

Canadian Stroke Quality of Care Study: Identification of performance indicators for acute stroke care

M. Patrice Lindsay, Moira K. Kapral, Robert Holloway, David J. Gladstone, Jack V. Tu, Andreas Laupacis, Jeremy M. Grimshaw

Abstract

Background: Initiatives including regionalization of stroke care, clinical practice guideline development and quality-of-care improvement efforts are best supported using clearly defined performance measures and accurate, high-quality data sources. In Canada, there are no published consensus statements or guidelines, and consensus-based indicators to evaluate the quality of stroke care are lacking. We sought to identify a core set of quality-of-care indicators to evaluate acute ischemic stroke care in hospitals.

Methods: A Canadian expert panel was convened to select key quality-of-care measures for acute stroke using a modified Delphi process. A list of 51 potential quality-of-care indicators was compiled from 44 indicators chosen in a previous US study and others identified from a review of current stroke literature including practice guidelines, randomized trials, systematic reviews and observational studies of stroke care best-practice; the list was accompanied by a summary of available evidence supporting each indicator. Panel members rated each indicator using 6 dimensions of quality and then met to discuss the overall value of, levels of evidence for, and reliability of using each indicator to measure acute stroke care.

Results: On the basis of panel discussions and recommendations, 24 of the 51 potential indicators were discarded or combined with other indicators. Of the final 27 potential indicators, 23 were strongly supported by the majority of panel members and underwent further development and measurement. Of these 23 indicators, 16 were also strongly supported by at least 75% of panelists in the previous US study.

Interpretation: A core set of Canadian quality-of-care indicators for monitoring acute ischemic stroke care is now available. These indicators present a foundation for stroke care improvement initiatives and for ongoing research in acute stroke management.

tem responsiveness and optimize patient outcomes after acute ischemic stroke. The best available evidence should inform these efforts, and their impact should be measured using validated, clinically relevant and empirically feasible stroke quality-of-care indicators.²⁻⁴

Research into quality-of-care measurement for stroke is in its early stages. Improving quality of care is best supported using clearly defined performance measures and accurate, high-quality data sources.⁵ Clinical trials in stroke have provided some of the needed data and established the effectiveness of a variety of interventions for acute stroke care and secondary stroke prevention, including thrombolysis in appropriate patients, care on an acute stroke unit, antithrombotic agents for ischemic stroke and carotid endarterectomy for carotid stenosis.⁶⁻¹⁰ These trials were in part the basis for the clinical practice guidelines and recommendations for optimal stroke care delivery developed in many countries.¹¹⁻¹⁴ In Canada, there are no published consensus statements or guidelines that define best practice for stroke care with clear links between processes and expected outcomes and that have been consistently adopted across hospitals.^{15,16} Studies of stroke care delivery in multiple jurisdictions, including Canada, have demonstrated variations in practices and gaps in the quality of stroke care, with the result that some stroke patients do not receive care that is consistent with evidence-based standards.¹⁷⁻¹⁹

In 2001, a US research team published a set of performance measures that provide a structured approach to measuring acute ischemic stroke care and understanding variations among hospitals.²⁰ The US indicators have been applied to support a national quality-improvement initiative in acute stroke care across the United States known as the "SPIN" project (the Stroke Practice Improvement Network) and to inform the development of the standardized stroke measure set used for the pilot testing currently occurring in the Joint Commission of Accreditation of Health Care Organizations around the world.^{21,22} The purpose of this study was to build upon the findings of the US study and identify a core set of quality-of-care indicators for stroke care that are valid, clinically relevant and empirically feasible, applicable to the Canadian health care system and pertinent to practitioners in other countries who manage acute stroke patients in health care systems similar to Canada's.

