as an inpatient).

Measurement notes

- Emergency department records and administrative databases track patients who arrive by ambulance as a standard data element. Ambulance transport may be by land, air or water.
- For performance measure 2, "appropriate" emergency department refers to an emergency department that has access to a CT scanner within 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 prenotification (see www.canadianstrokestrategy.ca).

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 2008 update of the Canadian Best Practice Recommendations for Stroke Care 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 to maximize access to and eligibility for these therapies.[169]

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.[170] Patient delays in seeking care represent 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 critical participants in systems of care for stroke. Crocco[170] cites the appropriate training of emergency medical services 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 American Heart Association/American Stroke 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.[171] 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 services 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 Emergency Medical Services Chiefs of Canada recommended 11 key policy points that can be enacted by emergency medical services to improve services in Canada.[172] The areas addressed in their report included 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; and emergency medical services leaders should pursue opportunities to provide enhanced types and levels of health care, 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 use of a standardized stroke diagnostic screening tool by emergency medical service responders has been recommended to increase the sensitivity of identifying potential stroke patients on scene, especially those who may be candidates for time-sensitive interventions. The Cincinnati Prehospital Stroke Scale is a 3-item scale based on a simplification of the National Institutes of Health Stroke Scale.[173] 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 0.89, 95% CI 0.87–0.92) 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 (intra-

class correlation coefficient 0.92, 95% CI 0.89–0.93) and for the specific items of the scale (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 is a 1-page instrument designed to allow prehospital personnel to rapidly identify acute stroke patients in the field.[174] Over 7 months, paramedics completed the screening tool on noncomatose, nontrauma patients with complaints suggestive of neurologic disease. A prospective, in-the-field validation study of this tool was conducted by paramedics assigned to 3 University of California at Los Angeles-based advanced life support units and were trained and certified in use of the tool. Stroke identification results from the screening forms were compared with emergency department and final hospital discharge diagnoses. The forms were completed for 206 patients. Paramedic performance when completing the Los Angeles Prehospital Stroke Screen demonstrated sensitivity of 91% (95% CI 76%–98%), specificity of 97% (95% CI 93%–99%), positive predictive value of 86% (95% CI 70%–95%) and negative predictive value of 98% (95% CI 95%–99%). With correction for the 4 documentation errors, positive predictive value increased to 97% (95% CI 84%–99%).[174]

Best practice recommendation 3.2: Acute management of transient ischemic attack and minor stroke (new for 2008)

Patients who present with symptoms suggestive of minor stroke or transient ischemic attack must undergo a comprehensive evaluation to confirm the diagnosis and begin treatment to reduce the risk of major stroke as soon as is appropriate to the clinical situation.

Table 6: Suggested timelines for assessment and investigation of minor stroke or transient ischemic attack: classification of patient urgency*

Urgency	Characteristics
Emergent	• Symptoms within the previous 24 h with 2 or more high-risk clinical features (features include focal weakness, speech difficulties, symptoms lasted > 10 min, age > 60 yr, presence of diabetes) • Acute persistent or fluctuating stroke symptoms • One positive investigation (evidence of acute infarct on CT/MRI; evidence of carotid artery stenosis > 50%) • Other factors based on individual presentation and clinical judgment
Urgent	• Transient ischemic attack within previous 72 h
Semiurgent	• Does not fit emergent or urgent definition

Note: CT = computed tomography, MRI = magnetic resonance imaging.
*Developed by a national consensus panel held in Canada in November 2006 on secondary stroke prevention.[20]

3.2a Assessment

i. All patients with suspected transient ischemic attack or minor stroke should have an immediate clinical evaluation and additional investigations as required to establish the diagnosis, rule out stroke mimics and develop a plan of care [Evidence Level B] (ASA, AU, CSQCS, ESO, EXPRESS, RCP).
ii. Use of a standardized risk stratification tool at the initial point of health care contact — whether first seen in primary, secondary or tertiary care — should be used to guide the triage process [Evidence Level B] (AU, CSQCS). See Table 6, Table 7.
iii. Patients with suspected transient ischemic attack or minor stroke should be referred to a designated stroke prevention clinic or to a physician with expertise in stroke assessment and management or, if these options are not available, to an emergency department that has access to neurovascular imaging facilities and stroke expertise [Evidence Level B] (CSQCS, ESO, EXPRESS, SIGN 13).
iv. Patients with suspected transient ischemic attack or minor stroke require brain imaging with CT or magnetic resonance imaging (MRI). Emergent patients (those patients classified at *highest risk* of recurrent stroke) should have neurovascular imaging within 24 hours, and patients classified as *urgent* should have neurovascular imaging within 7 days [Evidence Level B] (ASA, AU, CSQCS, ESO, SIGN 13).
v. Patients who may be candidates for carotid revascularization should have computed tomographic angiography, magnetic resonance angiography, or a carotid duplex ultrasound as soon as possible (within 24 hours for emergent patients, and 7 days for urgent patients) [Evidence Level C] (AU, CSQCS).
vi. The following investigations should be undertaken routinely for patients with suspected transient ischemic attack or minor stroke: complete blood count, electrolytes,

Table 7: Suggested timelines for assessment and investigation of minor stroke or transient ischemic attack: recommended timing of diagnostic tests*

	Timing of tests†		
Diagnostic test	Emergent	Urgent	Semiurgent
Assessment by neurologist or other medical specialist trained in stroke, from time of medical first contact	24 h	7 d	30 d
Brain CT or MRI	24 h	7 d	30 d
Carotid imaging‡	24 h	7 d	30 d
Electrocardiography	24 h	7 d	30 d

Note: CT = computed tomography, MRI = magnetic resonance imaging.
*Developed by a national consensus panel held in Canada in November 2006 on secondary stroke prevention.[20]
†From time of onset of signs and symptoms of stroke to testing, unless otherwise indicated.
‡Carotid Doppler, CT angiography or magnetic resonance angiography.

renal function, cholesterol level, glucose level, and electrocardiography [Evidence Level C] (AU).

vii. Patients with suspected transient ischemic attack or minor stroke with confirmed cerebral infarction on brain imaging should undergo a comprehensive outpatient assessment(s) for functional impairment, which includes a cognitive evaluation, screening for depression, screening of fitness to drive, as well as functional assessments for potential rehabilitation treatment [Evidence Level B] (RCP), preferably within 2 weeks [Evidence Level C]. Refer to Recommendation 5.1, "Initial stroke rehabilitation assessment," and recommendation 5.5, "Follow-up and community reintegration," for further details.

3.2b Management

i. All patients with transient ischemic attack or minor stroke 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] (ASA, CAST/IST, ESO, RCP). The initial dose of ASA should be at least 160 mg. For clopidogrel the loading dose is 300 mg. Refer to recommendation 2.5, "Antiplatelet therapy," for details on long-term antiplatelet therapy.

ii. Patients with transient ischemic attack or minor stroke and > 70% carotid stenosis and select patients with acutely symptomatic 50%–69% carotid stenosis on the side implicated by their neurologic symptoms, who are otherwise candidates for carotid revascularization, should have carotid endarterectomy performed as soon as possible, within 2 weeks [Evidence Level A] (AU, CSQCS, ESO, NICE, NZ, SIGN 14). Refer to Recommendation 2.7, "Carotid intervention," for additional details.

iii. Patients with transient ischemic attack or minor stroke and atrial fibrillation should begin anticoagulation using warfarin immediately after brain imaging has excluded intracranial hemorrhage, aiming for a target therapeutic international normalized ratio 2 to 3. [Evidence Level A] (AU, CSQCS, ESO, NICE, NZ, SIGN 14). Refer to Recommendation 2.6, "Antithrombotic therapy in atrial fibrillation," for additional details.

iv. All risk factors for cerebrovascular disease must be aggressively managed, through both pharmacologic and nonpharmacologic means, to achieve optimal control [Evidence Level A] (ESO). While evidence for 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 (EXPRESS). Refer to recommendations 2.2, "Blood pressure management," and 2.3, "Lipid management," for additional details.

v. Patients with transient ischemic attack or minor stroke who smoke cigarettes should be strongly counselled to quit immediately, and be provided with the pharmacologic and nonpharmacologic means to do so [Evidence Level B] (ASA, CSQCS, ESO, RCP).

Refer to section 2, "Prevention of stroke," for additional details.

Rationale

Evidence clearly demonstrates that a transient ischemic attack or minor stroke is an unstable condition that warns of high future risk of stroke, death or other vascular events. The risk of recurrent stroke after a transient ischemic attack is 10%–20% within 90 days, and the risk is "front-loaded," with half of strokes occurring in the first 2 days. The 7-day risk of stroke following a transient ischemic attack can be as high as 36% in patients with additional risk factors. If a minor stroke does recur it is more likely to result in death or dependency. Therefore, experts advise that transient ischemic attack and minor stroke should be considered as neurologic emergencies requiring prompt diagnostic evaluation, risk stratification and treatment. Immediate initiation of secondary prevention medical therapy and carotid endarterectomy within 2 weeks has been shown to drastically reduce the risk of recurrent stroke.

System implications

- Processes and protocols in community health care settings and acute health care facilities to enable patients with transient ischemic attack or minor stroke rapid access to diagnostic tests and expertise necessary to optimize their management.
- Physicians, including those who work in primary, secondary and tertiary care settings, who have education, training and knowledge to manage patients with transient ischemic attack or minor stroke.
- Established and accessible stroke prevention clinics, or broader vascular prevention programs in all communities, and health care practitioners who are aware of these programs.

Performance measures

1. **Recurrence of stroke or transient ischemic attack within 30 days, 90 days and 1 year following an initial stroke-related event.**
2. Time from first encounter with medical care (primary care or emergency department) to neurologic assessment by a stroke expert (in clinic or other setting).
3. Time from first encounter with medical care to brain imaging (CT or MRI) and other vascular imaging (Doppler ultrasonography of cervical arteries, echocardiography).

Measurement notes

- Data access and quality with respect to timing of first encounter and referral dates and times.
- Primary care data from physician billing — should rely on International Classification of Disease codes, not physician diagnoses, as these may be less accurate.
- Measures from other prevention recommendations in this document are also applicable to this recommendation but are not repeated here.

Summary of the evidence

The goal of this recommendation is to reduce the risk of recurrent stroke following an initial transient ischemic attack or minor stroke. Recurrent stroke contributes a disproportionate share of the overall national burden of stroke compared with

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 10% in the week immediately following a transient ischemic attack or minor stroke.[47] Increasing evidence emphasizes the need for diagnostic evaluation and stroke prevention strategies to be delivered *promptly* after a cerebral ischemic event.

Giles and Rothwell[175] conducted a systematic review and meta-analysis to develop overall estimates of the risk of stroke within 2 and 7 days after transient ischemic attack. Eighteen independent studies were identified with data on 10 126 transient ischemic attack patients. Stroke risk at 7 days ranged from 0% to 12.8% 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% (95% CI 2.0%–4.1%) at 2 days and 5.2% (95% CI 3.9%–6.5%) at 7 days.[175] Lowest risk was demonstrated in studies of emergency treatment in specialist stroke services.

The aim of the Early use of Existing Preventive Strategies for Stroke (EXPRESS) study[47] was to determine the effect of rapid treatment following transient ischemic attack and minor stroke in patients who were not admitted directly to hospital. Rothwell and associates[47] 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 directly to hospital. The study was nested within a rigorous population-based incidence study of all transient ischemic attack and stroke (the 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% 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 and public education about transient ischemic attack and minor stroke.

Investigators in the Fast Assessment of Stroke and Transient ischemic attack to prevent Early Recurrence (FASTER) study postulated that the immediate risk of stroke following transient ischemic attack or minor stroke might be reduced by using clopidogrel in addition to ASA.[176] Kennedy and collaborators[176] investigated the aggressive treatment of such patients using antiplatelets. The hemorrhagic risks of the combination of ASA 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 then 75 mg daily) or placebo ($n = 194$), and simvastatin (40 mg daily; 199 patients) or placebo ($n = 193$). All patients were also given ASA and were followed for 90 days. The median time to stroke outcome was 1 day (range 0–62 days). The trial was stopped early because of a failure to recruit patients at the prespecified minimum enrolment rate because of increased use of statins. The FASTER trial underscored the high risk of stroke in the immediate aftermath of symptom onset in patients with acute ischemic cerebrovascular events, whose symptoms have either 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 enrol patients within 24 hours of symptom onset into a prevention trial, the trial failed to meet its recruitment rate target and was stopped prematurely.

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.[177] 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 4 independent groups of patients ($n = 2893$) diagnosed with transient ischemic attack in emergency departments and clinics in defined populations in the United States and the United Kingdom.[178] The 2 groups used to derive the original scores ($n = 1916$) were used to derive a new unified score based on logistic regression. The 2 existing scores predicted the risk of stroke similarly in each of the 4 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 5 factors: age ≥ 60 years, blood pressure ≥ 140/90 mm Hg, clinical features (unilateral weakness, speech impairment without weakness), duration and diabetes. The *c* statistics score for ABCD2 was 0.62–0.83. While the ABCD and ABCD2 tools are important because they have focused attention upon transient ischemic attack, minor stroke and clinical risk factors for early stroke recurrence, their sensitivity is still low for them to be considered good screening tools at this time.

Best practice recommendation 3.3: Neurovascular imaging

Note: This recommendation on neurovascular imaging has been developed by combining 2 separate recommendations from the 2006 edition of Canadian Best Practice Recommendations for Stroke Care: brain imaging and carotid imaging.

All patients with suspected acute stroke or transient ischemic attack should undergo brain imaging immediately [Evidence Level A] (ASA, CSQCS).

i. In most instances, the initial modality of choice is a noncontrast CT scan [Evidence Level B] (ASA, CSQCS).
ii. Vascular imaging should be done as soon as possible to better understand the cause of the stroke event and guide management decisions. Vascular imaging may include CT angiography, magnetic resonance angiography, catheter angiography and duplex ultrasonography [Evidence Level B] (ASA).
iii. If MRI is performed, it should include diffusion-

weighted sequences to detect ischemia and gradient echo and fluid-attenuated inversion recovery (FLAIR) sequences to determine extent of infarct or presence of hemorrhage [Evidence Level B] (CSQCS, NZ, RCP).

iv. In children, if the initial CT is negative, MRI should be performed to assist with diagnosis and management plans [Evidence Level B] (AHA-P).

v. Carotid imaging should be performed within 24 hours of a carotid territory transient ischemic attack or nondisabling ischemic stroke (if not done as part of the original assessment) unless the patient is clearly not a candidate for carotid endarterectomy [Evidence Level B] (CSQCS, SIGN 14).

vi. In pediatric cases, cerebral and cervical arteries should be imaged as soon as possible, preferably within 24 hours [Evidence Level C] (AHA-P).

Rationale

Clinicians disagree on the clinical diagnosis of stroke (v. not stroke) in about 20% of patients. It is impossible to differentiate infarct from hemorrhage by clinical examination alone. Brain imaging is required to guide management, including the selection of acute, time-sensitive interventions. 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." In pediatric cases 12% have dissections and should be on anticoagulants rather than ASA, and therefore imaging is required to guide these management decisions.

Symptomatic carotid artery stenosis is a known modifiable risk factor for stroke. Therefore, patients who may be suitable for carotid endarterectomy should have rapid access to noninvasive imaging of the carotid arteries. Noninvasive imaging typically comprises Doppler ultrasound, followed (if necessary) by magnetic resonance angiography or CT angiography. Recent meta-analyses of individual patient data have demonstrated that the timing of endarterectomy is of paramount importance. For patients with moderate (50%–69%) stenosis, statistically significant benefit from carotid endarterectomy cannot be demonstrated if surgery is delayed by more than 4 weeks after symptom onset. For patients with severe (> 70%) stenosis, statistically significant benefit from carotid endarterectomy cannot be demonstrated if surgery is delayed by more than 12 weeks after symptom onset.

System implications

- Initial assessment performed by clinicians experienced in stroke to determine diagnostic needs and urgency.
- Timely access to diagnostic services (neuroimaging), including local protocols for prioritizing stroke patients for rapid access to appropriate diagnostics such as CT scans.
- Initial assessment performed by clinicians experienced in stroke who are able to determine carotid territory involvement.
- Timely access to diagnostic services for evaluating carotid arteries.
- Organized system of stroke care across regions to ensure timely access to diagnostic services if not available at the initial hospital for stroke patients.

Performance measures

1. **Proportion of stroke patients who receive a brain CT or MRI within 25 minutes of hospital arrival.**
2. **Proportion of stroke patients who receive a brain CT or MRI within 24 hours of hospital arrival.**
3. Proportion of stroke patients who receive a brain CT or MRI before hospital discharge (core).
4. **Proportion of stroke patients who receive carotid imaging before hospital discharge.**
5. Proportion of patients who do not undergo carotid imaging in hospital who have an appointment booked before discharge for carotid imaging as an outpatient.
6. Median time from stroke symptom onset to carotid imaging.

Measurement notes

- Time interval measurements should be taken from the time the patient is triaged or registered at the hospital (whichever time comes first chronologically) until the time noted on the actual brain imaging scan. These numbers are both generated by hospital computer systems and have been found to be the most reliable. In the absence of an information system-generated arrival time, the first time documented on the patient record should be used for calculations.
- Analysis should be stratified for those patients who arrive within 4 hours of stroke symptom onset and those who arrive beyond 4 hours.
- Performance measure 1 should be applied to patients who may be candidates for acute thrombolysis (arrive at hospital within 4 hours of stroke onset) and for patients who may be eligible for other time-sensitive interventions.
- For carotid imaging booked on an outpatient basis, a notation should appear in the discharge summary, or in nursing notes, with an indication that the test has actually been booked before the patient leaves hospital.

Summary of the evidence

Despite the absence of randomized trials, there is uniform agreement that noncontrast 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 department to completion of the scan and 45 minutes until interpretation have been recommended based on randomized controlled trials of thrombolytic therapy. Although MRI may provide more information in specific cases, it is not generally recommended as the initial brain imaging study in patients with an acute stroke.

