

## AHA SCIENTIFIC STATEMENT

# Care of the Patient With Acute Ischemic Stroke (Posthyperacute and Prehospital Discharge): Update to 2009 Comprehensive Nursing Care Scientific Statement

A Scientific Statement From the American Heart Association

*Endorsed by the American Association of Neuroscience Nurses*

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**ABSTRACT:** In 2009, the American Heart Association/American Stroke Association published a comprehensive scientific statement detailing the nursing care of the patient with an acute ischemic stroke through all phases of hospitalization. The purpose of this statement is to provide an update to the 2009 document by summarizing and incorporating current best practice evidence relevant to the provision of nursing and interprofessional care to patients with ischemic stroke and their families during the acute (posthyperacute phase) inpatient admission phase of recovery. Many of the nursing care elements are informed by nurse-led research to embed best practices in the provision and standard of care for patients with stroke. The writing group comprised members of the Stroke Nursing Committee of the Council on Cardiovascular and Stroke Nursing and the Stroke Council. A literature review was undertaken to examine the best practices in the care of the patient with acute ischemic stroke. The drafts were circulated and reviewed by all committee members. This statement provides a summary of best practices based on available evidence to guide nurses caring for adult patients with acute ischemic stroke in the hospital posthyperacute/intensive care unit. In many instances, however, knowledge gaps exist, demonstrating the need for continued nurse-led research on care of the patient with acute ischemic stroke.

**Key Words:** AHA Scientific Statements ■ inpatients ■ nursing ■ standard of care ■ stroke

Despite remarkable changes in the diagnosis and treatment of acute ischemic stroke, it remains a devastating disease with significant personal, family, and health system impacts. Because assessments, treatments, and care for acute stroke have changed over the past decade, the nursing and interprofessional care best practices require revisions and updates to inform best practice standards. The landmark article written by Summers et al<sup>1</sup> in 2009, highlighting the importance of excellence in nursing and interprofessional care in optimizing outcomes for patients with stroke, provided the foundation for this update.

Globally, there are 10.3 million new strokes (67% ischemic) annually with higher disability rates in lower- and middle-income countries.<sup>2</sup> Disparities between high- and low-income countries have increased the incidence and burden associated with the costs of care and disability after stroke.<sup>2,3</sup>

The World Stroke Organization and American Heart Association/American Stroke Association suggest that, when available, patients should be treated in a specialized inpatient stroke unit that is geographically defined, incorporates rehabilitation, and is staffed by an

interprofessional stroke team.<sup>4</sup> The World Stroke Organization Global Stroke Services Guidelines and Action Plan suggests that, when minimal health care services are available, patients admitted to a hospital with an acute stroke or transient ischemic attack should be treated by an interprofessional stroke team consisting of at least a physician with training in stroke care, a nurse, and a rehabilitation specialist.<sup>4,5</sup> The main goal of this document is to summarize and incorporate best practice evidence relevant to the provision of nursing and interprofessional care to patients with stroke and their families during the acute (posthyperacute phase) inpatient admission phase of recovery. Based on a review of several international stroke guidelines, best practices for the updated management of acute ischemic stroke, including appropriate screening, monitoring, and treatment according to stroke-specific order sets or pathways developed within a hospital, are presented. Within this framework, the need for further research into specialized nursing practice, advanced education/certification in stroke nursing, and adequate staffing is acknowledged. This article is aligned with 2 companion articles (“Care of the Patient With Acute Ischemic Stroke (Prehospital and Acute Phase of Care): Update to the 2009 Comprehensive Nursing Care Scientific Statement”<sup>5a</sup> and “Care of the Patient With Acute Ischemic Stroke (Endovascular/Intensive Care Unit-Postinterventional Therapy): Update to 2009 Comprehensive Nursing Care Scientific Statement”<sup>5b</sup>) to form a comprehensive update on nursing care of the patient with acute ischemic stroke.

## BEST PRACTICES FOR ACUTE CARE UNIT STROKE NURSING CARE

The benefits of a stroke specific unit are well documented. Patients with acute ischemic stroke admitted to an acute stroke unit for care by an interprofessional team of health care professionals have consistently reported better outcomes.<sup>4,5</sup> The benefits, most apparent in units based in a discrete ward, are noted across a wide range of patients with stroke. Patients who have had a stroke and receive organized inpatient care in a stroke unit from an interprofessional team who specialize in stroke management are more likely to be alive, independent, and living at home 1 year after stroke.<sup>6,7</sup> This effect could be attributed to staff expertise, better diagnostic procedures, high-quality nursing care, early mobilization, the prevention of complications, or more effective rehabilitation procedures.<sup>7</sup> Health care providers should consider developing standardized stroke care order sets or pathways to guide patient care decisions that lead to high-quality care for patients experiencing acute ischemic stroke.<sup>8</sup>

Implementation of evidence-based practices is compromised by multiple factors. One systematic review

identified health care professionals' perceptions of barriers to the implementation of acute ischemic stroke care.<sup>9</sup> The most commonly cited reason was a lack of institutional support, namely not hiring needed staff such as qualified nurses and specialists.<sup>9</sup> More research is needed pertaining to methods to successfully implement best evidence-based stroke care practices.

## OUTCOMES IN STROKE UNITS VERSUS NONSTROKE UNITS

The purpose of a dedicated acute stroke unit is to provide interprofessional care, including specialized nursing care, to improve outcomes and to reduce complications after stroke.<sup>7</sup> However, achieving success differs widely according to the specific type of unit. The strongest evidence supporting the value of stroke unit care is apparent in outcomes relating to mortality,<sup>8</sup> function,<sup>7</sup> and return to home.<sup>6</sup> There is emerging evidence for other patient-reported outcomes such as health-related quality of life and patient-reported experience outcomes.<sup>7,10</sup>

In addition to management of patients admitted to the hospital with acute ischemic stroke in acute stroke units, patients admitted to nonstroke units or with in-hospital stroke require the same level of care and immediate attention.<sup>11–13</sup> In-hospital stroke accounts for  $\approx 4\%$  to  $\approx 17\%$  of patients with acute ischemic stroke, but compared with patients admitted to an acute stroke unit from the emergency department with community-onset strokes, in-hospital patients with stroke have been shown to have worse outcomes, more severe strokes, and less coordinated evidenced-based care.<sup>12,14,15</sup> In a study by Cumbler et al,<sup>16</sup> the top 3 admitting diagnoses of patients who had an in-hospital stroke were cardiovascular (24%), neurology/neurosurgery (15%), and hematology/oncology (8%). One-half of in-hospital strokes in this cohort were caused by cardioembolic events, including periprocedural strokes, whereas large vessel occlusion accounted for only 12%. Atrial fibrillation has been identified as the primary cardiac risk factor for in-hospital stroke compared with hypertension for those patients with community-onset stroke.<sup>14</sup>

Many barriers to quality care for patients with in-hospital stroke exist such as comorbidities, contraindications to thrombolytic therapy, delay in stroke recognition, and unfamiliarity of health care providers on general medical/surgical units with stroke best practices.<sup>11</sup> Management goals for in-hospital stroke are rapid recognition, diagnosis, and timely evidence-based treatment, similar to goals for patients admitted with community onset stroke.<sup>14,17</sup>

## Mortality, Function, and Return to Home

Stroke mortality was examined in 3 studies in Australia and Canada.<sup>18–20</sup> Results indicated that overall mortality at 90 days to 1 year after stroke was better when the

patient was cared for in an acute stroke unit. Care in a stroke unit resulted in an increased chance of functional recovery from acute stroke assessed with Barthel scores.<sup>21</sup> In a cluster randomized Australian trial, patients cared for in acute stroke units using standardized protocols were significantly more likely to have better Short Form Health Survey scores, indicating better physical function at 90 days<sup>22</sup> and reduced mortality,<sup>21</sup> compared with patients from acute stroke units not using protocols.

