Stroke

PERFORMANCE AND QUALITY MEASURES

2024 AHA/ASA Performance and Quality Measures for Spontaneous Intracerebral Hemorrhage: A Report From the American Heart Association/American Stroke Association

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ABSTRACT: The American Heart Association/American Stroke Association released a revised spontaneous intracerebral hemorrhage guideline in 2022. A working group of stroke experts reviewed this guideline and identified a subset of recommendations that were deemed suitable for creating performance measures. These 15 performance measures encompass a wide spectrum of intracerebral hemorrhage patient care, from prehospital to posthospital settings, highlighting the importance of timely interventions. The measures also include 5 quality measures and address potential challenges in data collection, with the aim of future improvements.

Key Words: AHA Scientific Statements ■ cerebral hemorrhage ■ data collection ■ quality indicators, health care ■ stroke

KEY MESSAGES

- Performance measures are created as a tool to translate a subset of clinical practice guideline recommendations into evidence-based patient care to improve outcomes.
- The scope of patients with intracerebral hemorrhage in these performance measures includes patients presenting with acute, spontaneous, nontraumatic intracerebral hemorrhage without a known structural or macrovascular cause.
- The current performance measures differ from the 2018 American Heart Association/American Stroke Association Clinical Performance Measures for Adults Hospitalized With Intracerebral Hemorrhage in that they address both patients presenting to the hospital with intracerebral hemorrhage and patients who develop an acute spontaneous nontraumatic intracerebral hemorrhage during their hospitalization. In addition, measures were created to address both the prehospital and posthospital settings.
- The current document includes quality measures to address evidence-based recommendations from the 2022 guideline that have anticipated challenges with respect to feasibility of data collection and attribution. In the future, it is hoped that this will spur improved data collection and reporting so that these quality measures can be translated into performance measures.

PREAMBLE

The purpose of the American Heart Association (AHA)/American Stroke Association (ASA) stroke performance measurement is to expedite the translation of scientific evidence into clinical practice. Measure sets developed by the AHA/ASA are intended to provide practitioners and institutions with tools to measure the quality of care and identify opportunities that will improve outcomes for patients with stroke.

The writing groups tasked with developing these measures consider the methodology of performance measure development and ensure that the measures align with AHA/ASA clinical practice guidelines. These committees identify measures that effectively capture essential elements of quality care such as timeliness, safety, effectiveness, efficiency, equity, and patient-centeredness while minimizing the data collection burden on hospitals, practices, and practitioners.

Performance measures are often imperfect, and we recognize that implementation may lead to unintended consequences. The manner in which challenges are addressed depends on several factors, including the measure design, data collection method, performance attribution, baseline performance rates, reporting methods, and incentives linked to these reports.

The AHA Stroke Performance Measures Oversight Committee (SPMOC) distinguishes quality measures from performance measures. Quality measures are those metrics that may be useful for local quality improvement but lack the strength of evidence or guideline inclusion to support public reporting or pay for performance programs (uses of performance measures). In other instances, when the guideline supports a measure, the writing group may feel it is necessary to have the measure tested to identify the impact of measure implementation. Quality measures may then be promoted to the status of performance measures as supporting evidence becomes available.

Daniel P. Gibson, MD
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INTRODUCTION

Approximately 80 000 people experience intracerebral hemorrhage (ICH) each year in the United States.[1] Despite the significant functional disability and 30% to 40% mortality rate after ICH,[2] systems of care for patients with ICH have long trailed that of patients with acute ischemic stroke. One recent study, published after the guideline recommendations, showed that the implementation of a care bundle for patients with ICH improved patient outcome.[3] This increases the urgency for the stroke community to promote better systems of care and to ensure rapid translation of research into clinical practice for patients with ICH. The AHA/ASA launched the Target Stroke Initiative in 2011 to reduce door-to-needle times and to promote best practices for patients with acute ischemic stroke. More than a decade later, it is time to mobilize the stroke community to do the same for patients with ICH, given the potential for improved patient outcomes with coordinated care.[4]

Guidelines evaluate the scientific evidence behind clinical decision-making and patient management. The type and quality of clinical trials supporting the evidence determine the Level of Evidence for each recommendation. The Class, or Strength of Recommendation, evaluates the ratio of benefit to harm for patients that would occur from following each recommendation. Guideline writing groups are tasked with developing a set of recommendations based on treatments that have been shown to improve patient outcome. Therefore, the guidelines themselves are limited by outcome-based evidence. This is particularly challenging for ICH studies, in which patients have significant comorbidities at presentation and often have in-hospital complications that influence outcome independently of study treatments. Given the high morbidity and mortality of ICH and the need for rapid identification and treatment, it is more likely that a bundle of care rather than any single intervention is likely to significantly affect patient outcome. Performance measures incorporate only a small portion of the overall clinical guideline recommendations and include only those recommendations in which adherence to the guideline recommendation would lead to the greatest benefit for the patient (Class 1 recommendations) or those recommendations in which failure to follow would lead to demonstrable patient harm (Class 3 recommendations). Performance measures are also crafted to ensure that they address clinically meaningful topics. They should be clearly written for practitioners to follow, and data should be feasible to measure and collect. Overall, the purpose of clinical performance measures is to reduce variability and to ensure that all patients get high-quality, evidence-based care that improves patient outcome.

