

# Quality improvement in neurology: Inpatient and emergency care quality measure set

## Executive summary



S. Andrew Josephson, MD  
John Ferro, MD, MS  
Adam Cohen, MD  
Adam Webb, MD  
Erin Lee  
Paul M. Vespa, MD

Correspondence to  
American Academy of Neurology:  
quality@aan.com

The emergence of inpatient neurologic specialists including neurohospitalists and neurointensivists has led to an increased focus on the quality of neurologic care delivered in the hospital. Each year, there are over 1.5 million nonsurgical neurologic hospital discharges in the United States, making neurology a large inpatient specialty even without accounting for non-admitted emergency patients.<sup>1</sup> National quality metrics in other non-neurologic specialties have focused primarily on inpatient care since hospitals, insurers, professional organizations, and the general public have turned their attention to outcomes achieved during and following hospitalization. Many of these metrics have been applied to neurology patients, despite their not being developed with neurology-specific patient populations or disorders in mind. This gap highlights the need for measures for neurology patients in both inpatient and emergency settings.

In 2015, the American Academy of Neurology (AAN), Neurocritical Care Society (NCS), and Neurohospitalist Society (NHS) formed an Inpatient and Emergency Neurology Work Group to review existing guidelines, current evidence, and gaps in care in order to develop a measurement set for inpatient and emergency neurology. The goal of this effort was to develop a quality measurement set, which should not be confused for a clinical practice guideline. This article is a result of a formal process that was conducted according to standards and methods created by the AAN. The same methodology has been used to develop many other quality measures that focus on other conditions and diseases within neurology. This quality measurement set aims to promote quality improvement and drive better outcomes for neurologically ill patients in inpatient and emergency settings while providing a roadmap for improving care at national, regional, and local levels.

The AAN, NCS, and NHS developed this quality measure set based on the belief that specialists should play a major role in selecting and creating measures that will drive performance improvement and possibly be used in accountability programs. The AAN, NCS, and NHS formed the Work Group with representatives from professional associations and patient advocacy organizations to ensure the developed measures represented the diverse experience, views, and skills of broad and multidisciplinary health care teams.

No single quality measure set is able to capture all the aspects of treatment needed for the diverse patients in these settings. This quality measure set is focused on measuring the quality of care provided for a variety of conditions and diseases and does not address the whole scope of each disorder, nor all of inpatient or emergency neurology. In this executive summary, we report on the quality measure set developed by the Work Group. The full quality measure set, including specifications, is available in appendix e-1 at [Neurology.org](http://Neurology.org).

**OPPORTUNITIES FOR IMPROVEMENT** Inpatient and emergency neurology focuses on diseases that span the neurologic spectrum. Patients with these disorders are treated by both neurologists and non-neurologists. Opportunities for quality improvement were identified for a variety of these conditions based on a review of the literature that revealed both gaps in care and areas where quality measures might be used to drive improvement. This measurement set focuses on brain death, urinary catheters, delirium, Guillain-Barré syndrome (GBS), myasthenic crisis, status epilepticus, bacterial meningitis, advanced directives, and goals of care.

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Supplemental data  
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### GLOSSARY

**AAN** = American Academy of Neurology; **CAUTI** = catheter-associated urinary tract infection; **GBS** = Guillain-Barré syndrome; **NCS** = Neurocritical Care Society; **NHS** = Neurohospitalist Society.

From the Department of Neurology (S.A.J.), University of California San Francisco; Vassar Brothers Medical Center (J.F.), Poughkeepsie, NY; Massachusetts General Hospital (A.C.), Department of Neurology, Boston; Department of Neurology (A.W.), Emory School of Medicine, Atlanta, GA; American Academy of Neurology (E.L.), Minneapolis, MN; and Department of Neurology (P.M.V.), University of California Los Angeles.

Approved by the AAN Quality and Safety Subcommittee on August 29, 2016; by the AAN Practice Committee on September 16, 2016; by the Neurohospitalist Society Board of Directors on September 30, 2016; by the Neurocritical Care Society Board of Directors on October 26, 2016; and by the AAN Board of Directors on November 3, 2016.