In summary, acute stroke units appear to save lives, but the research is difficult to compare because different in-hospital care, assessments of outcome measures, and variable time frames for follow-up (anywhere between 30 days and 1 year) have been used in existing studies. More research using consistent methods, measures, and time frames is required, particularly for patients cared for in acute stroke units. Specifically, more research is necessary to address the impact of nursing care on patient outcomes in acute stroke units and for patients experiencing in-hospital strokes.

## NURSING ASSESSMENT: INITIAL ASSESSMENTS AFTER ADMISSION TO ACUTE INPATIENT CARE

Nurses play a vital role in identifying patients at risk of clinical deterioration by undertaking ongoing observation and assessments, including timely and appropriate action in response to changes in patient health status.<sup>23</sup> Nurses are expected to perform comprehensive and systematic physical assessments for all patients with stroke, including monitoring the main 5 vital signs: body temperature, blood pressure (BP), breathing effort (rate, patterns, and chest expansion), oxygen saturation, and mental status/level of consciousness.<sup>23</sup> Evidence-based nursing care and ongoing assessment are necessary to minimize adverse outcomes for patients after stroke.<sup>7,20,24</sup>

All patients with stroke should be admitted to an acute stroke unit as soon as possible, ideally within 3 hours of stroke onset.<sup>7,12,20,25</sup> In the absence of a specialized stroke unit, patients should still receive stroke nursing care consistent with best practice regardless the hospital unit to which they are admitted. In this instance, recommendations for vital sign monitoring in acute stroke units also apply to patients admitted to a general hospital unit. The initial and ongoing clinical assessment for a patient with stroke after admission to the hospital is critical to improving long-term outcomes for the patient. The following sections provide evidence-based guidelines and protocols for nurses to focus their assessment on the overall health status of patients with acute stroke.

### Vital Signs Monitoring

The initial nursing assessment of the patient with stroke after admission to the hospital should include evaluating

the patient's vital signs, particularly oxygen saturation, BP, and temperature, in addition to measuring blood glucose and performing a bedside dysphagia screen/assessment. These assessments are applicable to all patients with stroke, including those who receive reperfusion therapy and thrombectomy. Monitoring these aspects of care is important to prevent or to allow early detection of stroke complications.<sup>5,12,20</sup> Nursing assessment of airway support and breathing is essential to determine continued need for oxygen support. For patients who are not hypoxic, the routine use of supplemental oxygen is not recommended. Supplemental oxygen should be provided only to maintain oxygen saturation >94% and as long as there are no contraindications.<sup>5,12,26</sup> Nurses should closely monitor the patient's BP in the first 48 hours after stroke onset.<sup>5</sup> Given the varied evidence available, the BP level that should be maintained in patients with acute ischemic stroke to ensure the best outcome remains unknown. Intensive BP lowering in the acute phase after stroke (systolic BP <140 mmHg) is not recommended.<sup>27</sup> Best practice BP management recommends cautious reduction in BP to >220/120 mmHg (by no more than 20%) over the first 24 hours.<sup>12</sup> Hypotension and hypovolemia should be corrected to maintain systemic perfusion levels necessary to support organ function.<sup>5</sup> In patients with hypertension, evidence suggests reducing BP to <185/110 mmHg before treatment with intravenous thrombolysis for patients who are eligible and maintaining BP at <180/105 mmHg in the first 24 hours after treatment.<sup>12</sup> Furthermore, ongoing assessment of the patient by the nurse should be on an individual basis regardless of whether the patient received reperfusion therapy. The frequency of all assessments and observations should be determined by the patient's status.<sup>12</sup>

### Fever, Hyperglycemia, and Swallowing Dysfunction

The monitoring of body temperature, blood glucose, and dysphagia is considered standard of care for all patients with stroke. Nonetheless, data from the 2019 Australian Stroke Foundation national stroke audit<sup>12</sup> indicated that fewer than half (48%) of patients with fever received acetaminophen/paracetamol within an hour, 30% received insulin within 1 hour when indicated, and 55% of patients received a swallow screen/assessment before food or drink consumption. Similar gaps in temperature, blood glucose, and dysphagia monitoring and treatment have been identified from various studies internationally, with inadequate nursing oversight for these core parameters.<sup>28,29</sup>

Evidence from the QASC trial (Quality in Acute Stroke Care) reported that use of the fever, sugar, swallowing (FeSS) clinical protocols for the management of fever, hyperglycemia, and swallowing dysfunction in the first

**Table 1. Recommended Protocol for FeSS**

Elements	Recommended protocol
Fever	Monitor temperature at least 4 times per day (for 3 days) with treatment of temperature >37.5°C (99.5°F) with acetaminophen/paracetamol (intravenous, per rectum, or oral) unless clinically contraindicated.
Sugar (hyperglycemia)	Measure formal glucose (venous blood) and finger-prick glucose on admission to hospital.
	Measure finger-prick glucose at least 4 times per day (for 3 days).
	Treat elevated glucose >180 mg/dL (10 mol/L) with insulin.
Swallowing (dysphagia)	A trained nurse or a speech pathologist should perform a swallowing screen within 24 h of admission to hospital using a validated evidence-based tool and before giving food, fluids, or oral medications.
	Refer patients who fail the swallowing screening to a speech pathologist for a swallowing assessment.

FeSS indicates fever, sugar, and swallowing.

Data derived from Middleton et al<sup>21</sup> and McNair.<sup>24</sup>

72 hours of acute stroke unit admission significantly reduced mortality and dependency by 16%.<sup>22</sup> Use of these protocols also significantly decreased temperature and blood glucose levels and improved swallowing management.<sup>22</sup> Patients who received care in an acute stroke unit that implemented the FeSS protocols demonstrated sustained improved survival, with >20% of patients more likely to be alive after 4 years.<sup>21</sup> The FeSS clinical protocols are also applicable to patients with stroke managed in a general inpatient ward. The key elements of the FeSS protocols are presented in Table 1.

Secondary analysis of the QASC trial data further demonstrated that patients with stroke were more likely to be independent at 90 days when blood glucose was measured on admission to the hospital or within 2 hours of acute stroke unit admission, when finger-prick blood glucose was measured within 72 hours of stroke unit admission, or when swallowing screening or assessment was performed within 24 hours of acute stroke unit admission.<sup>30</sup> These findings clearly demonstrate the important role of assessment by nurses in acute stroke care. FeSS protocols are now strongly recommended by the Australian clinical guidelines for stroke management.<sup>12</sup> The American Heart Association/American Stroke Association guidelines describe these interventions based on Class I evidence, and they are recommended in the care of patients with acute ischemic stroke.<sup>5</sup>

To maintain normothermia in patients with stroke and to reduce the occurrence of adverse outcomes, nurses need to ensure timely monitoring of temperature after the patients' admission to an acute stroke unit.<sup>31</sup> Few international stroke guidelines<sup>13,25</sup> specify frequency, but the Canadian guidelines recommend that temperature monitoring should be undertaken at least every 4 hours for the first 48 hours and then as per local stroke unit protocols or according to the nurses' clinical judgment.<sup>13</sup>

Similarly, the Australian guidelines recommend temperature monitoring at least 4 times a day for 72 hours.<sup>25</sup> For temperature readings >37.5°C (99.5°F), the best evidence is to increase the frequency of monitoring and to initiate temperature-reducing measures.<sup>13</sup>

It is imperative to note that blood glucose monitoring is necessary not only for patients with diabetes and stroke but also for patients who are not diabetic and have had a stroke; glucose monitoring is often overlooked in these patients.<sup>32</sup> Patients who are hyperglycemic after stroke have a 3-fold higher risk of mortality and an increased risk of poor functional recovery<sup>33</sup> compared with patients who are normoglycemic and nondiabetic. Of note, intensive treatment of hyperglycemia (target blood glucose between 80 and 130 mg/dL [4.44 and 7.22 mmol/L]) is not recommended in those with ischemic stroke<sup>34</sup>; in contrast, the FeSS protocols support treatment with insulin of major episodes of hyperglycemia (blood glucose >180 mg/dL [10 mol/L]).