In 2018, the AHA/ASA created the first ICH performance measure set based on the 2015 AHA/ASA management of spontaneous ICH guideline.[5,6] In 2022, the AHA/ASA released a new guideline for the management of patients with spontaneous ICH.[7] In 2023, the AHA Hemorrhagic Stroke Initiative released a group of Get With The Guidelines measures specific to patients with ICH as a pilot for quality improvement.[8] The current performance measures are an update to the 2018 AHA/ASA clinical performance measures for adults hospitalized with ICH[5] and are based on the 2022 AHA/ASA management of spontaneous ICH guideline.[7] The scope of patients with ICH to be included in these performance measures parallels those in the 2022 guideline and is therefore limited to patients presenting with acute, spontaneous, nontraumatic intracranial hemorrhage without a known structural cause (eg, underlying tumor or vascular malformation). These performance

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measures should not be applied to patients with chronic hemorrhage, exclusive microhemorrhages on magnetic resonance imaging, resolving known hemorrhage, or hemorrhagic conversion from prior ischemic stroke.

Edwards Deming, a leader in quality improvement, once said, "You can't improve what you don't measure." The current guideline makes several Class 1 recommendations showing improvement in patient outcome with interventions across the entire spectrum of ICH care, starting at prehospital recognition of stroke symptoms and extending into outpatient screening and management of cognitive and mood disorders. The writing group felt that it was important to incorporate guideline recommendations in the prehospital and posthospital settings but also recognized the current limitations on data collection and attribution in these areas. Hence, several guideline recommendations were transformed into quality measures to allow pilot testing of their implementation. It is our hope that this will drive quality improvement in systems across the spectrum of care to improve the outcome of patients with ICH and that these quality measures will ultimately rise to the level of performance measures in the future.

STRUCTURE AND MEMBERSHIP OF THE WRITING GROUP

A member of the SPMOC was appointed to serve on the 2022 AHA/ASA Management of Spontaneous ICH Guideline Writing Group and served as a liaison to the SPMOC to identify guideline recommendations that may affect existing and future performance measures. Selection of the AHA/ASA Performance Measure Writing Group was performed by the AHA/ASA SPMOC, including the appointment of the chair and vice chair. Diversity in sex, race, ethnicity, career stage, and geography was considered when the writing group was composed to ensure that the writing group mirrored the medical and stroke patient community. Experts involved in the entire spectrum of ICH care were invited to join the writing group, including specialists in emergency medical services (EMS), emergency medicine, neurointensive care, vascular neurology, neurosurgery, and nursing and a stroke fellow in training. Consideration was also given to experience with quality improvement and data abstraction and collection. The AHA staff provided administrative oversight and direction for the final manuscript but were not involved in the direct selection of performance measures. Meetings were held by video conferences with email correspondence between meetings.

DISCLOSURE OF RELATIONSHIPS WITH INDUSTRY

All members of the writing group were volunteers who were supported by staff from the AHA/ASA. All financial relationships with industry were required to be disclosed per standard AHA policies. In addition, all peer reviewers of this document were required to disclose their relevant relationships. Detailed information on the AHA/ASA Relationships With Industry policy can be found online.[9] The AHA/ASA policy states that the writing group chair and at least 50% of the writing group have no relevant relationships with industry. Meetings of the writing group were confidential and were attended only by the writing group members and staff from AHA/ASA. No compensation was provided for participation.

METHODS

Development of the clinical performance measures followed the procedures developed by the American College of Cardiology and AHA.[10] The chair and vice chair of the writing group reviewed all Class 1 and 3 recommendations from the 2022 AHA/ASA management of spontaneous ICH guideline.[7] The guideline conforms to the categories of recommendation and levels of evidence in use by the AHA/ASA at the time they were released (Table 1). Class 1 recommendations include those in which the benefit of providing therapy greatly exceeds the risk and failure to provide therapy reduces the likelihood of a good outcome for the patient. For Class 3 recommendations, failure to follow recommendations could lead to patient harm and risk of the treatment was felt to exceed the benefit. Preference was given to those Class 1 and 3 recommendations with Level of Evidence A or B, for which there was at least 1 randomized trial with moderate-quality evidence to show benefit or reduced harm. A total of 29 Class 1 and 3 recommendations from the 2022 AHA/ASA management of spontaneous ICH guideline were considered. The writing group narrowed down these recommendations to include measures that were actionable, interpretable, and attributable to a clinician or institution. The writing group met to discuss this smaller set and voted on which to include as performance measures.

