Evaluation of neurological status is imperative to patient assessment. Multiple assessment tools are readily available for clinicians to diagnose and report changes in neurological condition. Some of these tools include the Glasgow Coma Scale, the National Institutes of Health Stroke Scale, the Canadian Neurological Scale, and the Four Score. Although assessment tools are beneficial to help standardize the assessment and communication of findings, they are at times cumbersome, leaving bedside clinicians with questions concerning which tool is appropriate for a given patient population. This initiative began as a means to standardize assessments and communication for neuroscience patients. As success was met, the project was moved forward locally at our hospital campus and later extended to the entire health system. With the support of the chief of neurology, the neuroscience patient care services director, the stroke coordinator, and the neuroscience clinical educator, three different neurological examinations were developed. They were defined as the Basic Neurological Check, the Coma Neurological Check, and the National Institutes of Health Stroke Scale/Stroke Neurological Check. The neurological examinations would address the assessment needs of patients with acute stroke, general neurosurgery/neurology patients, and patients in coma.

Keywords: Canadian Neurological Scale, Four Score, Glasgow Coma Scale, neurologic assessment, NIH Stroke Scale

A variety of assessment tools are available for the patient with a neuroscience diagnosis including the Glasgow Coma Scale (GCS; Teasdale & Jennett, 1976), the National Institutes of Health Stroke Scale (NIHSS; Brott et al., 1989), the Canadian Neurological Scale (Cote et al., 1989), and the Four Score (Wijdicks, Bamlet, Maramattom, Manno, & McClelland, 2005). These tools utilize numeric scales to objectively classify neurological function, identify neurological deterioration, guide treatment, and aid in predicting patient outcome. In addition, the tools provide a standardized language understood by the entire neuroscience team. Neurology, neurosurgery, and critical care disciplines all favor the use of different neurological scales with some redundancy or deviation depending on the aim of the scale.

Although assessment tools are beneficial to help standardize the assessment and communication of findings, they can be time consuming and can leave the nurse with many questions. For example, which patients need a GCS score? Should the GCS or the Four Score be used for intubated and sedated patients, or should the assessment be limited to a motor grading system? Does a GCS sufficiently address motor examination deficits in a stroke patient? Is orientation accurately assessed by asking the month, day, and year? Although neurological assessment tools can help to inform the clinical picture, not all assessment scales are equal, nor is it a one-size-fits-all process.

Background
North Shore University Hospital (NSUH) is an 806-bed quaternary facility in the North Shore-Long Island Jewish Health System (NSLIJ), located in Manhasset, NY. The NSUH has 54,525 admissions in the most recent year reported (2011). It performed 12,049 annual inpatient and 20,161 outpatient surgeries. It is considered a center of excellence for neurosciences among its 14 facilities in the NSLIJ Health System and is recognized by the Joint Commission as a certified Primary Stroke Center and by the American Stroke Association for exceeding national benchmarks using “Get with the Guidelines-Stroke.” The NSUH received the Gold Level Achievement Award annually from 2009 to 2012 for sustained adherence to the Get With The Guidelines Stroke Achievement Indicators.