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 department 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 middle cerebral artery 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.[4] The authors strongly recommended CT of the head without contrast enhancement as the initial brain imaging procedure in patients with acute stroke. This recommendation was classified by the authors 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 and coworkers[179] conducted a cost-effectiveness analysis of the use of CT and tested 13 strategies. The study indicated 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 ASA, and there is no good evidence of a time dependency of the effect of ASA up to 48 hours after stroke.

About 15% to 20% 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 1 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.[168]

While brain imaging is essential for diagnosis, referral and management of suspected pediatric stroke patients, the wide differential diagnosis for stroke-like presentations in children requires more specific initial imaging, namely MRI, compared with adults. MRI can also screen for the site of arterial or venous occlusion[7] 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.[180] Of 97 children having 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%. High-risk patients can be rapidly identified with the use of cerebrovascular imaging. In children, arterial dissection is common (14% of childhood stroke) and clinical indicators are unreliable. Neck pain is rarely found, and 50% of cases are nontraumatic.

Best practice recommendation 3.4: Blood glucose abnormalities

All patients with suspected acute stroke should have their blood glucose concentration checked immediately.

i. Blood glucose measurement should be repeated if the first value is abnormal or if the patient is known to have diabetes. Hypoglycemia should be corrected immediately [Evidence Level B] (AU, CSQCS, ESO).
ii. Elevated blood glucose concentrations should be treated with glucose-lowering agents [Evidence Level B] (AU, CSQCS, ESO).

Rationale

Diabetes is a major modifiable risk factor for vascular disease that may be first diagnosed at the time of a stroke. Severe hyperglycemia (high blood glucose > 22 mmol/L) is a relative contraindication to the intravenous administration of alteplase. Hyperglycemia at the time of acute stroke increased the size of the infarct (damaged area) in experimental animals and has been associated with poor clinical outcomes in epidemiologic studies. Some individuals treated for diabetes may experience hypoglycemia (low blood glucose), which may present with focal neurologic deficits; if recognized promptly, these can be reversed by giving glucose.

System implications

- Initial comprehensive assessment performed by clinicians experienced in stroke.
- Timely access to diagnostic services, with predetermined protocols for initial blood work, including glucose screening.
- Definition, dissemination and implementation of best practices for stroke patients across the continuum of care to ensure ongoing monitoring and management of blood glucose levels as required.

- Mechanisms for ongoing monitoring and evaluation, with a feedback loop for interpretation of findings and opportunities for quality improvement.

Performance measures

1. **Proportion of patients with blood glucose levels documented during assessment in the emergency department or on the inpatient ward.**
2. 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.
- Medical history should indicate whether patient was known to be diabetic before stroke event.
- Glucose levels need to be monitored for a period of time to determine whether glucose levels achieve and are sustained in therapeutic range. Therapeutic range may vary between patients.
- Hb_{A1c} levels may also be considered in determining performance measure 2 as well as blood glucose levels.

Summary of the evidence

Elevated blood glucose (hyperglycemia) in the acute phase of stroke is common, documented in up to 40% 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" physiologic 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%. 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 6 months and 1 year after 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 with a normal saline infusion control group, enrolled a total of 933 patients.[181] 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. There was 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.

Best practice recommendation 3.5: Acute thrombolytic therapy

All patients with disabling acute ischemic stroke who can be treated within 4.5 hours after 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 the National Institute of Neurological Disorders and Stroke (NINDS) rt-PA Stroke Study and the Third European Cooperative Acute Stroke Study (ECASS III) (see Box 3) [Evidence Level A] (Cochrane, ECASS III).
ii. All eligible patients should receive intravenous alteplase within 1 hour of hospital arrival (door-to-needle time < 60 minutes) [Evidence Level C] (CSQCS, RCP).
iii. Administration of alteplase should follow the American Stroke Association guidelines: total dose 0.9 mg/kg with 10% (0.09 mg/kg) given as an intravenous bolus over 1 minute and the remaining 90% (0.81 mg/kg) given as an intravenous infusion over 60 minutes [Evidence Level A] (ASA, CSQCS, RCP).
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 5 on the Alberta Stroke Program Early CT Score [ASPECTS]). 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] (Dzialowski et al. 2006).[183]
v. There remain situations where there are sparse or no clinical trial data to support the use of thrombolytic therapy: pediatric stroke, stroke in patients over the age of 80 years, 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 made available [Evidence Level A] (Cochrane, ECASS III, AHA-P).

Note: In Canada, alteplase is currently approved by Health Canada for use in adults with acute ischemic stroke within 3 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.

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

- Bypass agreements in place among all emergency medical service providers and hospitals to ensure that all patients with suspected stroke who can be treated within 4.5 hours of symptom onset are taken to a hospital that has the capability to administer intravenous alteplase. (Refer to Recommendation 3.1, "Emergency medical services care management of acute stroke patients," for further details.)
- Initial assessment performed by clinicians experienced in stroke to determine appropriateness for treatment with intravenous alteplase, either in person or through the use of telemedicine technology.
- Timely access to brain imaging for potential alteplase candidates.
- Timely access to treatment with intravenous alteplase.
- Organized stroke care (stroke units with critical mass of trained staff, interdisciplinary team).

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 thrombolysed stroke patients who receive alteplase within 1 hour of hospital arrival (core).**
4. **Median time from patient arrival in the emergency department to administration of alteplase (in minutes).**
5. 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).
6. **Proportion of patients with symptomatic intracerebral hemorrhage following alteplase treatment.**

Measurement notes

- Data source is the patient chart, obtained by chart audit or review.

Box 3: Criteria for intravenous administration of alteplase[2,46,182]

Treatment criteria

- Ischemic stroke in a patient aged ≥ 18 yr
- Stroke onset > 1 h and < 4.5 h before alteplase administration
- Stroke deficit that is disabling or measurable on the National Institutes of Health Stroke Scale
- No intracranial hemorrhage on CT or MRI scan

Exclusion criteria

- Time of stroke onset unknown or > 4.5 h
- Any hemorrhage on brain CT or MRI scan
- Symptoms suggestive of subarachnoid hemorrhage
- 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 < 5)
- History of intracranial hemorrhage
- Stroke or serious head or spinal trauma within the preceding 3 mo
- Seizure at stroke onset
- Systolic blood pressure > 185 mm Hg or diastolic blood pressure > 110 mm Hg or aggressive treatment (intravenous medication) necessary to reduce blood pressure to these limits
- Recent major surgery
- Arterial puncture at a noncompressible site within the previous 7 d
- Elevated activated partial thromboplastin time
- International normalized ratio > 1.7
- Platelet count < 100×10^9/L
- Blood glucose concentration < 2.7 mmol/L or > 22.2 mmol/L
- Any other condition that could increase the risk of hemorrhage after alteplase administration

Note: CT = computed tomography, MRI = magnetic resonance imaging.

- Time interval measurements should be taken from the time the patient is triaged or registered at the hospital (whichever time comes first chronologically) until the time of medication administration noted in the patient chart (nursing notes, emergency department record or medication record).
- When recording if alteplase is given, the route of administration (intravenous or intra-arterial or both) should also be recorded.

Summary of the evidence

New information from several clinical trials has become available since the release of the 2006 Best Practice Recommendations for Stroke Care. 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.[46] 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 3 hours and 59 minutes after stroke onset. More patients had a favourable 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.

The Third European Cooperative Acute Stroke Study[46] 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.[184] The analysis found that earlier administration of alteplase improved the odds ratio of having a favourable 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. The pooled analysis is expected to be updated in the near future.

The 2003 Cochrane systematic review of thrombolysis for acute ischemic stroke[169] has been updated[45] to include the results of the Third European Cooperative Acute Stroke Study and 7 other trials. The database now includes a total of 7152 patients in trials that tested urokinase, streptokinase, alteplase, recombinant pro-urokinase or desmoteplase. More than 50% of the patients were enrolled in trials of alteplase. Few patients were aged over 80 years, and there have been no trials involving children. Four trials used intra-arterial administration, but the rest used the intravenous route. Thrombolytic therapy significantly reduced the proportion of patients who were dead or dependent (modified Rankin score 3 to 6) at the end of follow-up (OR 0.8, 95% CI 0.7–0.9). This was in spite of a significant increase in the odds of symptomatic (including fatal) intracranial hemorrhage (OR 3.3, 95% CI 2.7–4.1). Late death was not significantly increased (OR 1.3, 95% CI 1.1–1.5). Restricting the analyses to the trials of alteplase did not alter the results substantially. Earlier treatment was better: 110 (95% CI 50–170) patients per 1000 treated with alteplase within 3 hours avoided death or dependency compared with 40 (95% CI 10–80) treated 3 to 6 hours after stroke onset. Defining death or dependency as a modified Rankin score of 2–6 or 3–6 produced similar results. Later treatment with alteplase was not associated with a greater risk of symptomatic intracranial hemorrhage (70 [95% CI 40–100] per 1000 patients treated within 3 hours and 60 [95% CI 50–80] per 1000 patients treated 3–6 hours after stroke onset).

There was significant heterogeneity between the trials, which confounds interpretation of the results of the meta-analysis. This heterogeneity was not explained by metaregression on time to treatment, prior antithrombotic therapy, selection by CT scanning versus diffusion/perfusion MRI, stroke severity or trial size. The time window for alteplase administration remains imprecisely defined, there have been no trials in children, and there is a paucity of data relating to elderly people, patients with diabetes, antithrombotic use, use of intra-arterial therapy, and stroke severity and subtype. Further trials are necessary to address these issues.

Postmarketing 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.[185–187] The Canadian Alteplase for Stroke Effectiveness Study (CASES) assessed the effectiveness of alteplase therapy for ischemic stroke in a prospective national cohort study.[185] Data were collected over 2.5 years between 1999 and 2001 from centres capable of administering alteplase according to Canadian guidelines.[188] A total of 1135 adults were enrolled at 60 hospitals across Canada (an estimated 84% of all treated ischemic stroke patients in the country) with follow-up at 3 months. An excellent clinical outcome was observed in 37% of the patients. Symptomatic intracranial hemorrhage occurred in 4.6% of the patients (95% CI 3.4%–6.0%); however, 75% 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.[186] Comparison of a cohort of 11 865 patients

treated within 3 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).[187]

Best practice recommendation 3.6: Acute ASA therapy

All acute stroke patients should be given at least 160 mg of ASA immediately as a one-time loading dose after brain imaging has excluded intracranial hemorrhage [Evidence Level A] (ESO, NZ, RCP, SIGN 13).

i. In patients treated with recombinant tissue plasminogen activator, ASA should be delayed until after the 24-hour post-thrombolysis scan has excluded intracranial hemorrhage [Evidence Level A] (NZ, RCP).
ii. ASA (80–325 mg daily) should then be continued indefinitely or until an alternative antithrombotic regime is started [Evidence Level A] (RCP). Refer to recommendation 2.5, "Antiplatelet therapy," and 2.6, "Antithrombotic therapy in atrial fibrillation," for further details on antiplatelet therapy and anticoagulation.
iii. In dysphagic patients, ASA may be given by enteral tube or by rectal suppository [Evidence Level A] (RCP).
iv. In pediatric patients, initial treatment with low molecular weight heparin should be considered and continued until vertebral artery dissection and intracardiac thrombus is excluded. If neither is present, switch to acute ASA therapy at a dose of 3–5 mg/kg [Evidence Level A] (AHA-P).

Rationale

Acute-phase ASA therapy reduces the risk of early recurrent ischemic stroke. Long-term ASA therapy reduces the risk of ischemic stroke, myocardial infarction and vascular death. The randomized trials of ASA therapy in acute ischemic stroke enrolled patients within 48 hours of stroke onset and used doses of 160 to 325 mg daily. 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 rt-PA Stroke Study, antithrombotic drugs (including ASA) were avoided until after the 24-hour post-thrombolysis scan had excluded intracranial hemorrhage. In trials of long-term secondary prevention therapy, daily ASA doses of 50 to 325 mg were as effective as higher doses and less likely to cause gastrointestinal side effects. ASA therapy reduces the risk of venous thromboembolism.

System implications

- Organized stroke care on stroke units with critical mass of trained staff and an interdisciplinary team approach.
- Initial assessment performed by clinicians experienced in stroke to determine appropriateness for acute ASA therapy.
- Protocols for timely access to diagnostic services (neuroimaging).
- Protocols for timely access to thrombolytic therapy (tissue plasminogen activator) and other reperfusion strategies.

Performance measures

1. **Proportion of ischemic stroke patients who receive acute ASA therapy within the first 48 hours following a stroke event.**
2. Median time from stroke onset to administration of first dose of ASA 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 chronologically) until the time noted for the first dose administered.
- This indicator focuses on ASA. Some centres may also choose to include other antiplatelet medications, such as clopidogrel, ticlopidine or ASA combined with extended-release dipyridamole. In cases where another agent is used instead of ASA in the first 48 hours, this should be clearly noted in the indicator definition.
- Possible data sources include history and physical examination, physician's admission notes, nurses' admission notes, and the medication record.

Summary of the evidence

The most recent Cochrane systematic review update (in 2006) of ASA in acute stroke included 9 trials involving 41 399 patients.[189] Two trials testing ASA 160 to 300 mg once daily started within 48 hours of onset contributed 98% of the data. The maximum follow-up was 6 months. With treatment, there was a significant decrease in death or dependency at the end of follow-up (OR 0.94, 95% CI 0.91–0.98). In absolute terms, 13 more patients were alive and independent at the end of follow-up for every 1000 patients treated. Furthermore, treatment increased the odds of making a complete recovery from the stroke (OR 1.06, 95% CI 1.01–1.11). In absolute terms, 10 more patients made a complete recovery for every 1000 patients treated. Antiplatelet therapy was associated with a small but definite excess of 2 symptomatic intracranial hemorrhages for every 1000 patients treated, but this was more than offset by a reduction of 7 recurrent ischemic strokes and about 1 pulmonary embolus for every 1000 patients treated. The authors concluded that antiplatelet therapy with ASA 160 to 300 mg daily, given orally (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 guidelines included in this document state that patients treated with recombinant tissue plasminogen activator 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.[131] 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 3 months after hospitalization.[190]

The lack of high-quality, randomized controlled trials in the

literature has created controvery in the discussion of hyperacute management of pediatric stroke patients. The pediatric stroke guidelines of both the Royal College of Physicians[38] in the United Kingdom and the American Heart Association[9] 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.[10]

Although the pediatric research is just emerging, it is clear that transient ischemic attack or stroke recurrence rate in children with arterial ischemic stroke is nearly 50% without antithrombotic treatment, demonstrating that pediatric stroke must be promptly diagnosed and treated.[143] Data from the Warfarin–Aspirin Recurrent Stroke Study in the adult subgroups most similar to children with stroke (i.e., nonhypertensive, nonatherosclerotic) showed benefit to anticoagulation over ASA in preventing recurrent stroke.[191]

Best practice recommendation 3.7: Management of subarachnoid and intracerebral hemorrhage

i. Patients with suspected subarachnoid hemorrhage should have an urgent neurosurgical consultation for diagnosis and treatment [Evidence Level B].
ii. Patients with cerebellar hemorrhage should have an urgent neurosurgical consultation for consideration of craniotomy and evacuation of the hemorrhage [Evidence Level C].
iii. Patients with supratentorial intracerebral hemorrhage should be cared for on a stroke unit [Evidence Level B].

Rationale

Subarachnoid and intracerebral hemorrhage are prevalent in both adults and children. Subarachnoid hemorrhage is a neurosurgical emergency. Cerebellar hemorrhage poses a risk of obstruction of the fourth ventricle, brain stem compression and sudden death. Although no trial evidence exists, most would consider it good clinical practice to closely monitor such patients to determine the need for surgical decompression of the posterior fossa.

There is currently no good evidence to support a surgical approach to treat supratentorial intracerebral hemorrhage. However, all patients, regardless of stroke type, stand to benefit from organized care on a stroke unit.

System implications

- Organized stroke care (stroke units with critical mass of trained staff, interdisciplinary team).
- Initial assessment performed by clinicians experienced in stroke, to determine nature of stroke and appropriate management.
- Timely access to diagnostic services (neuroimaging). with protocols for prioritizing potential stroke patients.
- Timely access to neurosurgical specialists for hemorrhagic patient management, including rapid referral process if neurosurgical services are not available within the initial treating hospital.
- Definition, dissemination and implementation of best practices for stroke patients across the continuum of care to ensure appropriate and comprehensive management of hemorrhagic stroke patients.
- Mechanisms for ongoing monitoring and evaluation, with a feedback loop for interpretation of findings and opportunities for quality improvement.

Performance measures

1. Proportion of hemorrhagic stroke patients treated on an acute stroke unit.
2. Proportion of total time in hospital spent on an acute stroke unit.
3. Percentage of hemorrhagic stroke patients who receive a neurosurgical consult while in hospital.
4. Proportion of hemorrhagic stroke patients discharged to their place of residence, inpatient stroke rehabilitation, complex continuing care or long-term care following hospital discharge.
5. Mortality rate for subarachnoid and intracerebral hemorrhage at 30 days in hospital.

Measurement notes

- Analysis should be stratified for intracerebral and subarachnoid hemorrhage patients.
- Analyses should be risk adjusted for age, sex and comorbidities, as well as stroke severity.