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Despite the development of evidence-based guidelines for the determination of brain death by neurologic criteria (e.g., brain death), significant variability in the practice has been identified.<sup>2</sup> A review of more than 30 major institutions' guidelines on brain death showed there was inconsistency in nearly every aspect of brain death declaration, identifying a clear opportunity for quality improvement.<sup>3</sup>

Delirium is extremely common in hospitalized patients, especially in those with preexisting neurologic conditions including cognitive impairment as well as in those with advanced age. Delirium has been associated with poor outcomes, including increased length of hospital stay, greater incidence of hospital-acquired conditions, and death, while increasing average daily costs substantially.<sup>4</sup>

Patients with GBS and patients with myasthenia gravis in crisis are frequently admitted to the hospital. These neuromuscular emergencies may be difficult to recognize, especially by non-neurologists, but they require prompt recognition and treatment in order to prevent prolonged neurologic disability.<sup>5-7</sup>

Status epilepticus is a neurologic emergency that affects between 50,000 and 150,000 patients annually in the United States and requires rapid treatment.<sup>8-10</sup> The estimated mortality is up to 30% in adults, and rapid termination of both clinical and electrical seizure activity reduces both mortality and morbidity associated with this condition.<sup>8,9,11,12</sup>

The administration of dexamethasone prior to or concurrent with the first dose of antimicrobials is now widely accepted as standard practice in the management of acute bacterial meningitis in the industrialized world and can reduce morbidity and mortality by mitigating the brisk inflammatory reaction that can result in the meninges.<sup>13-16</sup> Neurologists and non-neurologists in inpatient and emergency settings need to be aware of appropriate empiric treatment algorithms while lumbar puncture results, including cultures, are pending.

Catheter-associated urinary tract infection (CAUTI) is regarded as one of the most common health care-associated infections and a variety of efforts have been initiated nationally to reduce their frequency. Overuse of indwelling urinary tract catheters is particularly common in hospitalized neurologic patients with stroke or dementia, increasing CAUTI rates in these conditions.<sup>17,18</sup>

Patients admitted to the hospital for neurologic emergencies have a high risk of mortality and often face important choices regarding life-sustaining therapies. However, it is estimated that only about 1 in 5 seriously ill patients have documented advanced directives; increasing the use of these advanced directives and documentation of discussions regarding goals of care with patients and families could improve

patient satisfaction and outcomes while assuring our patients' wishes are respected at the end of life.<sup>19</sup>

**METHODS** The AAN, NHS, and NCS formed a cross-specialty and multidisciplinary expert work group of diverse key stakeholders from physician and nonphysician associations, patient and caregiver advocacy organizations, and payers. Details of the full measure development process are available online (Quality and Safety Subcommittee, American Academy of Neurology Quality Measurement Manual 2014 Update, January 2015; available at: [aan.com/uploadedFiles/Website\\_Library\\_Assets/Documents/3.Practice\\_Management/2.Quality\\_Improvement/1.Quality\\_Measures/2.About\\_Quality\\_Measures/2015%2002%2011%20Process%20Manual%20Final.pdf](http://aan.com/uploadedFiles/Website_Library_Assets/Documents/3.Practice_Management/2.Quality_Improvement/1.Quality_Measures/2.About_Quality_Measures/2015%2002%2011%20Process%20Manual%20Final.pdf)). The formation of the work group began with a nomination process from each organization, which led to a 23-member final work group, which is listed at the conclusion of the article.

All work group members were required to disclose potential conflicts of interest and completed applications summarizing their experiences and interests. The co-chairs and facilitators independently selected members from the pool of qualified specialists and expert nominees. The selection was based on the nominee's clinical activities and experience with performance measures and quality improvement.

The measure development process included the following: (1) performing an evidence-based literature search; (2) drafting candidate measures and technical specifications; (3) establishing a multidisciplinary work group adhering to the AAN conflict of interest policy; (4) convening the work group in person to review candidate measures; (5) refining and discussing the candidate measures; (6) soliciting public comments on approved measures during a 30-day period; (7) refining the final measures according to input received during the public comment period and corresponding technical specifications; and (8) obtaining approvals from the work group, AAN Quality and Safety Subcommittee, AAN Practice Committee, AAN Institute Board of Directors, NHS Board of Directors, and NCS Board of Directors.