In September 2010, the nursing and physician neuroscience leadership team at NSUH identified an opportunity for improvement in neurological assessment. The neuroscience team (stroke coordinator, stroke unit and neurosurgical intensive care unit [NSCU] nurses, physicians, physician assistants [PAs], and nurse practitioners [NPs]) recognized communication inconsistencies when reporting neurological deterioration to
other healthcare providers, during shift to shift handoff and during level-of-care transitions. Furthermore, the neuroscience nurses caring for patients on the general neuroscience floor struggled with describing neurological deteriorations upon transfer to the Stroke Unit or NSCU and when sharing this information with the neurology and neurosurgery teams for new consultations. In addition, nurses in the NSCU and medical intensive care unit (MICU) consistently used the GCS rather than the NIHSS when caring for patients with hemorrhagic and ischemic strokes, thereby complicating the communication between nurses and MDs, NPs, or PAs. The NSCU and MICU nurses reported a lack in confidence in utilizing the NIHSS and would defer to use the GCS despite the patient being awake and able to participate in performing the NIHSS. For example, a patient with an ischemic stroke as well as a hemiparesis and expressive aphasia would be described using GCS as eyes open spontaneously (E = 4), incomprehensible sounds (V = 1), and withdrawing to painful stimuli (M = 4). The licensed independent practitioners (LIPs), for example, NPs, PAs, and physicians were accustomed to the stroke unit nurses describing their assessments using the NIHSS and were confused when the critical care nurses reported changes in GCS terminology, creating a practice gap. This gap also existed when patients were transferred between the stroke unit and the NSCU. The stroke unit nurses, familiar with NIHSS, were puzzled by GCS descriptions of patients with stroke. Discrepancies even existed between the general neurology floor and the stroke unit in the assessment of an “extremity drift.” What the neuroscience floor nurses were calling an extremity drift was, upon closer examination, “some resistance against gravity.” In addition, the manual muscle testing (MMT) scale was at times used to document extremity strength when nurses felt the GCS did not adequately reflect the patient’s motor deficit (Florence et al., 1992; Frese, Brown, & Norton, 1987). Multiple assessment tools and no standardized rationale led to miscommunication among many levels of providers. This began the impetus to standardize assessments and communication across all disciplines. Guidelines for selecting the best neurological assessment tool and training were needed so nurses caring for our neuroscience patients were able to communicate changes in neurological status using a common language.

**Neurological Assessment Standardization**

Because of NSUH’s designation as a primary stroke center by The Joint Commission in 2009, leadership made the decision to utilize the NIHSS for all patients admitted with an ischemic or hemorrhagic stroke diagnosis. Before our designation as a primary stroke center, only the stroke unit nurses utilized the NIHSS for patient assessments. Patients with a stroke diagnosis are geographically routed to the neuroscience nursing unit, the stroke unit, MICU, or NSCU depending on their level of care needs.

Representatives from the neuroscience team composed of the chief of neurology, the neuroscience patient care services director, the stroke coordinator, and the neuroscience clinical educator sought approval from NSLIJ’s Nursing Executive Council and the Medical Board to modify the neurological assessments and implement an improved process for describing neurological deterioration. In December 2010, approval was granted, and the process began for the implementation of the three distinct neurological examinations. The three examinations were identified as the Basic Neurological Check, NIHSS Neurological Check, and Coma Neurological Check. The new neurological checks were based on the GCS and the NIHSS. A pupillary examination would be performed as part of each neurological check, assessing for pupil size, shape, and reaction to light bilaterally.

The neuroscience team created a Basic Neurological Check addressing the following domains: alertness, orientation, facial palsy, and four-limb strength. The Basic Neurological Check incorporated some simple elements of the NIHSS. We opted to include the alertness scoring because we wanted a more descriptive way to assess and document the level of consciousness. These three domains in the NIHSS address not only level of alertness but also orientation and the patient’s ability to follow one-step commands. Facial palsy was also added to the Basic Neurological Check in an attempt to systematically screen all neurological patients for new stroke onset. We also decided that a four-extremity motor assessment was more robust than the typical best upper extremity response seen in GCS assessments, and we incorporated the NIHSS motor scoring into the Basic Neurological Check.

The NIHSS Neurological Check encompasses all 11 items. The NIHSS is a reliable and valid tool for stroke research allowing the examiner to rank focal

---

The availability of myriad neurologic assessment tools and the lack of a standardized rationale for choosing among them provided the impetus for practitioners to develop a single tool to be used across disciplines.
neurological deficits often overlooked by the GCS. The MMT scale would be eliminated. The MMT scale, which is routinely used by physical therapists, requires repeated use to obtain proficiency. At times, this scale can be considered subjective and requires knowledge of how much resistance a normal muscle can tolerate as well as knowledge of when a muscle is not performing well, making this scale difficult for nurses to utilize.