Summary of the evidence

Subarachnoid hemorrhage

Recurrent hemorrhage remains a serious consequence of aneurysmal subarachnoid hemorrhage, with a case-fatality rate of approximately 70% for persons who rebleed. In recent years improved diagnosis of subarachnoid hemorrhage and rapid referral to specialized centres 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 1%–2% per day over the subsequent 4 weeks.[192] Several prospective follow-up cohorts have demonstrated that the risk of rebleeding with conservative therapy is between 20% and 30% for the first month after hemorrhage and then stabilizes at a rate of approximately 3% per year.[193]

The International Subarachnoid Aneurysm Trial (ISAT) was a randomized controlled trial that compared endovascular treatment with neurosurgical treatment in patients with aneurysmal subarachnoid hemorrhage.[194] This study enrolled 2143 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 2 months and at 1 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 1 year. Trial recruitment was stopped by the steering committee after a planned interim analysis (published in 2002).[194] Analysis was per protocol. Final analysis was completed after

all patients completed the 1-year follow-up (published in 2005).[195] Secondary outcomes included rebleeding from the treated aneurysm and risk of seizures.

The 1-year outcomes of the International Subarachnoid Aneurysm Trial (ISAT) were reported for 1063 of the 1073 patients assigned to endovascular treatment and for 1055 of the 1070 patients assigned to neurosurgical treatment.[195] Two hundred and fifty (23.5%) of the 1063 patients assigned to endovascular treatment were dead or dependent at 1 year, compared with 326 (30.9%) of the 1055 patients assigned to neurosurgery, an absolute risk reduction of 7.4% (95% CI 3.6%–11.2%, $p = 0.0001$). The early survival advantage was maintained for up to 7 years and was significant (log rank $p = 0.03$). The risk of epilepsy was substantially lower in patients assigned 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% (95% CI 12.4%–33.9%). This equates to an absolute risk reduction of 7.4% (95% CI 3.6%–11.2%), which is equivalent to 74 patients avoiding death or dependency at 1 year for every 1000 patients treated.

Timing of aneurysm surgery has been addressed in several nonrandomized clinical series. Kassell and coworkers[192] observed no preoperative rebleeds in 27 patients with early (less than 3 days after subarachnoid hemorrhage) surgery compared with 7 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 in 3521 patients, of whom 83% underwent surgical repair of the ruptured aneurysm.[196] Timing of surgery after subarachnoid hemorrhage was significantly related to the likelihood of preoperative rebleeding (0–3 days, 5.7%; 4–6 days, 9.4%; 7–10 days, 12.7%; 11–14 days, 13.9%; and 15–32 days, 21.5%). Postoperative rebleeding did not differ among time intervals (1.6% 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. Regardless of surgical timing, early referral to centres with facilities for intensive care of patients with subarachnoid hemorrhage is essential, since many therapies need to be initiated in the acute period.[193]

Supratentorial intracerebral hemorrhage

A recent update of a Cochrane review (in 2007) assessed the effects of surgery plus routine medical management, compared with routine medical management alone, in patients with primary supratentorial intracerebral hematoma.[197] Randomized trials of routine medical treatment plus intracranial surgery were compared with routine medical treatment alone in patients with CT-confirmed primary supratentorial intracerebral hematoma. Intracranial surgery included craniotomy, stereotactic endoscopic evacuation or stereotactic aspiration. Ten trials with 2059 participants were included. The quality of most of the trials was acceptable but not high, and the results were sensitive to the losses to follow-up in the largest trial. Therefore, the estimates of effect may not be robust and may be subject to bias. The review showed that surgery was associated with statistically significant reduction in the odds of being dead or dependent at final follow-up (OR 0.71, 95% CI 0.58–0.88; $p = 0.001$) with no significant heterogeneity among the study results. Surgery was also associated with significant reduction in the odds of death at final follow up (OR 0.74, 95% CI 0.61–0.90; $p = 0.003$); however, there was significant heterogeneity for death as outcome. The authors concluded that in patients with CT-proven primary supratentorial intracerebral hemorrhage, surgery added to medical management reduces the odds of being dead or dependent compared with medical management alone, but the result is not very robust and further randomized trials are required.

Four small randomized trials of medical therapy for intracerebral hemorrhage have been conducted: 2 for steroid versus placebo treatment and 1 each for hemodilution versus best medical therapy and for glycerol versus placebo. None of these studies showed any significant benefit for the 3 therapies; patients who were treated with steroids were more likely to develop infectious complications than those treated with placebo.

Stroke unit

In a prospective randomized study comparing mortality rates among intracranial hemorrhage patients managed on an acute stroke unit versus medical ward, Ronning and collaborators[198] found that stroke unit care was associated with reduced mortality at 30 days (39% v. 63%, $p = 0.007$) and 1 year (52% v. 69%, $p = 0.013$).

4: Acute inpatient stroke care

Best practice recommendation 4.1: Stroke unit care

Patients admitted to hospital because of an acute stroke or transient ischemic attack should be treated in an interdisciplinary stroke unit [Evidence Level A] (CSQCS, ESO, SCORE, SIGN 64).

i. A stroke unit is a specialized, geographically defined hospital unit dedicated to the management of stroke patients [Evidence Level A] (AU, RCP).
ii. The core interdisciplinary team should consist of people with appropriate levels of expertise in medicine, nursing, occupational therapy, physiotherapy, speech–language pathology, social work and clinical nutrition. Additional disciplines may include pharmacy, (neuro)psychology and recreation therapy [Evidence Level B] (AU, SCORE, SIGN 64).
iii. The interdisciplinary team should assess patients within 48 hours of admission 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] (ASA, RCP).
v. Any child admitted to hospital with stroke should be

managed in a centre with pediatric stroke expertise and/or managed using standardized pediatric stroke protocols [Evidence Level B] (ACCP, AHA-P, RCP-P).

Rationale

Stroke unit care reduces the likelihood of death and disability in men and women of any age with mild, moderate or severe stroke by as much as 30%. Stroke unit care is characterized by a coordinated interdisciplinary 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 recognition of pneumonia and earlier mobilization. Patients should be treated in a geographically defined unit, as roving stroke teams do not provide the same benefit as stroke units.

Refer to Recommendation 5.3 for the components of inpatient stroke rehabilitation (which commences in the acute care hospital) and for additional information on stroke rehabilitation units.

System implications

- Organized system of stroke care including stroke units with a critical mass of trained staff (interdisciplinary team). If stroke unit not feasible, then mechanisms for coordinating the care of stroke patients to ensure application of best practices and optimization of outcomes.
- Protocols and mechanisms to enable the rapid transfer of stroke patients from the emergency department to an interdisciplinary stroke unit as soon as possible after arrival in hospital, ideally within the first 3 hours, as delays in transfer may result in adverse patient outcomes.
- Information on geographic location of stroke units and other specialized stroke care models need to be made available to community service providers. This will facilitate navigation to appropriate resources and strengthen the relationship among sectors along the stroke continuum of care.

Performance measures

1. **Number of stroke patients treated on a stroke unit at any time during their inpatient hospital stay for an acute stroke event (numerator), as a percentage of total number of stroke patients admitted to hospital (denominator) (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 could be calculated for all cases, then stratified by type of stroke.
- Definition of stroke unit varies widely from institution to institution. Where stroke units do not exist that meet the criteria defined in the recommendation, then a hierarchy of other stroke care models could be considered: (1) dedicated stroke unit, (2) designated area within a general nursing unit where clustering of stroke patients occurs, (3) mobile stroke team care and (4) management on a general nursing unit by staff using guidelines and protocols.
- The operational definition of "stroke unit" being used by any institution collecting these data must be noted to ensure standardization and validity when data are collected and reported across institutions.

Summary of the evidence

As noted in the recent Australian Clinical Practice Guidelines for Acute Stroke Management,[12] several models of stroke unit care have been described in the literature. These include an acute stroke unit within a discrete ward, a comprehensive stroke unit encompassing the stroke acute and rehabilitation unit within a discrete ward, or a stroke rehabilitation unit and a mixed rehabilitation ward providing rehabilitation for stroke patients on a ward with a general caseload.

The typical components of care in the stroke unit trials, as evidenced in one study, included several components: (1) assessment — medical evaluation and diagnostic testing (including CT scanning) and early assessment of nursing and rehabilitation therapy needs; (2) 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 (3) ongoing rehabilitation policies (coordinated interdisciplinary team care, early assessment of needs after discharge).[199]

The Stroke Unit Trialists' systematic review included 31 randomized and quasi-randomized trials containing outcome information on 6936 patients comparing stroke unit care with alternative service.[200] Of the 31 trials, 26 trials (n = 5592) compared stroke unit care with care on general wards. The alternative service was usual care provided on an acute medical ward without routine interdisciplinary input. Organized inpatient (stroke unit) care typically involved (1) coordinated interdisciplinary rehabilitation, (2) staff with a specialist interest in stroke or rehabilitation, (3) routine involvement of caregivers in the rehabilitation process and (4) regular programs of education and training. The core characteristics that were invariably included in the stroke unit setting were interdisciplinary staffing, i.e., medical, nursing and therapy staff (usually including physiotherapy, occupational therapy, speech therapy, social work), and coordinated interdisciplinary team care with meetings at least once per week. Stroke unit care showed reductions in the odds of death recorded at final (median 1 year) follow-up (OR 0.86, 95% CI 0.76–0.98; p = 0.02), the odds of death or institutionalized care (OR 0.82, 95% CI 0.73–0.92; p = 0.0006), and death or dependency (OR 0.82, 95% CI 0.73–0.92; 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 1 year after the stroke. The benefits were most apparent in units based in a discrete ward. No systematic in-

crease was observed in the length of inpatient stay.

A recent 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.[201] During the first week, nearly 64% 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%), nonserious 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 nonserious falls (25.0%). The severity of stroke on admission was the most important risk factor for complications.

Within clinical trials, stroke patients assigned to receive organized inpatient (stroke unit) care are more likely to survive, return home and regain independence than those assigned to conventional care. However, there are concerns that the benefits seen in clinical trials may not be replicated in routine practice. Seenan and associates[202] 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 1 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 (OR 0.79, 95% CI 0.73–0.86; $p < 0.00001$) and of death or poor outcome (OR 0.87, 95% CI 0.80–0.95; $p = 0.002$) within 1 year of stroke. Results were complicated by significant heterogeneity ($p < 0.05$), mainly in single-centre studies. Although these results are complicated by potential bias and heterogeneity, the observed benefit associated with stroke unit care in routine practice was comparable to that in clinical trials.

In a synthesis of evidence demonstrating the benefits of organized stroke care, Kalra and Langhorne[203] 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 was designed to monitor mentation and motor functions in stroke patients. This scale was initially validated by Côté and associates[204,205] and was found to be internally consistent and to have a high level of interrater reliability. Initial scores were found to be a significant predictor of death, morbidity and recovery of activities of daily living. Patients with high initial scores were at lower risk of poor outcomes at 6 months. This relationship held even after adjustments for other covariates.[204]

The National Institutes of Health Stroke Scale is another validated scale used in clinical practice.[206] 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).[206] Test–retest reliability did not differ significantly among a neurologist, a neurology house officer, a neurology nurse and 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 CT scan at 1 week and to the patients' clinical outcome as determined at 3 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 2 stroke scales at academic medical centres and community hospitals.[207] The intraclass correlation coefficient for the National Institutes of Health Stroke Scale and the Canadian Neurological Scale, respectively, were 0.93 (95% CI 0.82–1.00) and 0.97 (95% CI 0.90–1.00) for the academic medical centres, 0.89 (95% CI 0.75–1.00) and 0.88 (95%, 0.73–1.00) for community hospitals with neurologic services and 0.48 (95% CI 0.26–0.70) and 0.78 (95% CI 0.60–0.96) for community hospitals without neurologic services. More items on the National Institutes of Health Stroke Scale were missing at the community hospitals without neurologic services (62%) than at the academic medical centres (27%) and the community hospitals with neurologic services (23%, $p = 0.0001$). In comparison, 33%, 0% and 8% of Canadian Neurological Scale items were missing from records from community hospitals without neurologic services, academic medical centres and the community hospitals with neurologic services, respectively ($p = 0.0001$). The study found that the levels of interrater agreement were almost perfect for retrospectively assigned National Institutes of Health Stroke Scale and Canadian Neurological Scale scores for patients initially evaluated by a neurologist at both an academic medical centre and a community hospital. Levels of agreement for the Canadian Neurological Scale were substantial at a community hospital without neurologic services, but interrater agreement for the National Institutes of Health Stroke Scale was only moderate in this setting. The proportions of missing items were higher for the National Institutes of Health Stroke Scale than the Canadian Neurological Scale in each setting, particularly limiting its application in the hospital without acute neurologic consultative services. (Functional assessment

tools are described in section 5, "Stroke rehabilitation and community reintegration.")

Best practice recommendation 4.2: Components of acute inpatient care (new for 2008)

Risk for venous thromboembolism, 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.

4.2a Venous thromboembolism prophylaxis

All stroke patients should be assessed for their risk of developing venous thromboembolism (including deep vein thrombosis and pulmonary embolism).

Patients considered as high risk include patients with inability to move one or both lower limbs and those patients unable to mobilize independently.

i. Patients who are identified as high risk for venous thromboembolism should be considered for prophylaxis provided there are no contraindications [Evidence Level B] (ESO).
ii. Early mobilization and adequate hydration should be encouraged with all acute stroke patients to help prevent venous thromboembolism [Evidence Level C] (AU, ESO, SCORE).
iii. The use of secondary stroke prevention measures, such as antiplatelet therapy, should be optimized in all stroke patients [Evidence Level A] (ASA, AU, NZ, RCP, SIGN 13).
iv. The following interventions may be used for patients with acute ischemic stroke at high risk of venous thromboembolism in the absence of contraindications:
    a. low molecular weight heparin (with appropriate prophylactic doses per agent) or heparin in prophylactic doses (5000 units twice a day) [Evidence Level A] (ASA, AU, ESO);
    b. external compression stockings [Evidence Level B] (AU, ESO).
v. For patients with hemorrhagic stroke, nonpharmacologic means of prophylaxis (as described above) should be considered to reduce the risk of venous thromboembolism [Evidence Level C].

4.2b Temperature

i. Temperature should be monitored as part of routine vital sign assessments (every 4 hours for first 48 hours and then as per ward routine or based on clinical judgment) [Evidence Level C] (ESO).
ii. For temperature greater than 37.5°C, increase frequency of monitoring and initiate temperature reducing measures [Evidence Level C] (ESO).
iii. Sources of fever should be treated and antipyretic medications should be administered to lower temperature in febrile patients with stroke to < 38°C [Evidence Level B] (ASA, CSQCS).
iv. In case of fever, the search for a possible infection (site and cause) is recommended, in order to start tailored antibiotic treatment [Evidence Level C] (ESO).

4.2c Mobilization

Mobilization is defined as "the act of getting a patient to move in the bed, sit up, stand, and eventually walk."[11]

i. All people 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] (CSQCS). See Box 4 for contraindications.
ii. Within the first 3 days after stroke, blood pressure, oxygen saturation and heart rate should be monitored before each mobilization [Evidence Level C] (AVERT).
iii. All people admitted to hospital with acute stroke should be assessed by rehabilitation professionals as soon as possible after admission [Evidence Level A] (RCP), preferably within the first 24 to 48 hours [Evidence Level C] (NZ). Refer to section 5, "Stroke rehabilitation and community reintegration," for related recommendations.

4.2d Continence

i. All stroke patients should be screened for urinary incontinence and retention (with or without overflow), fecal incontinence and constipation [Evidence Level C] (RNAO).
ii. Stroke patients with urinary incontinence should be assessed by trained personnel using a structured functional assessment [Evidence Level B] (AU).
iii. The use of indwelling catheters should be avoided. If used, indwelling catheters should be assessed daily and removed as soon as possible [Evidence Level C] (AU, CSQCS, RCP, VA/DoD).
iv. A bladder training program should be implemented in patients who are incontinent of urine [Evidence Level C] (AU, VA/DoD).
v. The use of portable ultrasound is recommended as the preferred noninvasive painless method for assessing postvoid residual and eliminates the risk of introducing urinary infection or causing urethral trauma by catheterization [Evidence Level C] (CCF).
vi. A bowel management program should be implemented in stroke patients with persistent constipation or bowel incontinence [Evidence Level A] (VA/DoD).

4.2e Nutrition

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] (AU, RPC, SIGN 78).
ii. Results from the screening process should guide appropriate referral to a dietitian for further assessment and the need for ongoing management of nutritional and hydration status [Evidence Level C] (NZ, SIGN 78).
iii. Stroke patients with suspected nutritional and/or hydration deficits, including dysphagia, 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 based on the assessment by a speech–language pathologist or other trained professional [Evidence Level C] (AU, SCORE);
b. consideration of enteral nutrition support (tube feeding) within 7 days of admission for patients who are unable to meet their nutrient and fluid requirements orally. This decision should be made collaboratively with the multidisciplinary team, the patients, and their caregivers and families [Evidence Level B]. (AU, SIGN 78).

Also refer to recommendation 6.1, "Dysphagia assessment," for dysphagia management.

4.2f Oral care

i. All stroke patients should have an oral/dental assessment, which includes screening for obvious signs of dental disease, level of oral care and appliances, upon or soon after admission [Evidence Level C] (Canadian Dental Association).
ii. For patients wearing a full or partial denture it must 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] (SIGN 78). An oral care protocol should address areas including frequency of oral care (twice per day or more), types of oral care products (toothpaste, floss and mouthwash) and specific management for patients with dysphagia and should be consistent with current recommendations of the Canadian Dental Association [Evidence Level B] (Canadian Dental Association).
iv. If concerns are identified with implementing an oral care protocol, consider consulting a dentist, occupational therapist, speech–language pathologist and/or 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].

Box 4: Contraindications to mobilization*

- Deterioration in the person's condition in the first hour of admission resulting in direct admission to the intensive care unit or a documented clinical decision for palliative treatment (e.g., those with devastating stroke) or immediate surgery
- Unstable coronary or other medical condition
- Suspected or confirmed lower limb fracture at the time of stroke preventing mobilization
- Systolic blood pressure < 110 mm Hg or > 220 mm Hg
- Oxygen saturation < 92% with supplementation
- Resting heart rate < 40 or > 110 beats/minute
- Temperature > 38.5°C
- Persons who have received recombinant tissue plasminogen activator can be mobilized if the attending physician permits

*Consensus, based on A Very Early Rehabilitation Trial (AVERT).[40,41]

4.2g Discharge planning

Discharge planning should be initiated as soon as possible after patient admission to hospital (emergency department or inpatient care) [Evidence Level B] (AU, RCP).

i. A process should be established to ensure involvement of patients and caregivers in the development of the care plan, management and 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] (AU, RCP).
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].