The work group sought to develop evidence-based measures to support the delivery of high-quality care and to improve patient outcomes. The co-chairs and facilitators, guided by a medical librarian, conducted a comprehensive literature search identifying 1,595 abstracts relevant to the potential measures. This search included 16 guideline documents representing a core feature of the evidence base for the measures developed.

Prior to the work group meeting, the leadership group put forth a set of candidate measures for work group review and discussion. The work group met on August 28, 2014, developing and approving 12 candidate measures. Following the development of draft measure concepts during the in-person meeting, a public comment period resulted in 115 comments from 16 individuals. Following a review of these public comments, which were incorporated into the measurement set, the work group ultimately approved 12 revised measures for inclusion in the AAN 2016 Inpatient and Emergency Neurology Quality Measurement Set.

The AAN, NHS, and NCS plan to provide resources to update these measures every 3 years. Thus, this measure set aims to provide a working framework for measurement and refinement, rather than a long-term mandate.

## **RESULTS: INPATIENT AND EMERGENCY NEUROLOGY QUALITY MEASUREMENT SET**

Potential gaps in care quality span all neurologic conditions that bring patients to inpatient and emergency

hospital settings. This measure set aims to address some of these gaps, particularly where clinical evidence exists to support measure development. The measures were not intended to address all such conditions or all complications of neurologic disease. Instead, they were chosen and developed to affect large, broad neurologic populations, cutting across many neurologic conditions. If broadly adopted, some of these measures would also affect non-neurologic patients (table).

Brain death determination remains an important and common task in the neurologist's domain. Adhering to published guidelines may lead to improved communication with families, reduced hospital costs, and increased rates of successful organ donation. Apnea testing should be performed in all patients when possible and documented clearly per established guidelines to assure hospitals and the

public that this important determination is being performed carefully and with great accuracy. When apnea testing is not possible or there are potential confounders, appropriate ancillary testing should be utilized and documented.

In the last decade, delirium has been increasingly recognized as an important complication in hospitalized patients, disproportionately affecting patients with primary neurologic diagnoses and those of advanced age. Patients at risk for delirium can be identified through a host of validated bedside instruments and standardized clinical assessments; prevention efforts can then be initiated to reduce the rate of hospital-acquired delirium in these high-risk patients. Once delirium is newly identified in the hospital, evidence-based management includes multicomponent and multidisciplinary efforts in which nonpharmacologic interventions