Stroke is a leading cause of death and disability in Canada. Each year, about 50 000 Canadians are admitted to hospital because of stroke, with an estimated cost to the health care system of \$2.7 billion.¹ As the management of acute ischemic stroke advances, widespread implementation of optimal stroke care continues to pose enormous challenges for health care systems. Initiatives such as regionalization of stroke care, clinical practice guideline development and quality-of-care improvement efforts have been established in an attempt to increase sys-

Methods

A multiphase research design was implemented to identify, select and rate performance indicators for acute stroke care. Acute stroke care was defined as the care patients receive during a stay in hospital because of acute ischemic stroke, beginning at arrival in the emergency department and continuing to hospital discharge or patient death. This study did not include quality-of-care indicators for other points along the continuum of care. The design included potential indicator identification through a detailed literature review, formation of an expert panel, indicator selection and rating through a modified Delphi survey and a nominal-group process.^{23,24,25} The study was approved by the Sunnybrook and Women's College Health Sciences Centre Research Ethics Board.

To convene the expert panel, a call for nominations was sent to 12 professional organizations in Canada whose members are directly involved in stroke care in Canada: the Heart and Stroke Foundation of Canada (including the Ontario chapter), the Canadian Stroke Network, the Canadian Stroke Consortium, the Canadian Stroke Society, the Canadian Congress of Neurological Sciences, the Canadian Neurological Society, the Canadian Association of Neuroscience Nurses, the Canadian Association of Emergency Physicians, the Canadian Society of Internal Medicine, the College of Family Physicians of Canada, the Canadian Institutes for Health Research Institute for Circulatory and Respiratory Health and the Ontario TeleStroke Working Group. A total of 43 nominations were received, and the research team selected the final panel of 14 members on the basis of pre-established criteria: representation from across the country; representation from a range of practice settings (i.e., academic, community and rural centres); representation across disciplines (i.e., physicians [stroke and general neurologists, emergency physicians and internists], nurses, rehabilitation specialists, health system management and government funding agencies, researchers); and active involvement in acute stroke care. Panel members are listed in Appendix 1.

Several steps were undertaken to identify an initial set of indicators for consideration. First, the list of 44 stroke quality-of-care indicators and accompanying supporting evidence given in the 2001 US study were reviewed by the research team for relevance to the Canadian setting and to current practice.

Second, the research team applied the same literature review strategy used by the US study to update the master list of possi-

ble indicators for acute stroke care. MEDLINE, CINAHL, HealthStar and EBM Reviews (which includes Cochrane, ACP Journal Club, DARE and CCTR) were searched for practice guidelines, systematic reviews, randomized controlled trials, observational studies and quality-improvement reports. Search dates started Jan. 1, 1994 to allow some overlap with the previous literature review and ended as of Mar. 31, 2004. The tables of contents of major peer-reviewed stroke journals and general medical journals (e.g., *Canadian Medical Association Journal*, *Journal of the American Medical Association*, *British Medical Journal*, *New England Journal of Medicine*) from Jan. 1, 2000, to Mar. 31, 2004, were manually searched for stroke care articles. Unpublished manuscripts and grey literature were accessed directly from authors whose papers were considered highly relevant to this research. The Web sites of neurological and stroke-specific professional organizations and performance measurement groups were also reviewed to locate additional practice guidelines, best-practice recommendations, position statements and quality-of-care indicators regarding stroke care. To ensure the indicators reflected Canadian practices and content, the search was extended to include indicator documents and reports produced by the Canadian Council of Health Services Accreditation Indicator Project, the Canadian Institute for Health Information Report on Cardiac Disease and Stroke, the Institute for Clinical Evaluative Sciences atlases, the Ontario Stroke Strategy and the Hospital Report Research Collaborative.

Full-text copies of all relevant research papers, systematic reviews, practice guidelines and other reports identified during the literature review were obtained. Members of the research team reviewed the abstracts and articles to identify additional quality-of-care indicators, and they rated research reports and guidelines according to the quality of the evidence provided using the evidence rating scale developed by Guyatt and colleagues.²⁶

A final set of 51 potential acute stroke quality-of-care indicators emerged from the review process and were grouped into 9 domains (Box 1). These 51 indicators included most of the original 44 indicators, as well as new indicators that emerged from the literature review and that reflected current practices for acute stroke care in Canada.

