

Implementation of the Canadian Neurological Scale on an Acute Care Neuroscience Unit: A Program Evaluation

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Abstract: The Canadian Neurological Scale (CNS), a validated stroke assessment tool, was implemented for the neurological assessment of patients with stroke. The purpose of this study was to explore nurses' values and perceptions of best-practice guidelines (BPGs) and the CNS assessment, to evaluate the effect of a workshop and implementation process on nurses' self-efficacy for CNS use, to determine whether the workshop and implementation process met the needs of the nurses, and to evaluate the accuracy and appropriateness of CNS assessment documentation. Nurses reported moderate-to-strong awareness and use of BPGs and expressed the belief that BPGs were valuable; however, they had some difficulty accessing BPGs. At 3 months after the workshop, nurses reported using the CNS assessment in practice but said that it was not easy to use and that it was not useful as a patient status communication tool or for documenting neurological changes. Nurses were moderately confident while performing the CNS assessment before the workshop. Confidence increased immediately afterward ($p < .0001$), and then decreased slightly at 3 months. The majority of nurses said the workshop met their learning needs. A chart audit demonstrated that only 69% of patients appropriate for the CNS assessment were assessed with this tool. Although nurses are aware of BPGs, translating these changes into practice takes time and may require BPG modification to best fit the needs of the areas in which they will be used. When choosing a validated stroke assessment tool, clinicians must consider how often the tool will be used for assessments, particularly in the acute phase.

The Canadian Stroke Strategy (Heart and Stroke Foundation of Ontario, 2003) and the Registered Nurses Association of Ontario (2005b) have published best-practice guidelines (BPGs) for stroke assessment and care. Both guidelines recommend that neurological assessment of patients with stroke include the use of a validated tool for stroke. A recent survey of 9 regional stroke centers in Ontario found that only 67% of centers were using a validated stroke assessment tool and that 66% of centers had recently implemented the use of a validated stroke scale to facilitate neurological nursing assessment (Gocan & Fisher, 2005).

The interdisciplinary stroke team at University Hospital in London, Ontario, Canada, held a retreat in Spring 2005. Participants included staff nurses, allied health personnel, nurse practitioners, nurse educators, stroke neurologists, and administrators. BPGs for stroke care were highlighted at this meeting, and a committee was formed to implement the use of a validated tool for neurological assessment of stroke patients as the standard of care. The Registered Nurses Association of Ontario *Toolkit*

(2002) and *Educator's Resource* (2005a) helped to guide the implementation. The committee considered the Canadian Neurological Scale (CNS; Côté et al., 1989; Fig 1), a validated stroke assessment tool, to be the most applicable for frequent bedside nursing assessment. This choice was verified by feedback elicited from staff nurses who considered the CNS assessment easier and faster to use than the National Institutes of Health Stroke Scale (NIHSS), which has more components to the assessment. A workshop was developed to educate

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Fig 1. The Canadian Neurological Scale (CNS)

			Date			
			Time			
Mentation	Level of Consciousness	Alert	3			
		Drowsy	1.5			
	Orientation	Oriented	1			
		Disoriented or Nonapplicable	0			
	Speech	Normal	1			
		Expressive Aphasia	0.5			
Receptive Aphasia		0				
Section A1	No Comprehensive Deficit	Motor Functions:				
		Weakness:				
		Face:	None	0.5		
			Present	0		
		Arm: Proximal	None	1.5		
			Mild	1		
			Significant	0.5		
			Total	0		
		Arm: Distal	None	1.5		
			Mild	1		
			Significant	0.5		
			Total	0		
		Leg: Proximal	None	1.5		
			Mild	1		
			Significant	0.5		
			Total	0		
Leg: Distal	None	1.5				
	Mild	1				
	Significant	0.5				
	Total	0				
Section A2	Comprehensive Deficit	Face:	Symmetrical	0.5		
			Asymmetrical	0		
		Arms:	Equal	1.5		
			Unequal	0		
		Legs:	Equal	1.5		
			Unequal	0		
Total Score						

staff; the CNS was implemented on the acute-care neuroscience unit at University Hospital in June 2006 to assess alert or drowsy patients admitted with ischemic stroke, intracerebral hemorrhage, and subarachnoid hemorrhage. Patients whose level of consciousness was less-than-drowsy were assessed using the Glasgow Coma Scale (GCS). The initial purpose of this project was to evaluate the effectiveness of the workshop and the subsequent accuracy of CNS documentation. During the development of the workshop, the purpose expanded to include the assessment of nurses' perceptions of BPGs and their confidence in performing the CNS assessment.