The Coma Neurological Check includes the elements of the GCS (eyes, verbal, and motor); however, we evaluate all limbs according to the GCS criteria rather than the traditional best upper extremity response. Because of the overwhelming familiarity with the GCS and its high interrater reliability, the neuroscience team decided to maintain this tool for all patients in coma, regardless of the cause. For patients in coma with a neurological cause, the nurses perform a GCS once per shift and utilize the Coma Neurological Check as ordered for their hourly assessments.

**GCS**

The GCS was developed and first published in 1974 by neurosurgery professors Graham Teasdale and Bryan J. Jennett in an effort to standardize clinical observations and predict prognosis in patients with altered consciousness (Teasdale & Jennett, 1974). When combined with other data, such as intracranial pressure and cerebral perfusion pressure, the GCS is useful in identifying neurological changes, guiding and evaluating treatment, and predicting prognosis in patients with traumatic brain injury. The GCS evaluates various responses for eye opening, verbal ability, and best motor response of an upper extremity. It is a four-to-six-point grading system with lower scores indicating varying degrees of coma and higher scores indicating intact cerebral function. The first documented application of the GCS for nontraumatic coma was by Bates et al. (1977). Worse outcomes were observed in patients with extensor or flaccid motor responses, there were no verbal response or incomprehensible sounds, and persistent abnormal flexion did not rule out the chances for moderate disability or good recovery. Overall, the results verified that, regardless of the cause of coma, brain function or the lack of brain function is the key to neurological and overall recovery. Over the next 3 decades, the GCS remained the gold standard for neurological evaluation, even in sedated, intubated, or tracheotomized patients, despite recommendations that it should not be used in this subset of patients (Juarez & Lyons, 1995; Marion & Carlier, 1994).

**NIHSS**

The NIHSS was originally developed in 1983 as a research tool to measure the severity of ischemic stroke (Brott et al., 1989). It was considered a reliable and valid tool for stroke research because it allowed the examiner to rank focal neurological deficits often overlooked by the GCS. The NIHSS is composed of 11 items using a 0-to-four-point scale, with higher scores indicating greater deficits. The 11 items include level of consciousness with three distinct components (level of consciousness, questions, and commands), best gaze, visual, facial palsy, motor arm, motor leg, limb ataxia, sensory, best language, dysarthria, and extinction or inattention. It shows good correlation with the volume of cerebral infarction measured by brain computed tomography (scan) at 7 days and also shows good predictive correlation of 3-month outcome (Brott et al., 1989). The NIHSS possesses good interrater reliability (mean kappa = 0.69) and test–retest reliability when performed by neurologists and nonneurologists (mean kappa = 0.66–0.77). The NIHSS requires specialized training, which can be obtained from the American Stroke Association. The online training can take up to 3 hours to complete and provides a certificate upon completion. Proficiency in NIHSS scoring is gained during repeated use and skill development, not solely through online training. It is now considered the primary tool for evaluating neurological changes in patients with acute ischemic stroke and for determining treatment options and predicting patient outcomes.

**New Neurological Assessments**

The NIHSS Neurological Check became the standard for assessing any patient with an acute stroke diagnosis. This included patients with aneurismal subarachnoid hemorrhage, intraparenchymal hemorrhage, intraventricular hemorrhage, and all ischemic strokes (Figure 1). If the patient is intubated, mechanically ventilated, and sedated, then the coma neurological check is utilized. Twice a day, at the beginning of each shift (7 A.M. and 7 P.M.), the NIHSS is scored by the nurse using all 11 items. Then, hourly or as ordered by the LIP, the patient assessment includes only items 1 through 6. If there is a worsening change in any one item or if the overall score increases by two or more points, an LIP is notified.