Rationale

Acute stroke accounts for the longest length of stay in Canadian hospitals and places a significant burden on inpatient resources, which increases further when complications are experienced.

Patients who have experienced an acute stroke are at risk for complications during the acute phase of recovery. The priorities for acute 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

- Acute stroke patients admitted to stroke units during inpatient stay.
- Acute stroke inpatients managed by multidisciplinary stroke teams.
- Standardized evidence-based protocols for optimal acute inpatient care of all stroke patients, regardless of location in a health care facility (stroke unit or other ward).
- Ongoing professional development and educational opportunities for all health care professionals who participate in the care of patients with stroke in acute care.
- Referral systems to ensure rapid access to specialty care such as dentistry.

Performance measures

1. **Percentage of inpatients with stroke who experience complications (pneumonia, venous thromboembolism, gastrointestinal bleed, secondary cerebral hemorrhage, pressure ulcers, urinary tract infection, pulmonary embolus, seizures or convulsions) during inpatient stay.**
2. **Length of stay for stroke patients admitted to hospital.**

Measurement notes

- Risk adjustment to account for other comorbidities and age/sex.

- Length of stay analysis should be stratified by presence or absence of in-hospital complications.
- Refer to the *Canadian Stroke Strategy Performance Measurement Manual* (2008) for additional performance measures for each specific component of inpatient care (www.canadianstrokestrategy.ca)

Summary of the evidence

Venous thrombo-embolism

The risk of venous thromboembolism in patients hospitalized with stroke is 20%–50%.[10] 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. 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 recommendations on the use of prophylactic anticoagulation for venous thromboembolism are controversial.[27]

The Royal College of Physicians[36] guidelines state that prophylactic anticoagulation should *not be used routinely* (Evidence Level A). Although subcutaneous heparin and low molecular weight heparin may prevent venous thromboembolism, this beneficial effect may be counterbalanced by an increased risk of intracranial hemorrhage. The American Stroke Association and the Scottish Intercollegiate Guidelines Network both *recommend* prophylactic administration of heparin, low molecular weight heparin or heparinoids to prevent venous thromboembolism in immobilized people following a stroke (Evidence Level A).[4,28]

The Prevention of VTE after Acute Ischemic Stroke with LMWH Enoxaparin (PREVAIL) study investigated optimal treatment for venous thromboembolism prophylaxis to compare the efficacy and safety of enoxaparin with that of unfractionated heparin for patients with stroke.[208] A total of 1762 patients with acute ischemic stroke who were unable to walk unassisted were randomly assigned within 48 hour of symptom onset to receive either enoxaparin 40 mg subcutaneously once daily or unfractionated heparin 5000 U subcutaneously every 12 hour for 10 days (range 6–14). Patients were stratified by National Institutes of Health Stroke Scale score (severe stroke ≥ 14, less severe stroke < 14). In the efficacy population (i.e., one or more doses received, presence of deep vein thrombosis or pulmonary embolism, or assessment for venous thromboembolism), enoxaparin (n = 666) and unfractionated heparin (n = 669) were given for 10.5 days (SD 3.2). Enoxaparin treatment resulted in a significant 43% relative risk reduction in venous thromboembolism compared with unfractionated heparin (68 [10%] v. 121 [18%]; RR 0.57, 95% CI 0.44–0.76, p = 0.0001; difference –7.9%, 95% CI –11.6% to –4.2%) for the primary end point of a composite of symptomatic or asymptomatic deep vein thrombosis and symptomatic or fatal pulmonary embolus during the 90-day treatment period. This reduction was consistent for patients with a National Institutes of Health Stroke Scale score of 14 or more (26 [16%] v. 52 [30%]; p = 0.0036) and for those with a score of less than 14 (42 [8%] v. 69 [14%]; p = 0.0044). The occurrence of any bleeding was similar with enoxaparin (69/877 [8%]) or unfractionated heparin (71/872 [8%]; p = 0.83). The frequency of the composite of symptomatic intracranial and major extracranial hemorrhage was small and very similar between groups (enoxaparin 11 [1%] v. unfractionated heparin 6 [1%]; p = 0.23). Sherman and collaborators[208] noted no difference for symptomatic intracranial hemorrhage between groups (4 [1%] v. 6 [1%]; p = 0.55); the rate of major extracranial bleeding was higher with enoxaparin than with unfractionated heparin (7 [1%] v. 0; p = 0.015). It was suggested that for patients with acute ischemic stroke, enoxaparin is preferable to unfractionated heparin.

Temperature management

Jones and coworkers[209] 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. This review reinforced the importance of monitoring physiologic parameters in the acute phase of stroke, providing support to the recommendation that monitoring should play a key role within nursing care.

Nutrition

The Feed or Ordinary Food (FOOD) trial aimed to establish whether routine oral nutritional supplements improve outcome after stroke.[210] The trials are a family of 3 pragmatic, multicentre randomized controlled trials. Outcomes of stroke patients who could swallow and who were randomly assigned normal hospital diet or normal hospital diet plus oral nutritional supplements until hospital discharge were measured, the primary outcome being death or poor outcome (modified Rankin scale grade 3–5), 6 months after enrolment, measured unaware of treatment assignment. 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% (95% CI –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% or 2% absolute benefit or harm from oral supplements. These results did not support a policy of routine oral supplementation after stroke.

Another Feed or Ordinary Food (FOOD) trial investigation examined acute treatment of dysphagic patients.[211] In one trial, patients enrolled within 7 days of admission were randomly assigned to early enteral tube feeding or no tube feeding for more than 7 days (early versus avoid). In the other trial, patients were assigned to 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% (95% CI –0.8% to 12.5%; $p = 0.09$) and a reduction in death or poor outcome of 1.2% (95% CI –4.2% to 6.6%; $p = 0.7$). In the percutaneous endoscopic gastrostomy v. 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% (95% CI –10.0% to 11.9%; $p = 0.9$) and an increased risk of death or poor outcome of 7.8% (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 and associates[212] 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% of patients were malnourished. Malnourished patients, in comparison to nourished patients, had longer lengths of stay (13 v. 8 days), more complications (50% v. 14%), greater frequency of dysphagia (71% v. 32%) and more enteral feeding (93% v. 59%). No association was found between nutritional status and discharge destination.

Horn and collaborators[213] 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 after stroke.

Mobilization

Arias and Smith[214] examined early mobilization of acute stroke patients in the United Kingdom. It was noted that although early mobilization in acute stroke care is recommended in a range of European, US and UK policy guidelines as a strategy to minimize or prevent complications, the evidence base to support early mobilization in acute stroke is missing. Health professionals require a research-based approach to deliver safe and effective early mobilization to acute stroke patients. A Canadian survey study assessed functional mobility training for individuals admitted to acute care following a stroke event.[215] 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. 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%, with higher rates of incontinence expected for women.[43,216,217] A recent Cochrane review suggested that rates can be as high as 40%–60% of people admitted to hospital following a stroke event, with 25% still having problems at time of discharge.[218] More alarming still, 15% of these patients remain incontinent at 1 year after stroke. The Cochrane review set out to determine optimal treatment techniques of urinary incontinence after stroke. Twelve trials (total $n = 724$) were included in the review: 3 trials assessed behavioural interventions, 2 assessed professional input interventions, 3 small trials examined complementary therapies as interventions, and 3 small trials investigated pharmacotherapy and hormonal interventions. The authors concluded that the data were 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. A wide range of interventions are suggested for dealing with this distressing issue, and better evidence is required.

Dumoulin and collaborators[219] 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% of occupational therapists and 41% of physical therapists identified urinary incontinence after stroke as a problem. Fewer than 20% of occupational therapists and 15% of physical therapists used best practice assessments, while only 2% and 3% used best practice interventions, respectively. Variables identified to explain between 6% and 9% of the variance included working in Ontario, allocated learning time and university teaching.

Oral care

Poor oral hygiene has been linked with the development of aspiration pneumonia due to bacterial colonization in the mouth.[220] Aerobic gram-negative bacilli have been shown to be common in the mouths of stroke patients and are also correlated with dysphagia. In addition, physical weakness following stroke can prevent patients from being independent in completing their own oral care.[221] Dry mouth, oral ulcers and stomatitis may be caused by medication following a stroke. Patients with dysphagia are also at high risk due to reduced cough sensation and greater potential for aspiration of their own saliva.[222]

A Cochrane Database Systematic Review was carried out to compare the effectiveness of staff-led oral care interventions and standard care in improving oral hygiene in patients after stroke.[223] Only one study ($n = 67$ stroke patients) identified stroke-specific treatment information, comparing an oral health care education training program delivered to nursing home care assistants with delayed training intervention in the control group. Results indicated that denture plaque scores were significantly reduced up to 6 months after the intervention ($p < 0.00001$). Although conclusions were based on one study, it seems that providing oral care training for caregivers in a nursing home setting improves attitudes toward the provision of oral care after stroke. This review demonstrated that all members of the interdisciplinary team can 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 and associates[224] 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 after the 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.[225] 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 6 months following discharge to the community.[226]

Discharge planning

Effective discharge planning is essential for the successful reintegration of individuals living with stroke into the community and should be considered at various transition points along the continuum of stroke care. Components of effective discharge planning should include:

- Family and team meetings (regular multidisciplinary meetings to discuss issues and patient progress, set team and rehabilitation goals, set care plans, determine supports required and available postdischarge, determine physician or physiatrist involvement required, involve patient and family for family conferences)
- Care plans
- Predischarge needs assessment (occupational therapist home visit before discharge to assess home environment, suitability for safe discharge, equipment needs, home modifications, caregiver education, information on how patient will manage aids to daily living and instrumental aids to daily living in this environment)
- Caregiver training (multidisciplinary education about communication strategies if the patient is aphasic, positioning and handling, transfers, shoulder care, how to promote independence, according to individual patient's strengths and limitations)
- Postdischarge follow-up (ensure plans are made for medical care, secondary prevention, rehabilitation, social support, home care and nursing if needed, caregiver support and education)
- General information and education (for patient and caregivers)
- Liaison with community providers, linkage with appropriate resources
- Regular review of individual patient and caregiver psychosocial and support needs

5: Stroke rehabilitation and community reintegration

Best practice recommendation 5.1: Initial stroke rehabilitation assessment

All persons with stroke should be assessed for their rehabilitation needs.

i. All people admitted to hospital with acute stroke should have an initial assessment by rehabilitation professionals as soon as possible after admission [Evidence Level A] (RCP), preferably within the first 24 to 48 hours [Evidence Level C] (NZ).
ii. All people 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 of fitness to drive, as well as functional assessments for potential rehabilitation treatment [Evidence Level A] (RCP), preferably within 2 weeks [Evidence Level C].
iii. Clinicians should use standardized, valid assessment tools to evaluate the patient's stroke-related impairments and functional status [Evidence Level C] (ASA, RCP-P). See Table 8 for recommended tools.
iv. Survivors of a severe or moderate stroke should be reassessed at regular intervals for their rehabilitation needs [Evidence Level C] (HSFO).

Note: Outpatient rehabilitation includes day hospital, outpatient ambulatory care and home-based rehabilitation.

Rationale

The first interdisciplinary stroke assessment after admission must identify the physical, cognitive or communication complications of the stroke and will help to 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 interdisciplinary 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. Each member of the team should have expertise in stroke care and has an important role. Patients with milder strokes may have subtle cognitive difficulties that need to be followed, whereas those with severe stroke may not initially be candidates for rehabilitation but of these individuals 40%–50% may be able to return home following rehabilitation rather than requiring institutional care and therefore should be followed.[25] Early assessment should reduce the overall cost of episode of care through improved outcomes and reduced time to discharge.

System implications

To achieve a timely early stroke rehabilitation assessment, the acute care organization requires:

- Adequate complement of clinicians experienced in stroke and stroke rehabilitation.
- Development of stroke rehabilitation expertise in children's hospitals.
- A clear process for referral to rehabilitation professionals after admission.
- Interdisciplinary team that is well resourced to provide prescribed levels of rehabilitation therapy.
- A defined geographic area or unit where individuals with stroke are admitted to ensure access to an experienced team.
- Standard expert consensus-based screening assessment tools and training

Table 8: Outcome tools for stroke rehabilitation*

Domain	Selected measure
Measures of stroke severity	• Orpington Prognostic Scale (OPS) • National Institute of Health Stroke Scale
Medical comorbidities	• Charlson Comorbidity Index (CCI)
Upper extremity structure and function	• Chedoke-McMaster Stroke Assessment (CMSA)
Lower extremity structure and function	• Chedoke-McMaster Stroke Assessment (CMSA)
Spasticity	• Modified Ashworth Scale (MAS) • Chedoke-McMaster Stroke Assessment Spasticity Subscale
Visual perception	• Comb and Razor Test (CRT) (interdisciplinary administration) • Behavioural Inattention Test • Line Bisection Test (LBT) (unilateral spatial neglect) • Alternatives: Rivermead, Ontario Society of Occupational Therapy Perceptual Evaluation (OSOT) and Motor Free Visual Perceptual Test (MVPT)
Language	• Screening in acute care and follow-up, with Frenchay Aphasia Screening Test (FAST) • Boston Diagnostic Aphasia Examination (BDAE)
Speech intelligibility tool	• No tool in published literature
Depression	• Hospital Anxiety and Depression Scale (HAD) • Montgomery Asberg Depression Rating Scale (MADRS)
Cognition	• Montreal Cognitive Assessment (new addition by Canadian Stroke Strategy cognitive working group, January 2008) • Five-minute protocol from the Montreal Cognitive Assessment • Screening (as per Stroke Canada Optimization of Rehabilitation through Evidence), Mini-Mental State Examination and Line Bisection Test + Semantic Fluency Test • Initial selection: Cambridge Examination for Mental Disorders of the Elderly (Cognitive Examination) (CAM-COG)
Arm function	• Chedoke Arm and Hand Activity Inventory • Box and Block Test (BBT) • Nine Hole Peg Test (NHPT)
Walking/lower extremity	• Chedoke-McMaster Stroke Assessment (CMSA) • Timed Up and Go Test (TUG) • 6-minute Walk Test (6MWT) • Alternate: Rivermead Mobility Index
Balance	• Berg Balance Scale (BBS)
Functional communication	• Amsterdam–Nijmegen Everyday Language Test (ANELT) • Alternative: American Speech-Language-Hearing Association Functional Assessment of Communication Skills for Adults (ASHA FACS)
Self-care activities of daily living	• Functional Independence Measure (FIM)
Instrumental activities of daily living	• Reintegration to Normal Living Index (RNLI) • Leisure section of the Assessment of Life Habits (LIFE-H)
Participation	• Stroke Impact Scale (SIS)

*Recommended by the Stroke Canada Optimization of Rehabilitation through Evidence/Canadian Stroke Quality of Care Study Stroke Rehabilitation Outcomes Panel.[21]

- A process for timely referral to specialized stroke inpatient services should be in place in all centres (for example, electronic referral system and standardized assessment tools).
- Access to a follow-up clinic to ensure mild stroke-related difficulties are assessed and rehabilitation organized when required. For children, this should also include follow-up within their school environments.
- 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 services across settings

Performance measures

1. **Median time from hospital admission for stroke to initial rehabilitation assessment for each of the rehabilitation disciplines.**
2. **Proportion of acute stroke patients discharged from acute care to inpatient rehabilitation.**
3. Percentage of stroke patients discharged to the community who receive a referral for outpatient rehabilitation before discharge from acute and/or inpatient rehabilitation hospital (referrals may include either facility-based or community-based programs).
4. Median length of time between referral for outpatient rehabilitation to admission to a community rehabilitation program.
5. Length of time between referral for outpatient rehabilitation to commencement of therapy.
6. Percentage of those with severe stroke reassessed for rehabilitation following initial assessment.
7. Percentage of those with severe stroke admitted to inpatient rehabilitation.
8. 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 though 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 service provider organizations monitor when the first service started but cannot determine easily the onset of rehabilitation therapy.

Summary of the evidence

Benefits of early stroke rehabilitation assessment

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.[227] 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.[227,228] Evidence is also emerging for the rehabilitative effects of swallowing therapy after stroke.[229–231] 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.[232]

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.[48]

Definition of functional assessment

Standardized or nonstandardized 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.

Best practice recommendation 5.2: Provision of inpatient stroke rehabilitation

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 interdisciplinary team [Evidence Level A] (AU-R).

i. Post–acute stroke care should be delivered in a setting in which rehabilitation care is formally coordinated and organized [Evidence Level A] (ASA).
ii. All patients should be referred to a specialist rehabilitation team on a geographically defined unit as soon as possible after admission [Evidence Level A] (RCP). Pediatric acute and rehabilitation stroke care should be provided on a specialized pediatric unit [Evidence Level B] (RCP-P).

iii. 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] (RCP).
iv. The interdisciplinary rehabilitation team may consist of a physician, nurse, physical therapist, occupational therapist, speech–language pathologist, psychologist, recreation therapist, patient and family/caregivers [Evidence Level A] (ASA). For children, this would also include educators and child-life workers. This "core" interdisciplinary team should consist of appropriate levels of these disciplines, as identified by the Stroke Unit Trialists' Collaboration [Evidence Level B] (AHA-P, SIGN 64).
v. The interdisciplinary 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] (HSFO, NZ).
vi. 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] (HSFO).
vii. Stroke unit teams should conduct at least one formal interdisciplinary meeting per week to discuss the progress and problems, rehabilitation goals and discharge arrangements for patients on the unit [Evidence Level B] (SIGN 64). Individualized rehabilitation plans should be regularly updated based on patient status reviews [Evidence Level C].
viii. Clinicians should use standardized, valid assessment tools to evaluate the patient's stroke-related impairments and functional status [Evidence Level B] (ASA, RCP). See Table 8 for a list of tools.
ix. 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 interdisciplinary care is provided to patients disabled by a range of disorders including stroke) [Evidence Level B] (SIGN 64).