Each panel member was sent a detailed reference manual, which contained the search strategy, a synopsis of the current evidence available for each of the 51 indicators and a comprehensive reference list (the full literature review document is available on the Canadian Stroke Network Web site at www.canadianstroke-network.ca). They also received a ratings booklet, which identified each indicator and included a summary of the evidence, identification of the quality of the evidence and individual rating scales to evaluate each indicator. Both documents were reviewed by 3 panel members (C.J., G.G., M.S.) for accuracy and completeness before distribution to the full panel.

Panel members evaluated each indicator using 6 dimensions of quality: validity, feasibility of measurement, relevance, opportunity for improvement, expected impact of improvement and overall utility.²⁰ All 6 dimensions were rated along identical 9-point Likert scales to ensure consistency and comparability of ratings, with end-anchors of "definitely disagree" (1) and "definitely agree" (9).^{3,27}

Panel members were sent both the reference manual and the ratings booklet in April 2004. In accordance with the modified Delphi approach, they were asked to review the evidence, then rate each indicator in each of the 6 dimensions. Panel members were given the opportunity to add comments regarding each indicator and to suggest additional indicators for consideration. All of

Box 1: Domains of potential quality-of-care indicators (no. of indicators) for evaluating acute ischemic care in hospitals

- Organization of stroke care delivery (2)
- Thrombolytic management (9)
- Emergent evaluation of acute ischemic stroke (8)
- Emergent supportive care and treatment of acute complications (7)
- Prevention of complications (12)
- Diagnostic testing in acute ischemic stroke (1)
- Secondary prevention (6)
- Nontechnical aspects of care (1)
- Telemedicine stroke ("TeleStroke") care* (5)

*Not included in the original US study.²⁰

the panel members returned their completed packages. The data were entered into a database, and response frequencies and mean and median scores were tabulated.

The panel members then met in person for a 1-day meeting, where the results of the initial indicator ratings were shared. Eleven of the 14 panel members were able to attend the meeting for the entire day, and a 12th member was present for the morning session. The panel meeting was facilitated by a member of the research team (J.M.G.). Following a nominal-group process, all of the panel members were given an opportunity to comment on each indicator and to express their opinions on the basis of available research evidence and personal clinical experience.^{4,28,29} After the discussions, several indicators were combined, reworded or deleted. Each panel member then privately re-rated the revised and remaining indicators using 3 of the 6 dimensions: validity, relevance and overall utility. The panel considered their priority to be the identification of the most valid and relevant indicators. They felt that feasibility of measurement should be addressed separately, since the dimension might act as a potential barrier to indicator selection. All of the panel members also agreed that each indicator had the potential for significant quality improvement and that implementation of quality improvement initiatives would have a positive impact on patient care and outcomes, so they did not feel that rating these 2 dimensions were warranted. The results of the final indicator ratings for the 3 remaining dimensions were analyzed using response frequencies and mean and median scores.

Criteria for interpreting both rounds of the indicator ratings were established beforehand. On the basis of the 9-point Likert scale, indicators were considered to have "strong support" for adoption if at least two-thirds of the panel members (10/14) rated an indicator with a score of 7, 8 or 9. Support would be labelled as "unsure" if at least two-thirds of the panel members rated an indicator with a score of 4, 5 or 6. If at least two-thirds of the panel members rated an indicator with a score of 1, 2 or 3, it was felt that there was strong support for rejecting the indicator. Support was considered to have "lack of consensus" when indicators received a wide range of scores across the 3 response categories, and these indicators were highlighted for discussion. The final set of stroke quality-of-care indicators was selected on the basis of the second round of ratings in the "overall utility" dimension. All indicators that received a rating of 7–9 ("strong support for adoption") from more than two-thirds of the panel were included as part of the final core set of acute stroke quality-of-care indicators.