Nurses should assess the swallowing status of patients as early after stroke as possible on admission to the hospital using a validated screening tool.<sup>13</sup> Patients need to be placed on nil per os status—no oral foods, fluids, or medications given—until their swallowing ability has been determined. Patients who fail the screen should be referred to a speech-language pathologist for a swallowing assessment.<sup>5,35</sup> This may mean that poststroke antiplatelet therapy may need to be administered rectally or intravenously if patients fail the swallow screen. Patients should be rescreened over the course of the admission as needed or if swallowing or neurological status changes. It is also crucial to establish operational definitions for dysphagia screening and dysphagia assessment. A dysphagia screening tool is not diagnostic; it is a pass/fail procedure done by a trained nurse to determine whether the patient can eat or drink orally before the speech-language pathologist performs a formal dysphagia assessment (Table 2).

## National Institutes of Health Stroke Scale Tool

The use of stroke assessment tools by nurses is necessary for regular evaluation of the patient with stroke during acute inpatient care. The National Institutes of Health Stroke Scale is the most widely used measure, with a lower score indicating a less severe stroke and better patient prognosis. Use of this standardized scale allows quantification of stroke severity and is considered in patient eligibility for thrombolysis or endovascular therapy. It allows objective measurement of changing clinical status and identifies those at higher risk for complications such as intracerebral hemorrhage.<sup>5</sup> Research demonstrates that when nurses are educated about using the National Institutes of Health Stroke Scale, they achieve high levels of reliability and validity administering the scale.<sup>39</sup> Furthermore, nurses should use the full version of the National Institutes of Health Stroke Scale rather than shortened versions to avoid false-negative results, particularly in patients with low National



**Table 2. Dysphagia Screening and Assessment**

Nursing screening assessment: observe for symptoms of dysphagia <sup>36,37</sup>	Speech-language pathologist formal swallowing assessment	Compensatory safe-swallowing strategies
Facial weakness Dysarthria Dysphonia Hoarseness Abnormal volitional coughing Throat clearing Choking Aspiration Unable to control secretions, drooling	Cranial nerve examination Observation of oral anatomy Head position and swallowing techniques with different liquid and food consistencies to reduce aspiration and choking Performs instrumental examination, ie, VFSS or FEES Speech-language pathologist gives recommendations to clinical team to establish mechanisms for nutrition <sup>38</sup>	Head position including chin tuck, head turn, and backward head tilt Dietary texture modification of liquids and solid food Small sips and no straws Multiple swallows Throat clearing/coughing Small bites Sips of liquids between bites Avoidance of talking until all food and liquid are swallowed Checking for pocketing of food in cheek or under tongue Supervision and frequent cues Sitting upright <sup>36</sup>

FEES indicates fiberoptic endoscopic evaluation of swallowing; and VFSS, videofluoroscopic swallowing study.

Institutes of Health Stroke Scale scores. The Glasgow Coma Scale should not be used in acute stroke.<sup>39</sup>

### Other Key Nursing Assessments

Additional assessments to be undertaken by nurses within 4 hours of admission of a patient with stroke to the hospital include comprehensive assessments for nutrition and hydration status, deep vein thrombosis risk, mobilization needs, falls risk, pressure ulcer risk, and oral care.<sup>5,13,20</sup> (Table 3).

Nurses should assess patients for malnutrition on admission and at least weekly while in the hospital.<sup>25</sup> An enteral diet should be started within 7 days of admission,<sup>5</sup> but nurses should first feed patients with swallowing difficulty with a nasogastric tube in the early phase of stroke. For those with longer anticipated persistent swallowing difficulty, insertion of a percutaneous gastrostomy tube may be warranted.<sup>5</sup>

Patients at high risk of deep venous thromboembolism are those who are unable to independently mobilize, those with comorbidities, and patients with a history of venous thromboembolism.<sup>13,65</sup> Prophylaxis for deep venous thromboembolism is presented later in this article. Regular skin assessments also should be performed by nurses using objective scales (eg, Braden scale) to assess the risk of pressure injury.<sup>66</sup>

An assessment for oral hygiene, including screening for signs of dental disease, is often overlooked. Patients

with stroke may experience difficulty with attending to their oral care because of physical and cognitive impairments, reduced level of consciousness, and comorbidities.<sup>67</sup> Hence, shortly after admission to the hospital, all patients with stroke, including those with dentures, should have an oral assessment with subsequent implementation of oral care protocols consistent with evidence-based practices.<sup>5,13,25</sup> Implementing such protocols has the potential to reduce the risk of stroke-associated pneumonia.<sup>5</sup> Nursing staff need to be trained in the assessment and management of oral hygiene,<sup>5,25</sup> with mouth care performed at least 3 times a day.<sup>26</sup> Many of the nursing assessments and practices described will reduce patient poststroke complications, as noted in the following section.

### NURSING ASSESSMENT: COMPLICATIONS IN ACUTE ISCHEMIC STROKE

Anticipation, prevention, early recognition, and management of potential poststroke medical complications are essential for patients with an acute stroke because complications may directly or indirectly affect clinical outcomes. Data from the Berlin Stroke Registry review of 16 518 patients with acute stroke treated in stroke units revealed that, among patients with a shorter length of stay, between 60% and 70% of early deaths and poor outcomes are attributed to nonmodifiable predictors.<sup>68</sup> Stroke severity on admission, age, and prestroke disability have the highest impact. In contrast, modifiable factors are of major importance for in-hospital death in patients staying longer (>7 days) in the hospital, accounting for 39% of the late deaths.<sup>68</sup> In a Danish Medical Registry review of 13 721 subjects with stroke, 25.2% experienced at least 1 medical complication; all complications were associated with longer lengths of stay and a higher risk of adverse outcomes.<sup>69</sup>

Management strategies should be implemented for every patient with stroke to prevent complications.<sup>4</sup> Careful monitoring of clinical parameters is vital.<sup>69</sup> Studies involving a small number of patients revealed that, compared with intermittent monitoring with manual and portable equipment, continuous monitoring supported by automatic equipment significantly reduced death and disability at 3 months or discharge.<sup>70</sup> When to start or interrupt these treatments, which patients should be a priority, and what parameters to monitor are uncertain and require further research.<sup>70</sup> Screening should also be undertaken to assess for communication issues or sensory deficits (eg, impaired vision, speech, hearing), and referrals to interprofessional team members should be made as needed.<sup>40</sup> Care teams have an opportunity to positively affect the outcome of patients with acute stroke through the prevention and management of stroke complications.<sup>71</sup>