Rationale

All patients with moderate and severe stroke should be admitted to a geographically defined stroke rehabilitation unit that is staffed by an interdisciplinary team of professionals. When post-acute stroke patients receive coordinated, interdisciplinary evaluation and intervention on a stroke rehabilitation unit there is a reduction in death and disability.[228] 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. For every 100 patients receiving organized inpatient interdisciplinary rehabilitation, an extra 5 returned home in an independent state.[228] Stroke patients should be admitted early to stroke rehabilitation units as this also enhances functional outcomes.[25] 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. 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.

System implications

- Timely access to specialized inpatient stroke rehabilitation services.
- Adequate number of geographically defined stroke units with critical mass of trained staff; interdisciplinary team during the rehabilitation period following stroke.
- Clinicians with expertise in stroke rehabilitation.
- Timely access to appropriate type and intensity of rehabilitation professionals.
- Optimization of strategies to prevent complications and the recurrence of stroke.
- Consistent implementation of evidence-based best practices for stroke rehabilitation across the continuum of care.

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 survivors 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 physiotherapist, 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

- 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.
- For performance measure 1, the denominator should be the total number of stroke patients admitted to inpatient rehabilitation.

- For duration and intensity of services by rehabilitation professionals, this would require a chart review or consistent use of reliable workload measurement tools that are implemented locally or regionally.
- Data for performance measure 2 should be correlated with stroke severity scores during analysis.

Summary of the evidence

Langhorne and Duncan[228] conducted a systematic review of a subset of the studies identified by the Stroke Unit Trialists' Collaboration, those dealing with postacute rehabilitation stroke services. They defined intervention as "organized inpatient multidisciplinary 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 9 trials (6 involving stroke rehabilitation units and 3 involving general rehabilitation wards) that recruited a total of 1437 patients, organized inpatient multidisciplinary 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 can be substantial benefit from organized inpatient interdisciplinary rehabilitation in the postacute 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.[200] 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.[228,233]

Teasell and collaborators[25] concluded from another meta-analysis 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, interdisciplinary 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).[25] Patients treated on a stroke rehabilitation unit are more likely to be discharged home and less likely to require institutionalization. Kalra and Eade[234] 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[235] 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 6 weeks of treatment) and enhanced quality of life.[24] 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.[25]

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).[25] 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.

Best practice recommendation 5.3: Components of inpatient stroke rehabilitation

All patients with stroke should begin rehabilitation therapy as early as possible once medical stability is reached [Evidence Level A] (ASA).

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] (HSFO, RCP).
ii. Stroke patients should receive, through an individualized treatment plan, a minimum of 1 hour of direct therapy by the interprofessional stroke team for each relevant core therapy, for a minimum of 5 days per week based on individual need and tolerance [Evidence Level A] (EBRSR), with duration of therapy being dependent on stroke severity [Evidence Level C] (EBRSR).
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] (RCP).
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] (SCORE).
v. Stroke unit teams should conduct at least one formal interdisciplinary meeting per week at which patient problems are identified, rehabilitation goals set, progress monitored and support after discharge planned [Evidence Level B] (SIGN 64).
vi. The care management plan should include a predischarge

needs assessment to ensure a smooth transition from rehabilitation back to the community. Elements of discharge planning should include a home visit by a health care 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 survivors 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

Organizations with specialized stroke rehabilitation must ensure the following elements are present:

- Timely access to specialized, interdisciplinary stroke rehabilitation services.
- A critical mass of trained staff functioning as an interdisciplinary 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.
- Optimization of strategies to prevent the recurrence of stroke.
- Stroke rehabilitation support initiatives for caregivers.
- Process in place for patients and caregivers to re-access the rehabilitation system as required.

Performance measures

1. **Length of time from stroke admission in an acute care hospital to assessment of rehabilitation potential by a rehabilitation health care professional.**
2. **Length of time between stroke onset and admission to stroke inpatient rehabilitation.**
3. **Number or percentage of patients admitted to a coordinated 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 survivors 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.**
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 length of time (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. Currently 7 provinces contribute to the National Rehabilitation Reporting System, and 2 more are expected to join by 2008. The National Rehabilitation Reporting System has information on approximately 75% 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.

Summary of the evidence

Importance of adequate intensity of inpatient rehabilitation

A review by Cifu and Stewart[236] found 4 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[237] 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.[25] De Wit and colleagues[238] studied 4 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,[239] 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 concluded that there was strong evidence that greater intensities of physiotherapy and occupational therapy resulted in improved functional outcomes after stroke.[25] The authors highlighted, however, that the overall beneficial effect of intensified therapy was modest and positive benefits may not hold over time.

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.[24] 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, biofeedback, 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),[240] enhanced physiotherapy (Evidence Level A)[241,242] and enhanced occupational therapy (Evidence Level A).[243–246]

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 is an important aspect of rehabilitation assessment and goal-setting, allowing optimization of patient participation and independence, as well as aiding with caregiver needs and concerns.[13] Components of effective discharge planning should include:

- Family and team meetings (regular multidisciplinary meetings to discuss issues and patient progress, set team and rehabilitation goals, set care plans, determine supports required and available after discharge, determine physician or physiatrist involvement required, involve patient and family for family conferences)
- Care plans
- Predischarge needs assessment (with occupational therapist home visit before discharge to assess home environment and suitability for safe discharge, determine equipment needs and home modifications, begin caregiver education, add to information about how patient will manage activities of daily living and instrumental activities of daily living in this environment)
- Caregiver training (multidisciplinary; educate about communication strategies if patient is aphasic, positioning and handling, transfers, shoulder care, how to promote independence, etc., according to individual patient's strengths and limitations)
- Postdischarge follow-up (ensure plans are made for medical care, secondary prevention, rehabilitation, social support, home care and nursing if needed, caregiver support and education, etc.)
- General information and education (for patient and caregivers)
- Liaison with community providers, linkage with appropriate resources
- Regular review of individual patient and caregiver psychosocial and support needs

Best practice recommendation 5.4: Outpatient and community-based 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] (RCP).

i. Early supported discharge services and transition planning should be provided by a well-resourced, coordinated specialist interdisciplinary team with age-appropriate expertise. These are an acceptable alternative to extended in-hospital rehabilitation and can reduce the length of hospital stay for selected patients [Evidence Level A] (SIGN 64). Patients requiring early supported discharge services should not be referred to generic (nonspecific) community services [Evidence Level A] (RCP). See "Rationale," below, for explanation of early supported discharge.

ii. People who have difficulty in activities of daily living, including self-care, productivity and leisure, should receive occupational therapy or multidisciplinary interventions targeting activities of daily living [Evi-

dence Level A] (AU) [Evidence Level C for pediatrics].

iii. Multifactorial interventions provided in the community, including an individually prescribed exercise program, may be provided for people who are at risk of falling, in order to prevent or reduce the number and severity of falls [Evidence Level A] (AU).

iv. People with difficulties in mobility should be offered an exercise program and monitored throughout the program [Evidence Level B] (MacKay-Lyons and Howlett,[247] Pang et al.[248]).

v. Patients with aphasia should be taught supportive conversation techniques [Evidence Level A] (EBRSR).

vi. Patients with dysphagia should be offered swallowing therapy and opportunity for reassessment as required [Evidence Level A] (Singh and Hamdy[232]).

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] (Kirton et al.,[249] RCP-P).

Rationale

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.[250] Community-based rehabilitation may be defined as care received once the patient has passed the acute stage and has transitioned back to their home and community environment. Options for specialized stroke care and rehabilitation may include outpatient services, day hospital programs, 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."[8] Outpatient stroke rehabilitation may be characterized by:

- a case coordination approach
- an interdisciplinary 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

Early supported discharge links inpatient care with community services. It enables stroke survivors with mild to moderate disability to go home earlier than might otherwise be possible, with the support of rehabilitation (occupational therapy, physiotherapy, speech–language pathology) and nursing services in the home, while reducing disability and need for long-term institutional care. Early supported discharge programs can reduce hospital lengths of stay for high-level (higher functioning) stroke patients by approximately 1 week.[251] Early supported discharge services also reduce adverse events (e.g., readmission rates) and increase the likelihood of being independent and living at home. Supportive conversation techniques allow patients with aphasia to participate more fully in the community.

System implications

There is a marked lack of outpatient rehabilitation resources and the health system must provide the following:

- Organized and accessible stroke care in communities.
- Increased number of outpatient clinicians experienced in stroke and stroke rehabilitation.
- Timely access to stroke rehabilitation services in the community after 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.
- 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.

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).**
2. Median length of time between referral for outpatient rehabilitation to admission to a community rehabilitation program.
3. Frequency and duration of services 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/telestroke 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 by rehabilitation staff 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.

Summary of the evidence

Benefits of early supported discharge

The efficacy of early supported discharge for acute stroke patients, evaluated by the Early Supported Discharge Trialists, was first published in 2001 and was updated in 2004.[252] 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 interdisciplinary team care that was provided in the patients' homes. One trial provided a wide range of services which were not centrally coordinated.[253] A variety of outcomes were assessed comparing early supported discharge with conventional care at the end of scheduled follow-up, which ranged from 3 months to 1 year. While early supported discharge programs were associated with shorter periods of initial hospitalization, their impact on the well-being of caregivers remains unknown. The authors concluded that the "relative risks and benefits of this type of intervention remain unclear" and await the results of ongoing trials. Costing data were available for only 2 of the trials, both of which reported cost savings associated with early supported discharge programs. However, the authors suggested that further data are required before recommendations can be made regarding potential cost savings.[251]

Langhorne and colleagues[233] 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 interdisciplinary team coordinated discharge from hospital and postdischarge care and provided rehabilitation therapies in the home; (2) early supported discharge team coordination, whereby discharge and immediate postdischarge plans were coordinated by an interdisciplinary care team, but rehabilitation therapies were provided by community-based agencies; and (3) no early supported discharge team coordination, whereby therapies were provided by uncoordinated community services or by health care volunteers. As hypothesized by the authors, increasing coordination of services was associated with an improved outcome.[251]

Comparison of models of outpatient rehabilitation

In a review of factors affecting functional outcomes following stroke, Cifu and Stewart[236] reported the results of 3 "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.,[254–256] Teasell and coworkers[251] 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.[250] 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 interdisciplinary 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% 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.

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.[251] 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.[233] 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 health care 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.[257] The intervention group received a 1-hour fitness and mobility exercise session, 3 times a week for 19 weeks. The control group participated in a seated upper-extremity program. Pang and associates[257] 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. Pang and collaborators[248] conducted a systematic review of aerobic exercise following stroke. 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."[25] 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.[247]

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.[232] An estimate of incidence of dysphagia after stroke is difficult to determine; however, it is thought that the range is anywhere between 23% and 50%. 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[232] 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 manoeuvre. There is no evidence to support the use of drug therapy for dysphagia treatment after stroke.

Pediatric 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.[249,258] As with adult stroke patients, rehabilitation of children who have experienced a stroke or transient ischemic attack should involve a multidisciplinary team to ensure enhanced outcome and quality of life for the child and family.[38] 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 event may have an adverse impact on the rehabilitation progress of the child.[38]

Best practice recommendation 5.5: Follow-up and community reintegration

People with stroke living in the community should have regular and ongoing follow-up assessment to assess recovery, prevent deterioration and maximize functional outcome.

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 other sequelae of stroke [Evidence Level C] (ASA).
ii. Stroke survivors and their caregivers should have their individual psychosocial and support needs reviewed on a regular basis [Evidence Level A] (RCP).
iii. People living in the community who have difficulty with activities of daily living should have access, as appropriate, to therapy services to improve or prevent deterioration in activities of daily living [Evidence Level A] (AU).
iv. Recommendation 6.2, "Identification and management of post-stroke depression," should also be observed as part of follow-up and evaluation of stroke survivors in the community [Evidence Level C].
v. Any stroke survivor with declining activity at 6 months or later after stroke should be assessed for appropriate targeted rehabilitation [Evidence Level A] (RCP).
vi. Infants and children, in whom new motor, language or cognitive deficits emerge over time, require ongoing follow-up and assessment throughout their development [Evidence Level C] (AHA-P).
vii. Pediatric stroke survivors in the community should have ongoing assessments of education and vocational needs throughout their development [Evidence Level C] (AHA-P).
viii. Stroke survivors and their families should be provided with timely, up-to-date information in conjunction with opportunities to learn from members of the interdisciplinary team and other appropriate community service providers. Simple information provision alone is not effective [Evidence Level A] (AU).
ix. Patients and their caregivers should be offered education programs to assist them in adapting to their new role [Evidence Level B] (RCP).

Rationale

The postdischarge period is consistently reported by stroke survivors and their families to be a difficult time.[259,260] Patients and their families often lose the social, emotional and practical support offered by an inpatient stroke service.[36] In one study, only 10% of families were actively in contact with professional rehabilitation services after hospital discharge.[259] 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.[8,259] The evidence shows that when support services are provided, patient and caregiver satisfaction improves.[36,261]

Ongoing rehabilitation (beyond 6 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.[36] 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, 7 patients are spared a poor outcome.[13,36,250] "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."[36] The interdisciplinary 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."[8] 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 programs matched to the stroke survivor's preferences and needs and conduct follow-up with stroke survivors and caregivers at regular intervals.

In children, regular follow-up is necessary to screen for other neurologic sequelae, as 30% of pediatric stroke survivors develop concurrent neurologic complications, including seizures, migraine, headaches and movement disorders that may not manifest in the immediate acute and postacute phases of stroke.

System implications

All provinces, territories and regions should have adequate follow-up care providers to support community reintegration of stroke survivors.

- Assistance for stroke survivors and their families with an evolving care plan and regular follow-up assessments.
- Health care professionals and caregivers in 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 in 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.

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 (by stroke type).**
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 what services are 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 support services (e.g., home care or respite care).
8. Length of time from hospital discharge (following acute care or inpatient rehabilitation) to initiation of community support services.
9. Frequency and duration of community support 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 who require admission to long-term care or a nursing home within 6 months or 1 year.
12. Median wait time from referral to admission to nursing home or long-term care facility.
13. Documentation to indicate that assessment for fitness to drive and related patient counselling 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

- Data for performance measure 1 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 performance measures in recommendation 2.1, "Lifestyle and risk factor management," related to patient and family education.
- 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.

Summary of the evidence

Anderson[259] 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[259] stated that the social, psychological, family and economic aspects of stroke must be directly addressed. Pound and associates,[261] 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[260] 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 4 to 7 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% would have had a poor outcome with no treatment.[250] "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."[8,11]

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.[38] 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.

6: Selected topics in stroke management

This section is new for the 2008 update. It includes 3 original recommendations from 2006 (dysphagia assessment, post-stroke depression and shoulder pain) and a new recommendation on vascular cognitive impairment. These recommendations apply across the continuum of stroke care, from onset of symptoms of stroke or transient ischemic attack, and should be considered throughout short-term recovery. In addition, screening for and management of vascular cognitive impairment and post-stroke depression should be revisited beyond the postacute recovery phase and return to the community.

Best practice recommendation 6.1: 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] (CSQCS, NZ, SCORE, SIGN 78).

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 who should advise on safety of swallowing ability and consistency of diet and fluids [Evidence Level A] (CSQCS, NZ, RCP, SCORE).

iii. Patients who are at risk of malnutrition, including those 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] (AU). Also refer to recommendation 4.2e, "Components of acute inpatient care—Nutrition," for additional information.

Rationale

Dysphagia, or difficulty swallowing, occurs in approximately 55% of people with new-onset strokes. Only about 50% of those affected recover their normal swallowing ability by 6 months after onset. Dysphagia itself may lead to poor nutrition and dehydration in stroke patients.[262,263] It can result in aspiration leading to pneumonia (lung infection). Using a screening tool followed by a detailed swallowing analysis by a trained health care 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 health care professionals for in-depth assessments, such as speech–language pathologists, occupational therapists and dietitians.

Performance measures

1. **Proportion of stroke patients with documentation that an initial dysphagia screening assessment was performed during hospital admission.**
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 health care professional.**
3. Median time from patient arrival in the emergency department to initial swallowing screening by a trained clinician (in minutes).

Measurement notes

- These indicators may be altered or refined pending the results of the Canadian Stroke Rehabilitation Outcomes Consensus Panel.
- Data sources include emergency department record, nursing notes, medical notes and allied health care professional notes.

Summary of the evidence

Information on the incidence and prevalence of dysphagia is now emerging. 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 within the first week.[264] Based on a systematic review of the stroke literature, it was estimated that 55% of patients demonstrate some degree of dysphagia during their acute care stay.[265] Dysphagia tends to be lower after hemispheric stroke and remains prominent in the rehabilitation of brain stem stroke.[265] 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). Aspiration is a precursor to pneumonia and therefore has the potential to be life-threatening in a population that is already dealing with the serious effects of stroke.[266]

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.[264,267–269] Prompt attention to dysphagia screening, followed by appropriate assessment and management, is a deterrent to concomitant problems of aspiration, compromised nutrition and hydration. Currently available data, however, are too sparse and unsatisfactory to conclusively recommend one screening technique over another or one treatment program over another.

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 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 1 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.

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 videofluoroscopic 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.[270] Malnutrition as a result of dysphagia is a valid concern, and nutritional status of patients with dysphagia should be assessed. For more information related to nutrition and dysphagia, refer to recommendation 4.2, "Components of acute inpatient care—Nutrition."