Results

Of the 51 indicators rated by the panel members, 37 initially received strong support for adoption in the "overall utility" category and in at least 1 other category (Table 1). Of these 37, 24 were rated with strong support for adoption across all 6 dimensions, 12 had the highest levels of evidence to support them (A1 or B1), and the rest had weaker evidence.²⁶

During the panel discussions, 24 of the 51 initial indicators were either discarded or combined with other indicators. A total of 27 initial and revised indicators were available for the panel to rate in the second round, including 18 of the 24 indicators that had been given strong support across all 6 dimensions. Feasibility of measurement (e.g., poor documentation), lack of definitive research evidence

and indicators considered to be beyond the control of health care professionals (e.g., availability of hospital beds) were the most common reasons to alter or eliminate an indicator. Indicators for prophylaxis for deep vein thrombosis or pulmonary embolism were deferred until current research trials are completed,³⁰ and indicators for telemedicine stroke care were delegated to a future advisory panel with greater expertise in that area (the telemedicine panel convened January 2005).

Of the final 27 indicators, 23 were rated high for overall utility by the majority ($\geq 8/12$) of panel members and were subsequently recommended for adoption (Box 2). Of these 23 indicators, 22 were also rated high for relevance, as were 20 for validity. Levels of evidence for these 23 indicators ranged from highest (A1) to lowest (C2). Scores for the remaining 4 indicators, related to initial blood work, echocardiography and avoiding the use of nifedipine therapy, were spread across the scale and therefore lacked consensus for inclusion at this time.

Interpretation

The Canadian Stroke Quality of Care Study acute stroke advisory panel proposes 23 core indicators to be used by clinicians, researchers and policy-makers to ensure accountability, facilitate regional comparisons and enable continuous quality-of-care improvement. The indicators will also inform efforts to develop consensus guidelines in Canada for acute stroke management. The measurement of these indicators may facilitate the establishment of benchmarks for quality stroke management that are realistic to achieve in clinical practice. This, in turn, will provide a mechanism to identify gaps in the quality of acute stroke care and enable comparative reporting within Canada and other jurisdictions.

The highest rated indicators in this study focused on treatment in a stroke unit, maximizing tissue plasminogen activator (tPA) administration in a timely fashion for eligible patients, and in-hospital initiation of secondary prevention interventions after acute ischemic stroke. Care for acute stroke patients in a dedicated stroke unit has been shown to improve survival and reduce dependence after ischemic stroke.^{11,31–33} Our panel members from community and rural settings expressed concern that resources did not always allow for such dedicated units. Following an in-depth discussion regarding models for acute stroke management across Canada, the panel proposed a graded approach to evaluate performance regarding acute stroke management. This grading system is reflected in the final wording of the indicator and recommends that patients be cared for by a multidisciplinary team by way of: (1) an organized stroke unit located in a dedicated area of the hospital, (2) formal stroke protocols implemented regardless of patient location or (3) ongoing management by a stroke team.

In the area of maximizing tPA administration, the most strongly supported indicators included CT scan within 25

Table 1: Quality-of-care indicators receiving strong support for adoption in “overall utility” category and at least 1 other category after initial rating