Review of the Literature

The CNS was designed as a simple clinical tool to evaluate the neurological status of acute-stroke patients (Côté, Hachinski, Shurvell, Norris, & Wolfson, 1986). The tool was further tested and found to be valid and reliable and a predictor of outcome (Côté et al., 1989); however, this study included few patients with a comprehensive language deficit, which limited the analysis of this assessment component. Further studies have found the CNS to be a useful retrospective assessment of stroke severity (Bushnell, Johnston, & Goldstein, 2001). No studies were found that prospectively

examined the CNS assessment as a continuous monitoring tool (e.g., to evaluate its ability to detect clinically significant changes in patients requiring assessments multiple times daily).

Gocan and Fisher (2005) conducted a survey of the 9 regional stroke centers in Ontario and interviewed one clinical nursing expert at each stroke center to discuss several aspects of stroke care. Participants who had been involved with implementing a stroke assessment tool at their center were asked to describe their implementation strategies and related challenges. The primary challenges identified were the consistency of the assessment and accommodating hospital staff who already were overwhelmed with their work demands. Although this study identified the strategies used to implement the stroke tool (including staff involvement with decision making, integrating the tool into daily practice and documentation, and educational workshops), it did not evaluate these strategies, nor did it address bedside nurses' perceptions of implementing this BPG.

Richardson, Murray, House, and Lowenkopf (2006) published a presurvey and a postsurvey to evaluate the implementation of the NIHSS on a stroke unit. The NIHSS was performed on admission and every 8 hours afterward on all stroke patients. The implementation plan included NIHSS instruction via in-services and videotapes during mandatory education days, distribution of NIHSS resource booklets and pocket cards at every bedside, encouragement to obtain NIHSS certification, and daily patient rounds with review of NIHSS scores. Forty-six nurses completed surveys before implementation, and 34 nurses completed surveys 9 months after implementation. Nurses were required to complete the surveys at mandatory meetings; they were encouraged, but not required, to write their names on the surveys. The percentage of nurses who reported feeling more comfortable performing the NIHSS increased from 30% preimplementation to 85% postimplementation. The percentage of nurses who said the tool was concise, comprehensive, and helpful in communicating a patient's neurological status to others also increased after implementation. The percentage of nurses who reported that they did not know how to use the NIHSS dropped from 50% preimplementation to 9% postimplementation; however, reports that the NIHSS took too much time to use remained similar before and after implementation, at 24% and 21%, respectively. Use of the NIHSS by nurses increased from 12% preimplementation to 69% postimplementation.

Bandura's Self-Efficacy Theory (1997) was used to guide this evaluation because self-efficacy (perceived confidence) has been shown to be an accurate predictor of future behavior. Self-efficacy expectations are developed from four principal sources: performance

attainment, vicarious experience, physiological state, and verbal persuasion. Bandura (1997) hypothesized that self-efficacy plays an important mediating role between knowledge and behavior. More recently, self-efficacy has been useful in evaluating educational programs for nurses (DiIorio & Price, 2001; O'Farrell, Ford-Gilboe, & Wong, 2000). Ngo and Murphy (2005) studied the effect of an educational program to manage patients with a peripherally inserted central catheter (PICC). After implementing the program, nurses' mean ranking for self-efficacy increased by 34% ($p < .0001$), and the number of PICC occlusions decreased from 44 to 12 ($p = .000$).

Purpose

The CNS workshop was created for several purposes, the first of which was to explore nurses' values and perceptions of BPGs and the CNS assessment and to evaluate the effect of the workshop and implementation process on nurses' self-efficacy while using the CNS assessment. The second purpose was to determine whether the workshop and implementation process met nurses' needs and to evaluate the accuracy and appropriateness of CNS assessment documentation.

Method

Questionnaires administered before, immediately after, and 3 months after the workshop were used to examine the effect of a CNS assessment workshop on nurses' values and perceptions of BPGs and the CNS assessment, and their confidence in performing the assessment. The questionnaire given immediately after the workshop also sought participants' perceptions of the content and format of the workshop. Following implementation, a patient chart audit was performed to evaluate the appropriateness and accuracy of documentation of the bedside CNS tool.

All statistical analyses were performed using Statistical Analysis Software v. 9.1 (SAS Institute Inc., Cary, NC). Demographic characteristics of the participants were analyzed by descriptive methods. The impact of the intervention was assessed by comparing the before- and after-training outcomes using the *t* test. All statistical tests were two-tailed and performed at the .05 level of significance.

The Canadian Neurological Scale Workshop

A committee comprising neuroscience frontline staff nurses, an acute care neurology nurse practitioner, a neuroscience nurse educator, and a neurology nurse coordinator was formed to implement the CNS assessment on the acute-care neuroscience unit. The committee developed a 3-hour workshop for all staff nurses working on the acute-care neuroscience unit at University Hospital. The workshop consisted of a

presentation of the CNS assessment, a video demonstration of a CNS assessment of 3 patients with stroke, and a laboratory session. In the laboratory, the nurses role-played, performed, and documented the CNS assessment using four case studies. The mandatory workshop was offered four times within a 2-week period just before implementing the CNS assessment on the neuroscience unit.