Best practice recommendation 6.2: Identification and management of post-stroke depression

All patients with stroke should be considered to be at a high level of risk for depression. At the time of the first assessment, the clinical team should determine whether the patient has a history of depression or risk factors for depression [Evidence Level B] (SCORE).

i. All patients with stroke should be screened for depression using a validated tool [Evidence Level A] (SCORE) (for recommended tools, see Table 8). 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 changes is noted
   b. before discharge home 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 at risk for depression during screening should be referred to a psychiatrist or psychologist for further assessment and diagnosis [Evidence Level B] (RCP, RCP-P).
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] (RCP).
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 (SSRIs) may be favoured in this patient population [Evidence Level A] (ASA).
v. In adult patients with severe, persistent or troublesome tearfulness, SSRIs are recommended as the antidepressant of choice [Evidence Level A] (ASA).
vi. Treatment should be monitored and should continue for a minimum of 6 months, if a good response is achieved [Evidence Level A] (RCP).
vii. All patients with apparent depressive symptoms should be carefully screened for the presence of hypoactive delirium [Evidence Level C].
viii. Routine use of prophylactic antidepressants is not recommended in post-stroke patients [Evidence Level A] (ASA, RCP).
ix. Patients should be given information and advice about the impact of stroke, and the opportunity to talk about the impact of illness upon their lives [Evidence Level B] (RCP).
x. Patients with marked anxiety should be offered psychologic therapy [Evidence Level B] (RCP).
xi. Patients and their caregivers should have their individual psychosocial and support needs reviewed on a regular basis as part of the longer-term recovery and management of stroke [Evidence Level A] (RCP).

Rationale

Post-stroke depression may affect as many as 1 in every 4 individuals with a significant stroke. The stroke survivor is at greatest risk in the first few months, especially the first 6 months, after a stroke. Depression may affect a patient's ability to participate in 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 too much with therapy and the patient's well-being. Standardized screening assessments for depression can indicate that depression exists and 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.[8] Anxiety should be assessed and treated, especially when found in conjunction with depressive symptoms. Aphasic patients provide a unique challenge for assessment and treatment. Antidepressant medications and counselling appear to be helpful in treating this condition.

System implications

- Education for primary care practitioners and health care providers throughout 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 (medication and counselling 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 stroke patients with documentation to indicate assessment or screening for depression was performed either informally or using a formal assessment tool in the acute care or rehabilitation setting following an acute stroke event.**
2. Proportion of stroke patients referred for additional assessment or intervention for a suspected diagnosis of depression following an acute stroke event.
3. Proportion of stroke patients treated with antidepressants at 1 month, 3 months, 6 months and 1 year following 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 communicate 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 health care professionals.
- For patients referred to psychiatry, information may be available through provincial physician billing databases.
- For persons over 65 years, information on medication prescriptions may be available through provincial senior drug benefit plan databases.

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.[8] Post-stroke depression has a negative impact on functional recovery and social activity. A reduction is 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.[271] It has been reported that 21.6% of patients were depressed when assessed within the first month of stroke. The proportion of incident cases decreased to 5.1%, 6.0%, 5.6% and 7.1% at 3-, 6-, 9- and 12-month assessments, respectively.[272] While the incidence of major depression after stroke may decrease over the first 24 months following stroke,[273,274] minor depression tends to persist or increase over the same time period.[274–276] In a recent study, approximately one-half of individuals identified as experiencing depression during the acute phase after stroke continued to experience depression at 18 months; however, more women than men were identified in the acute phase, while more men than women were identified as depressed at 18 months after stroke.[276]

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 2 subscales: anxiety and depression.[25] Bjelland and associates[277] found a mean correlation of 0.56 between the subscales. Teasell and collaborators[25] previously summarized the sensitivity and specificity of this tool. O'Rourke and coworkers[278] demonstrated a sensitivity of 80% and specificity of 79% with a cut-off of 6/7 on the depression subscale, while Bjelland and associates[277] 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,[277] only 1 included individuals who had experienced a stroke. Using a stroke population, Aben and collaborators[272] determined an optimal cut-off of 11/12 for the Hospital Anxiety Depression Scale total, with sensitivity nearly 87% and specificity close to 70%. 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.[279]

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.[280] 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%) and the authors have noted difficulties completing the scale with a stroke population.[272] In the Evidence-Based Review of Stroke Rehabilitation, Teasell and collaborators[25] 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 5 to 7 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 rigour and results for reliability (test–retest and internal consistency) and validity (excellent, meaning most major forms of testing were reported).[25] 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.[281] 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.[281]

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.[36] There is no evidence that the provision of information alone helps resolve clinical depression in stroke patients.[25] A systematic evidence-based review of counselling and psychologic therapies has looked at the level of expertise that is required for working with patients with depression. It concluded that generic counselling 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.[31]

About 15% 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.[8] Literature suggests that post stroke depres-

sion is treatable with a variety of medications, with SSRIs and tricyclic antidepressants being the most frequently studied.[25] When compared with placebo, heterocyclic antidepressant medications demonstrated a significant treatment effect.[282,283] Robinson and associates[283] compared a heterocyclic antidepressant with an SSRI and found nortriptyline (a heterocyclic drug) to be more effective than the SSRI fluoxetine. Robinson and associates[283] 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[282] 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[284] 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 (3 positive studies, 2 negative studies) regarding the effectiveness of SSRIs in treatment for post-stroke depression.[285] Fruehwald and associates[286] 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 3 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.[25]

The incidence of post-stroke delirium is high, but with variably reported incidence (between 7.6% and 48%).[287,288] The onset of delirium after stroke may lead to a significantly elevated risk of mortality, poor functional outcome, cognitive impairment and/or institutionalization.[287] Several guidelines have discussed general management of delirium,[36,289] as have several Cochrane reviews.[290,291] 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 in the guidelines, the strongest data existed for the safety and efficacy of very low dose haloperidol; however, controversy surrounding the relative risk between haloperidol, other conventional antipsychotics and second-generation (atypical) antipsychotics, with respect to the risk of increased vascular mortality, continues. 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. Current practice is divided. 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.[292]

Best practice recommendation 6.3: Vascular cognitive impairment and dementia (new for 2008)

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, damage to other target organs, and/or those patients with cognitive or functional changes that are clinically evident or reported during history-taking.

6.3a Assessment

i. All patients described above should be screened for cognitive impairment using a validated screening tool [Evidence Level B] (AU, SCORE). (See Table 8 for recommended screening tools for cognitive assessment.)
ii. Screening to investigate a person's cognitive status should address the following domains: 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] (CC-CDTD). 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 (see Box 5).
iv. 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] (CC-CDTD). Also refer to recommendation 6.2, "Identification and management of post-stroke depression."
v. Persons 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] (CCCDTD).

6.3b 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 suffered a transient ischemic attack or stroke should have a screening assessment and, where indicated, 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 health care provider according to client's needs, progress and current goals.

6.3c Management

i. All vascular risk factors should be managed aggressively to achieve optimal control [Evidence Level A] (CCCDTD). Also refer to section 2, "Prevention of stroke."
ii. Patients who demonstrate cognitive impairments in the screening process should be referred to a health care professional with specific expertise in this area for additional cognitive, perceptual and/or functional assessment 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] (CCCDTD). A team approach is recommended, and health care professionals may include an occupational therapist, neuropsychologist, psychiatrist, neurologist, geriatrician, speech–language pathologist or social worker.
iii. An individualized, client-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] (CCCDTD).
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] (SCORE).
v. Strategic or compensatory training appears to be effective in the treatment of apraxia post stroke and should be considered [Evidence Level A] (EBRSR). The evidence for the effectiveness of specific interventions for cognitive impairment in stroke is limited and requires more research. Attention training may have a positive effect on specific, targeted outcomes and should be implemented with appropriate patients [Evidence Level C] (EBRSR). Compensatory strategies can be used to improve memory outcomes [Evidence Level C] (EBRSR).
vi. Patients with evidence of depression or anxiety on screening should be referred and managed by an appropriate mental health professional [Evidence Level C]. Note: Also refer to recommendation 6.2, "Identification and management of post-stroke depression."
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 Neurosciences (AIREN) diagnostic criteria [Evidence Level B] (CCCDTD).
    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] (CCCDTD).
    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] (CCCDTD).

Box 5: Components of 5-minute protocol for vascular cognitive impairment screening*

The recommended 5-minute protocol consists of selected subtests from the Montreal Cognitive Assessment (MoCA 78):

- 5-word immediate and delayed memory test.
- 6-item orientation task.
- 1-letter phonemic fluency test (the letter F).

*Sources: Montreal Cognitive Assessment (www.mocatest.org); National Institute of Neurological Disorders and Stroke – Canadian Stroke Network Vascular Cognitive Impairment Harmonization Standards (http://stroke.ahajournals.org/cgi/reprint/37/9/2220).[293]

Rationale

Vascular cognitive impairment affects up to 60% 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.[25,294] 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.[25] In addition, cognitive impairment can be chronic and progressive after stroke; post-stroke dementia is estimated to occur in 26% of stroke patients by 3 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% v. 25%).[295]

Cognitive impairment due to covert vascular pathology is also increasing. Covert strokes, usually lacunes, are common (23% of community elderly) and are associated with cognitive decline, dementia and stroke.[295] Evidence is emerging that demonstrates that for every clinically evident stroke, there are 6 to 9 so-called "covert" strokes occurring. Signs of covert stroke are often manifested as cognitive impairment signs and symptoms.[25] Small-vessel vascular disease is a significant issue, which 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.[295] The combination of Alzheimer disease and vascular disease results in the commonest substrate of dementia in the elderly. A single macroscopic hemispheral 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 persons 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 a patient's cognitive status.**
2. Percentage of persons 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 in 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 health care professionals and in the area of documentation.

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, no dementia to vascular dementia. As pointed out by the latest version of 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.[25] Nyenhuis and Gorelick[296] 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[25] further noted that mortality rates among stroke patients with dementia were 2 to 6 times greater than among patients without dementia. In terms of factors affecting recovery, Newman and associates[297] 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.

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[298,299] and can remain chronic in the long-term.[300–304] Hoffmann[305] reported that the frequency of higher cortical function abnormality (aphasia, apraxia, amnesia and executive dysfunction) based on bedside neurologic testing was 63.5% in 1000 patients within the first month after stroke. High rates have been found in other studies using neuropsychologic testing 2–3 months after stroke as well.[294,306] These deficits persist in the chronic phase after stroke; in one study examining cognitive recovery from 3 to 27.7 months, most patients showed no improvement or declined.[306] Likewise, Tatemichi and coworkers[307] found that 35% of a group

of 227 patients showed cognitive impairment on multiple tests at 3 months after stroke, with improvement seen in only 12% of patients in memory, orientation, visuospatial function and attention in yearly follow-ups.

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 3 months after stroke (after spontaneous recovery has already occurred).[308] Van Zandvoort and associates[309] attempted to describe the feasibility and validity of neuropsychologic evaluation in the early stage following a stroke event, examining consecutive stroke patients 4 to 20 days following their first ischemic stroke (n = 57). At the early stage of evaluation, 77% of patients were able to successfully complete 82% of the tasks required of them. Despite the later phases of baseline testing, however, cognitive impairment in many stroke survivors still 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.[307,310,311] Poor outcome has been specifically associated with spatial neglect and related symptoms, such as anosognosia.[312–316] Attention and memory deficits also affect outcome, as well as executive dysfunction.[301,317–322] Cognitive deficits may also adversely affect physical disability via reduced skill reacquisition in physical rehabilitation.[319,323,324]

In terms of the more severe spectrum of vascular cognitive impairment, up to 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),[325] stroke was significantly associated with an increasing risk for the development of dementia, and Kalaria and Ballard[326] found that post-stroke dementia occurs in up to 30% of stroke patients. The risk for developing dementia may be up to 10 times greater among individuals with stroke than for those without.[25] 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 5% 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).[327] Forty-four percent of the subgroup with vascular cognitive impairment, no dementia developed dementia over a 5-year period.[328] 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.[329] Vascular dementia is the second most common cause of dementia after Alzheimer disease, in the order of 20%. Population autopsy studies, however, suggest that while pure vascular dementia is less frequent (< 10% of cases), combined cerebrovascular disease and Alzheimer disease is the most common neuropathologic finding.[295,330] 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.[331]

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[293] 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. In addition to screening for cognitive impairment, the following subset of the above recommendations was suggested:

1. *Demographic characteristics:* The minimum data set should include sex, birth date, race or ethnicity, and education.
2. *Informant:* If available and deemed to be necessary, basic information regarding the informant's demographic characteristics, as mentioned above, and the time and quality of the contact with the patient should be obtained.
3. *Family history:* History concerning first-degree relatives for a history of stroke, vascular disease or dementia should be obtained.
4. *Health history:* Historical questions concerning cardiovascular or cerebrovascular conditions, hypertension, hyperlipidemia, diabetes mellitus, alcohol use, tobacco use, physical inactivity, presence of depression and medication use should be obtained.
5. *Evaluation:* The subjective impression of the individual being evaluated should be sought with regard to the person's general health, including whether, during the past year, the person has experienced changes in memory, speed of thinking and acting, or mood. Information should be obtained regarding functional abilities that include instrumental activities of daily living.

Best practice recommendation 6.4: Shoulder pain assessment and treatment

All stroke patients should be assessed for shoulder pain and, when symptoms present, have strategies implemented to minimize shoulder joint pain and trauma [Evidence Level A] (Ottawa Panel, RCP, SCORE).

i. Factors that contribute to, or exacerbate, shoulder pain should be identified and managed appropriately.
   a. Educate staff and caregivers about correct handling of the hemiplegic arm [Evidence Level B] (RCP, SCORE).
   b. Consider use of supports for the arm [Evidence Level A] (RCP).

ii. Joint protection strategies should be instituted to minimize joint trauma.

a. The shoulder should not be passively moved beyond 90° of flexion and abduction unless the scapula is upwardly rotated and the humerus is laterally rotated [Evidence Level A] (SCORE).
b. Overhead pulleys should not be used [Evidence Level A] (Ottawa Panel).
c. The upper limb must be handled carefully during functional activities [Evidence Level B] (SCORE).
d. Staff should position patients, whether lying or sitting, to minimize the risk of complications such as shoulder pain [Evidence Level B] (RCP).

iii. Shoulder pain and limitations in range of motion should be treated through gentle stretching and mobilization techniques focusing especially on external rotation and abduction [Evidence Level B] (SCORE).

Rationale

The incidence of shoulder pain following a stroke is high, with as many as 72% 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.[8]

Hemiplegic shoulder pain may contribute to poor functional recovery of the arm and hand, depression and sleeplessness.[31] Preventing shoulder pain may affect quality of life. In a study of 86 patients in 1994, Braus and coworkers[332] found that early awareness of potential injuries to the shoulder joint reduced the frequency of shoulder–hand syndrome from 27% to 8%. Incorrect handling is a contributing factor in development and/or exacerbation of shoulder pain. Careful handling of the affected upper limb along with supportive positioning strategies should be practised at all times.

System implications

- Organized stroke care available, including stroke units with critical mass of trained staff and interdisciplinary team during the rehabilitation period following stroke.
- Initial assessment performed by clinicians experienced in stroke and stroke rehabilitation.
- Timely access to specialized, interdisciplinary stroke rehabilitation services.
- Timely access to appropriate type and intensity of rehabilitation for stroke survivors.
- Optimization of strategies to prevent the recurrence of stroke.
- Stroke rehabilitation support provided to caregivers
- 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
3. Proportion of stroke patients who report shoulder pain at 3-month and 6-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

- For 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 health care 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.

Summary of the evidence

Shoulder pain after stroke is strongly associated with prolonged hospital stay and poor recovery of arm function. A number of well-conducted randomized controlled trials and high-quality systematic reviews have failed to provide unequivocal evidence of any one effective intervention. Various and specific interventions have been studied to determine beneficial assessment and treatment of shoulder pain after stroke.

Careful handling of the affected upper limb in conjunction with consistent supportive positioning strategies should be practised at all times. Education of staff, patients and caregivers should be provided.[31] Braus and coworkers[332] reported that the incidence of shoulder–hand syndrome was 27% in their sample of 132 stroke patients. In the second part of that study, on another 86 patients, early awareness of potential injuries to the shoulder joint structures reduced the frequency of shoulder–hand syndrome from 27% to 8%. In subacute patients, one randomized controlled trial (n = 28) demonstrated that shoulder positioning compared with treatment also showed a trend (clinically important benefit, without statistical significance) toward improvement in active range-of-motion shoulder abduction.[24]

Teasell and collaborators[25] stated that "careful positioning of the shoulder serves to minimize subluxation and later contractures as well as possibly promote recovery, while poor positioning may adversely affect symmetry, balance and body image." Gilmore and associates[333] and Turner-Stokes and Jackson[334] suggested that through careful and correct positioning, the development of shoulder pain can be prevented. Bender and McKenna[335] noted that the "recommended position for the upper limb is towards abduction, external rotation and flexion of the shoulder," but also noted that the "most popular

theories failed to yield consensus for exact degrees of the positioning."

One randomized controlled trial compared the use of an overhead pulley with use of a skateboard with control.[336] The control group, with 28 patients, received passive range-of-motion exercises. No benefit for overhead pulleys was found, but results favoured the control treatment for pain relief (in terms of number of patients without pain) at the end of 8 to 10 weeks of treatment. Pain was the only outcome measured. The Ottawa Panel does not recommend the use of overhead pulleys, especially if the shoulder is subluxed, as the pulleys do not give adequate stabilization of the shoulder girdle during the movement. Passive range-of-motion exercises by a qualified rehabilitation practitioner represent the favoured treatment to maintain passive shoulder mobility. The quality of the shoulder movement can be controlled by an experienced therapist more so than with the overhead pulleys and skateboard.