**Table 3. Key Nursing Assessments**

Potential complication	Assessment parameters	Nursing interventions
<b>Neurological</b>		
Hemorrhagic transformation incidence: 1.5% in the absence of reperfusion therapy <sup>40</sup>	Ongoing neurological examinations with comparison to baseline Risks: advanced age stroke severity, hypertension, diabetes, and early infarct signs on baseline neuroimaging <sup>40</sup>	Close monitoring for signs of neurological worsening: Decreased LOC Worsening neurological deficits New pupil changes Changes in respiratory status Optimize BP Consider cryoprecipitate
Cerebral edema, elevated ICP, herniation incidence: 10% of patients with MCA infarct will experience malignant MCA syndrome <sup>40</sup>	Ongoing neurological examination with comparison to baseline Risks: large territorial cerebral and cerebellar infarcts <sup>40</sup>	Close monitoring for signs of neurological deterioration Osmotic therapy Hyperventilation Decompressive craniectomy or ventriculostomy may be necessary <sup>5</sup>
Evolution of stroke incidence: early reocclusion with clinical worsening may occur in up to 14% of patients receiving alteplase	Serial NIHSS with comparison to baseline Assess for results of carotid ultrasound or angiography Risks: high NIHSS score and severe carotid stenosis <sup>40</sup>	In-hospital code stroke if eligible for reperfusion therapy <sup>17</sup>
Seizure incidence: 5%–12% of patients with acute ischemic stroke <sup>41</sup>	Neurological examination Assessment/documentation of the seizure Assessment of results of medical intervention Risks: cortical location, stroke severity <sup>42</sup>	EEG or a change in mental status or depressed mental status out of proportion to the stroke <sup>42,43</sup> Antiseizure medication for patients with documented seizure Prophylactic seizure medication is not recommended <sup>5,44</sup>
<b>Dysphagia and pneumonia</b>		
Dysphagia incidence: up to 40%–78% of patients <sup>45</sup>	Bedside swallow screen by nurse There is no consensus on optimal screening tool <sup>38</sup> Consult speech-language pathologist to perform formal dysphagia assessment <sup>36</sup>	Keep all patients with stroke NPO until dysphagia screening completed within 4–24 h by trained nurse <sup>24</sup> If patient fails dysphagia screening, consult speech-language pathologist to do a formal dysphagia assessment that will provide a dysphagia management plan providing compensatory strategies to prevent aspiration <sup>39</sup> Consult dietician to provide the team with patient-specific nutritional needs or tube feeding recommendations <sup>44</sup> Train patient and caregiver on dysphagia management <sup>21,36</sup>
Stroke-associated pneumonia incidence: 14% in first 7 d <sup>41</sup>	Monitor patient for signs of respiratory compromise (tachypnea, hypoxia), auscultate the patient's lungs, monitor for fever >38°C and altered mental status Prompt notification of abnormal assessment	Intensive oral hygiene protocols may reduce the risk of stroke-associated pneumonia from 28% to 7% (chlorhexidine) <sup>45</sup> Use of enteral feeding by nasogastric tube or PEG/PEJ has shown no difference in aspiration pneumonia incidence <sup>46</sup> Good pulmonary toiletry and early mobility
<b>Urinary and gastrointestinal</b>		
UTI incidence: 10%–28% and leads to decreased functional outcome and increased length of stay <sup>47</sup>	Monitor for UTI symptoms Monitor for change in LOC with no known reason Monitor for fever Risks: catheterization, bladder dysfunction, poststroke disability, and increasing age	Avoid inserting indwelling urinary catheters; if required use aseptic technique Daily reminder or stop order has shown to help reduce UTI Nursing interventions that promote the reduction of UTI include: Handwashing Maintaining hydration Ensuring good patient hygiene catheter Routine perineal cleaning Keep as clean as possible because incontinence may lead to dermatitis and skin breakdown Consider alternatives to indwelling catheters, intermittent catheterization Recommendations include maintaining a closed drainage system and securing the catheter to prevent movement leading to possible urethral trauma A urinalysis and urine culture should be done and the patient treated with antibiotics if indicated <sup>48</sup>

(Continued)

**Table 3. Continued**

Potential complication	Assessment parameters	Nursing interventions
Urinary retention incidence: commonly seen in the first 72 h after acute stroke in 21%–47% of patients <sup>49,50</sup>	Assess bladder for retention Use bladder scanning to obtain PVR Risks: potentially age, preexisting urologic disease, <sup>50</sup> stroke in the dominant hemisphere <sup>51</sup>	Frequent toileting, every 2 h during the day and every 4 h at night Intermittent catheterization Use bladder scanning to obtain PVR or performance of and in-and-out catheterization within 30 min of voiding. If the PVR is <100 mL consecutively for 3 times, monitoring can be discontinued. If PVR is >100 mL, scheduled intermittent catheterization will be necessary, every 4–6 h <sup>49</sup>
Constipation incidence: 45% during acute hospitalization <sup>42</sup>	Assess prestroke bowel function: stool consistency, frequency, timing, bowel care practices <sup>52</sup> Risks: immobility and bedpan use <sup>52</sup>	Mobility Prophylactic stool softener <sup>52</sup>
Gastrointestinal bleeding: 1.2%–8.5% during hospitalization <sup>53</sup>	Assess for melanic stool Assess for blood in any emesis Monitor hemoglobin and haematocrit Risks: advanced age, history of peptic ulcer disease or liver disease <sup>54</sup>	Consideration of withdrawal of antiplatelet or anticoagulation medications Administer blood products as necessary <sup>54</sup>
<b>Psychosocial and neuropsychological</b>		
Poststroke cognitive impairment incidence: 1 in 10 will develop dementia after a stroke <sup>54,55</sup>	Assess mental status as a component of the neurological examination Risks: baseline poor cognition, comorbid conditions, effect of the stroke, stroke complications <sup>55</sup>	Cognitive rehabilitation to improve attention, memory, visual neglect, and executive functioning Enriched environments to increase engagement with cognitive activities <sup>44</sup>
Depression incidence: up to one-third of patients with ischemic stroke <sup>56</sup>	Assess for history of depression Early depression screening <sup>57</sup> Risks: physical disability, severity of stroke, prestroke depression, cognitive impairment <sup>57</sup>	Provide interventions to enhance rehabilitation and improve recovery. Patients with PSD should be treated with antidepressants in the absence of contraindications and closely monitored for effectiveness <sup>5,56</sup>
Pseudobulbar affect incidence: 10%–48% <sup>57</sup>	Assess for mood swings and other mood disorders Pathological Laughing and Crying Scale and the Center for Neurological Study-Liability Scale <sup>57</sup>	Cognitive and emotional therapy, psychotherapy, and support groups <sup>57</sup> Acknowledgment of and education about pseudobulbar affect can defuse potentially uncomfortable situations Dextromethorphan/quinidine is FDA approved <sup>57</sup>
Delirium incidence: 1:4 during acute period <sup>58</sup>	The 4 Assessment Test for Delirium or the Confusion Assessment Method ICU <sup>59</sup> Risks: older age, preexisting cognitive deficits, higher NIHSS score, infection, right hemispheric location <sup>60</sup>	Avoid infection, dehydration, and drugs with sedative or neuroactive effects Regulate sleep/wake cycles, day/night orientation Cognitive stimulation Early mobilization Consider having a family member stay with the patient to promote orientation, sense of security, and safety Evaluate for reversible causes Antipsychotic agents may be considered for the short term <sup>58</sup>
<b>Mobility</b>		
Impaired mobility	Formal rehabilitation assessment Risks: hemiparesis, sensory changes, altered LOC, poststroke pain syndromes <sup>5,44</sup>	Early, short, frequent exercise <sup>61</sup> Daily stretching of the hemiplegic limbs may avoid contracture Patients and families should be taught proper stretching techniques Positioning of the hemiplegic shoulder in maximum external rotation for 30 min every day in either in a bed or chair can be useful for preventing shoulder contracture Positioning and use of supportive devices and slings may prevent shoulder subluxation Resting ankle splints used at night and during assisted standing may be considered for the prevention of ankle contracture in the hemiplegic limb <sup>44</sup>

(Continued)

