Implementation of a Stroke Competency Program to Improve Nurses' Knowledge of and Adherence to Stroke Guidelines

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Staci Sue Reynolds, Laura L. Murray, Susan M. McLennon, Tamilyn Bakas

ABSTRACT

Background: Nurses play an integral part in providing evidence-based care to patients with stroke, yet some patients receive unnecessary or even harmful care. The literature supports the use of multifaceted strategies to promote implementation of evidence-based practice; however, there is a gap in knowing which combinations of strategies are most successful. **Purpose:** The purpose of this study was to determine if a tailored, multifaceted Stroke Competency Program would improve nurses' knowledge of and adherence to evidence-based practices in the care of patients with stroke. This program bundled implementation strategies of local opinion leaders, printed educational materials, and educational outreach. **Methods:** This study used a pretest/posttest program design. Nursing adherence was measured via documentation audits with knowledge measured by an author-developed assessment. **Findings:** Most participating nurses had approximately 10 years of nursing experience and were baccalaureate prepared; participation ranged from 32% to 58% (*n* = 88). Overall, an improvement in nursing adherence was noted after the program as well as significant improvements in nursing knowledge. **Conclusion:** Although the Stroke Competency Program improved nursing knowledge of and adherence to stroke guidelines, future research should seek to extend these findings to identify which bundle of strategies are most effective for implementing evidence into nursing practice using psychometrically sound outcome measures.

Keywords: adherence, implementation strategies, nurse, stroke

Background

Stroke continues to be a leading cause of serious long-term disability in the United States (Mozaffarian et al., 2015). Vulnerable patients with stroke require tailored evidence-based nursing interventions to decrease practice variations and reduce further harm (Jauch et al., 2013; Wuchner, Bakas, Adams, Buelow, & Cohn, 2012). The American Heart Association and American Association of Neuroscience Nurses provide several guidelines to standardize nursing care of the patient with stroke (Mozaffarian et al., 2015; Summers et al., 2009). Despite such guidelines, many patients do not receive evidence-based healthcare, and some receive unnecessary or harmful care (Jauch et al., 2013).

Successful implementation of stroke guidelines can improve patient outcomes (Hubbard et al., 2012). Wuchner (2014) completed an integrative review to evaluate strategies aimed at improving nursing compliance with implementing evidence-based guidelines. Findings indicated limited research in this area, underscoring the need for more information regarding translation of guidelines for stroke care.

Single strategies, such as traditional didactic education and passive dissemination, have been shown to be less effective in translating guidelines into practice, whereas the use of multiple strategies has shown positive results (Powell et al., 2015). However, it is difficult to assess which multiple strategies are most beneficial (Powell et al., 2015). According to Proctor, Powell, and McMillen (2013), this is because of variable methodological qualities and use of strategies that are "inconsistently labeled, poorly described, rarely justified theoretically, and lack operational definitions to guide their use" (p. 1).

Purpose

This study sought to identify a bundle of implementation strategies that would improve critical care nurses'

Questions or comments about this article may be directed to Staci Sue Reynolds, PhD RN ACNS-BC CCRN CNRN SCRN, at staci.reynolds1024@gmail.com. She is a Neuroscience CNS, Duke University Hospital, and a Clinical Associate, Duke University School of Nursing, Durham, NC.

Laura L. Murray, PhD, is Professor, Department of Speech and Hearing Sciences, Indiana University, Bloomington, IN.

Susan M. McLennon, PhD RN, is Assistant Chair and Associate Professor, Indiana University School of Nursing, Indianapolis, IN.

Tamilyn Bakas, PhD RN FAHA FAAN, is Professor and Jane E. Procter Endowed Chair, University of Cincinnati College of Nursing, Cincinnati, OH.