There is moderate evidence that gentle exercises to improve range of motion are the preferred approach to treatment of the hemiplegic shoulder.[25] The Ottawa Panel recommends that passive range-of-motion exercises performed on the shoulder of the stroke patient by a qualified rehabilitation practitioner are favoured over overhead pulley and skateboard exercises. This will serve as a means of preventing frozen shoulder and shoulder–hand pain syndrome. The quality of the shoulder motion can be better controlled by an experienced therapist and thus can be beneficial in avoiding undesired movements that could further potentiate pain and damage the hemiplegic shoulder.

This article has been peer reviewed.

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Dr. Lindsay was the project leader and was responsible for the overall process for the development of the guidelines and supporting documentation, including development and editing of the sections of each recommendation template and editing and collating the work of each task group for individual recommendations. She was responsible for final completion of the full document and the shorter print version for publication. Dr. Bayley contributed significantly to the whole guideline process and to the development and writing of the rehabilitation and selected topics sections, as well as reviewing and editing earlier drafts of the full document. Ms. Hellings was the project coordinator. She developed and prepared all the summary of evidence sections, and contributed to the development of other components of the recommendation templates and appendices. Dr. Hill was responsible for the development and editing of the performance measures and measurement notes sections of the document, as well as making significant contributions to the sections on acute care and prevention. Ms. Woodbury contributed to the development and writing of the overview section and the appendices, as well as reviewing and editing earlier drafts of the full document. Dr. Phillips was the senior author of these guidelines. He contributed significantly to the development and writing of the acute care and prevention sections, well as reviewing and editing multiple drafts of the full document. All members of the writing group approved the final version prepared for publication.

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Appendix 1: Members of the Best Practices and Standards Working Group and the Information and Evaluation Working Group of the Canadian Stroke Strategy (part 1)

Name	Position	Facility or organization	Competing interests
Best Practices and Standards National Platform Working Group			
Dr. Stephen Phillips* (Co-Chair)	Director, Acute Stroke Program	Queen Elizabeth II Health Sciences Centre, Halifax, NS	None declared.
Ms. Alison McDonald (Co-Chair)	Physiotherapist, Nova Scotia Rehabilitation Centre	Queen Elizabeth II Health Sciences Centre, Halifax, NS	None declared.
Dr. Mark Bayley*	Physiatrist and Medical Director, Neuro Rehabilitation Program	Toronto Rehabilitation Institute, Toronto, Ont.	None declared.
Dr. Alan Bell	Family Practitioner	College of Family Physicians of Canada, Toronto, Ont.	Grants and honoraria for research, consultancy and speaking from Sanofi-Aventis, Bristol-Myers Squibb, Bayer and AstraZeneca.
Ms. Laurie Cameron	Program Coordinator and Executive Assistant	Canadian Stroke Strategy, Ottawa, Ont.	None declared.
Ms. Nancy Cooper	Director of Policy and Professional Development	Ontario Long-Term Care Association, Markham, Ont.	None declared.
Ms. Bev Culham	Project Manager	Alberta Provincial Stroke Strategy, Calgary, Alta.	None declared
Dr. Ian Graham	Vice President, Knowledge Translation	Canadian Institutes of Health Research, Ottawa, Ont.	None declared.
Dr. Gordon Gubitz	Neurologist, Acute Stroke Unit and Outpatient Neurovascular Clinic	Queen Elizabeth II Health Sciences Centre, Halifax, NS	None declared.
Ms. Mary Elizabeth Harriman	Associate Executive Director	Heart and Stroke Foundation of Canada, Ottawa, Ont.	None declared.
Ms. Chelsea Hellings*	Research Coordinator	Canadian Stroke Strategy, Toronto, Ont.	None declared.
Ms. Shelley Irvine-Day	Speech–Language Pathologist	Deer Lodge Centre, Winnipeg, Man.	None declared.
Ms. Nina I. Jetha	Senior Program Manager, Health Promotion and Chronic Disease Prevention Branch	Public Health Agency of Canada, Ottawa, Ont.	None declared.
Ms. Katie Lafferty	Executive Director	Canadian Stroke Network, Ottawa, Ont.	None declared.
Dr. Sylvain Lanthier	Stroke Neurologist	Centre hospitalier de l'Université de Montréal, Montréal, Que.	Honoraria for lectures and participation on advisory boards (in no case > $10 000) from Pfizer, Sanofi-Aventis, Bristol-Myers Squibb, Boehringer Ingelheim, Merck-Frosst and Servier. Travel fees related to these activities were also received.
Dr. Patrice Lindsay* (staff lead)	Performance and Standards Specialist	Canadian Stroke Network, Toronto, Ont.	None declared.
Ms. Michelle McKay	Specialty Nurse Practitioner, neurology	Queen Elizabeth II Health Sciences Centre, Halifax, NS	None declared.
Ms. Janel Nadeau	Patient advocate	Stroke Recovery Association, Calgary, Alta.	None declared.
Ms. Louise Nichol	Community Team Manager, Home Care Program	Community Stroke Care Service, Winnipeg, Man.	None declared.
Ms. Christina O'Callaghan	Manager, Regional Stroke Program	London Health Sciences Centre, London, Ont.	None declared.
Dr. Tejal Patel	Pharmacist	St. Michael's Hospital, Toronto, Ont.	None declared.

Appendix 1: Members of the Best Practices and Standards Working Group and the Information and Evaluation Working Group of the Canadian Stroke Strategy (part 2)

Name	Position	Facility or organization	Competing interests
Best Practices and Standards National Platform Working Group (continued)			
Ms. Elizabeth Woodbury*	Executive Director	Canadian Stroke Strategy, Ottawa, Ont.	None declared.
Information and Evaluation National Platform Working Group			
Dr. Michael Hill* (Co-Chair)	Director, Stroke Unit, Calgary Stroke Program	Foothills Medical Centre, Calgary, Alta.	Trial support from Baxter, Merck, and Hoffmann-LaRoche. Consultant with Genentech Ltd., Vanalis Group Ltd., Sanofi, Portola Inc., NONO Inc., Stem Cell Therapeutics, Hoffmann-LaRoche. Honoraria received for talks from all of the companies listed above, as well as Boehringer Ingelheim and Bristol-Myers Squibb Canada.
Dr. Patrice Lindsay* (Co-Chair)	Performance and Standards Specialist	Canadian Stroke Network, Toronto, Ont.	None declared.
Ms. Asako Bienek	Analyst, Surveillance Division, Centre for Chronic Disease Prevention and Control	Public Health Agency of Canada, Ottawa, Ont.	None declared.
Dr. Robert Côté	Stroke Neurologist and Chair, Research Policy and Planning Advisory Committee, Heart and Stroke Foundation of Canada	Montreal General Hospital, Montréal, Que.	Speaker fees from Aventis-Sanofi, Boehringer-Ingelheim, Merck, Solvay; travel reimbursement for Pfizer advisory meetings.
Ms. Mary Elizabeth Harriman	Associate Executive Director	Heart and Stroke Foundation of Canada, Ottawa, Ont.	None declared.
Dr. Tom Jeerakathil	Stroke Neurologist	Department of Medicine, University of Alberta, Edmonton, Alta.	Sat on an advisory committee for Novo Nordisk, with one meeting in 2007.
Dr. Moira Kapral	General Internist and Researcher	Toronto General Hospital, University Health Network, Toronto, Ont.	None declared.
Ms. Katie Lafferty	Executive Director	Canadian Stroke Network, Ottawa, Ont.	None declared.
Dr. Grace Warner	Researcher	Atlantic Health Promotion Research Centre, Dalhousie University, Halifax, NS	None declared.
Ms. Elizabeth Woodbury*	Executive Director	Canadian Stroke Strategy, Ottawa, Ont.	None declared.

*Members of the Best Practices and Standards Writing Group.

Appendix 2: Members of the task groups for the Canadian Best Practices Recommendations for Stroke Care (part 1)

Name	Position	Facility or organization	Competing interests
Prevention Task Group			
Dr. Demetrios Sahlas (Chair)	Stroke Neurologist	Hamilton Health Sciences, Hamilton, Ont.	Speaker fees 2 years ago from Pfizer regarding Stroke Prevention by Aggressive Reduction in Cholesterol Levels (SPARCL) trial.
Dr. Alan Bell	Family Practitioner	College of Family Physicians of Canada, Toronto, Ont.	Grants and honoraria for research, consultancy and speaking from Sanofi-Aventis, Bristol-Myers Squibb, Bayer and AstraZeneca.
Ms. Eryka Hailey	Stroke Prevention Nurse and Investigator	Foothills Medical Centre, Calgary, Alta.	None declared.
Ms. Chelsea Hellings	Research Coordinator	Canadian Stroke Strategy, Toronto, Ont.	None declared.
Dr. Mark Hudon	Neuroradiologist	Foothills Medical Centre, Calgary, Alta.	None declared.
Dr. Tom Jeerakathil	Stroke Neurologist	Department of Medicine, University of Alberta, Edmonton, Alta.	Sat on an advisory committee for Novo Nordisk, with one meeting in 2007.
Ms. Linda Kelloway	Stroke Education Consultant	Heart and Stroke Foundation of Canada, Toronto, Ont.	None declared.
Dr. Patrice Lindsay	Performance and Standards Specialist	Canadian Stroke Network, Toronto, Ont.	None declared.
Dr. Tejal Patel	Pharmacist	St. Michael's Hospital, Toronto, Ont.	None declared.
Dr. Stephen Phillips	Director, Acute Stroke Program	Queen Elizabeth II Health Sciences Centre, Halifax, NS	None declared.
Dr. Jon Witt	Director, Acute Stroke Care, Department of Emergency Medicine	Royal University Hospital, Saskatoon, Sask.	Speaker's fees and travel assistance for educational program (Canadian Association of Emergency Physicians 2007 satellite symposium); 3-day Advisory Board meeting for Roche in 2007.
Pre-Hospital Task Group			
Mr. Pierre Poirier (Chair)	Executive Director	Paramedic Association of Canada, Ottawa, Ont.	None declared.
Ms. Chelsea Hellings	Research Coordinator	Canadian Stroke Strategy, Toronto, Ont.	None declared.
Ms. Linda Kelloway	Stroke Education Consultant	Heart and Stroke Foundation of Canada, Toronto, Ont.	None declared.
Ms. Brenda Kwiatkowski	Coordinator, Stroke Prevention Clinic	Saskatoon Health Region, Saskatoon, Sask.	None declared.
Dr. Patrice Lindsay	Performance and Standards Specialist	Canadian Stroke Network, Toronto, Ont.	None declared.
Mr. Mike Nolan	Emergency Services/Chief, Paramedic Services	County of Renfrew Paramedic Service, Renfrew, Ont.	None declared.
Ms. Chris O'Callaghan	Coordinator, Regional Stroke Program	London Health Sciences Centre, London, Ont.	None declared.
Dr. Andrew Travers	Provincial Medical Director, Emergency Health Services	Halifax, NS	Speaker's fees regarding emergency medical services and STEMI/stroke care from Roche.
Dr. Karen Wanger	Medical Director, Mainland Administration	British Columbia Ambulance Service, Vancouver, BC	None declared.

Appendix 2: Members of the task groups for the Canadian Best Practices Recommendations for Stroke Care (part 2)

Name	Position	Faculty or organization	Competing interests
Pre-Hospital Task Group (continued)			
Dr. Jon Witt	Director, Acute Stroke Care, Department of Emergency Medicine	Royal University Hospital, Saskatoon, Sask.	Speaker's fees and travel assistance for educational program (Canadian Association of Emergency Physicians 2007 satellite symposium); 3-day Advisory Board meeting for Roche in 2007.
Acute Care Stroke Task Group			
Dr. Gordon Gubitz (Chair)	Neurologist, Acute Stroke Unit and Outpatient Neurovascular Clinic	Queen Elizabeth II Health Sciences Centre, Halifax, NS	None declared.
Ms. Cindy Bolton	Program Manager and Member of Canadian Stroke Strategy Steering Committee	Kingston General Hospital, Kingston, Ont.	None declared.
Ms. Margaret Grant	Rehabilitation Education Coordinator	Alberta Provincial Stroke Strategy, Calgary, Alta.	None declared.
Dr. Teri Green	Coordinator, Calgary Stroke Program	Foothills Medical Centre, Calgary, Alta.	None declared.
Ms. Chelsea Hellings	Research Coordinator	Canadian Stroke Strategy, Toronto, Ont.	None declared.
Ms. Shelly Irvine-Day	Speech Language Pathologist	Deer Lodge Centre, Winnipeg, Man.	None declared.
Ms. Joanne Lee	Dietitian	Calgary Health Region, Calgary, Alta.	None declared.
Ms. Linda Kelloway	Stroke Education Consultant	Heart and Stroke Foundation of Canada, Toronto, Ont.	None declared.
Dr. Patrice Lindsay	Performance and Standards Specialist	Canadian Stroke Network, Toronto, Ont.	None declared.
Ms. Alison McDonald	Physiotherapist, Nova Scotia Rehabilitation Centre	Queen Elizabeth II Health Sciences Centre, Halifax, NS	None declared.
Ms. Michelle McKay	Specialty Nurse Practitioner, Neurology	Queen Elizabeth II Health Sciences Centre, Halifax, NS	None declared.
Dr. Tejal Patel	Pharmacist	St. Michael's Hospital, Toronto, Ont.	None declared.
Dr. Michael Sigal	Dentist-in-Chief	Mount Sinai Hospital, Toronto, Ont.	None declared.
Stroke Dementia Task Group			
Dr. Sandra Black (Chair)	Brill Professor of Neurology	University of Toronto, Sunnybrook Health Sciences Centre, Toronto, Ont.	Ad hoc consulting, including advisory board membership, subject to availability, for Novartis, Pfizer, Eisai, Janssen-Ortho, Lundbeck, Glaxo-Smith-Kline, Myriad, EBIX (not in excess of $10 000 per company). Speaker fees from Novartis, Pfizer, Janssen-Ortho, Lundbeck, Myriad.
Dr. Mark Bayley	Physiatrist and Medical Director, Neuro Rehabilitation Program	Toronto Rehabilitation Institute, Toronto, Ont.	None declared.

Appendix 2: Members of the task groups for the Canadian Best Practices Recommendations for Stroke Care (part 3)

Name	Position	Faculty or organization	Competing interests
Stroke Dementia Task Group (continued)			
Dr. Gail Eskes	Associate Professor of Psychiatry and Psychology	Dalhousie University, Halifax, NS	None declared.
Dr. Antoine Hakim	Chief Executive Officer and Scientific Director	Canadian Stroke Network, Ottawa, Ont.	None declared.
Ms. Chelsea Hellings	Research Coordinator	Canadian Stroke Strategy, Toronto, Ont.	None declared.
Ms. Shelley Irvine-Day	Speech Language Pathologist	Deer Lodge Centre, Winnipeg, Man.	None declared.
Dr. Patrice Lindsay	Performance and Standards Specialist	Canadian Stroke Network, Toronto, Ont.	None declared.
Ms. Louise Nichol	Community Team Manager, Home Care Program	Community Stroke Care Service, Winnipeg, Man.	None declared.
Dr. David L. Nyenhuis	Department of Neurology and Rehabilitation	University of Illinois, Chicago Center for Stroke Research, Chicago, IL	Speaker fees from Eisai-Pfizer and consultant to Eisai-Pfizer.
Ms. Jill Moats	Regional Educator, Rehabilitation and Geriatrics Program	Winnipeg Regional Health Authority, Winnipeg, Man.	None declared.
Dr. Stephen Phillips	Director, Acute Stroke Program	Queen Elizabeth II Health Sciences Centre, Halifax, NS	None declared.
Dr. Kenneth Rockwood	Department of Medicine	Queen Elizabeth II Health Sciences Centre, Halifax, NS	Consultant for Pfizer, Jansen-Ortho, Novartis. Speaker's fees from Novartis.
Dr. Jon Ween	Director, Stroke and Cognition Clinic	Baycrest Centre for Geriatric Care, Toronto, Ont.	None declared.
Rehabilitation Task Group			
Dr. Mark Bayley (Chair)	Physiatrist, and Medical Director, Neuro Rehabilitation Program	Toronto Rehabilitation Institute, Toronto, Ont.	None declared.
Ms. Barb Ansley	Coordinator, Rehabilitation Research and Program Evaluation	Hamilton Health Sciences, Hamilton, Ont.	None declared.
Ms. Nancy Boaro	Advance Practice Leader, Neuro Rehabilitation Program	Toronto Rehabilitation Institute, Toronto, Ont.	None declared.
Ms. Jenn Fearn	Northeastern Ontario Stroke Network, Rehabilitation Coordinator	Sudbury Regional Hospital, Sudbury, Ont.	None declared.
Ms. Chelsea Hellings	Research Coordinator	Canadian Stroke Strategy, Toronto, Ont.	None declared.
Ms. Shelley Irvine-Day	Speech Language Pathologist	Deer Lodge Centre, Winnipeg, Man.	None declared.
Dr. Patrice Lindsay	Performance and Standards Specialist	Canadian Stroke Network, Toronto, Ont.	None declared.
Ms. Alison McDonald	Physiotherapist, Nova Scotia Rehabilitation Centre	Queen Elizabeth II Health Sciences Centre, Halifax, NS	None declared.
Ms. Louise Nichol	Community Team Manager, Home Care Program	Community Stroke Care Service, Winnipeg, Man.	None declared.