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**Table 3. Continued**

Potential complication	Assessment parameters	Nursing interventions
Falls	Fall risk assessment with a validated tool Risks: anxiety, delirium, fear of falls, prior falls, male sex, NIHSS $\geq$ score $\geq$ 8, history of MI, or renal insufficiency Most falls occur during transfers, toileting, or attempting activities without supervision <sup>62</sup>	Fall prevention program Physiotherapy Music therapy Postural training and task-oriented therapy Assist with transfers and toileting Prevent delirium Consider bed/chair alarms and video monitoring <sup>62</sup>
Pressure injury	Regular skin assessment and documentation Use of an objective scale such as the Braden scale <sup>44,63</sup> Risks: older age, being unmarried, mRS score 3–5 on admission, higher NIHSS score, diabetes, anemia, peripheral vascular disease, incontinence, longer length of stay <sup>44</sup>	Minimize skin friction and pressure Provide support surfaces Practice good skin hygiene Avoid excessive moisture Maintain adequate nutrition and hydration Turn regularly Use specialized mattresses, wheelchair cushions, and seating until mobility returns <sup>44</sup>
Poststroke pain	Pain rating scales and physical examination Formal rehabilitation assessment Risks: increased muscle tone, reduced upper extremity movement, and sensory deficits; poststroke pain syndromes and poststroke headache <sup>64</sup>	Short, frequent mobilization Train family members to assist Pain management with judicious use of medications <sup>64</sup>
Venous thromboembolism	Assess for signs of venous thromboembolism especially in the lower extremities Risks: immobility after stroke and potential long-term risk over time after stroke <sup>65</sup>	Early mobilization after stroke IPC if no contraindications in addition to using routine care Aspirin and hydration Patient and family education on importance of IPC <sup>65</sup>

BP indicates blood pressure; EEG, electroencephalography; FDA, US Food and Drug Administration; ICP, intracranial pressure; IPC, infection prevention and control; LOC, level of consciousness; MCA, middle cerebral artery; MI, myocardial infarction; mRS, modified Rankin Scale; NIHSS, National Institutes of Health Stroke Scale; NPO, nil per os; PEG/PEJ, percutaneous endoscopic gastrostomy/percutaneous endoscopic jejunostomy; PSD, poststroke depression; PVR, postvoid residual; and UTI, urinary tract infection.

## Neurological Complications

Neurological complications, including hemorrhagic transformation, cerebral edema, stroke evolution, and poststroke seizures, result in early neurological deterioration associated with poor outcomes. These complications are commonly treated in the neuro-intensive care unit. However, all nurses caring for patients with acute ischemic stroke should be knowledgeable about the risk of these complications to facilitate appropriate management should they occur outside the neuro-intensive care setting. Nurses should develop a standardized approach to recognition and management of time-sensitive complications of stroke, including an inpatient code stroke protocol. Nurse leaders and unit managers should educate staff, including physicians and nurses, on these protocols.<sup>16</sup>

## Cardiac Complications

Stroke and heart disease share common risk factors, and hypertension and cardioembolic mechanisms such as atrial fibrillation are the most common causes of ischemic stroke. Recent evidence suggests that although hypertension doubles the risk of stroke, a patient with atrial fibrillation has 5 times the risk of stroke.<sup>72,73</sup> Cardiac complications of stroke account for 2% to 6% of

mortality within the first 3 months, with the highest risk in the first 2 weeks. Predictors of cardiac complications include a history of heart failure, diabetes, elevated creatinine, severe stroke, and a long-QT segment or ventricular extrasystoles on ECG. Myocardial infarction, cardiac arrhythmias, heart failure, or takotsubo syndrome may complicate stroke. Patients at the highest risk for cardiac events may benefit from cardiac monitoring.<sup>40</sup> A baseline ECG and cardiac monitoring for at least the first 24 hours are needed.<sup>5</sup>

## Dysphagia and Pneumonia

Between 40% and 78% of patients with acute stroke experience dysphagia.<sup>74</sup> The majority of the patient's swallowing function returns in 7 days, but 11% to 50% may continue having dysphagia 6 months after stroke.<sup>75–77</sup> Major consequences of dysphagia include stroke-associated pneumonia, malnutrition, dehydration, increased mortality, and an impact on patient discharge location and quality of life.<sup>78</sup> There may also be increased health care costs attributable to increased length of stay and resource allocation.<sup>41</sup> Nurses are in a prime position to identify dysphagia, to initiate screening and referrals as needed, to manage interventions, and to educate the patient and caregiver.



While the patient is nil per os, it is essential to maintain hydration by administering maintenance fluid until dysphagia assessment is complete. A nasogastric tube or small-bore feeding tube placement is essential if the patient is unable to swallow safely to provide medication access and enteral nutrition. A dietician consult identifies for the team patient-specific nutritional needs and tube-feeding regimens. Dysphagia can lead to malnutrition, which can lead to impairment in physical and mental functioning. Inadequate nutrition will lead to risk for increased weakness, weight loss, length of stay, and skin breakdown, and put a patient at risk for impaired immune response.<sup>37</sup>

It is also crucial to assess for the presence of dysphagia after patients are extubated. Increasing evidence demonstrates the presence of postextubation dysphagia in all critically ill patients.<sup>79</sup> Older age and duration of intubation were the 2 main factors associated with the risk of developing postextubation dysphagia in all intubated patients. The patient with stroke is at risk of dysphagia related to disease, and dysphagia may worsen with intubation. Once the patient is extubated, the nurse should perform a dysphagia screening before administering anything orally and refer to a speech-language pathologist for formal dysphagia assessment.<sup>79</sup>

All staff caring for patients with stroke should be knowledgeable about and trained on appropriate role skills to optimize care for patients with dysphagia. The nurse has a vital role in educating the patient and caregiver on dysphagia management. Persistent swallowing difficulties can affect the patient and their caregiver. Studies have demonstrated that an interprofessional team approach to dysphagia management using evidence-based protocols and standardized care can improve patient outcomes. The nurse is imperative in organizing the interprofessional team, which includes the physician, speech-language pathologist, dietician, physical therapist, occupational therapist, and social worker, to optimally monitor and manage the care of the patient with stroke with dysphagia.<sup>22,80</sup>

### Stroke-Associated Pneumonia

Stroke-associated pneumonia is a respiratory infection occurring during the first 7 days after stroke, affecting ≈14% of patients with stroke. It is associated with a 3-fold increase in in-hospital mortality, prolonged length of stay, and poorer functional outcomes.<sup>81</sup> Recent large retrospective studies in the United States reported individual costs of stroke-associated pneumonia caused by dysphagia as ranging between \$19 000 and \$25 000 per occurrence; if associated with feeding tube placements, even higher costs were incurred.<sup>82,83</sup>

Dysphagia management includes decreasing the risk of aspiration through diet and fluid modification and using compensatory strategies and rehabilitation exercises outlined by the therapists (physical therapist, occupational therapist, and

speech-language pathologist). A stroke may cause lower esophageal sphincter and gastric dysfunctions. Gastroparesis increases residual volumes, and gastroesophageal reflux can lead to vomiting and regurgitation, increasing the risk for stroke-associated pneumonia caused by aspiration. Treatments with antiemetic medication are vital to prevent vomiting and further risk of aspiration. With the insertion of feeding tubes, there is a 38% higher incidence of stroke-associated pneumonia resulting from aspiration.<sup>84,85</sup> Factors that lead to a higher incidence of pneumonia include the bacterial load in the oral cavity, the number of decayed teeth, poor oral hygiene, and nasogastric tubes, which may predispose a patient to gastroesophageal reflux and vomiting. The use of enteral feeding by nasogastric tube or percutaneously inserted gastrotomy or jejunostomy tube has shown no difference in aspiration pneumonia incidence.<sup>46</sup>

Nurses should establish goals of care and collaborate with the interprofessional team on dysphagia management, safe feeding, and prevention of stroke-associated pneumonia. The nurse should have education related to dysphagia management and the care of feeding tubes, which includes checking tube position regularly, monitoring continuous or bolus feeding, checking for residuals, and flushing according to the standard of care.