The writing group felt that it was important to address Class 1 recommendations for the entire spectrum of ICH care. Recognizing the challenge of data collection in the prehospital setting and difficulties with assigning attribution to prehospital and posthospital measures, the writing group felt that several of the recommendations should first be trialed as quality measures. Because performance measures are based on the highest level of evidence (Class 1 and 3 recommendations), they are often used for public reporting and pay-for-performance programs. In contrast, quality measures are recommendations that may lack the strength of evidence of performance measures and are not yet appropriate for public reporting or pay for performance but are useful for internal benchmarking and can later be incorporated as performance measures when more evidence or feasibility with data collection is demonstrated. There was also extensive discussion about the importance of including blood pressure (BP) control

Table 1. Applying Class of Recommendation and Level of Evidence to Clinical Strategies, Interventions, Treatments, or Diagnostic Testing in Patient Care (Updated May 2019)*

CLASS (STRENGTH) OF RECOMMENDATION	LEVEL (QUALITY) OF EVIDENCE‡
CLASS 1 (STRONG) — **Benefit >>> Risk** **Suggested phrases for writing recommendations:** • Is recommended • Is indicated/useful/effective/beneficial • Should be performed/administered/other • Comparative-Effectiveness Phrases†: – Treatment/strategy A is recommended/indicated in preference to treatment B – Treatment A should be chosen over treatment B	**LEVEL A** • High-quality evidence‡ from more than 1 RCT • Meta-analyses of high-quality RCTs • One or more RCTs corroborated by high-quality registry studies
CLASS 2a (MODERATE) — **Benefit >> Risk** **Suggested phrases for writing recommendations:** • Is reasonable • Can be useful/effective/beneficial • Comparative-Effectiveness Phrases†: – Treatment/strategy A is probably recommended/indicated in preference to treatment B – It is reasonable to choose treatment A over treatment B	**LEVEL B-R (Randomized)** • Moderate-quality evidence‡ from 1 or more RCTs • Meta-analyses of moderate-quality RCTs
CLASS 2b (WEAK) — **Benefit ≥ Risk** **Suggested phrases for writing recommendations:** • May/might be reasonable • May/might be considered • Usefulness/effectiveness is unknown/unclear/uncertain or not well-established	**LEVEL B-NR (Nonrandomized)** • Moderate-quality evidence‡ from 1 or more well-designed, well-executed nonrandomized studies, observational studies, or registry studies • Meta-analyses of such studies
CLASS 3: No Benefit (MODERATE) (Generally, LOE A or B use only) — **Benefit = Risk** **Suggested phrases for writing recommendations:** • Is not recommended • Is not indicated/useful/effective/beneficial • Should not be performed/administered/other	**LEVEL C-LD (Limited Data)** • Randomized or nonrandomized observational or registry studies with limitations of design or execution • Meta-analyses of such studies • Physiological or mechanistic studies in human subjects
Class 3: Harm (STRONG) — **Risk > Benefit** **Suggested phrases for writing recommendations:** • Potentially harmful • Causes harm • Associated with excess morbidity/mortality • Should not be performed/administered/other	**LEVEL C-EO (Expert Opinion)** • Consensus of expert opinion based on clinical experience

COR and LOE are determined independently (any COR may be paired with any LOE).

A recommendation with LOE C does not imply that the recommendation is weak. Many important clinical questions addressed in guidelines do not lend themselves to clinical trials. Although RCTs are unavailable, there may be a very clear clinical consensus that a particular test or therapy is useful or effective.

* The outcome or result of the intervention should be specified (an improved clinical outcome or increased diagnostic accuracy or incremental prognostic information).

† For comparative-effectiveness recommendations (COR 1 and 2a; LOE A and B only), studies that support the use of comparator verbs should involve direct comparisons of the treatments or strategies being evaluated.

‡ The method of assessing quality is evolving, including the application of standardized, widely-used, and preferably validated evidence grading tools; and for systematic reviews, the incorporation of an Evidence Review Committee.

COR indicates Class of Recommendation; EO, expert opinion; LD, limited data; LOE, Level of Evidence; NR, nonrandomized; R, randomized; and RCT, randomized controlled trial.

in the measures, but because of a lack of clinical trial evidence, the guideline did not have a Class 1 recommendation for a specific BP target. It was therefore determined that a quality measure should be created to support rapid BP control and to have institutions define their own target; this was based on a Class 2a recommendation from the guideline. After discussion and voting, 5 quality measures were chosen to allow improvement in data collection, standardization, and promotion of these quality measures to performance measures in the future.

Once performance and quality measure candidates were selected, they were assigned to individual writing group members and a primary reviewer for development into performance and quality measures. Measures were designed with precisely defined numerators and denominators that are intended to be reliable and to follow the evidence-based recommendations. Each measure was reviewed and discussed by the entire group and assessed for feasibility, considering cost, effort, and time to collect and report the data. Every attempt was made to harmonize with existing performance measures (Tables 2 and 3).[11–15] The writing group voted on the final performance measures. The final document was written by the chair of the writing group with input from both the writing group and the SPMOC.