Indicator	Quality of evidence	Ratings of overall utility;* no. of panel members		
		Reject	Uncertain	Adopt
Evidence base A1–B1				
Patients should be managed on a designated stroke unit	A1	0	0	14
Patients should be discharged with antithrombotic therapy	A1	0	0	14
Patients with atrial fibrillation should receive warfarin therapy	A1	0	0	14
Patients should be assessed at discharge for appropriateness of statin therapy	A1	0	0	14
Patients should be assessed at discharge for appropriateness of antihypertensive therapy	A1	0	0	14
Blood glucose level should be checked on arrival and regularly for first 24 h	B1	0	1	13
Noninvasive carotid artery imaging should be conducted	C1/A1	0	2	12
Patients and caregivers should receive stroke education	B1	0	2	12
Elevated blood glucose level should be treated	B1	0	3	11
Patients should be mobilized within 48 h of onset of stroke symptoms	A1/C1	0	3	11
Patients should be mobilized within 24 h of onset of stroke symptoms	A1/C1	0	4	10
Patients with thrombolysis should receive heparin or stockings	B1	1	3	9
Evidence base B2				
Acute ASA therapy should be initiated	B2	0	1	13
Patients should be evaluated for and offered thrombolysis	B2	1	1	12
Fever should be treated with antipyretics	B2	0	3	11
New antihypertensive agents should not be added within 24 h	B2	0	5	9
Evidence base C1–C2				
Patients should have CT completed within 25 min of arrival in ED	C1/C2	0	1	13
Patients with failed dysphagia screen should receive nothing by mouth until further assessment	C1	0	1	13
Patients should be seen within 10 min of arrival in ED	C1/C2	0	2	12
Dysphagia screen should be completed	C1	0	2	12
Indwelling urethral catheter should be avoided	C1	0	2	12
Telehealth neurologist should have access to patient CT scan	C2	0	2	12
NINDS inclusion and exclusion criteria should be applied for thrombolysis	C1/C2	1	1	11
Patients should be assessed for hypoxia	C1	1	2	11
Cause of stroke should be documented	C1	1	2	11
Smoking cessation counselling should be given	C1	1	2	11
Patient should have a neurological assessment	C1	1	2	11
Telehealth remote neurological assessment should be made	C1	0	2	11
Care should be managed with aid of stroke protocol	C1	1	3	10
CT should be interpreted within 45 min of arrival in ED	C1	1	3	10
A telehealth consultation should be conducted on real time 2-way videoconference	C1	1	4	9
For telehealth assistance, the time from patient arrival to teleconference should be less than 30 min	C1	0	4	9
Physician with stroke expertise should see patient within 15 min of arrival in ED	C1/C2	1	4	9
Patients should have an electrocardiogram	C2	2	3	9
Complete blood count including platelets should be completed	C2	2	3	9
Patients should have prothrombin time and partial thromboplastin time checked	C2	1	4	9
Imaging should be done for patients ineligible for thrombolysis within 72 h of admission	C1/C2	0	5	9

Note: ED = emergency department, NINDS = National Institute of Neurological Diseases and Stroke.

*Eleven of the 14 panel members were able to attend the panel meeting for the full day. Ratings were based on a 9-point Likert scale. “Reject” (ratings of 1–3) indicates support to reject the indicator, “uncertain” (ratings of 4–6) indicates uncertainty about the indicator and “adopt” (ratings of 7–9) indicates strong support to adopt the indicator. Indicators were selected for the final core set if more than 66% of the panel members rated the indicator in the “strong support to adopt” category (ratings of 7–9).

minutes of emergency department arrival, evaluation of tPA eligibility, proportion of patients receiving tPA, time to receive tPA and use of standardized tPA protocols for tPA administration. The panel was in full agreement that assessment, diagnosis and urgent treatment of stroke patients eligible for tPA should be a high priority in emergency departments and that processes should be in place to facilitate efficient and timely administration of tPA when indicated. The challenge again arose that limited resources in many community and rural hospitals (e.g., lack of neuroimaging, lack of a specialist with expertise in CT interpretation for acute stroke) may not permit tPA administra-

tion. During this discussion, consideration was given to the Canadian Association of Emergency Physicians (CAEP) position statement regarding tPA for stroke, which states that “until it is clear that the benefits of this therapy outweigh the risks, thrombolytic therapy for acute stroke should be restricted to use within formal research protocols or in monitored practice protocols that adhere to the NINDS [National Institute of Neurological Diseases and Stroke] eligibility criteria.”³⁴ Emergency department panel members felt that the discussion and final indicators for this section were consistent with the CAEP position, particularly references to the need to have specific protocols