### Urinary and Gastrointestinal Complications

Nurses play a key role in the assessment and management of urinary and gastrointestinal complications after stroke. One of the most common poststroke complications is a urinary tract infection.<sup>86</sup> A recent meta-analysis reviewed 16 studies with 13 513 patients with stroke; 19% of this population developed urinary tract infection.<sup>86</sup> Urinary tract infection decreases functional outcomes, increases length of stay (median, 3 days longer than for patients without urinary tract infection), and increases acute care costs.<sup>86</sup> Patients with urinary tract infection also have an increased likelihood of discharge to care homes or long-term care facilities.<sup>86</sup>

Voiding dysfunction after a stroke includes urinary incontinence and urinary retention. Elderly men and women also may have preexisting incontinence or retention. According to a Cochrane review, urinary incontinence may affect 40% to 60% of patients admitted after a stroke; 25% continue at the time of discharge, and 15% continue 1 year after stroke.<sup>37</sup> Urinary incontinence management includes using 3 interventions: (1) behavioral strategies such as timed voiding and bladder retraining, (2) complementary therapies using manual or electro-acupuncture, and (3) physical therapy with transcutaneous electric nerve stimulation and pelvic floor muscle training.<sup>50</sup> Behavioral therapies may reduce incontinent episodes, whereas physical therapy interventions improve functional voiding capabilities.<sup>50</sup> Bladder training strategies are part of the rehabilitation plan of care.

Constipation contributes to decreased quality of life, limitation of social activities, and adverse outcomes, including disability, poor neurological function, and even death.<sup>55</sup> It is essential to have an appropriate evaluation in order to manage constipation properly. The early occurrence, on day 2 of admission, calls for prompt preventive interventions for constipation.<sup>52</sup>

Gastrointestinal bleeding increases hospital length of stay an average of 5.8 days.<sup>53</sup> Gastrointestinal bleeding is independently associated with a 46% increased likelihood of severe disability and 82% increased likelihood of in-hospital death.<sup>53</sup>

### Neuropsychological and Psychosocial Complications

Poststroke cognitive impairment, depression, pseudobulbar affect (inappropriate involuntary laughing or crying), delirium, and sleep disorders may contribute to increased length of stay, higher health care use, poorer functional outcomes and quality of life, social isolation, and higher mortality.<sup>54,56</sup> Psychosocial symptoms such as fatigue, anxiety, and depression may affect poststroke recovery.<sup>87</sup> Thus, an assessment of psychosocial needs after stroke for the patient and family is an important nursing function.

Ischemic stroke can also facilitate the onset of vascular dementia and aggravate preexisting cognitive decline.<sup>44,55</sup> It is therefore imperative for nurses to screen for cognitive issues such as problem-solving and executive function even if the patient is experiencing mild physical impairments after stroke. Nursing staff should refer patients to the speech-language pathologist or neuropsychologist as needed. The incidence, risk factors, and nursing interventions related to neuropsychological/psychosocial complications are described in Table 3. Patients with stroke present unique challenges in the diagnosis and assessment of neuropsychological complications attributable to neurological symptoms such as aprosodic speech (lack of inflection), abulia (decreased motivation), or flat affect. Individuals with aphasia may go undiagnosed or receive inadequate treatment. Increased awareness, timely screening, and prompt evidence-based management are essential. Further studies are required to determine the optimal timing and methods for screening for neuropsychiatric complications and ideal treatment strategies.<sup>56</sup>

Depression is common after stroke; however, the pathophysiology and pathogenesis of poststroke depression (PSD) are poorly understood.<sup>88</sup> Proposed mechanisms include psychosocial factors such as the patient response to new disability and social isolation, sleep disturbance, and biological factors such as disruption of neural networks and alterations in serotonergic, noradrenergic, and dopamine pathways.<sup>89</sup> Clues for PSD can be subtle such as declining to participate in therapy. Patients can experience emotional

ability or pseudobulbar affect after a stroke, often prompting the team to erroneously diagnose a patient with PSD.<sup>56</sup> Nurses should identify patients at risk for PSD through early depression screening and provide interventions to enhance rehabilitation and improve recovery.

Some data are available on the usefulness of antidepressants for managing depression and promoting functional recovery. Trials of antidepressants and psychosocial therapies are limited but have shown a beneficial effect on depression remission and response. Medications trials were associated with increased bone fractures<sup>90</sup> and gastrointestinal symptoms.<sup>91</sup> Although currently available research cannot recommend routine administration of antidepressant medication, patients with PSD should be treated with antidepressants in the absence of contraindications and closely monitored for effectiveness. The choice of drug and length of treatment should be individualized to the patient.<sup>5</sup>

Fatigue is a common and debilitating sequela of stroke, with at least half of survivors of stroke experiencing poststroke fatigue.<sup>92</sup> Although patients with poststroke fatigue are often depressed, the relationship between poststroke fatigue and PSD is challenging to evaluate because many of the assessment tools for assessing depression also contain items about fatigue. The impact of depression on poststroke fatigue may differ according to the stage of stroke. Although stroke severity and neurological disability lead to exertional fatigue in the early stage of stroke recovery, depression seems to play a more important role in the long-term stages of stroke.<sup>92</sup> Poststroke fatigue exerts a negative impact on a patient's daily activities such as decreased participation in physical activities and rehabilitation.<sup>93</sup> Consequently, patients with poststroke fatigue are reported to have a poor neurological recovery, decreased quality of life, and increased mortality.<sup>94</sup>

It is important to identify and assess sleep disorders, which have been identified as independent risk factors for stroke and may contribute to poststroke fatigue and affect stroke recovery.<sup>95,96</sup> The 3 main sleep disorders among stroke survivors are sleep apnea, nighttime sleep disturbances, and excessive daytime sleepiness. The prevalence of poststroke sleep disorders ranges from 13.2% to 94.0%.<sup>97</sup> The causative mechanism seems to be multifactorial, and occurrence may differ depending on the stroke stage. Combined use of subjective and objective assessment methods may increase poststroke sleep disorder detection and early treatment.

### Complications of Impaired Mobility

As outlined in Table 3, impaired mobility predisposes the patient with acute ischemic stroke to falls, pressure injury, pain, and venous thromboembolism. When mobilization is attempted early after stroke, short,

frequent mobilization is associated with a better outcome. High-dose, very early mobilization within 24 hours of stroke onset should not be performed because it may carry an increased risk in some people with stroke.<sup>98</sup> Patients with stroke should receive rehabilitation at an intensity commensurate with anticipated benefits and tolerance.<sup>5</sup> The World Stroke Organization states that family members should also be trained to assist with mobilization.<sup>4</sup> Active participation in exercise should be encouraged early after stroke to minimize the detrimental effects of bed rest and inactivity, to capitalize on heightened neuroplasticity present in the early poststroke period, and to begin the important process of fostering exercise self-efficacy and self-monitoring.

Regardless of whether rehabilitation is started during the inpatient stay, all patients should undergo a formal rehabilitation assessment by clinicians with expertise in rehabilitation. Activities of daily living, communication abilities, and functional mobility should be evaluated to assess the patient's rehabilitation needs before discharge.

Falls are a common complication after stroke. The incidence ranges from 7% in the first week to 73% in the first year after stroke.<sup>99</sup> Among survivors of stroke, 22% to 48% have experienced at least 1 fall during a hospital stay.<sup>100</sup> Patients with stroke are at risk of being repeat fallers and suffering injury associated with falls.<sup>44</sup> Falls may lead to increased cost and length of stay and have been independently associated with a loss of function even after adjustment for age, stroke severity, gait abnormalities, and previous stroke.<sup>101</sup>

Pressure injury is a localized injury to the skin or soft tissue caused by long-term or strong pressure (including shear force or abrasion with pressure) commonly around bone protuberances. Pressure injuries not only are painful but also restrict movement and may lead to infection. They affect stroke prognosis and increase nursing care time, length of stay, and medical expenditures.<sup>102</sup>

Patients with poststroke pain experience greater cognitive and functional decline, lower quality of life, fatigue, and depression. Poststroke pain syndromes are often underdiagnosed and undertreated<sup>103</sup>; often considered a hidden complication of stroke, pain may be caused by poststroke neuropathic and nociceptive (physical tissue injury) elements. Stroke sequelae such as spasticity and contractures, central poststroke pain syndrome, or shoulder pain are common causes.<sup>104</sup> Treatment of pain has been associated with improvements in cognition and quality of life.<sup>64,105</sup>