Sample and Setting

University Hospital, London Health Sciences Centre, is a 284-bed hospital that serves as the regional stroke center for the Southwestern Ontario region (population 1.6 million), providing care to 450 stroke patients annually. The 55-bed acute-care neuroscience unit includes a 6-bed neuro-observation unit and a 5-bed stroke unit. Patients with stroke are cared for in all areas of the 55-bed unit. At the time of the June 2006 workshop, 76 staff registered nurses (61 full-time and regular part-time and 15 casual part-time) worked on the unit; 67 attended the workshop and were invited to participate in the evaluation.

Sixty-six nurses completed or partially completed questionnaires before and immediately after the workshop. At 3 months postimplementation, 24 nurses returned completed or partially completed questionnaires. The mean age of the participants was 36 years ($CI = 11.65$). Their educational backgrounds included diploma (74%), baccalaureate degree (23%), and master's degree (3%). Six percent of the nurses held the Canadian Nurses Association Certification in Neuroscience Nursing, and 5% had completed a postgraduate neuroscience program. The nurses had a mean of 13 years' nursing experience ($SD = 11.74$), with 10 of those years in the neurosciences ($SD = 9.43$). The distribution of full-time, part-time, and casual employment was 60%, 20%, and 20%, respectively. The majority of nurses (63%) reported working more than 50% of the time on the general neuroscience unit, while the remainder usually worked in the neuro-observation or stroke unit. Previous involvement with a best-practice committee was reported by 14% of participants. The demographics of the 24 nurses who returned questionnaires at 3 months were similar to those of the baseline group.

A patient chart audit was performed at 2 weeks, 1 month, and 3 months after implementation of the CNS assessment on 17, 12, and 15 patients, respectively. The charts audited were those of a convenience sample of patients on the acute-care neuroscience unit who had a diagnosis of ischemic stroke (70%), intracerebral hemorrhage (18%), or subarachnoid hemorrhage (12%) and were in hospital on a given day. Forty-four patient charts were audited; the mean age of the subjects was 69 years

(range 31–90), and 45% were men. Patient consent was not obtained because the CNS assessment was implemented as a practice change on the neuroscience unit.

Procedure

Nurses were given an information letter and invited to complete 2–3 brief questionnaires immediately before and after the workshop. Each set of questionnaires required 10 minutes to complete. These same nurses also received questionnaires in the mail 3 months after the workshop. The questionnaires were designed to elicit information on participants' demographics, learning experience and evaluation of the workshop, values and perception of BPGs and the CNS assessment, and confidence in performing the CNS assessment. The questionnaires were coded, and a master list was kept in a locked area in the researcher's office. All questionnaires were returned and secured in a locked area off-site. Return of a completed questionnaire constituted consent. The study protocol was approved by the Health Sciences Research Ethics Board at the University of Western Ontario.

Instruments

The Perception of Best Practice and Neurological Assessment Tool is a 6-item questionnaire developed by the investigator to explore nurses' awareness of best practices, perception of accessibility and use of BPGs, and beliefs about the value of BPGs in providing care to neuroscience patients. Five items were added to the instrument at the final 3-month questionnaire to obtain information on nurses' perceptions of using the CNS assessment in practice, including ease of use, usefulness as a communication tool, and ability to identify neurological changes in patients with ischemic stroke, intracerebral hemorrhage, and subarachnoid hemorrhage. For each item, participants were asked to indicate their level of agreement with a statement on a 5-point Likert scale ranging from *strongly disagree* (1) to *strongly agree* (5).

The Self-Evaluation of Performance of Canadian Neurological Scale Assessment Questionnaire was developed by the investigator to measure nurses' confidence in performing the CNS assessment. The instrument consists of 1 item for overall performance of the assessment and 17 items that measure focused components of neurological assessment skills listed as level of consciousness, orientation, speech, motor function in a patient with no comprehensive deficit, motor function in a patient with a comprehensive deficit, and motor function in an uncooperative patient. For each of the 18 items listed, participants were asked to rate their confidence in performance

on a 5-point Likert-type scale ranging from *not confident at all* (1) to *very confident* (5).

An Evaluation of Workshop Tool was developed to elicit information about the following content and format of the workshop: the PowerPoint presentation, the use of demonstration, the patient video case studies, the opportunity to practice in the laboratory, and whether the workshop met overall learning needs. Participants were asked to indicate their degree of agreement with a series of statements on a 5-point Likert scale ranging from *strongly disagree* (1) to *strongly agree* (5).