Box 2: Final indicators for evaluating optimal acute ischemic stroke care selected in the Canadian Stroke Quality of Care Study*

- Patients with acute stroke should be managed on a designated stroke unit
- All patients with acute stroke should be evaluated for tPA eligibility
- NINDS inclusion/exclusion criteria should be applied for patient selection for thrombolysis
- tPA best-practice treatment protocol should be followed for tPA administration (e.g., AHA, AAN)
- All eligible patients should receive tPA, and within 1 h of arrival at hospital†
- Patients potentially eligible for tPA should have CT brain scan completed within 25 min of arrival at ED
- CT/MRI should be completed within 24 h for patients ineligible for tPA
- CT/MRI should be completed before hospital discharge for patients ineligible for tPA and if CT/MRI was not completed within 24 h of arrival at ED
- Blood glucose level should be checked on arrival at ED and regularly for first 24 h
- Elevated preprandial blood glucose level should be treated with glucose-lowering agents
- All patients presenting with acute stroke symptoms should have an ECG in the ED
- Fever should be treated with antipyretics to reduce temperature to less than 38°C
- Patients should be mobilized and out of bed within 24 h of onset of stroke symptoms unless contraindicated
- Acute ASA therapy should be initiated within 48 h (and as soon as possible) after stroke onset unless contraindicated
- Dysphagia screen or protocol should be initiated before the patient is given food or drink, and the results should be documented
- Indwelling urethral catheter should be avoided in all acute ischemic stroke patients
- Carotid imaging should be completed during hospital stay or documentation should be made that a test has been arranged as outpatient after discharge
- Patients with acute ischemic stroke should be discharged with antithrombotic therapy unless contraindicated
- Patients with acute ischemic stroke and nonvalvular atrial fibrillation should be discharged with anticoagulant therapy unless contraindicated
- Patients with acute ischemic stroke should be assessed for and prescribed a lipid-lowering agent if appropriate
- Patients should be assessed for and prescribed a blood pressure-lowering agent if appropriate
- Education should be provided for patients and caregivers before patient discharge and documented in a chart
- Smoking history should be assessed before patient discharge and documented in a chart

Note: tPA = tissue plasminogen activator, AHA = American Heart Association, AAN = American Academy of Neurology.

*Eleven of the 14 panel members were able to attend the panel meeting for the full day. Indicators were selected for the final core set if more than 66% of the panel members rated the indicator in the “strong support to adopt” category (ratings 7–9).

†“Eligible patients” refers to patients who arrive at hospital within 3 hours of the onset of stroke symptoms and for whom tPA is not contraindicated.

and expertise available to manage tPA administration. In a recent presentation one of the original authors of the CAEP position statement acknowledged that the evidence has evolved sufficiently to warrant a review and update of this position statement.³⁵

Indicators related to the use of statin and antihypertensive therapies were included on the basis of strong emerging evidence in the area of secondary stroke prevention. In a recently published review of the literature on drug therapies for secondary prevention of stroke, several recommendations were put forth, including those related to statin and antihypertensive therapies. These recommendations stated that (a) most patients with ischemic stroke or transient ischemic attack will benefit from statin therapy, and aggressive reduction of low-density lipoprotein cholesterol levels is likely to yield greater benefit than more modest reduction; and (b) most patients with stroke or transient ischemic attack will benefit from treatment with an antihypertensive agent, regardless of the presence or absence of hypertension.³⁶ Panel members strongly supported the adoption of these recommendations for incorporation into the core set of quality-of-care indicators.