Appendix 2: Members of the task groups for the Canadian Best Practices Recommendations for Stroke Care (part 4)

Name	Position	Faculty or organization	Competing interests
Rehabilitation Task Group (continued)			
Dr. Robert Teasell	Physiatrist	Parkwood Hospital, London, Ont.	Travel expenses to make presentations in Winnipeg, Toronto, Ottawa and St. John's.
Patient/Family Education Task Group			
Ms. Linda Kelloway (Chair)	Stroke Education Consultant	Heart and Stroke Foundation of Canada, Toronto, Ont.	None declared.
Ms. Jill Cameron	Assistant Professor, Department of Occupational Science and Therapy	University of Toronto, Toronto, Ont.	None declared.
Ms. Patti Gallagher	Clinical Nurse Specialist, Neuroscience	Saint John Regional Hospital, Saint John, NB	None declared.
Ms. Chelsea Hellings	Research Coordinator	Canadian Stroke Strategy, Toronto, Ont.	None declared.
Ms. Samantha Li	Senior Associate Manager, Health Information	Heart and Stroke Foundation of Ontario, Toronto, Ont.	None declared.
Dr. Patrice Lindsay	Performance and Standards Specialist	Canadian Stroke Network, Toronto, Ont.	None declared.
Ms. Alison McDonald	Physiotherapist, Nova Scotia Rehabilitation Centre	Queen Elizabeth II Health Sciences Centre, Halifax, NS	None declared.
Mr. Frank Nieboer	Past President	Alberta Stroke Recovery Association, Calgary, Alta.	None declared.
Ms. Jody Yuzik	Care Management Leader	GF Strong Rehabilitation Centre, Vancouver, BC	None declared.
Public Awareness Task Group			
Dr. Patrice Lindsay (Chair)	Performance and Standards Specialist	Canadian Stroke Network, Toronto, Ont.	None declared.
Ms. Heather Rourke	Director of Communications	Heart and Stroke Foundation of Canada, Ottawa, Ont.	None declared.
Ms. Chelsea Hellings	Research Coordinator	Canadian Stroke Strategy, Toronto, Ont.	None declared.
Ms. Corinne Hodgson	Consultant	Toronto, Ont.	None declared.
Ms. Brenda Kwiatkowski	Member, National Stroke Nursing Council	Saskatoon Health, Saskatoon, Sask.	None declared.
Mr. Craig Pierre	General Manager	Island EMS, Charlottetown, PEI	None declared.
Mr. Pierre Poirier	Executive Director	Paramedic Association of Canada, Ottawa, ON	None declared.
Dr. Eli Segal	Attending Physician, Emergency Department	Sir Mortimer B. Davis Jewish General Hospital, Montréal, Que.	None declared.

Appendix 3: Members of the Best Practices Expert Consensus Panel (part 1)

Name	Position	Facility or organization	Competing interests
Dr. Mark Bayley (co-facilitator)	Physiatrist and Medical Director, Neuro Rehabilitation Program	Toronto Rehabilitation Institute, Toronto, Ont.	None declared.
Dr. Stephen Phillips (co-facilitator)	Director, Acute Stroke Program	Queen Elizabeth II Health Sciences Centre, Halifax, NS	None declared.
Ms. Barb Ansley	Coordinator, Rehabilitation Research and Program Evaluation	Hamilton Health Sciences, Hamilton, Ont.	None declared.
Dr. Kim Barker	Public advisor	Assembly of First Nations, Toronto, Ont.	None declared.
Mr. Louis Barre	Stroke advocate	Winnipeg, Man.	None declared.
Dr. Allan Bell	Family practitioner	College of Family Physicians of Canada, Toronto, Ont.	Grants and honoraria for research, consultancy and speaking from Sanofi-Aventis, Bristol-Myers Squibb, Bayer and AstraZeneca.
Ms. Asako Bienek	Analyst, Surveillance Division, Centre for Chronic Disease Prevention and Control	Public Health Agency of Canada, Ottawa, Ont.	None declared.
Dr. Sandra Black	Brill Professor of Neurology	University of Toronto, Sunnybrook Health Sciences Centre, Toronto, Ont.	Ad hoc consulting, including advisory board membership, subject to availability, for Novartis, Pfizer, Eisai, Janssen-Ortho, Lundbeck, Glaxo-Smith-Kline, Myriad, EBIX (not in excess of $10,000 per company). Speaker fees from Novartis, Pfizer, Janssen-Ortho, Lundbeck, Myriad.
Ms. Laurie Cameron	Program Coordinator and Executive Assistant	Canadian Stroke Strategy, Ottawa, Ont.	None declared.
Ms. Lorna Clarke	Executive Director, Acute Care	Saskatoon Health Region, Saskatoon, Sask.	None declared.
Ms. Charlotte Comrie	Executive Director	Heart and Stroke Foundation of Prince Edward Island, Charlottetown, PEI	None declared.
Dr. Alan Cook	Neuropsychiatrist	Halifax, NS	None declared.
Dr. Robert Cushman	Chief Executive Officer	Champlain Local Health Integration Network, Ottawa, Ont.	None declared.
Ms. Natalie Damiano	Physiotherapist and Program Lead, Rehabilitation	Canadian Institutes of Health Research, Ottawa, Ont.	None declared.
Ms. Rita den Otter	Director, Neurosciences and Rehabilitation Services	Vancouver Island Coastal Health Authority, Victoria, BC	None declared.
Dr. Gabrielle deVebers	Pediatric neurologist	The Hospital for Sick Children, Toronto, Ont.	None declared.
Dr. Pamela Duncan	Physiotherapist and Epidemiologist	Durham, NC	None declared.
Dr. Marsha Eustace	Stroke Fellow	St. John's, NL	None declared.
Mr. Wayne Fyffe	Chief Executive Officer	Credit Valley Hospital, Mississauga, Ont.	None declared.
Ms. Patti Gallagher	Clinical Nurse Specialist, Neuroscience	Saint John Regional Hospital, Saint John, NB	None declared.

Appendix 3: Members of the Best Practices Expert Consensus Panel (part 2)

Name	Position	Facility or organization	Competing interests
Ms. Neala Gill	Program Manager	Cardiovascular Health Nova Scotia, Halifax, NS	None declared.
Dr. Ian Graham	Vice President, Knowledge Translation	Canadian Institutes of Health Research, Ottawa, ON	None declared.
Dr. Teri Green	Coordinator, Calgary Stroke Program	Foothills Medical Centre, Calgary, Alta.	None declared.
Dr. Gordon Gubitz	Neurologist, Acute Stroke Unit and Outpatient Neurovascular Clinic	Queen Elizabeth II Health Sciences Centre, Halifax, NS	None declared.
Dr. Ruth Hall	Dietitian and Epidemiologist	Institute for Clinical Evaluative Sciences, Toronto, Ont.	None declared.
Dr. Antoine Hakim	Chief Executive Officer and Scientific Director	Canadian Stroke Network, Ottawa, Ont.	None declared.
Ms. Mary Elizabeth Harriman	Associate Executive Director	Heart and Stroke Foundation of Canada, Ottawa, Ont.	None declared.
Ms. Donna Hastings	Director, Health Promotion	Heart and Stroke Foundation of Alberta, NWT and Nunavut, Calgary, Alta.	None declared.
Ms. Chelsea Hellings	Research Coordinator	Canadian Stroke Strategy, Toronto, Ont.	None declared.
Dr. Anthony Herd	Emergency Physician	Winnipeg Health Sciences Centre, Winnipeg, Man.	Speaking fees from Roche in September 2006 and 2007.
Ms. Shelley Irvine-Day	Speech Language Pathologist	Deer Lodge Centre, Winnipeg, Man.	None declared.
Ms. Aura Kagan	Executive Director	The Aphasia Institute, Toronto, Ont.	None declared.
Ms. Linda Kelloway	Stroke Education Consultant	Heart and Stroke Foundation of Canada, Toronto, Ont.	None declared.
Dr. Nicol Korner Bitensky	Associate Professor, Faculty of Medicine, School of Physical and Occupational Therapy	McGill University, Montréal. Que.	None declared.
Ms. Katie Lafferty	Executive Director	Canadian Stroke Network, Ottawa, Ont.	None declared.
Dr. Sylvain Lanthier	Stroke Neurologist	Centre hospitalier de l'Université de Montréal, Montréal, Que.	Honoraria for lectures and participation on advisory boards (in no case > $10 000) from Pfizer, Bristol-Myers Squibb, Sanofi-Aventis, Boehringer Ingelheim, Merck-Frosst and Servier. Travel fees related to these activities were also received.
Ms. Carole Laurin	Stroke advocate	Winnipeg, Man.	None declared.
Dr. Louise-Héléne LeBrun	Stroke Neurologist	Centre hospitalier de l'Université de Montréal (CHUM), Montréal, Que.	Honoraria and speaker fees from Boehringer-Ingelheim and Pfizer (neither > $10,000), as well as travel assistance. Grant from Boehringer for a fellowship to the Centre under CHUM Foundation.

Appendix 3: Members of the Best Practices Expert Consensus Panel (part 3)

Name	Position	Facility or organization	Competing interests
Ms. Joanne Lee	Dietitian	Calgary Health Region, Calgary, Alta.	None declared.
Dr. Patrice Lindsay	Performance and Standards Specialist	Canadian Stroke Network, Toronto, Ont.	None declared.
Mr. Patrick McCarthy	Stroke advocate	Toronto, Ont.	None declared.
Ms. Alison McDonald	Physiotherapist, Nova Scotia Rehabilitation Centre	Queen Elizabeth II Health Sciences Centre, Halifax, NS	None declared.
Ms. Louise Nichol	Community Team Manager, Home Care Program	Community Stroke Care Service, Winnipeg, Man.	None declared.
Dr. Tejal Patel	Pharmacist	St. Michael's Hospital, Toronto, Ont.	None declared.
Mr. Pierre Poirier	Executive Director	Paramedic Association of Canada, Ottawa, Ont.	None declared.
Ms. Annette Robertson	Project Manager	Registry of the Canadian Stroke Network , Toronto, Ont.	None declared.
Dr. Demetrios Sahlas	Stroke Neurologist	Hamilton Health Sciences, Hamilton, Ontario	Speaker fees 2 years ago from Pfizer regarding Stroke Prevention by Aggressive Reduction in Cholesterol Levels (SPARCL) trial
Mr. Stephen Samis	Director, Health Policy	Heart and Stroke Foundation of Canada, Ottawa, Ont.	None declared.
Dr. Eli Segal	Attending Physician, Emergency Department	Sir Mortimer B. Davis Jewish General Hospital, Montréal, Que.	None declared.
Ms. Sarah Taber	Research Specialist	Accreditation Canada, Ottawa, Ont.	None declared.
Dr. Robert Teasell	Physiatrist	Parkwood Hospital, London, Ont.	Travel expenses to make presentations in Winnipeg, Toronto, Ottawa and St. John's.
Dr. Andrew Travers	Provincial Medical Director, Emergency Health Services	Halifax, NS	Speaker's fees regarding emergency medical services and STEMI/stroke care from Roche.
Ms. Jacqueline Willems	Manager, Regional Stroke Program	Toronto, Ont.	None declared.
Ms. Elizabeth Woodbury	Executive Director	Canadian Stroke Strategy, Ottawa, Ont.	None declared.
Ms. Ivanna Yau	Advance Practice Nurse, Stroke Program, Division of Neurology	The Hospital for Sick Children, Toronto, Ont.	None declared.

Appendix 4: External presubmission reviewers for 2008 update of Canadian Best Practice Recommendations for Stroke Care

Name	Position	Facility or organization	Competing interests
Ms. Mary-Elizabeth Cooper	Acute Care Nurse Practitioner	Calgary Stroke Program, Calgary, Alta.	None declared.
Dr. Robert Côté	Stroke Neurologist and Chair, Research Policy and Planning Advisory Committee, Heart and Stroke Foundation of Canada	Montreal General Hospital, Montréal, Que.	Speaker fees from Aventis-Sanofi, Boehringer-Ingelheim, Merck, Solvay; travel reimbursement for Pfizer advisory meetings.
Dr. Andrew Demchuk	Stroke Neurologist; Director, Calgary Stroke Program; Associate Professor, Department of Clinical Neurosciences	Foothills Medical Centre and University of Calgary, Calgary, Alta.	Speaker fees from Sanofi, AstraZeneca, Boehringer-Ingelheim. Travel assistance for American Heart Association (Sanofi) and European Stroke Congress (BI) 2008.
Dr. Milo Fink	Physiatrist, Consultant	Wascana Rehabilitation Centre, Regina, Sask.	None declared
Ms. Donna Gill	Stroke Prevention Nurse	Kitchener, Ont.	None declared.
Dr. Vladimir Hachinski	Stroke Neurologist; Distinguished University Professor; Editor-in-Chief, *Stroke, The Journal of the American Stroke Association*	University of Western Ontario, London Health Sciences Centre, London, Ont.	Received honorarium for participating in symposium sponsored by Ferrer Group and for chairing a symposium sponsored by Mitsubi Tanalsa Pharma Corporation.
Ms. Linda Lane-Devlin	Executive Director	Stroke Recovery Association of British Columbia, Vancouver, BC	None declared.
Mr. Malcolm Moffat	President and Chief Executive Officer	St. John's Rehabilitation Hospital, Toronto, Ont.	None declared.
Dr. Gary Teare	Director of Quality Management and Analysis	Health Quality Council Saskatchewan, Saskatoon, Sask.	None declared.
Ms. Gail Williams	Medical Editor, consultant	Ottawa, Ont.	None declared

Appendix 5: Glossary of stroke-related terms and definitions of abbreviations (part 1)

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.
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'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 Database Abstracting Manual, 2000–2001[1])
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 ability 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.
Atrial fibrillation: Rapid, irregular beating of the heart.
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 integrated, high quality, and efficient services in stroke prevention, treatment, rehabilitation and community reintegration."
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, through 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.
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 stroke 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.
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 care 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).
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).

Appendix 5: Glossary of terms (part 2)

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 to the same location as before their visit to hospital.
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 2 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 feeding: Delivery of nutrients directly into the intestine 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.
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.
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 through 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.
Impairment: A problem in the structure of the body (e.g., loss of a limb) or the way the body or 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.
Interdisciplinary stroke team: A comprehensive team of health care 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, physiotherapists, occupational therapists, speech language pathologists, social workers, dietitians, 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.
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% of the data points above it and 50% below it.
Medical redirect bypass: Following predefined medical criteria and a written agreement between physicians, hospitals, dispatch and ambulance services, 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.

Appendix 5: Glossary of terms (part 3)

National Ambulatory Care Reporting System: Includes data for all hospital-based ambulatory care provided in emergency 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 inpatient stroke rehabilitation units. (*Evidenced-Based Review of Stroke Rehabilitation*, 10th edition[2])
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. Scores range from 0 (asymptomatic) to 6 (death).
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, complications, 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.
Risk factor: A characteristic of a person (or group of people) that is positively associated with a particular disease or condition.
Stroke: Sudden and unexpected damage to brain cells that causes symptoms that last for more than 24 hours in the parts of the body controlled by those cells. It happens when the blood supply to part of the brain is suddenly disrupted, either by blockage of an artery or by bleeding within the brain. (*Clinical Guidelines for Acute Stroke Management*, Australia[3])
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 materials, 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 health care 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.

Appendix 5: Glossary of terms (part 4)

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.
Venous thrombosis: Development of a blood clot in a vein, primarily in the legs or pelvis.
Definitions of abbreviations used in this document: ASA = acetylsalicylic acid (Aspirin); CT = computed tomography; HR = hazard ratio; ICU = intensive care unit; LDL = low-density lipoprotein; MRI = magnetic resonance imaging; OR = odds ratio, RN = registered nurse; RR = relative risk; UK = United Kingdom.

References

1. Discharge abstract database. Ottawa (ON): Canadian Institute for Health Information. Available: http://secure.cihi.ca/cihiweb/dispPage.jsp?cw_page=services_dad_e (accessed 2008 Nov 4).
2. Teasell R, Foley N, Salter K, et al. *EBRSR: evidence-based review of stroke rehabilitation*. 10th ed. Ottawa (ON): Canadian Stroke Network; 2007.
3. National Stroke Foundation. *Clinical guidelines for acute stroke management*. Melbourne (AU): The Foundation; 2007. Available: www.strokefoundation.com.au/acute-clinical-guidelines-for-Acute-stroke-management (accessed 2008 Oct 28).

Appendix 6: Evaluation of levels of evidence

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*

Grade	Criteria
A	Strong recommendation. Evidence from randomized controlled trials or meta-analyses of randomized controlled trials. Desirable effects clearly outweigh undesirable effects, or vice versa.
B	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.
C	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.

*Based on Guyatt GH, Cook DJ, Jaeschke R, et al. Grades of recommendation for antithrombotic agents: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines (8th edition). [published erratum in *Chest* 2008;34:47]. *Chest* 2008;133(6 Suppl):123S-131S.

Appendix 7: Additional publications since the consensus panel and final reviews

The developers of the Canadian Best Practices Recommendations for Stroke Care considered all relevant research and guideline publications up to June 30, 2008. Articles on topics related to the Canadian Best Practices Recommendations for Stroke Care that were reviewed after the April 2008 consensus meeting or published since June 2008 and that provide additional information relevant to the recommendations contained in this guideline are provided in the following list. This list is not intended as a comprehensive review of the literature since the conclusion of the consensus process for this update.

References

1. Eisenberg MJ, Filion KB, Yavin D, et al. Pharmacotherapies for smoking cessation: a meta-analysis of randomized controlled trials. *CMAJ* 2008;179:135-44.
2. Schrader J, Lüders S, Kulschewski A, et al. Morbidity and mortality after stroke, eprosartan compared with nitrendipine for secondary prevention: principal results of a prospective randomized controlled study (MOSES). *Stroke* 2005;36:1218-26.
3. Mochizuki S, Shimizu M, Taniguchi I, et al; JIKEI HEART Study Group. JIKEI HEART Study. a morbid—mortality and remodeling study with valsartan in Japanese patients with hypertension and cardiovascular disease. *Cardiovasc Drugs Ther* 2004;18:305-9.
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5. Vergouwen MDI, de Haan RJ, Vermeulen M, et al. Statin treatment and the occurrence of hemorrhagic stroke in patients with a history of cerebrovascular disease. *Stroke* 2008;39:497-502.
6. Cholesterol Treatment Trialists Collaborators. Efficacy of cholesterol-lowering therapy in 18,686 people with diabetes in 14 randomised trials of statins: a meta-analysis. *Lancet* 2008;371:117-25.