REVIEW AND ENDORSEMENT

The ICH performance measures document underwent 14 days of public comment, allowing members of the AHA and other health care organizations and public

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Table 2. AHA/ASA Performance Measure Set for Hospitalized Patients With ICH

Performance measure	Performance measure	TJC	DNV	GWTG-ICH (2023)	Other society guidelines	New measure
PM-1	Rapid Neuroimaging					x
PM-2	ICH Baseline Severity Score	x	x	x	NCC[11]	
PM-3	Anticoagulant Reversal	x		x	NCC,[11] NCC/SCCM[12]	
PM-4	Avoidance of Platelet Transfusion in Patients Taking Antiplatelets			x	NCC/SCCM[12]	x
PM-5	Avoidance of Corticosteroids			x	NCC[11,13]	
PM-6	Diagnostic Vascular Imaging for Lobar ICH					x
PM-7	Diagnostic Vascular Imaging for Nonlobar ICH					x
PM-8	DSA for Acute Spontaneous, Isolated IVH					x
PM-9	Patients with Hydrocephalus Transferred					x
PM-10	EVD for Clinical Hydrocephalus					x
PM-11	Surgery for Deteriorating Cerebellar ICH					x
PM-12	Specialized Units			x	NCC[11,13]	
PM-13	Dysphagia Screening		x	x		
PM-14	VTE Prophylaxis	x	x	x	NCC[11]	
PM-15	Long-term BP Management			x		

AHA indicates American Heart Association; ASA, American Stroke Association; BP, blood pressure; DNV, Det Norke Veritas; DSA, digital subtraction angiography; EVD, external ventricular drain; GWTG, Get With The Guidelines; ICH, intracerebral hemorrhage; IVH, intraventricular hemorrhage; NCC, Neurocritical Care Society; SCCM, Society of Critical Care Medicine; TJC, The Joint Commission; and VTE, venous thromboembolism.

societies to review and provide input on the contents of the document and performance measures. Subsequently, peer review and AHA/ASA SPMOC review were conducted, and edits to the measures were made in response to reviewer feedback. All suggestions were then discussed within the writing group, and changes were made when appropriate. The final manuscript was approved by the SPMOC and finally by the AHA Science Advisory and Coordinating Committee and AHA Executive Committee. The performance and quality measures in this document should be considered valid until revised or rescinded by the AHA/ASA SPMOC. All final performance and quality measures are provided in Appendixes 1 and 2.

SPONTANEOUS ICH PERFORMANCE MEASURES

The scope of the current performance measures applies to patients who present with acute, spontaneous, nontraumatic ICH without a known underlying macrovascular (eg, cavernoma, arteriovenous malformation) or structural (eg, tumor, ischemic stroke with hemorrhagic transformation) cause. The current performance measures differ from the 2018 AHA/ASA ICH performance measures in that they address both patients presenting to the hospital with ICH and those patients who develop an acute spontaneous ICH during their hospitalization. The current measures address recommendations for the care of patients with

Table 3. AHA/ASA Quality Measure Set for Hospitalized Patients With ICH

Quality measure	Quality measure	NQF (now Battelle Partnership for Quality Management)	TJC	DNV	GWTG-ICH (2023)	Other society guidelines/ quality measures	New measure
QM-1	Prehospital Stroke Screen for ICH					EMS QAMS,[14] Mission: Lifeline SERC[15]	x
QM-2	EMS Prearrival Notification for ICH					Mission: Lifeline SERC[15]	x
QM-3	Neurobehavioral Screening					AAN	x
QM-4	Time to BP target						x
QM-5	Rapid Transfer for EVD						x

AAN indicates American Academy of Neurology; AHA, American Heart Association; ASA, American Stroke Association; BP, blood pressure; DNV, Det Norke Veritas; EMS, emergency medical services; EMS QAMS, National EMS Quality Alliance Measure Set; EVD, external ventricular drain; GWTG, Get With The Guidelines; ICH, intracerebral hemorrhage; NQF, National Quality Forum; SERC, Stroke EMS Recognition Criteria; and TJC, The Joint Commission.

ICH across a wide spectrum of care, including prehospital and posthospital settings. This includes EMS, emergency departments (EDs), intensive care units, hospital inpatient units, and primary care physicians, neurologists, and physiatrists in the outpatient setting.

Each performance measure is calculated as a percentage, composed of a numerator defining the patient population to which the measure is applicable and a denominator of the overall patient population. Denominator exclusions were created to ensure that each performance measure includes the patient population it was intended to address. Denominator exceptions for medical, patient, and system reasons were included with examples provided for abstraction.

The measurement period for each performance measure was clearly defined. Diagnosis of ICH begins at the time that radiology reports an ICH on imaging. This forms the basis for timing of anticoagulant reversal, admission to specialized units, dysphagia screening, and time to transfer for external ventricular drain (EVD) placement. For venous thromboembolism prophylaxis (PM-14), hospital day 0 is the day of arrival to the ED. To simplify abstraction, hospital day 0 or 1 is still used as the goal for documentation of venous thromboembolism prophylaxis, rather than using hours from admission. For timing of anticoagulant reversal, 90 minutes remained stable from the prior performance measures, which was based on expected time for obtaining and interpreting imaging results and timing to treatment from prior trials. There was significant discussion about changing this goal to 60 minutes, but because most hospitals were not attaining the 90-minute door-to-reversal time in the current state, the goal was not changed in this edition of the performance measures. The ultimate aim is to parallel ischemic stroke door-to-needle time with a 60-minute reversal goal in the future.