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knowledge of and adherence to evidence-based stroke practices. On the basis of a needs assessment via local nursing discussions, direct care nurses reported areas of opportunity for improving care of the patient with stroke. Per the direct care nurses, deficits were noted in knowledge of and adherence to completion of (a) the National Institute of Health Stroke Scale (NIHSS) and detailed neurological and other assessments at specified frequencies, (b) patient and family stroke education, and (c) dysphagia screening. As such, we developed a tailored, multifaceted Stroke Competency Program aimed at addressing these deficiencies and examined if this program improved nurses' knowledge of and adherence to these recommendations (see Table 1; Jauch et al., 2013; Summers et al., 2009). Adherence was measured by electronic nursing documentation; knowledge was measured by an author-developed stroke knowledge assessment. Scores from the knowledge assessment were also correlated with nursing demographic factors, such as years of experience and certification. The exempt

> Nurses who held a certification scored significantly higher on the preprogram NIHSS/neurological and assessment scores.

study was approved by the university's institutional review board for the protection of human subjects.

Research Question

In neurocritical care nurses, does implementation of a Stroke Competency Program improve their knowledge of and adherence to stroke guideline recommendations?

Methods

A pretest/posttest design study was used to evaluate the effects of implementing the Stroke Competency Program, based on nursing knowledge and adherence.

TABLE 1. Description of Necessary Nursing Activities for the Care of the Patient With Stroke and the Education Directed Toward These Activities Within the Stroke Competency Program

Nursing Activities	Description	Education Within the Stroke Competency Program
NIHSS/neurological and other assessment frequencies	Detailed, serial neurological assessments completed to prevent reinjury of brain tissue (Summers et al., 2009)	Review of resource packet that included the NIHSS assessment and necessary documents/pictures that accompany the NIHSS
		Tips on how to complete the NIHSS on intubated, comatose, and aphasic patients
	Post-tPA assessments completed according to Activase Alteplase tPA recommendations (Genentech, 2013)	Review of where to document the NIHSS, neurovascular checks, neurological checks, and vital signs in the electronic medical record
	Other assessments warranted include vital signs and neurovascular checks	Review of the frequency of documentation of these assessments
Patient and family stroke education	Six educational components must be provided (The Joint Commission, 2008):	Review of where to locate printed educational materials to provide to patients/families with the required information
	Activation of emergency medical system	Review of where to document this education in the electronic medical record
	Follow-up after discharge	
	Medications prescribed at discharge	
	Risk factors for stroke	
	Warning signs and symptoms of stroke	
	Documentation of written education provided	
Dysphagia screening	Dysphagia screen must be completed before having any food, liquid, or medications by mouth (The Joint Commission, 2008)	Review of how and why a dysphagia screen must be completed before oral intake
		Review of where to document dysphagia screens in the electronic medical record

Note. NIHSS = National Institute of Health Stroke Scale.

Adherence was measured via documentation audits. An experienced data collector performed these audits per Meaningful Use requirements from the Centers for Medicare and Medicaid Services (CMS, 2010). All patients with stroke were included in these audits (i.e., ischemic, hemorrhagic, and subarachnoid hemorrhage), because all patients with stroke must be provided the same evidence-based care per CMS guidelines (CMS, 2010).

The stroke knowledge assessment was developed based on existing guideline recommendations (Summers et al., 2009) and checked for face validity by four content experts. The assessment consisted of 13 multiple-choice knowledge questions categorized into three subscales: (a) frequency of NIHSS/neurological and other assessments, (b) patient and family education, and (c) dysphagia screening. There were also five demographic questions and one question related to perceived barriers to implementing stroke guidelines. The nurses were asked to participate in the survey at three different time points: (a) before the start of the program (preprogram), (b) immediately after the program (postprogram), and (c) 3 weeks after the program (follow-up). This survey, provided through Survey Monkey, was anonymous and not linked to any identifiers. The survey link was sent via electronic mail; consent was implied once the Survey Monkey link was clicked. To promote participation in the stroke knowledge assessment, nurses were offered 1 hour of continuing stroke education for completion of all three assessments.