**Table** 2016 Inpatient and emergency care measurement set

Measure title	Measure description	Potential challenges
<b>Documentation of brain death</b>	Percent of patients (>37 weeks gestational age) who died in the hospital with a diagnosis of brain death who had documentation of apnea testing or, if apnea testing not possible, an ancillary test for assessment of death by neurologic criteria was performed.	Different state laws regarding legal documentation required for the diagnosis. Variable screening practices for brain death, suggesting some cases may be missed.
<b>Delirium risk factor screening and preventative protocol</b>	Percentage of patients at high risk of developing delirium who had a preventative protocol instituted.	Multidisciplinary cooperation required between multiple physician and nonphysician stakeholders. Identifying a specific high-risk delirium screening tool for implementation of the many available, especially leveraging nursing or EMR-based screens that reduce physician workload.
<b>Nonpharmacologic treatment of delirium</b>	Percent of patients with delirium (that was not present on admission) who were treated initially with a nonpharmacologic treatment.	Identifying delirious patients. Incorporating nonpharmacologic treatments in the setting of busy units where pharmacologic therapies may currently be widely used.
<b>Immunosuppressive treatment for GBS</b>	Percent of patients admitted to an inpatient facility with GBS who are nonambulatory with documentation that immunosuppressive therapy (PE or IVIg), and not corticosteroids, was prescribed.	Recognition of AIDP early in the course of illness.
<b>Immunosuppressive therapy for myasthenic crisis</b>	Percent of patients with myasthenic crisis who are given immunosuppressive therapies (PE or IVIg).	Recognition of myasthenic crisis.
<b>Status epilepticus identification and seizure cessation</b>	Percent of patients in generalized convulsive status epilepticus rapidly identified and treated with benzodiazepines.	In some cases, benzodiazepines will be given in the prehospital setting, leading to challenges in documentation.
<b>Status epilepticus treatment with AED/antiseizure medication</b>	Percentage of patients with generalized convulsive SE rapidly treated with a nonbenzodiazepine antiepileptic/antiseizure medication following (or simultaneously ordered with) the administration of a benzodiazepine.	Determination with ongoing studies as to the most effective AED for this purpose.
<b>EEG for status epilepticus and coma</b>	Percentage of patients with generalized convulsive status epilepticus who remain in coma should have urgent EEG applied and interpreted.	Having transfer protocols in place for hospitals that do not have 24/7 EEG capabilities.
<b>Treatment of bacterial meningitis</b>	Percentage of patients >21 years of age in whom dexamethasone 10 mg is given IV before or with the first dose of antibiotics in suspected acute bacterial meningitis.	Identifying patients in whom bacterial meningitis is suspected prior to CSF analysis, therefore warranting empiric treatment.
<b>Reduction of urinary catheters used for patients with neurologic conditions</b>	Hospitals that have a protocol for rational urinary catheter use.	Multidisciplinary cooperation required between multiple physician and nonphysician stakeholders.
<b>Discussion and documentation of an advanced directive</b>	Percent of patients with a neurologic condition admitted to the hospital who have documentation of advanced directive and a health care proxy.	Making time for such discussions in patients in whom the discussion has not already occurred.
<b>Discussion and documentation of goals of care</b>	Percentage of patients with a primary neurologic condition who are admitted to the ICU who have documentation of a goals of care discussion with patient or patient surrogate.	Some patients will not have a surrogate easily identified to have such a discussion. Patients who are only transiently in the ICU, such as those in the postoperative setting, may not wish to have such a discussion.

Abbreviations: AED = antiepileptic drug; AIDP = acute inflammatory demyelinating polyneuropathy; EMR = electronic medical record; GBS = Guillain-Barré syndrome; ICU = intensive care unit; IVIg = IV immunoglobulin; PE = plasmapheresis.

should typically occur before medications such as antipsychotics are initiated.

Neuromuscular emergencies, such as GBS or myasthenic crisis, can be challenging diagnostically, and definitive immunosuppression therapy can therefore be delayed. The panel recognized that there is strong evidence for the usage of plasmapheresis or IV immunoglobulin in these conditions and that their timely initiation can reduce the duration of acute hospitalization and may avoid the need for mechanical ventilation. These therapies should be available in hospitals that serve this patient population, and if not available, patients should be transferred to hospitals with these capabilities.

Rapid identification and treatment of status epilepticus improves patient outcomes. The panel identified this as an important metric, but many uncertainties were identified, including the optimum treatment strategy, timing of EEG, treatment of non-convulsive seizures, and differences in treatment approach based on patient age. These uncertainties reflect the lack of robust data that define best current practice. Nonetheless, the treatment of convulsive status epilepticus in the adult patient appears to have strong evidence, and the panel endorsed the rapid identification and treatment of this disorder. This metric is likely to become refined and more specific as future studies clarify the optimal timing of testing and treatment.

Although neurologists do not always provide primary or initial management for adults with acute bacterial meningitis, some encounter such patients in the emergency and inpatient settings and therefore proper rapid acute treatment should be recognized. This treatment not only includes antibacterials but also the prompt administration of corticosteroids before or with the first dose of antibiotics whenever the diagnosis is suspected. Early administration of corticosteroids reduces morbidity, and possibly mortality, with certain forms of bacterial meningitis.

Urinary tract infection is one of the most common health care-associated infections, often occurring after the placement of an indwelling catheter. Between 21% and 56% of such catheters are placed without a clear medical indication.<sup>20</sup> Nearly half a million CAUTIs occur annually, at a cost of about \$1,000 per admission.<sup>21</sup> As a result of an apparent excess of iatrogenic CAUTIs, Medicare no longer reimburses hospitals for hospital-acquired CAUTI-associated costs. Nevertheless, this policy change resulted only in a small decrease (1%) in CAUTI rates.<sup>22</sup> Increasing efforts have focused on CAUTI rate reduction in neurology patients primarily through reducing catheter use in this population during the hospitalization.<sup>23–25</sup> Neurologists can work with hospitals to develop protocols for rational

catheter use in those patients with neurologic illness with the hopes of reducing CAUTI rates.