DISCUSSION

The goal of these performance measures is to provide a tool to implement guideline recommendations and improve the quality of care for patients with ICH. The current performance measures expand on the previously published ICH performance measures in 2018 by including new recommendations from the 2022 AHA/ASA management of spontaneous ICH guideline.[5,7] These measures may also serve as a guide to hospitals and ultimately may be adopted by regulatory agencies. In this vein, attempts were made to harmonize with existing measures (Tables 2 and 3).

The current performance measures incorporate new guideline recommendations with respect to imaging recommendations for the evaluation of ICH cause (PM-1, Rapid Neuroimaging; PM-6 and PM-7, Diagnostic Vascular Imaging for Lobar and Nonlobar ICH; and PM-8, DSA [Digital Subtraction Angiography] for Acute, Spontaneous, Isolated Intraventricular Hemorrhage), surgical treatment and indications for transfer (PM-9, Patients With Hydrocephalus Transferred; PM-10, EVD for Clinical Hydrocephalus; and PM-11, Surgery for Deteriorating Cerebellar ICH), and avoidance of platelet transfusions for nonsurgical patients with ICH (PM-4). The prior ICH performance measures included assessment for rehabilitation, but this was not included in the current measures because it was contained in the recently published clinical performance measures for stroke rehabilitation.[16] This document also expands the scope of care compared with the prior measures to include both patients presenting to the hospital with ICH and patients who developed ICH during a hospital admission. In addition, the current publication includes quality measures to allow piloting of measures that have high-quality evidence but with anticipated challenges to data collection or attribution.

The 2022 AHA/ASA management of spontaneous ICH guideline recommends avoidance of platelet transfusion for nonsurgical patients taking aspirin.[7] This recommendation was based on the PATCH trial (Platelet Transfusion in Cerebral Hemorrhage),[17] which found that nonsurgical patients on any antiplatelet therapy receiving platelet transfusion had an increased risk of death or dependency. Although most of the patients in the trial were taking aspirin, the type of antiplatelet therapy did not have a significant interaction with the effect of platelet transfusion compared with the standard of care in the trial. The writing group voted to create a performance measure to avoid platelet transfusions in nonsurgical patients with ICH taking any antiplatelet medication rather than restrict this recommendation to just aspirin as was written in the guideline.

The writing group wanted to emphasize the importance of BP control in ICH management but recognized that recommendation of a specific target was not a Class 1 recommendation due to variable findings in multiple randomized controlled trials. The writing group hoped that adding BP target as a quality measure (QM-4) based on a Class 2a recommendation would encourage clinicians to be thoughtful about the importance of setting a BP target and reaching it, therefore allowing for collection with potential for later transformation into a performance measure.

PHASES OF CARE

In most cases, performance and quality measures are attributable to the inpatient facility, recognizing that care of the patient with ICH is multidisciplinary and can rarely be attributed to a single clinician. The presenting facility is defined as the facility to which the patient initially presents with stroke symptoms. The admission facility is defined as the facility to which the patient is admitted for definitive inpatient ICH care. In many cases, the presenting and admitting facilities are the same, but they may differ if a patient presents to the ED of a facility that does not have

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the intensive care unit and neurosurgical resources to manage patients with ICH. Recognizing that time to treatment is an important aspect in improving ICH patient outcome, several of the performance measures apply specifically to the presenting facility, and it is expected that these treatments are initiated at a presenting facility before a planned transfer to improve patient outcomes. These performance measures include Rapid Neuroimaging (PM-1), ICH Baseline Severity Score (PM-2), Anticoagulant Reversal (PM-3), Avoidance of Platelet Transfusion in Patients Taking Antiplatelets (PM-4), and Avoidance of Corticosteroid Use (PM-5). Some of these measures are attributed to both the presenting facility and the transferring facility because they are applicable in both locations (eg, ICH baseline score, avoidance of platelet and corticosteroids). With the development of mobile stroke units, imaging may occur before hospital arrival. Currently, mobile stroke units are considered equivalent to an ambulance/EMS service, not a presenting facility. Hence, performance measures for a presenting facility should not be applied to mobile stroke units at the present time.