Discussion arose during the panel meeting regarding the use of heparin therapy or compression stockings or both for the prevention of deep vein thrombosis or pulmonary embolism when stroke patients are in hospital. Some panel members felt that definitive evidence for the use of heparin after stroke was lacking at this time. A recent systematic review of the use of heparin concluded that immediate anticoagulant therapy in patients with acute ischemic stroke is not associated with net short- or long-term benefit. The data from this review do not support the routine use of any type of anticoagulant in acute ischemic stroke.³⁷ The review also stated that people who receive anticoagulants after a stroke have less chance of developing deep vein thrombosis or pulmonary embolism, and these conditions may be prevented in other ways.³⁷ A clinical trial is currently underway to determine what role, if any, compression stockings play in the prevention of deep vein thrombosis and pulmonary embolism after stroke.³⁰ However, panel members also pointed out that, as a result of differences in the interpretation of the existing data and consideration of historical patterns of care (many of which are not evidence-based), some acute stroke units still use anticoagulants (usually in small doses) immediately after stroke to prevent deep vein thrombosis, and others will use mobilization, hydration and, sometimes, compression stockings. The panel members voted not to include these indicators for final rating at this meeting and to revisit the issue once new evidence is available.

In terms of strongly supported performance indicators, there were more similarities than differences between the 2001 US study and this study. In the US study, 21 of the 44 indicators were highly endorsed for overall utility (i.e., 75% of the panelists rated the indicator “should do” or “must do”), compared with 23 of the original 51 indicators in this

study (i.e., two-thirds of the panelists rated the indicator a 7, 8 or 9). Fifteen of the indicators were common to both panels. Of the 8 indicators highly endorsed by the Canadian panel and not present in the US rankings, 4 reflected evolution of evidence to support indicator use (treat elevated glucose level, treat fever, assess for lipids at discharge, assess for hypertension at discharge),³⁸⁻⁴² 3 reflected a more prominent role for neuroimaging (CT within 25 minutes in tPA-eligible patients, CT within 24 hours in tPA-ineligible patients and CT or MRI before discharge) and 1 provided a summary measure for overall tPA use (proportion receiving). Six indicators endorsed by the US panel were not endorsed by the Canadian panel: 4 indicators reflected a tempered enthusiasm for deep vein thrombosis and pulmonary embolism prophylaxis, and 2 reflected a more liberal approach to managing blood pressure in the acute setting. These differences emphasize the need to periodically update indicators as new evidence both for and against processes of care emerges and to allow for customization across countries and settings. Such flexibility will improve credibility and acceptance at the local level.

These stroke quality-of-care indicators emerge at an opportune time with respect to acute stroke management in Canada. Numerous initiatives are underway across Canada where these indicators will be able to have direct application. First, the Registry of the Canadian Stroke Network provides a structured chart audit system for participating sites in Ontario and Nova Scotia and has collected data on over 12 000 stroke patients. These data are used by health care providers and managers and government funding agencies to monitor, evaluate and improve the quality of stroke care provided to patients at the participating institutions. The indicators identified in this study will be incorporated into the audit and feedback information in the future, which will enable individual hospitals to identify gaps in their stroke care against their peers, encourage improvement in stroke care delivery and establish “standards” of what types of care are feasible to achieve.⁴³ The combination of these indicators and the data available from the Registry of the Canadian Stroke Network will play a crucial role in validating the indicators for ongoing stroke care measurement and facilitate the development of appropriate benchmarks for comparative reporting.

Second, provinces and territories across Canada have established, are in the process of establishing or are considering establishing coordinated systems for stroke management. For example, Ontario’s Ministry of Health and Long-term Care established a Stroke Strategy in 2000, with designated regional and district stroke centres and regional stroke prevention clinics throughout the province.⁴⁴ Most recently, the Canadian Stroke Network and the Heart and Stroke Foundation of Canada are collaborating to develop a Canadian Stroke Strategy, a coordinated effort to address the gaps between available best evidence and current stroke management practices along

the continuum of care and to improve consistency of care across all provinces and territories.⁴⁵ Given the resources invested in these initiatives to improve stroke care, it is important that their impact on patient management and outcome be evaluated. As each provincial and territorial coordinated stroke strategy is launched, the indicators identified in this study may be incorporated into provincial and national evaluation frameworks and used for benchmarking, performance measurement and quality improvement of stroke care.