Inpatient and emergency neurologic patient populations are increasingly complex and have a high severity of illness, increasing their mortality risk and that of long-term disability. Many such populations harbor conditions for which prospective planning, in the form of an advanced directive and a health care proxy, could help avoid futile care and unnecessary suffering. Such conditions include malignant brain tumors and end-stage neurodegenerative disorders, but also span a wide range of conditions that affect the nervous system. While prehospital discussions of prognosis, quality of life, long-term needs, and goals of care are critical to the quality of care in these patients, many patients have not had such discussions and can take the opportunity to do so during the hospitalization. An early hospital-based discussion may also be necessary to define the goals of care for the current hospitalization, especially for critically ill patients in the intensive care unit setting.

**DISCUSSION** Increased scrutiny on quality and safety in hospitals nationwide has led to the development of multiple metrics for inpatients across a variety of specialties. While some attention to readmission rates and nosocomial infections naturally involves patients with neurologic illness, few quality metrics exist specifically for disorders of the nervous system.<sup>25,26</sup> Rather than allow insurers or non-neurologists to define quality across neurologic conditions, this effort aimed to garner neurologic expertise by defining measures that were supported by evidence and were relevant to the practicing neurologist. This new quality measure set is based on a rigorous and careful process. It is important to reiterate that these quality measures are not clinical practice guidelines. Many important unanswered questions exist surrounding best practices, which require further research. However, it is incumbent upon neurologists to set forth a practical and clear quality measure set in the current era. Continued evolution of these metrics, as well as the addition of new metrics, is expected as further evidence emerges.

Implementation of quality metrics remains a difficult task across medicine. Many of the metrics defined here require a multidisciplinary approach, with some of these elements not being completely controlled by the practicing neurologist (e.g., out-of-hospital advanced directive discussions) or involving conditions where a neurologist may not always be consulted (e.g., meningitis, delirium). As a result, neurologists' involvement in the implementation of these metrics will be institution-specific. For example, at a local level, a neurologist may assist in the development of pathways or guidelines in concert with

a team of physicians, nurses, pharmacists, allied health professionals, and hospital staff. It is essential for neurology as a specialty to take the lead in these initiatives rather than allow quality in neurologic care to be defined by others less interested or knowledgeable in the care of neurologic patients.

Measurement of many of these metrics will be difficult for a single practicing neurologist to accomplish. Health care systems will need to invest in resources for data acquisition and management in order for neurologists to be able to quantify their adherence rates. This type of investment will not be trivial but will allow individual hospitals and health systems to demonstrate excellence in emergency and inpatient neurologic care to providers and the public at large, who increasingly have choices where to seek care even in emergent situations.

While the era of quality measures in neurologic care remains in its infancy, this partnership among the AAN, NCS, and NHS serves as an example of the type of collaborative effort required to advance the field. We look forward to continued refinement and discussion of these quality metrics as they are implemented.

#### AUTHOR CONTRIBUTIONS

Dr. Cohen contributed to study concept and design, acquisition of data, analysis or interpretation of data, drafting/ revising the manuscript, critical revision of the manuscript for important intellectual content, and study supervision. Dr. Ferro contributed to study concept and design, acquisition of data, analysis or interpretation of data, drafting/ revising the manuscript, critical revision of the manuscript for important intellectual content, and study supervision. Dr. Josephson contributed to study concept and design, acquisition of data, analysis or interpretation of data, drafting/ revising the manuscript, critical revision of the manuscript for important intellectual content, and study supervision. E. Lee contributed to study concept and design, acquisition of data, analysis or interpretation of data, drafting/ revising the manuscript, critical revision of the manuscript for important intellectual content, and study supervision. Dr. Vespa contributed to study concept and design, acquisition of data, analysis or interpretation of data, drafting/ revising the manuscript, critical revision of the manuscript for important intellectual content, and study supervision. Dr. Webb contributed to study concept and design, acquisition of data, analysis or interpretation of data, drafting/ revising the manuscript, critical revision of the manuscript for important intellectual content, and study supervision.