For those measures addressing neurosurgical care of ICH, facilities are defined as either tertiary facility with neurosurgical capabilities, for hospitals capable of neurosurgical management, or transferring facilities that do not have access to neurosurgical care. The 2022 AHA/ASA management of spontaneous ICH guideline makes recommendations for which patients should transfer to a higher level of care for EVD placement but does not specify transfer protocols for surgical interventions. Therefore, the current performance measures address transfer for patients with hydrocephalus (PM-9, Attributed to Transferring Facility; QM-5 Rapid Transfer for EVD), but given the lack of evidence and guideline recommendations, these performance measures do not address transfer protocols for surgical management of spontaneous ICH. For those facilities capable of neurosurgical management, the guideline does address which patients should receive an EVD for clinical hydrocephalus and which patients should undergo surgical management, so these were included in the current performance measures (PM-10 and PM-11). It should be noted that the criteria for transferring a patient from a presenting facility include any patient with ICH or intraventricular hemorrhage with hydrocephalus, whereas the criteria for placing an EVD requires clinical hydrocephalus, defined as radiographic hydrocephalus in addition to a change in neurological examination from baseline. This was intentional to ensure that patients with ICH with hydrocephalus were transferred to a hospital capable of EVD placement if the admitting hospital did not have neurosurgical coverage because patients can deteriorate rapidly and may need emergency EVD placement. The recommendation for EVD insertion at the admission hospital, however, is more nuanced and requires a change in the neurological examination. Last, the writing group had many discussions about the timing of transfer for EVD placement. Although there is a Class 1 recommendation to transfer patients with hydrocephalus for EVD placement, there was not high-level evidence for a specific time in which to make this transfer. It was felt that the recommendation for transfer should be a performance measure because it was a Class 1 recommendation but that the timing for transfer would be most appropriate as a quality measure. Ninety minutes was chosen as the goal for hydrocephalus diagnosis on computed tomography or magnetic resonance imaging of the brain to transfer (picture-to-door-out time), to parallel door-in-door-out time for patients with thrombectomy.

In the current 2022 AHA/ASA management of spontaneous ICH guideline, there were Class 1 recommendations for both prehospital stroke screening and prehospital arrival notification. Because both of these occur in the prehospital settings, these measures are attributed to EMS agencies in the performance measures. EMS agencies can vary from local fire departments to private ambulance companies to city-wide or hospital-based companies, making data collection inherently challenging. There is precedent for this quality measure in that both the 2023 Mission: Lifeline Stroke EMS Recognition Criteria and the 2019 National EMS Quality Alliance Measure Set include documentation of stroke assessment during EMS response.[14,15,18] In addition, both stroke screening and prearrival notification are requisite data elements that EMS agencies report to the National EMS Information System.[21] Quality measures can be an approach to strengthen linkages between prehospital and hospital data reporting. When ischemic stroke performance measures were first recommended, systems needed to be developed to collect data from various hospital settings. Similarly, new processes will need to be developed for completion of prehospital measures for patients with ICH. It is the hope that guideline recommendations and measures encourage the EMS community to organize, standardize, and reduce variation in prehospital care of patients with ICH.

Screening for cognitive impairment and depression and screening for anxiety were Class 1 recommendations in the guideline, but the timing of these screening was not specified because of a lack of evidence as to when and how often screening should occur across the spectrum of care and during recovery. Ultimately, the writing group felt that both of these screenings should occur at the end of a hospital admission or in the postacute hospital setting and likely more than once. Allowing both settings as appropriate to meet this measure allows the evaluation of patients who may benefit from early screening and be lost to follow up and captures patients whose recovery trajectory may make them more appropriate for screening in the postacute or outpatient setting. Given the novelty of an outpatient ICH measure and the anticipated challenge in attribution and data collection in the outpatient setting, this

was created as a quality measure, with the hope that after this is piloted as a quality measure, feasibility of data collection would improve, and this could rise to the level of a performance measure in the future.

LIMITATIONS AND EXCLUSIONS OF THE PERFORMANCE MEASURES FOR SPONTANEOUS ICH

The current performance measures are based on evidence for management of spontaneous ICH in adult patient populations and therefore do not apply to pediatric populations. The scope of these recommendations is for acute spontaneous nontraumatic ICH and intraventricular hemorrhage, not for the management of patients with other forms of ICH such as subdural or epidural hematomas or subarachnoid hemorrhage. These recommendations also do not apply to patients with intraparenchymal hemorrhage secondary to known underlying structural or macrovascular lesions, including ischemic stroke, tumors, or vascular malformations.

Although mobile stroke units have the capability of imaging and may even be able to administer therapeutics for ICH in the future, they are currently considered prehospital EMS, so it is out of scope to apply performance measures attributable to the presenting facility to a mobile stroke unit.

Exceptions and exclusions to the denominator were created to ensure that each performance measure was being applied to the population it was intended to measure. The use of patient-level exclusions can unintentionally lead to disparities in care. Hence, exceptions and exclusions were carefully discussed and reviewed to reduce this possibility.

Both guideline recommendations and the smaller set of performance measures are inherently limited by the evidence available for patient care, so these performance measures cannot and do not encompass all of the appropriate care for patients with ICH. It is recommended that clinicians refer to the guideline recommendations and other available literature for those patients who do not fit into this patient population or for individual patient management questions about complex patients with ICH. Future clinical research may change the guideline recommendations and hence performance measures. These are the most up-to-date recommendations based on the clinical research at the time of this performance and quality measures publication. In the current era of evolving research for patients with ICH, 3 trials have been completed that will likely change standard the care of patients with ICH with respect to anticoagulant reversal (ANNEXA-I [Trial of Andexanet Alfa in ICrH Patients Receiving an Oral FXa Inhibitor]), bundled care (INTERACT3 [Intensive Care Bundle with Blood Pressure Reduction in Acute Cerebral Haemorrhage Trial]),[3] and surgical management (ENRICH [Early Minimally Invasive Removal of Intracerebral Hemorrhage]). Because the performance measures are based on guideline recommendations from the 2022 AHA/ASA management of spontaneous ICH guideline, these data were not included. It is expected that these measures will continue to be updated and changed as new evidence and practices become available.