Implementation Steps

Implementation steps identified by Grol and Wensing (2013) provided overall guidance for this study (see Figure, available as Supplemental Digital Content 1 at http://links.lww.com/JNN/A70). Barriers to implementation of these activities were identified during discussions with the direct care nurses and included a lack of knowledge, motivation, time, and importance to the nurses as well as reports that the guidelines were difficult to understand, complex, and not easily accessible. Implementation strategies were tailored based on these perceived barriers and included the bundle of local opinion leaders, printed educational materials, and educational outreach (Powell et al., 2015).

Local Opinion Leaders

To start, an implementation team was formed consisting of the unit's clinical nurse specialist, clinical educator, stroke coordinator, and direct care nurses. These experienced direct care nurses served as local opinion leaders because they were experts in stroke and were noted by the staff and leadership to be informal leaders. When asked, direct care nurses stated that they went to these particular nurses often for questions regarding stroke care. Local opinion leaders involved in the implementation team were also certified in neuroscience nursing (CNRN). Through peer motivation, opinion leaders can influence others' attitudes and/or behaviors to improve their practice (Powell et al., 2015).

Printed Educational Materials

Previous printed educational materials were in a stroke resource binder and noted to be complex and not easily accessible. The implementation team therefore created new printed educational materials developed from guideline recommendations (Powell et al., 2015; Summers et al., 2009). These materials sought to decrease complexity by streamlining the information into one resource packet. To facilitate accessibility, these packets were placed in each patient's room.

Educational Outreach

The educational outreach process consisted of one-on-one, face-to-face educational sessions by members of the implementation team with each nurse employed on the neurocritical care unit. A script was created to ensure consistent messaging among implementation team members.

Findings
Primary Outcome: Adherence

Electronic nursing documentation was audited for 2 months before and after the program to measure adherence. Before the program, adherence to documentation of NIHSS/neurological and other assessments at the appropriate frequencies were 88.6% ($n = 960$); this improved to 90.5% ($n = 1855$) after the program. However, this was not a statistically significant improvement per a chi-square test of independence, $X^2(1, N = 2815) = 2.41$, $p = .12$. Patient and family education documentation adherence was measured by auditing documentation of the six necessary education components (see Table 1). Both preprogram and postprogram adherence were high (98% [$n = 40$] and 92% [$n = 48$], respectively) and did not significantly differ, $X^2(1, N = 88) = 1.44$, $p = .2301$. Dysphagia screening documentation improved from 71% ($n = 100$) preprogram to 75% ($n = 105$) postprogram; however, this difference was not statistically significant, $X^2(1, N = 205) = 0.49$, $p = .242$.

Secondary Outcome: Nursing Knowledge

Eighty-eight nurses were employed on the neurocritical care unit. Attrition occurred between the three stroke knowledge assessments: Response rates were 58% preprogram, 43% postprogram, and 33% at follow-up. On average, participating nurses had 10 years of nursing experience, with 7 years of experience as a neurocritical care nurse. There was relatively equal participation

between day- and night-shift nurses, with most holding a bachelor's degree. Most nurses did not hold a national certification. Of those who were certified, most held certifications in critical care (CCRN) and neuroscience (CNRN).

Stroke Knowledge Assessment Questions

A one-way analysis of variance (ANOVA) was conducted to determine differences among the groups of nurses that were assessed at preprogram, postprogram, and follow-up program time points. Because the assessments were anonymous in Survey Monkey, a repeated-measure ANOVA could not be used for longitudinal analysis. Instead, the analysis was conducted using each time point as an independent group (see Table 2), although many of the same nurses participated at multiple time points. There was a significant improvement in knowledge of the appropriate frequencies for the NIHSS/neurological and other assessment subscale scores, $F(2,115) = 10.78$, $p = .000$, and in the overall total assessment scores, $F(2, 111) = 10.457$, $p = .000$.