The Learning Experience Tool, based on Bandura's Self-Efficacy Theory, consists of 5 items and is designed to elicit information about the value of different types of learning experiences including participating in the 3-hour workshop, watching the video, observing role models and peers, practicing with patients, and receiving feedback on performance. Respondents were asked to indicate how much each type of learning experience contributed to their confidence in their ability to perform the CNS assessment on a 5-point Likert-type scale ranging from *not helpful at all* (1) to *very helpful* (5).

The Patient Chart Audit Tool was designed to obtain information on patient demographics, the need for neurological assessment requiring a validated tool, the appropriateness of the patient for CNS assessment, and whether the CNS or the GCS was used. For patients who were assessed using the CNS, the accuracy of documentation and reporting of significant change also was collected.

Results

Perception of BPGs and the CNS Assessment

Before participating in the workshop, study nurses reported moderate-to-strong awareness of BPGs and the belief that BPGs were valuable. They expressed moderate-to-strong agreement with the statement that they use BPGs in practice and use or will use the CNS to assess stroke patients. However, participants reported only mild agreement with the statement that BPGs were easy to access. Immediately after the workshop, there was an increased awareness of BPGs and a significant increased awareness of BPGs for stroke. Similarly, perception of value and utility of BPGs, ease of access to BPGs, and utility of the CNS assessment significantly increased immediately after the workshop (Table 1).

After 3 months, there was a further increase in awareness of and perception of ease of access to BPGs. There was a decrease in perceived value and use of BPGs and CNS assessment between immediately after and 3 months after the workshop; however, this change was not statistically significant (Table 2).

Three months after the workshop, nurses reported moderately strong agreement that they use the CNS tool in practice (Table 2); however, they reported mild disagreement with statements that the CNS was easy to use, was a useful communication tool, and was useful in identifying changes in awake patients with stroke, intracerebral hemorrhage, or subarachnoid hemorrhage (Table 3). These same nurses reported moderately strong agreement with the statement that, because of a decrease in a

Table 1. Perception of Best-Practice Guidelines (BPGs) Before Workshop and Immediately After Workshop

	Before Workshop	Immediately After	Change in Perception	
	(<i>n</i> = 66) <i>M</i> (<i>SD</i>)	Workshop (<i>n</i> = 67) ^a <i>M</i> (<i>SD</i>)	from Before to Immediately After Workshop (<i>n</i> = 66) <i>M</i> (95% CI)	<i>p</i> Value
Perception of BPGs				
Is aware of BPGs	4.27 (0.81)	4.42 (0.84)	0.14 (-0.83–0.36)	.21
Is aware of BPGs for stroke	3.94 (0.96)	4.25 (0.94)	0.30 (0.05–0.56)	.02
Finds BPGs easy to access	3.23 (1.00)	3.82 (0.94)	0.58 (0.35–0.80)	<.0001
Finds BPGs valuable in providing care for neuroscience patients	4.20 (0.77)	4.40 (0.82)	0.20 (-0.002–0.40)	.05
Uses BPGs in practice	3.86 (0.86)	4.14 (0.76)	0.26 (0.04–0.48)	.02
Uses or will use the Canadian Neurological Scale to assess patients with stroke	4.35 (0.75)	4.63 (0.79)	0.27 (0.07–0.47)	.01

Note. Participants indicated their level of agreement with these statements on a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). CI = confidence interval.

^a One participant completed only the postworkshop questionnaire, therefore the number of participants is not the same for all three time periods.

Table 2. Perception of Best-Practice Guidelines (BPGs) Immediately After and 3 Months After Workshop

Perception of BPGs	Immediately After Workshop	3 Months After Workshop	Change in Perception from Immediately After to 3 Months After Workshop	
	(<i>n</i> = 23) <i>M</i> (<i>SD</i>)	(<i>n</i> = 23) <i>M</i> (<i>SD</i>)	<i>M</i> (95% CI)	<i>p</i> Value
Is aware of BPGs	4.43 (0.90)	4.78 (0.42)	0.34 (-0.01–0.71)	.06
Is aware of BPGs for stroke	4.39 (0.84)	4.70 (0.63)	0.30 (-0.03–0.64)	.07
Finds BPGs easy to access	3.52 (0.95)	3.86 (0.94)	0.27 (-0.09–0.64)	.14
Finds BPGs valuable in providing care for neuroscience patients	4.22 (1.00)	3.91 (0.73)	-0.30 (-0.73–0.11)	.15
Uses BPGs in practice	4.00 (0.80)	3.87 (1.06)	-0.13 (-0.64–0.38)	.60
Uses or will use the Canadian Neurological Scale to assess patients with stroke	4.57 (0.84)	4.43 (0.73)	-0.13 (-0.57–0.31)	.54

Note. Participants indicated their level of agreement with these statements on a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). CI = confidence interval.