CONCLUSIONS

The continual improvement of care systems for patients with ICH is important given the high mortality and morbidity of ICH. The latest 2022 AHA/ASA management of spontaneous ICH guideline aims to translate research into practical, evidence-based care for patients with ICH, maximizing benefit and minimizing harm. The resulting performance measures discussed in this document reflect these advancements and are designed to guide practitioners toward providing the highest quality of care. These measures will be tested and evaluated for effectiveness and feasibility. This dynamic approach will ensure that the care system continuously evolves and improves. Such initiatives also serve as important reminders that quality care involves a broad spectrum of interventions, not just a singular one. Efforts to standardize these measures across different venues of care are essential to ensure uniform, high-quality care for all patients. As this guideline is implemented and evaluated, we move toward a future in which the mortality and morbidity rates associated with ICH can be significantly reduced. Ultimately, these steps are imperative for ensuring quality improvement and better patient outcomes.

ARTICLE INFORMATION

The American Heart Association makes every effort to avoid any actual or potential conflicts of interest that may arise as a result of an outside relationship or a personal, professional, or business interest of a member of the writing panel. Specifically, all members of the writing group are required to complete and submit a Disclosure Questionnaire showing all such relationships that might be perceived as real or potential conflicts of interest.

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*Significant.

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Appendix 1. Performance Measurement Set Specifications

PM-1: Rapid Neuroimaging

Measure description: Percentage of patients with acute spontaneous ICH who received brain CT or MRI within 25 min of arrival to the hospital	
Numerator	Patients with acute spontaneous ICH who received brain CT or MRI within 25 min of arrival to the hospital
Denominator	All patients with acute spontaneous ICH
Denominator exclusions	Patients <18 y of age Last-known-well time >24 h before hospital arrival Clear documentation for comfort care/hospice established before hospital arrival
Denominator exceptions	Documentation of a medical reason(s) (eg, unstable for transport to neuroimaging, hemodynamic instability, need for airway management, management of agitation) Patients undergoing a noncontrast head CT in the prehospital setting (eg, in a mobile stroke unit)
Measurement period	From ED arrival until start time of initial neuroimaging
Sources of data	EHR data Administrative data/claims (inpatient claims) Administrative data/claims expanded (multiple sources) Paper medical record Radiology imaging (eg, PACS)
Attribution	Presenting facility
Care setting	Initial setting with imaging capability
Rationale	
Neuroimaging is requisite to establish the diagnosis of spontaneous ICH, which is fundamental to all subsequent aspects of care, including both medical and surgical therapies.[22,23] Neuroimaging establishes ICH size and location and distinguishes it from mimics, including ischemic stroke. The recommended time to imaging for stroke symptoms should be the same regardless of whether the final diagnosis is ischemic or hemorrhagic. We harmonized this performance measure with ischemic stroke guidelines that recommend door-to-CT time of ≤25 min. Because patients with ICH may have a higher risk of airway or hemodynamic compromise, those requiring early airway management, hemodynamic support, or management of agitation (collectively considered unstable for transport to neuroimaging) can be excluded from this measure.	
Clinical recommendation(s)	
2022 AHA/ASA management of spontaneous ICH guideline[7] 1. In patients presenting with stroke-like symptoms, rapid neuroimaging with CT or MRI is recommended to confirm the diagnosis of spontaneous ICH *(Class 1; Level of Evidence B-NR)*.	

AHA indicates American Heart Association; ASA, American Stroke Association; CT, computed tomography; ED, emergency department; EHR, electronic health record; ICH, intracerebral hemorrhage; MRI, magnetic resonance imaging; and PACS, picture archiving and communication system.

Appendix 1. Continued

PM-2: ICH Baseline Severity Score

Measure description: Percentage of patients with acute spontaneous ICH in whom an ICH-specific baseline severity score is measured and recorded as part of the initial hospital evaluation	
Numerator	All patients with acute spontaneous ICH in whom a baseline measure of overall hemorrhage severity is measured and a total score is recorded within 6 h of ICH diagnosis by brain CT or MRI. If an intracranial procedure is performed within 6 h of arrival, the severity score must be measured before this procedure. An ICH-specific score (eg, ICH score) should be used as the baseline measure of ICH severity. NIHSS and GCS are not sufficient to meet this performance measure.
Denominator	All patients with acute spontaneous ICH
Denominator exclusions	Patients <18 y of age Clear documentation for comfort care measures or hospice established before hospital arrival or at time of ICH diagnosis (eg, if ICH was specified as an indication to change goals of care to comfort measures in an established living will)
Denominator exceptions	
Measurement period	First 6 h after hospital arrival
Sources of data	EHR data Paper medical record Administrative data/claims (inpatient claims) Administrative data/claims expanded (multiple sources) Prospective flowsheet and retrospective medical record review
Attribution	Presenting facility and admission facility (score should be documented once within 6 h of diagnosis of ICH and does not need to be repeated by admission facility if patient has ICH score documented by presenting facility)
Care setting	Inpatient
Rationale	
Baseline clinical evaluation is part of the standard care of every patient with ICH. Using an ICH-specific severity scores that incorporates patient characteristics, anatomic location, and clinical deficit can help risk-stratify patients for ICU admission and interventions and is a primary determinant of prognosis. It also helps with assessment of disease severity, quality measures, and communication between clinicians and patients and family members.	
Clinical recommendation(s)	
2022 AHA/ASA management of spontaneous ICH guideline[7] 1. In patients with spontaneous ICH, administering a baseline measure of overall hemorrhage severity is recommended as part of the initial evaluation to provide an overall measure of clinical severity *(Class 1; Level of Evidence B-NR)*.	