Pearson correlations were calculated to identify associations between subscale and total assessment scores and the participants' nursing experience (see Table, available as Supplemental Digital Content 2 at http://links.lww.com/JNN/A71). There were significant positive correlations between the follow-up knowledge of frequencies for NIHSS/neurological and other assessment subscale questions and months of experience, both as a nurse ($r = .407$, $n = 27$, $p = .035$) and as a neurocritical care nurse ($r = .481$, $n = 26$, $p = .013$); thus, nurses with more experience scored higher on this subscale. Similarly, there were significant positive correlations between the follow-up assessment total score and months of experience as a nurse ($r = .418$, $n = 27$, $p = .030$) and as a neurocritical care nurse ($r = .471$, $n = 26$, $p = .015$), indicating that

nurses with more experience scored higher on the follow-up assessment total score. Interestingly, correlations were only significant at follow-up.

A series of independent samples t tests were used to calculate differences in knowledge scores based on certification within each group of nurses that were assessed at pretest, posttest, and follow-up time points. Certification was collapsed into either having or not having certification. Nurses who held a certification scored significantly higher on both the preprogram NIHSS/neurological and other assessment frequencies subscale questions and the preprogram assessment total score (see Table, available as Supplemental Digital Content 3 at http://links.lww.com/JNN/A72).

Open-Ended Barriers Question

Nurses were asked to identify potential barriers to consistently providing stroke care based on guideline recommendations. In the initial preprogram assessment, 84% ($n = 51$) of the respondents reported a lack of knowledge of the required activities as a barrier; this percentage decreased to 65% ($n = 29$) during the follow-up assessment. In addition, complexity/difficulty in understanding the requirements was reported by 49% ($n = 51$) during the preprogram assessment, which decreased to 34% ($n = 29$) in the follow-up assessment. These differences were not significant based on chi-square tests of independence. Other barriers noted between all three assessments included lack of time (8%, $n = 9$), lack of motivation (26%, $n = 31$), and a perceived lack of importance (4%, $n = 5$).

Discussion
Implementation Strategies
The importance of using multifaceted implementation strategies that are tailored to perceived barriers has been cited in the literature (Grol & Wensing,

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TABLE 2. Comparison of Stroke Knowledge Assessment Scores at Each Time Point (Pre, Post, and Follow-Up)

Scale and Subscales	Preprogram Assessment Mean (*SD*)	Postprogram Assessment Mean (*SD*)	Follow-up Assessment Mean (*SD*)	*F*	*p*
NIHSS/neurological and other assessment frequency questions (possible range = 0–6)	4.00 (1.06)	5.18 (1.88)	5.11 (0.74)	$F(2,115) = 10.78$	.000*
Patient and family stroke education (possible range = 0–3)	2.86 (0.35)	2.95 (0.23)	2.93 (0.26)	$F(2,113) = 1.07$	.347
Dysphagia screening (possible range = 0–4)	3.96 (0.20)	4.0 (0.0)	4.0 (0.0)	$F(2,113) = 1.2389$	.254
Total score (possible range = 0–13)	10.85 (1.17)	12.11 (1.91)	12.04 (0.88)	$F(2,111) = 10.457$	.000*

Note. NIHSS = National Institute of Health Stroke Scale.
*$p < .001$.

2013). Grol and Wensing's (2013) implementation model was a useful guide for selection of strategies. Further exploration of educational theoretical models may enhance this type of work for future research. This study attempted to define which strategies could be bundled to improve nursing knowledge of and adherence to specific stroke care measures and utilized the strategies of local opinion leaders, printed educational materials, and educational outreach. Wuchner (2014) identified different pairings of these strategies in a previously published integrative review. Likewise, previous studies documented improvements in adherence to evidence-based practices with the use of local opinion leaders (e.g., Huis et al., 2013). Beeckman et al. (2013) and Murtaugh, Pezzin, McDonald, Feldman, and Peng (2005) used educational materials and outreach strategies and found improvements in nursing's adherence. Despite evidence supporting the adoption of the strategies used in the current study, there has been limited descriptions of how these strategies were operationalized, making it difficult for replication and comparison (Proctor et al., 2013; Wuchner, 2014).