#### ACKNOWLEDGMENT

The authors thank the Inpatient and Emergency Neurology Quality Measurement Set Work Group members for their dedication, time, energy, contributions, and work that supported the development of this manuscript: John Ferro, MD, MS, FAAN (co-chair) (American Academy of Neurology); S. Andrew Josephson, MD, FAAN (co-chair) (Neurohospitalist Society); Paul Vespa, MD, FAAN (co-chair) (Neurocritical Care Society); Rohit Das, MD, MPH (American Academy of Neurology); David Gloss, MD (American Academy of Neurology); David Jones, MD (American Academy of Neurology); William Mack, MD, MS, FAANS, FAHA (American Association of Neurological Surgeons; Congress of Neurological Surgeons); Virginia Prendergast, PhD, NP-C (American Association of Neuroscience Nurses); Chip Truwit, MD (American College of Radiology/American Society of Neuroradiology); Paul Van Ness, MD (American Epilepsy Society); Michael Perskin, MD (American Geriatrics Society); Sanjeev Sockalingam, MD, FRCP (American Psychiatric Association); Charlotte Jones, MD, PhD, MSPH (Child Neurology Society); Kevin Sheth, MD, FAAN, FNCS,

FAHA (Neurocritical Care Society); Navaz Karanjia, MD (Neurocritical Care Society); Salvador Cruz-Flores, MD, MPH, FAAN (Neurocritical Care Society); Corey Fehnel, MD, MPH (Neurocritical Care Society); John Probasco, MD (Neurohospitalist Society); Mark Rubin, MD (Neurohospitalist Society); Jennifer Simpson, MD (Neurohospitalist Society); Jana Wold, MD (Neurohospitalist Society); Adam Cohen, MD (American Academy of Neurology facilitator); Adam Webb, MD (American Academy of Neurology facilitator); Amy Bennett, JD (American Academy of Neurology staff); Gina Gjørvad (American Academy of Neurology staff); Erin Lee (American Academy of Neurology staff); Becky Schierman, MPH (American Academy of Neurology staff).

#### STUDY FUNDING

No targeted funding reported.

#### DISCLOSURE

S. Josephson receives personal compensation as Editor-in-Chief of *JAMA Neurology* and in an editorial capacity for *Continuum*. J. Ferro and A. Cohen report no disclosures relevant to the manuscript. A. Webb has received compensation for consulting and speaking activities from Bard Medical. E. Lee is an employee of the American Academy of Neurology. P. Vespa reports research funding from NINDS, DOD, and State of California; industry research funding from SAGE and EDGE; speaker for Zoll, Intouch Health and SAGE; and stock equity for Intouch Health. Go to [Neurology.org](http://Neurology.org) for full disclosures.

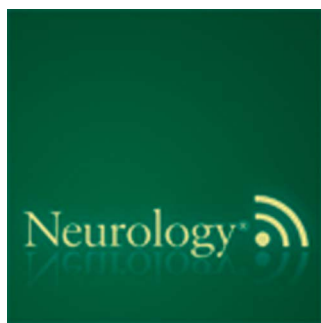
Received November 21, 2016. Accepted in final form April 10, 2017.

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This podcast begins and closes with Dr. Robert Gross, Editor-in-Chief, briefly discussing highlighted articles from the August 15, 2017, issue of *Neurology*. In the first segment, Dr. Jason Crowell talks with Dr. Paul Vespa about his paper on quality improvement in inpatient and emergency neurologic care. In the second part of the podcast, Dr. Teshamae Monteith focuses her interview with Dr. Randolph Evans on a *Neurology Today*<sup>®</sup> story about incidental findings and normal variants on brain MRI for adults with primary headache.

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*Neurology* 2017;89;730-735 Published Online before print July 21, 2017

DOI 10.1212/WNL.0000000000004230

**This information is current as of July 21, 2017**

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