Venous thromboembolism encompasses both deep venous thromboembolism and pulmonary embolism.<sup>65</sup> These complications can be fatal but are preventable in immobile patients. Venous thromboembolism manifests as deep venous thromboembolism in approximately two-thirds of patients and as a pulmonary embolism

in one-third of patients.<sup>106</sup> Both deep venous thromboembolism and pulmonary embolism increase the risk of mortality as high as 30%. Hospital stays after stroke are currently very short; thus, there has been a decline in venous thromboembolism occurrences in the hospital. Best practice guidelines have not defined an advantage in the use of low-molecular-weight heparin versus unfractionated heparin.<sup>5</sup> Both show a reduction in deep venous thromboembolism, with a slight risk of intracranial or extracranial hemorrhage.<sup>107</sup> Clinicians must determine whether the benefit of reducing venous thromboembolism outweighs the risk of intracranial or extracranial hemorrhage. The use of low-molecular-weight heparin daily is convenient for nurses and administration is comfortable for patients. The disadvantage of low-molecular-weight heparin is the higher cost and bleeding risk in older patients with renal impairment.<sup>5</sup>

## CARE TRANSITION INTERVENTIONS FOR SURVIVORS OF STROKE

The discharge transition from the acute setting to the community is one of the most vulnerable and significant periods in the continuum of care for patients with stroke and their families. Thus, dedicated communication and organization among the health care team members are essential. The principal goals of a healthy transition include preparing survivors of stroke and their family members for discharge, ensuring optimal secondary stroke prevention, maximizing stroke recovery and rehabilitation, avoiding unnecessary complications and hospital readmissions, and ensuring the best achievable quality of life for patients and their caregivers. Determination of postacute rehabilitation needs should be based on this assessment and assessments of residual neurological deficits; cognitive, communication, and psychological status; swallowing ability; determination of previous functional ability and medical comorbidities; level of family/caregiver support; capacity of family caregivers to meet the care needs of their family member with stroke; likelihood of returning to community living; and ability to participate in rehabilitation.<sup>65</sup> Strong interprofessional communication and collaboration are required among nurses, therapists, and family members to maximize the effectiveness and efficiency of early rehabilitation. The discharge process may involve rehabilitation nursing case managers and social workers who can assess psychosocial issues that may influence the transition.<sup>5,44</sup>

Key elements pertaining to the successful transition of care are listed in the Figure. The recommended discharge planning topics incorporate elements from several poststroke discharge resources.<sup>43,108-110</sup> From this list, a coordinated and holistic assessment and specific plan for the patient with stroke and their family must be developed to facilitate a successful transition.

Professional Completing \_\_\_\_\_ Date \_\_\_\_\_  
**Reviewed With Patient/Primary Family Caregiver\***  
 Patient/Primary Family Caregiver Signature \_\_\_\_\_ Date \_\_\_\_\_

Major Focus Areas	Rating	Actions Taken and/or Follow-up
Knowledge of what caused the stroke	Yes No	
Knowledge of risk factors for another stroke or TIA	Yes No	Secondary prevention activities
Knowledge of signs/symptoms of TIA/stroke and actions to be taken	Yes No	
Anticipated recovery and supportive services and/or referrals needed	Yes No	Provide listing and contact information
Potential behavioral, emotional, communication, lifestyle challenges	Yes No	
Assistance required with ADLs and IADLs	Yes No	
Mobility and exercise recommendations along with assistive devices and supplies needed	Yes No	
Diet recommendations provided and assistance given as needed	Yes No	
Bowel and bladder status evaluated, and supplies provided as needed	Yes No	
Medications: Why take, when, dosage, route, etc	Yes No	Suggest medication tracker
Follow-up appointments, tests, rehabilitation needed; encourage caregiver to make an appointment for a check-up if needed	Yes No	If yes, give appointment tracker
Living arrangements: Safety precautions to prepare home, home modifications needed, arranging for home care, etc	Yes No	
Caregiver education and/or assistance needed: Skill building (eg, problem solving, stress management, adapting to role, goal setting) and consideration of other responsibilities such as work, dependent care, volunteer commitments	Yes No	If other responsibilities, discuss strategies for managing the new responsibilities of caring for stroke survivor and consider referral to a social worker
Development of self-management abilities/skills of survivor (focus on survivor's recovery, health, and well-being)	Yes No	
Development of self-management/self-care abilities/skills of the caregiver (focus on caregiver's adjustment to the role, health, and well-being)	Yes No	
Does the caregiver have a plan for maintaining her/his self-care?	Yes No	If no, recommend strategies to address this and/or refer to social worker
Need for further information related to services, resources (eg, insurance, financial, support services in community)	Yes No	
Other	Yes No	

**Figure. Recommended discharge planning topics for the survivor and family caregiver.** ADL indicates activities of daily living; IADL, independent activities of daily living; and TIA, transient ischemic attack. \*List all resources provided for the major topic areas addressed. Data derived from Winstein et al,<sup>44</sup> Philp et al,<sup>108</sup> Camicia and Lutz,<sup>109</sup> and Stroke.Org.<sup>110</sup>



## Secondary Stroke Prevention

Secondary stroke prevention requires collaboration from all members of the health care team, which includes treatment of the specific stroke mechanism and reduction of modifiable stroke risk factors (eg, hypertension, diabetes, dyslipidemia). Optimal secondary stroke prevention also involves promoting a healthy lifestyle through diet and exercise, smoking cessation, and addressing social concerns.<sup>111</sup>

Foremost in this transition is the provision of stroke education to patients and families on the signs and symptoms of stroke and the importance of stroke risk factor reduction. To increase the effectiveness of these educational interventions, health care providers should implement evidence-based educational strategies that are individualized and tailored to patients' health needs and medical conditions. One method for stroke education is the use of educational pamphlets, which have been demonstrated to be an effective method to improve patients' knowledge and awareness of risk factors for acute ischemic stroke such as obstructive sleep apnea.<sup>112</sup> Another modality to deliver stroke education is online programs, which are preferred by some survivors of stroke and allow education to be delivered throughout the transition period and in the home setting.<sup>113</sup> In addition, developing culturally tailored educational interventions is critical to guarantee the success of stroke survivor education, especially for minorities and underrepresented groups. As an example, in a multiethnic cohort, a culturally tailored, skills-based educational program with telephone follow-up was effective in reducing systolic BP among Hispanic patients at 12 months compared with standard discharge programs.<sup>114</sup>

Although optimal secondary stroke prevention requires an interprofessional effort, nurse-led interventions may be among the most effective approaches and reduce 30-day readmissions of patients with stroke discharged to home.<sup>115,116</sup> In a study of a Swedish stroke cohort, patients were assigned a specially trained nurse who would maintain contact, perform needed educational interventions, assess patient and caregiver needs, ensure adherence with the treatment schedule/regimen, identify emerging health issues, and request additional input and referrals as needed.<sup>117</sup> However, this strategy requires regular communication between the nurse and provider team and may not be generalizable to resource-limited settings.