Adherence Outcomes

The primary outcome for this study was adherence as measured by nursing documentation. Albeit documentation may not always adequately reflect nursing practice (Murtaugh et al., 2005), a component of our Stroke Competency Program sought to improve nursing documentation. That is, during the educational outreach sessions, nurses were asked to show appropriate documentation of these activities. Although an increase in adherence was observed post-program, this improvement was not statistically significant. This likely reflected, at least in part, relatively high preprogram adherence.

Wuchner's (2014) integrative review identified published studies in which nursing compliance of evidence-based practices was the primary outcome. Two of these studies evaluated compliance of various practices through nursing documentation audits, which yielded mixed results. Murtaugh et al. (2005) utilized educational materials and outreach and found a significant increase in compliance with evidence-based heart failure practices. In contrast, Cheater et al. (2006) utilized audit and feedback and educational outreach strategies to address compliance with appropriate urinary incontinence practices but found no statistically significant difference in the documentation audit data.

The variations noted among findings can likely be attributed to procedural differences across studies. For example, the current and prior studies varied in terms of which implementation strategies are bundled,

making it difficult to identify which strategies may or may not foster adherence. In addition, because of insufficient descriptions of strategies, it remains possible that conflicting adherence outcomes reflect differences in how strategies were operationalized. Finally, this study sought to implement a stroke-specific program, whereas prior studies have focused on other healthcare guidelines; this could have also contributed to the finding variations noted across investigations.

Knowledge Outcomes

A commonly noted barrier to implementing evidence-based practices is a lack of knowledge (Grol & Wensing, 2013), which was also identified by the nurses on the neurocritical care unit. To target this perceived barrier, the Stroke Competency Program included printed educational materials and educational outreach sessions to decrease the nurses' lack of knowledge and improve adherence to these necessary activities. Thus, a secondary outcome for this study was nursing knowledge measured by an author-developed stroke knowledge assessment.

A statistically significant improvement in nursing knowledge was noted for frequencies of the NIHSS/ neurological and other assessment subscale score as well as the total stroke knowledge assessment score. Although Wuchner's (2014) integrative review found several articles that also incorporated strategies to improve knowledge, only Sutherland-Fraser, McInnes, Maher, and Middleton (2012) included knowledge as an outcome; Sutherland-Fraser and colleagues observed significant improvements in knowledge of pressure ulcer assessment and prevention strategies after a program composed of educational meetings, educational materials, and reminder strategies.

In congruence with prior findings (Duffy et al., 2015), nurses in the current study with more experience had significantly higher scores on portions of the stroke knowledge assessment only at the follow-up time point. This may be because of attrition of less experienced nurses throughout the three assessments, which may have led to the significant correlations between more nursing experience and knowledge scores at follow-up. Nurses with more experience have had the opportunity to gain more knowledge through their years of practice (Duffy et al., 2015).

Likewise, nurses who held certifications scored significantly higher on components of the stroke knowledge assessment, however, only during the preprogram assessment. Not only has certification been shown to improve nurses' knowledge, but it also signifies that a nurse is up to date in his or her practice and enhances professional credibility (Duffy et al., 2015). Before the Stroke Competency Program, those who were certified may have been more knowledgeable

of the guidelines recommendations. After receiving education from the stroke Competency Program, those not certified may have gained knowledge, thereby leading to no significant correlations between certification status and scores on the post-program and follow-up program assessments.

Limitations

The Stroke Competency Program evoked improvements in nurses' knowledge of and adherence to evidence-based activities for patients with stroke. However, several limitations to this study exist. Because stroke is considered a priority among Meaningful Use requirements (CMS, 2010), other coinciding quality improvement initiatives throughout the neuroscience service line may have contributed to improved documentation adherence rates. For example, an initiative to relay real-time deficiencies whereby stroke quality coordinators contacted nurses to inform them of missing activity requirements was instituted near the beginning of this program. Overlapping initiatives may have thus contributed to increased adherence to stroke activities. In addition, documentation audits measuring adherence to these stroke activities occur throughout the whole hospital and not solely on the neurocritical care unit in which this initiative was implemented. Whereas most patients with stroke are cared for on the neurocritical care unit, any deficits in documentation noted could potentially be because of other units' nonadherence.