Table 3. Perception of the Canadian Neurological Scale (CNS) Assessment Tool in Practice at 3 Months Postimplementation

Statement	3 Months Postimplementation of the CNS Assessment on the Neuroscience Unit (<i>n</i> = 24) <i>M</i> (<i>SD</i>)
I find the CNS easy to use.	2.92 (1.28)
I find the CNS useful to communicate the status of patients with stroke to other team members (e.g., other nurses, medical doctors).	2.63 (1.24)
I find the CNS useful in identifying changes in awake patients with ischemic stroke or intracerebral hemorrhage.	2.75 (1.29)
I find the CNS useful in identifying changes in awake patients with subarachnoid hemorrhage.	2.5 (1.18)
I find I have to switch between the CNS and the Glasgow Coma Scale when assessing patients with subarachnoid hemorrhage because their level of consciousness changes.	4.0 (0.88)

Note. Participants indicated their level of agreement with these statements on a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*).

patient's level of consciousness, they were required to switch from the CNS to the GCS when assessing patients with subarachnoid hemorrhage.

Confidence in Performing the Canadian Neurological Scale Assessment

Before the workshop, nurses' overall confidence in performing the CNS assessment was moderate ($M = 3.36$). Nurses were least confident when testing motor function in an uncooperative patient ($M = 3.92$) and most confident when testing orientation ($M = 4.79$). Immediately after the workshop, overall confidence in performing the CNS assessment was high ($M = 4.38$). There remained some variation in confidence in

performing components of the assessment (Table 4). At 3 months after the workshop, overall confidence in performing the CNS assessment was moderately high ($M = 4.14$; Table 5).

There was a significant increase in confidence in overall performance of the CNS assessment from before to immediately after the workshop ($p < .0001$; Table 4). There was also a significant increase in confidence in performing components of the assessment related to aphasia ($p = .0001$), motor function in patients with no comprehensive deficit ($p < .0001$), motor function in patients with a comprehensive deficit ($p < .0001$), and motor function in uncooperative patients ($p < .0001$). Confidence in assessing

Table 4. Confidence in Performing the Canadian Neurological Scale (CNS) Assessment Before and Immediately After Workshop

Components of the CNS Assessment	Before Workshop (<i>n</i> = 64)	Immediately After Workshop (<i>n</i> = 65) ^a	Change in Confidence from Before to Immediately After Workshop (<i>n</i> = 63) ^b	
	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)	<i>M</i> (95% CI)	<i>p</i> Value
Level of consciousness	4.70 (0.68)	4.72 (0.53)	0.05 (-0.06–0.16)	.37
Orientation	4.79 (0.63)	4.76 (0.52)	0.00 (-0.12–0.12)	1
Aphasia	4.10 (1.01)	4.59 (0.65)	0.48 (0.25–0.72)	.0001
Motor function (patient with no comprehensive deficit)	4.18 (0.91)	4.68 (0.54)	0.51 (0.32–0.71)	<.0001
Motor function (patient with comprehensive deficit)	3.99 (1.04)	4.64 (0.56)	0.66 (0.40–0.92)	<.0001
Motor function (uncooperative patient)	3.92 (0.90)	4.58 (0.61)	0.71 (0.48–0.94)	<.0001
Overall performance of CNS assessment ^c	3.36 (1.45) (<i>n</i> = 47)	4.38 (0.66) (<i>n</i> = 61)	1.14 (0.70–1.57) (<i>n</i> = 44)	<.0001

Note. Participants indicated their level of agreement with these statements on a 5-point Likert-type scale ranging from 1 (*not confident at all*) to 5 (*very confident*). CI = confidence interval.

^a One participant completed only the postworkshop questionnaire, therefore the number of participants is not the same as for “Before Workshop” data.

^b One participant’s preworkshop questionnaire was incomplete.

^c Not all participants completed the pre- and postworkshop questionnaires.