Individual hospitals should be encouraged to incorporate these indicators into routine evaluation of the stroke care they provide. As the panel members highlighted, not every hospital across Canada has access to all of the resources required to address each of the indicators. Each hospital should acknowledge a responsibility to focus on the subset of the 23 indicators that are appropriate to their circumstances.

In summary, we have systematically developed a core set of sound and clinically relevant indicators of acute stroke care within a quality framework using a valid and rigorous methodology. Indicators, like medical interventions, must evolve over time, and research and stakeholders, including the public, health system managers and health care providers, should inform that evolution. These indicators are intended to guide practice and evaluation of care provided to stroke patients in hospital, yet it is recognized that individual clinicians may make different decisions for individual patients that are outside the range of this set of indicators. In addition, these indicators focus on acute stroke care and need to be linked with other research initiatives that are addressing quality-of-care indicators across the full continuum of stroke care, from pre-hospital emergency medical care and transportation to acute care, rehabilitation and recovery. This study is an important step toward routinely measuring the quality of acute stroke care, and it must be followed by the development of benchmarks and incorporation into a process of continuous quality improvement.

This article has been peer reviewed.

From the Institute for Clinical Evaluative Sciences and the Department of Medicine, University of Toronto (Lindsay, Kapral, Gladstone, Tu, Laupacis); the Division of General Internal Medicine, University Health Network (Kapral); the Division of Neurology and Regional Stroke Centre, Sunnybrook and Women's College Health Sciences Centre, Toronto, Ont. (Gladstone); the Department of Neurology, University of Rochester School of Medicine and Dentistry, Rochester, NY (Holloway); the Ottawa Health Research Institute and the University of Ottawa, Ottawa, Ont. (Grimshaw)

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Correspondence to: Dr. M. Patrice Lindsay, Institute for Clinical Evaluative Sciences, 2075 Bayview Ave., Rm. G118, Toronto ON M4N 3M5; fax 416 480-6048; patty.lindsay@utoronto.ca

Appendix 1: Canadian Stroke Quality of Care Study Advisory Panel

Chair

Dr. Jeremy Grimshaw, Ottawa

Voting members

Dr. Todd Collier, General Neurologist, Kamloops, BC
 Dr. Gordon Gubitz, Stroke Neurologist, QEII Health Sciences Centre, Halifax, NS
 Dr. Cheryl Jaigobin, Stroke Neurologist, University Health Network, Toronto, Ont.
 Dr. Michael Sharma, Stroke Neurologist, The Ottawa Hospital, Ottawa, Ont.
 Dr. Frank Silver, Stroke Neurologist, University Health Network, Toronto, Ont.
 Dr. Jay Biem, General Internist, Royal University Hospital, Saskatoon, Sask.
 Dr. Moira Kapral, General Internist, University Health Network, Toronto, Ont.
 Dr. Yves Pesant, General Internist, Polyclinique Saint-Jerome, Saint-Jerome, Que.
 Dr. Ralph Dell'Aquila, Emergency Physician, North Bay General Hospital, North Bay, Ont.
 Dr. Devin Harris, Emergency Physician, St. Paul's Hospital, Vancouver, BC
 Dr. Adam Steacie, Family Practitioner, Brockville, Ont.
 Ms. Chris O'Callaghan, Regional Stroke Coordinator, London Health Sciences Centre, London, Ont.
 Ms. Theresa Green, Stroke Program Manager, Foothills Medical Centre Stroke Clinic, Calgary, Alta.
 Ms. Alexis Dishaw, Program Consultant, Ontario Stroke Strategy, Ontario Ministry of Health and Long-term Care

Observers*

Dr. Kevin Willis, Director of Partnerships, Canadian Stroke Network, Ottawa, Ont.
 Mrs. Janice Richards, Research Coordinator, Registry of the Canadian Stroke Network, Institute for Clinical Evaluative Sciences, Toronto, Ont.

*The observers participated in the discussion but did not vote on the indicators.