No statistically significant improvement in knowledge regarding patient and family education or dysphagia screening was found. This could have been attributed to a ceiling effect on the author-developed stroke knowledge assessment, which had limited psychometric testing. Indeed, post hoc item analyses conducted to assess item difficulty and discrimination suggest some issues with the stroke knowledge assessment (see Table, available as Supplemental Digital Content 4 at http://links.lww.com/JNN/A73). Internal consistency was calculated per the Kuder–Richardson formula and yielded a low Cronbach's alpha value (.30). This assessment measured three separate subscales; these subscales, although all focused on care of the patient with stroke, may have differed enough that the items were not interrelated, hence the low Cronbach's alpha. Because this assessment only included 13 items, this could have contributed to its low internal consistency. Whereas adding additional items in the future may be an option, the assessment was created to be brief and foster participation. This assessment was voluntary; thus, it remains possible that those taking the assessment may have been more knowledgeable on the subject and more motivated to take the examination.

Whereas an incentive (i.e., gaining on1 hour of stroke continuing education) was in place for the same nurses to complete the stroke knowledge assessment three times over the course of the study, there may have been variation among nurses who took the preprogram, postprogram, and follow-up assessments. As noted, the assessments taken via Survey Monkey were anonymous and could not be linked to nurses via identifiers. Because of this, a one-way ANOVA was completed, versus a repeated-measure ANOVA, which may have yielded different results. Therefore, although, as a group, improvements in knowledge were noted after the program, we cannot determine whether given individual nurses increased and maintained knowledge over time. Future studies should consider matching preprogram and postprogram data to each individual participant.

Implications

According to Grimshaw, Eccles, Lavis, Hill, and Squires (2012), there is substantial, albeit incomplete, evidence to "guide choice of knowledge translation activating targeting healthcare professionals and consumers" (p. 14). It is documented that traditional didactic education is not an effective strategy to translate guidelines into practice (Baker et al., 2010). Multifaceted techniques have been found to be beneficial; however, it is unknown which strategies are most effective, and research is warranted to identify the best bundle of strategies (Powell et al., 2015).

Furthermore, because of limitations unveiled during post hoc item analyses of the Stroke Knowledge Assessment, future nursing research should take place to provide higher-quality measures that have better evidence of reliability and validity. More rigorous testing of author-developed assessments is needed in clinical practice to measure implementation outcomes (Proctor et al., 2011). Without appropriate rigor, nurses may not be able to accurately determine if potential failure was because of strategies used or if the outcome assessment is simply not a quality measure.

This study added to the body of knowledge regarding which implementation strategies are most effective. By bundling the strategies of local opinion leader, printed educational materials, and educational outreach sessions, improvements in nursing knowledge and adherence to stroke guidelines were attained. Future studies should seek to replicate these strategies with similar guidelines to note whether the improvements found in this study are translatable.

Conclusion

Nurses are integral to the care of patients with stroke and should utilize evidence-based practices. Guidelines

must be successfully implemented into practice to ensure patients are receiving the best care. Tailored, multifaceted implementation strategies have been shown to be effective; however, only a limited literature has sought to identify which bundle of implementation strategies is most effective. Identified methodological issues need to be considered when conducting implementation research to enhance the reliability and validity of study outcomes. Improvements in nursing knowledge and adherence to the activities found in stroke care guidelines were noted in this study. These findings assist in closing the gap regarding which tailored, multifaceted strategies should be used. Future studies should seek to replicate these findings to assist in growing the body of knowledge regarding the most effective implementation strategies for use in nursing practice.

Acknowledgments

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