Table 5. Confidence in Performing Canadian Neurological Scale (CNS) Assessment Immediately After and 3 Months After Workshop

Components of the CNS Assessment	Immediately After Workshop (<i>n</i> = 23)	3 Months After Workshop (<i>n</i> = 23)	Change in Confidence from Immediately After to 3 Months After Workshop (<i>n</i> = 23)	
	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)	<i>M</i> (95% CI)	<i>p</i> Value
Level of consciousness	4.87 (0.34)	4.83 (0.39)	-0.04 (-0.20–0.12)	.57
Orientation	4.87 (0.34)	4.91 (0.29)	0.04 (-0.12–0.20)	.57
Aphasia	4.80 (0.39)	4.37 (1.07)	-0.44 (-0.83– -0.04)	.03
Motor function (patient with no comprehensive deficit)	4.85 (0.34)	4.59 (0.67)	-0.26 (-0.52– -0.02)	.05
Motor function (patient with comprehensive deficit)	4.80 (0.44)	4.41 (0.92)	-0.38 (-0.72– -0.04)	.03
Motor function (uncooperative patient)	4.73 (0.46)	4.36 (0.85)	-0.38 (-0.77–0.01)	.053
Overall performance of CNS assessment ^a	4.60 (0.59) (<i>n</i> = 20)	4.14 (0.96) (<i>n</i> = 21)	-0.47 (-0.99–0.04) (<i>n</i> = 19)	.07

Note. Participants indicated their level of agreement with these statements on a 5-point Likert-type scale ranging from 1 (*not confident at all*) to 5 (*very confident*). CI = confidence interval.

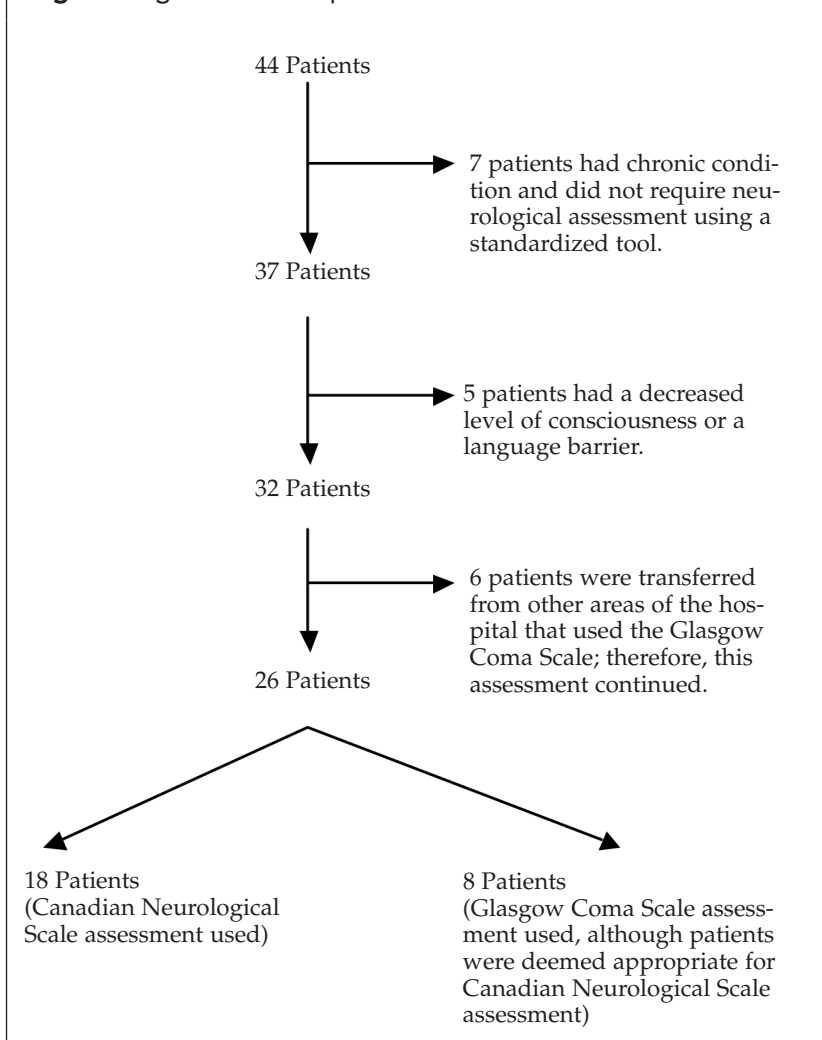
^a Not all participants completed the pre- and postworkshop questionnaires.

level of consciousness and orientation remained high with no significant change.

There was a slight decrease in confidence in overall performance of the CNS assessment from immediately after to 3 months after the workshop ($p = .07$; Table 5). There was a decrease in confidence in performing components of the assessment related

to aphasia ($p = .03$), motor function in patients with no comprehensive deficit ($p = .05$), motor function in patients with a comprehensive deficit ($p = .03$), and motor function in uncooperative patients ($p = .053$). Confidence in assessing level of consciousness and orientation remained high with no significant change.

Fig 2. Diagrammatic Representation of a Patient Chart Audit



Evaluation of the CNS Workshop and Learning Experience

Overall, 94% of participants agreed or strongly agreed that the workshop met their learning needs. More than 93% of participants agreed or strongly agreed that the content of the presentation, the use of demonstration during the presentation, and the case studies presented on the video were helpful. And 99% agreed or strongly agreed that the opportunity to practice in the laboratory setting with feedback was helpful.