## Self-Management of the Survivor and Family Caregiver

Self-management for survivors of stroke seeks to optimize independence in the posthospital environment by educating patients and caregivers on the skills of decision making and problem-solving, as well as establishing goals for stroke prevention and recovery.<sup>77,118</sup> Teaching should begin in the acute setting before hospital discharge. In a meta-analysis of multiple systematic

reviews, self-management interventions were effective in reducing mortality and fostering independence among survivors of stroke.<sup>119</sup> Examples of self-management interventions include enhancing self-efficacy with activities of daily living,<sup>77,120</sup> teaching problem-solving skills and strategies,<sup>121,122</sup> engaging patients in occupational therapy programs,<sup>123</sup> and incorporating information provision for survivors of stroke and their caregivers on stroke care after discharge.<sup>124</sup> A systematic review and meta-analysis of 18 randomized trials of interventions that focused on developing problem-solving and coping strategies for stroke family caregivers further revealed a positive effect on caregivers' psychological health and a reduction in health care resource use.<sup>125</sup>

In addition, it is imperative to identify premorbid depression and PSD, to provide prompt and targeted treatment, and to make any necessary referrals for supportive mental health therapy.<sup>126</sup> With improved awareness of the presence of PSD, including its variability and detrimental effects among survivors, more tailored patient and family interventions can be applied to address immediate needs and to enhance stroke recovery.<sup>56,126</sup>

## Reducing Readmissions

Hospital readmission during the 30 days after discharge has been identified by the Centers for Medicare & Medicaid Services as a key quality indicator for survivors of stroke.<sup>127</sup> In 2013, ≈12% of US patients with stroke had a readmission within 30 days, of which 90% were unscheduled and 13% were deemed preventable.<sup>128</sup> Preventing poststroke complications and hospital readmissions requires an interprofessional effort. A nurse-led transitional stroke clinic where the nurse performs follow-up phone calls and conducts office visits at regular time intervals after discharge may be an effective model for reducing readmission rates among survivors of stroke.<sup>115,116</sup> Moreover, team-coordinated early supported discharge helps prepare survivors of stroke and caregivers for the transition period, incorporating the recommended discharge planning topics outlined in the Figure.

In a qualitative study of patient-reported indicators of hospital readmission, participants identified several important factors, including poor preparation before discharge, insufficient medication reconciliation, lack of education on anticipated needs and resources, and limited support to receive available community services.<sup>129</sup> Although the sample size was small, the study suggestions for discharge preparation are applicable to the broader stroke population in that an individually tailored discharge plan and assessment of understanding of the plan by patients and caregivers are essential. Furthermore, patients should be oriented to location-specific available community resources and provided an early follow-up appointment scheduled before discharge. This is even more critical for patients in rural and socioeconomically



disparate areas where access to resources and rehabilitation services and distance to posthospital follow-up are important barriers to a successful transition to the home environment.

### Goals of Care

Decision making for patients with stroke, especially those who experience a complication during the acute phase of stroke, is complex. Discussion of care options and possible outcomes should take place quickly, and caregivers should ascertain and include patient preferences in shared decision making when considering interventions or limitations of care.<sup>130</sup> Poor communication about prognosis and the anticipated course of illness can result in patients receiving more aggressive care and treatment than they desire. Most patients with serious illness want health care providers to initiate and have conversations about the goals of care. Clinicians should direct patients with stroke and their families to palliative care resources as appropriate. The major foci of palliative care are communication, shared decision making about treatment options, advance care planning, and attention to physical, emotional, spiritual, and psychological distress with the inclusion of the patient's family and care system. When patients receive palliative care early in their illness trajectory, outcomes are better, including improved quality of life, less depression, and prolonged survival.

The compartmentalization of stroke care delivery in a stroke unit may improve site-specific care but hinder overall care if there is fragmented communication among providers and across settings. Knowledge and use of effective communication techniques is a critical core competency to improve the quality of stroke decision making, as well as patient and family satisfaction and outcomes.<sup>43</sup>

Providers should be knowledgeable and respectful of diverse cultural and religious preferences when establishing goals of care and refer to social workers and chaplains when appropriate. Lutz and Green<sup>131</sup> have well outlined the role of nursing in addressing palliative care needs of patients with stroke, including implementing family-centered care, ensuring families that core nursing care will be maintained, enhancing quality of life by managing symptoms, integrating spiritual care, and providing a support system for patients and caregivers.

### Innovation in Transitions of Care

Despite current best practices, many patients continue to receive suboptimal poststroke care in the home environment. Technological innovations in mobile health and telemedicine offer new methods to extend care remotely to patients with stroke after hospital discharge, often through the support of home health nurses. New approaches take advantage of the wide availability of

tablets and smartphones and incorporate a range of novel technologies such as gaming, sensors, robotics, virtual reality, and telemedicine.<sup>132</sup> A recent prospective, randomized clinical trial tested a home-based telerehabilitation system versus traditional in-clinic rehabilitation and found that patients experienced similar improvements in arm motor function regardless of the setting.<sup>133</sup> In terms of secondary stroke prevention, mobile cardiac telemetry, implantable loop recorders, and smartwatches allow remote detection of paroxysmal atrial fibrillation after hospital discharge.<sup>134,135</sup> Although additional investigation is needed into the implementation and generalizability of these novel technologies, further advances will continue to offer new ways to ensure stability and good outcomes for patients with stroke in the postdischarge environment.

### CONCLUSIONS

This scientific statement describes the vital role of nursing in the provision of acute stroke nursing care, updating and building on the foundation of the Summers et al<sup>1</sup> 2009 statement. Integrating this knowledge with the 2 companion articles ("Care of the Patient With Acute Ischemic Stroke (Prehospital and Acute Phase of Care): Update to the 2009 Comprehensive Nursing Care Scientific Statement"<sup>5a</sup> and "Care of the Patient With Acute Ischemic Stroke (Endovascular/Intensive Care Unit-Postinterventional Therapy): Update to 2009 Comprehensive Nursing Care Scientific Statement"<sup>5b</sup>) forms a comprehensive update on nursing care of the patient with acute ischemic stroke.

Several critical gaps in nursing research related to acute stroke care have become evident during the writing of this scientific review. One is that specialized nursing care is not clearly defined in evidence-based practice or the literature, and consensus is needed on what specialized stroke nursing care entails. Another gap is the lack of well-planned nursing research detailing the specific contribution that nurses make to patient and family outcomes after stroke and whether it makes a difference if nurses are certified in a subspecialty area. In the United States, 2 certifications are offered from the American Board of Neuroscience Nursing,<sup>136</sup> the Certified Neuroscience Registered Nurse and the Stroke Certified Registered Nurse. One small study reported that stroke-certified registered nurses delivered more timely care to patients who had strokes.<sup>7</sup> Although some researchers suggest that specialty certification can favorably affect some patient outcomes such as lower patient fall rates and reduced selected hospital-acquired infections,<sup>137,138</sup> the impact and benefits of stroke certification are an as-yet underexplored area of research. Other countries also offer additional opportunities to specialize in stroke care via graduate certificates and online learning modules, but

the evidence to support the efficacy of these in clinical practice settings is also lacking.

This updated statement describes the care of the patient with acute ischemic stroke in the posthyperacute phase. Using evidence-based best practices, specialized nurses can affect outcomes, decrease length of stay, decrease costs, and decrease event recurrence. Nursing research remains a cornerstone, building and expanding nursing knowledge, practice, and evidence-based care for patients and families living with stroke.

### ARTICLE INFORMATION

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\*Modest.

†Significant.

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## Reviewer Disclosures

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Tamilyn Bakas	University of Cincinnati	NIH/NINR (funding targeting stroke family caregivers)†	None	None	None	None	None	None
Barbara J. Lutz	University of North Carolina–Wilmington	PCORI (CO-I on a PCORI-funded grant testing an intervention for poststroke care)†	None	Medbridge*	None	None	National Center for Rehabilitation Research Advisory Board*	None
DaiWai M. Olson	UT Southwestern Medical Center	None	None	None	None	None	None	None

This table represents the relationships of reviewers that may be perceived as actual or reasonably perceived conflicts of interest as reported on the Disclosure Questionnaire, which all reviewers are required to complete and submit. A relationship is considered to be "significant" if (a) the person receives \$10 000 or more during any 12-month period, or 5% or more of the person's gross income; or (b) the person owns 5% or more of the voting stock or share of the entity, or owns \$10 000 or more of the fair market value of the entity. A relationship is considered to be "modest" if it is less than "significant" under the preceding definition.

\*Modest.

†Significant.

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