The Basic Neurological Check is intended for use on any patient with a confirmed or suspected neuroscience diagnosis, except stroke, and could be performed by any nurse regardless of his or her specialty. It consists of eight elements, including assessment of orientation, ability to follow commands, motor strength, and assessment for facial droop (Figure 2). Because of NSUH’s designation as a primary stroke center in 2009, all nurses throughout the health system are taught how to assess for a facial droop. The assessment of a facial droop occurs in orientation and again.
FIGURE 1 NIH Stroke Scale Neurological Check

NIH Stroke Scale
For Stroke Neuro Checks complete numbers 1-6 and PERH
For full NIHSS, complete numbers 1-11 and PERH

1a. Level of Consciousness
1b. LOC Questions (Month, age)
1c. LOC Commands (Open, close eyes, make fist, let go)
2. Best Gaze (Eyes open, patient follows examiner's finger or face)
3. Visual (Introduce visual stimulus/threat to patient's visual field quadrants)
4. Facial Palsy (Show teeth, raise eyebrows and squeeze eyes shut)
5a. Motor Arm, Left (Elevate arm 30 degrees and score drift/movement)
5b. Motor Arm, Right (Elevate arm 30 degrees and score drift/movement)
5c. Motor Leg, Left (Elevate leg 30 degrees and score drift/movement)
5d. Motor Leg, Right (Elevate leg 30 degrees and score drift/movement)
7. Limb Ataxia (Finger-nose, heel down shin)
8. Sensory (Pin prick to face, arm, trunk, and leg and compare side to side)
9. Best Language (Name items, describe a picture and read sentences)
10. Dysarthria (Evaluate speech clarity by patient repeating listed words)
11. Extinction and Inattention (Use prior testing to identify neglect or double sided)

Total

NIH Stroke Scale 2. Best Gaze (Eyes open, patient)

NIH Stroke Scale 3. Visual (Introduce visual stimul)

NIH Stroke Scale 4. Facial Palsy (Show teeth)

NIH Stroke Scale 5a. Motor Arm, Left (Elevate arm)

NIH Stroke Scale 5b. Motor Arm, Right (Elevate arm)

NIH Stroke Scale 5c. Motor Leg, Left (Elevate leg)

NIH Stroke Scale 5d. Motor Leg, Right (Elevate leg)

NIH Stroke Scale 7. Limb Ataxia (Finger-nose)

NIH Stroke Scale 8. Sensory (Pin prick to face)

NIH Stroke Scale 9. Best Language (Name items)

NIH Stroke Scale 10. Dysarthria (Evaluate speech)

NIH Stroke Scale 11. Extinction and Inattention

Copyright © 2014 American Association of Neuroscience Nurses. Unauthorized reproduction of this article is prohibited.
as part of the annual registered nurse (RN) education. The components of the Basic Neurological Check are taken directly from NIHSS items 1a, 1b, 1c, 4, 5, and 6. The members of the neuroscience team agreed that these items provide an assessment that is easy to perform by all levels of nursing and captures the essential elements of a neurological check.

The Coma Neurological Check is a combination of a four-extremity motor examination and the GCS. The four-extremity motor examination is the same examination used in the GCS, but instead of documenting only the best upper extremity response, all four extremity responses are documented. The neurologists, neurosurgeons, and neurointensivists at our institution wanted a full description of all extremity responses to better evaluate the neurological status of patients. They believed the GCS motor examination was an adequate assessment for patients in coma. The Coma Neurological Check is exclusively used in the critical care units (Figure 3).

Implementation
Training for the Basic Neurological Check and Coma Neurological Check for all NSUH nurses occurred as part of a mandatory initiative. Thirty-minute sessions were scheduled off the unit for the review. The sessions ran for 7 days on both the day and night shifts to ensure maximum nursing exposure. On average, 6–8 sessions were held each day. A lesson plan was developed and disseminated to all nurse educators so they were knowledgeable and conversant on the elements of the basic neurological check when teaching the session. Seventy-five percent of the nursing staff (excluding nurses on medical leave of absence or sick leave) attended the sessions. The remaining 25% received individual education by their unit-specific educator or nurse manager when they returned to work.