Three months after the workshop and implementation of the CNS assessment tool, 88% of nurses reported that the workshop had been helpful or very helpful in contributing to their confidence in performing the CNS assessment. Other learning experiences rated as helpful or very helpful during these 3 months included using the CNS assessment with patients (79%), watching a video/DVD of the CNS assessment (77%), observing role models and peers using the CNS assessment (71%), and receiving feedback on performing the CNS assessment (64%).

Chart Audit

Forty-four charts were audited (Fig 2). Twenty-six patients were appropriate for CNS assessment; in 18 cases (69%) the CNS was used, and in 8 cases (31%) the GCS was used.

Of those cases in which the CNS tool was used, documentation was fully accurate in 6 cases (33%). In the remaining 12 cases, the following was observed: the side of weakness was not identified each time the assessment was done although it always was identified at the first assessment ($n = 7$); the total score was calculated correctly but recorded in the wrong area ($n = 6$); dysarthric speech was not identified as slurred ($n = 2$); and motor testing for a patient with a comprehensive deficit was documented in an incorrect area ($n = 1$). There were 2 instances in which errors in documentation were potentially clinically important. Although there was a decrease of more than 1 point on the CNS scale in 6 patients, chart documentation of physician notification was present for only 2 of these patients. This may reflect an error in failing to communicate with the medical team, a lack of documentation of communication, or a perception by the nurse performing the assessment that the change was not significant.

Discussion

A limitation of this study was the low response rate at 3 months. The strengths of this study were that the choice regarding which validated stroke scale to use was nurse-initiated and the study included voluntary participation.

The majority of nurses are aware of BPGs; the workshop significantly increased nurses' awareness of BPGs for stroke, and it increased awareness of BPGs in general. This awareness was greater again at 3 months. Although perception of access to BPGs was moderate, the perception did increase over time. The majority of nurses reported that BPGs were valuable in providing care for neuroscience patients, although they were used less and valued less at 3 months after the workshop. Awareness of BPGs does not necessarily reflect a perception of value or of accessibility or actual use. A belief that a practice change is valuable is necessary to sustain change over time. Translating BPGs into bedside practice may require more effort directed at changing and maintaining nurses' perceptions of their value and accessibility and increasing their actual use.

Nurses strongly agreed that they used or would use the CNS assessment immediately after and 3 months after the workshop, although use was slightly less frequent at 3 months after the workshop. Although this finding was not significant, it requires further comment. Nurses may perceive the CNS assessment on its own as an incomplete assessment of a patient's neurological status. The CNS assessment scores only

the weaker side, and in patients with a comprehensive deficit it identifies only an asymmetry. Details of the degree of weakness or bilateral weakness are not captured; consequently, nurses must document their neurological assessment in another manner. Stroke assessment tools do not replace neurological assessments; they should be used in conjunction with them. Nurses also said the CNS was not a tool they found useful for communicating the status of patients with stroke to other team members. Physicians at this study center are more familiar with the GCS or the NIHSS scoring system, and reports of changes in the CNS score may have been more difficult to interpret.

The CNS was implemented not only for patients with ischemic stroke and intracerebral hemorrhage but also for those with subarachnoid hemorrhage to determine whether the tool provided a more useful assessment of neurological function. Nurses reported that, in the case of a patient with subarachnoid hemorrhage, they often switched between the CNS and the GCS because the patients' level of consciousness changed. There were 5 patients with subarachnoid hemorrhage in the chart review, and, although they were deemed appropriate for CNS assessment, the GCS was used in all instances. Verbal feedback from nurses during the implementation identified that, although these patients could be awake or drowsy, they often fluctuated in their ability to participate in the entire CNS assessment, particularly with hourly assessments. This is consistent with the findings reported by Doerksen, Naimark, and Tate (2002) and Doerksen, Naimark, and Tate (2004), in which the NIHSS was implemented with patients with subarachnoid hemorrhage.

In general, nurses were confident in performing the CNS assessment. When the components of the scale were subdivided, nurses were very confident in assessing level of consciousness and orientation. They also were confident in assessing aphasia and motor function, but there was more variation in confidence assessing these components over time. At 3 months after the workshop, although the nurses were confident in performing the CNS assessment and they used the CNS in practice, they mildly disagreed with the statement that the CNS was easy to use. This may indicate that it could take more than 3 months to assimilate a change in practice. Informal feedback included the comment that patients often tired of the same frequent physical assessments and questions and that solely identifying motor asymmetry for patients with receptive aphasia constituted an incomplete assessment. There was a significant decrease in the number of respondents at 3 months (34% response rate), and this group may reflect the opinions of nurses who had more difficulty using the tool. Richardson, Murray, House, and Lowenkopf

(2006) reported that nurses were more comfortable using the NIHSS after an education and implementation program; however, they did not explore whether the nurses found the tool easy to use. In this same study, the percentage of nurses who reported that the NIHSS took too much time remained similar before and after implementation (24% and 21%, respectively). The study conducted by Richardson and colleagues (2006) involved fewer nurses, participation was mandatory, the study was not blinded, and ethics approval was not reported.

The education phase should include an opportunity for nurses to practice the assessment and receive feedback so they can gain confidence in using the tool.

BPGs for stroke recommend the use of a validated stroke assessment tool, yet there are no clear recommendations or evidence to guide the frequency of using these tools. Hourly neurological assessments are common in the acute-stroke period, and the CNS or NIHSS may take too much time for bedside nurses to use frequently. Although an assessment using a validated stroke tool represents best practice, it is not necessarily relevant practice at all times. It may be more reasonable to use a stroke assessment tool upon admission and then every 4–12 hours or when nurses detect a change during a standard neurological assessment.

Nurses rated the CNS workshop as very helpful, especially the laboratory practice and feedback segments. At 3 months, the majority of nurses considered the workshop to be the most helpful learning experience that contributed to their confidence. This is consistent with Bandura's Self Efficacy Theory, which identifies the opportunity to practice with feedback as the strongest contributor to confidence. Centers that wish to implement a new stroke assessment tool should consider offering a workshop that includes the opportunity to practice as part of the implementation. Educators often rely on video and didactic presentations of stroke assessment scales, but these do not allow for valuable interaction that can be experienced only when performing the CNS assessment with opportunities for feedback.

Recommendations

Nurse awareness of BPGs is high; however, nurses are less likely to find BPGs accessible or easy to translate into practice. The use of BPGs in practice was less frequent at 3 months. It is important to consider several factors when implementing a validated stroke assessment scale as identified in BPGs

for stroke care. The education phase should include an opportunity for nurses to practice the assessment and receive feedback so they can gain confidence in using the tool. The educational approach used in this study was identified by the nurses as helpful and resulted in increased confidence in performing the CNS assessment that was sustained over time.

The implementation phase should include the opportunity for reinforcement of education and feedback on issues encountered with using the tool in nursing practice. Using feedback from nurses, we are in the process of revising the bedside documentation record, reviewing the need for hourly use of the CNS tool in the acute stroke phase, and developing “neurological assessment nursing rounds” to be conducted every 2–4 weeks to provide immediate feedback on assessments. The nursing round is of particular significance to address staff turnover and the subsequent educational needs.

Any neurological assessment tool has limitations. The advantages of the CNS assessment are that it can be performed in less than 5 minutes, and it assesses language and facial and proximal- and distal-limb motor strength. But the CNS scores only the motor strength of the weakest limb, and for patients with a comprehensive deficit, it scores only an asymmetry in limb strength. When assessing motor strength, nurses involved with this study did not consider the CNS assessment suited to a subgroup of stroke patients with comprehensive deficit. To address the limitations identified by nurses in this study, our center is in the process of revising the bedside documentation record to include not only the CNS but also an additional section in which to document bilateral upper- and lower-extremity power. Nurses use the bedside record to document their neurological assessment and communicate with their colleagues; consequently, it should reflect a more thorough examination, particularly for patients with a comprehensive deficit. Perhaps BPGs should be viewed as templates that require adjustment and refinement so they can work in specific settings.

When choosing which stroke scale to implement in acute care, the committee elicited feedback from staff nurses, the majority of whom considered the CNS assessment faster and easier to use than the NIHSS. This was of particular importance to the staff, given that hourly neurological assessments are common in work with acute neurological patients. Yet nurses still said that the CNS was not easy to use in practice. Although both the CNS and the NIHSS are validated stroke assessment tools to use at a specific time, they have not been validated in a prospective manner as monitoring tools. Future studies should address the validity and reliability of

these stroke assessment tools for capturing change in patients when used on a frequent basis.

Conclusion

Although nurses are aware of BPGs, a belief in their value is necessary to translate into changes in practice, and these changes take time. Implementation of any new stroke assessment scale should include the opportunity to practice the skill with feedback and requires an evaluation component so that adjustments can be made to best meet the needs of users.

Acknowledgments

The authors would like to thank the Registered Nurses Association of Ontario for providing a grant for the data entry and analysis and the Southwestern Ontario Stroke Network for funding the workshop. We would also like to acknowledge all of the staff nurses who participated in the evaluation, as well as the following committee members who developed the workshop and implementation process: Bronia McDougal, Cathy O'Brien, Kim Salway, and Kim Staikos.

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