The NIHSS was first used by nurses in the stroke unit in 2009 to structure communication between nurses and physicians when discussing neurological changes in our acute ischemic stroke population. Before the new process, training consisted of completing the online NIHSS certification program and follow-up validation by an educator or LIP such as a neurology NP, resident, or attending physician to refine assessment skills. Appropriate validators used these assessments as educational opportunities to improve the nurses’ clinical assessment of the patient while performing the NIHSS. Over time, the nurses and practitioners became more proficient and confident in their neurological assessments. After approval from the Nurse Executive...
Council and the Medical Board, the neuroscience team divided into two groups: one to work with the information technology department to incorporate the three neurological checks into the electronic medical record and the other to initiate reeducation on the NIHSS in the neuroscience specialty areas (e.g., neuroscience floor, stroke unit, and NSCU) and to revise the RN orientation education with a stronger emphasis on NIHSS and GCS scoring. From April through June 2011, all neuroscience nurses attended a neuroscience review day inclusive of neuroanatomy, neurophysiology, stroke, and specific practice scenarios for NIHSS and GCS scoring. Afterward, when new patients were admitted to the stroke unit or NSCU, handoff communication occurred at the bedside between the stroke unit nurse and the LIP and included a review of the

**FIGURE 3 Coma Neurological Check**

![Coma Neurological Check Diagram](image-url)
patient’s NIHSS. The neuroscience educator was also available to validate the nurse’s assessment or assist nurses in performing the NIHSS. In the stroke unit and the NSCU and on the neuroscience floor, the NIHSS was regarded as the assessment tool for all patients with a transient ischemic attack or stroke diagnosis. By July 2011, the new RN orientation was implemented, and all the incumbent neuroscience nurses were more confident and competent in performing the NIHSS because of their additional education, training, and daily use during patient assessment. Because stroke patients are less often admitted to the MICU, it was determined by the neuroscience team to educate the MICU nurses in real time and on the unit.

The NIHSS education for the MICU nurses was done in the ICU with real patients at scheduled intervals depending on the availability of patients with stroke. To accommodate the day and night shift nurses, education was conducted on both shifts. The MICU nursing leadership (day shift nurse manager, NP, and evening and night assistant nurse managers) received 1:1 in-depth training by the neuroscience educator so they could act as resources to the nursing staff in the absence of the educator. The education on NIHSS Neurological Check and Coma Neurological Check for the MICU nurses took approximately 6 weeks to complete utilizing the neuroscience educator and the MICU nursing leaders.

As an additional layer of reinforcement, the nursing education department created three short videos, one for each neurological check, explaining their purpose and describing the documentation process. The videos were launched on the NSLIJ intranet and are available for viewing at any time. To further simplify the process, the nursing education department developed an algorithm to help practitioners and nurses determine which neurological assessment tool to use (Figure 4).

**Summary**

Nurses throughout NSUH eagerly accepted the new neurological checks. Nurses verbalized that they experienced less burden with documentation and, when documenting on patients with neurological diagnoses, felt increased confidence in communicating changes. Although no formal process was conducted to evaluate the effectiveness of the changes, anecdotal accounts from nurses and LIPs continue to remain positive. Nurses report that the shift-to-shift report is more thorough; LIPs noted that nurses are more articulate in describing neurological changes and the nurses overall expressed more confidence in their assessment and communication skills. Both our nursing and physician leadership for neuroscience affirm that the NIHSS offers a more robust representation of their patient’s neurological condition, making observations quantifiable and thus easier to describe changes.

New nurses to the NSLIJ system receive training on the three types of neurological checks during their system orientation. Likewise, newly hired nurses to the MICU, NSCU, neuroscience floor, and stroke unit are required to successfully complete the NIHSS certification, so that when they begin their clinical orientation,
they are knowledgeable in the NIHSS. The validation of NIHSS and GCS skills by an educator during the orientation process assures sound clinical assessment when caring for patients with neurological injury. Use of standardized neurological assessment tools has helped in the early identification of neurological symptoms. Nurses verbalize more confidence in their ability to identify changes in clinical symptoms, promoting early recognition, intervention, and treatment for a wide range of neuroscience patients.

References