AHA indicates American Heart Association; ASA, American Stroke Association; CT, computed tomography; EHR, electronic health record; GCS, Glasgow Coma Scale; ICH, intracerebral hemorrhage; ICU, intensive care unit; MRI, magnetic resonance imaging; and NIHSS, National Institutes of Health Stroke Scale.

Appendix 1. Continued

PM-3: Anticoagulant Reversal

Measure description: Percentage of patients with anticoagulant-related acute ICH who receive an appropriate reversal agent within 90 min of ED arrival along with anticoagulant discontinuation	
Numerator	Patients with anticoagulant-related acute spontaneous ICH and known or presumed current anticoagulant use* who receive an appropriate reversal agent† within 90 min of ED arrival along with anticoagulant discontinuation
Denominator	All patients with acute spontaneous ICH with known or presumed current anticoagulant use*
Denominator exclusions	Patients <18 y of age Documented allergy or contraindication to indicated reversal agent Clear documentation of comfort care or hospice before hospital arrival or at time of ICH diagnosis by brain CT or MRI (eg, if ICH was specified as an indication to change goals of care to comfort measures in an established living will) ICH due to cerebral venous sinus thrombosis Elevated INR from other cause (eg, liver disease) Hospital transfer from another facility where appropriate therapy to reverse the anticoagulant was already initiated or completed Enrolled in a clinical trial that would affect the use of anticoagulant reversal agents
Denominator exceptions	Documentation of a patient reason(s) (eg, refusal of reversal agent administration for religious or cultural reasons after demonstration of understanding of risks and benefits) Documentation of a medical reason(s) (eg, concomitant life-threatening ischemic event, ICH due to cerebral venous sinus thrombosis)
Measurement period	Initial 90 min after ED arrival
Sources of data	EHR data Administrative data/claims (inpatient claims) Administrative data/claims expanded (multiple sources) Paper medical record Pharmacy records
Attribution	Presenting facility
Care setting	Inpatient
Rationale	
Anticoagulated patients with ICH are at increased risk of HE and worse outcome compared with noncoagulopathic patients with ICH.[17,24–26] Antithrombotic reversal is associated with lower mortality and improved outcomes in VKA-associated ICH.[27,28] Because the highest-risk period for HE is the first hours after initial hemorrhage,[29–31] reversal agents should be administered as quickly as possible. Ninety min was chosen as the appropriate time period to incorporate time required for head CT and its interpretation, preparation, and administration of coagulopathy reversal.	
Clinical recommendation(s)	
2022 AHA/ASA management of spontaneous ICH guideline[7] 1. In patients with anticoagulant-associated spontaneous ICH, anticoagulation should be discontinued immediately and rapid reversal of anticoagulation should be performed as soon as possible after diagnosis of spontaneous ICH to improve survival *(Class 1; Level of Evidence C-LD).* 2. In patients with VKA-associated spontaneous ICH and INR ≥2.0, 4-factor PCC is recommended in preference to FFP to achieve rapid correction of INR and limit HE *(Class 1; Level of Evidence B-R).* 3. In patients with VKA-associated spontaneous ICH, intravenous vitamin K should be administered directly after coagulation factor replacement (PCC or other) to prevent later increase in INR and subsequent HE *(Class 1; Level of Evidence C-LD).* 4. In patients with direct factor Xa inhibitor–associated spontaneous ICH, andexanet alfa is reasonable to reverse the anticoagulant effect of factor Xa inhibitors (*Class 2a; Level of Evidence B-NR*). 5. In patients with dabigatran-associated spontaneous ICH, idarucizumab is reasonable to reverse the anticoagulant effect of dabigatran *(Class 2a; Level of Evidence B-NR).* 6. In patients with direct factor Xa inhibitor–associated spontaneous ICH, a 4-factor PCC or aPCC may be considered to improve hemostasis *(Class 2b; Level of Evidence B-NR).* 7. In patients with UFH-associated spontaneous ICH, intravenous protamine is reasonable to reverse the anticoagulant effect of heparin *(Class 2a; Level of Evidence C-LD).* 8. In patients with LMWH-associated spontaneous ICH, intravenous protamine may be considered to partially reverse the anticoagulant effect of heparin *(Class 2b; Level of Evidence C-LD).*	

AHA indicates American Heart Association; aPCC, activated prothrombin complex concentrate; ASA, American Stroke Association; CT, computed tomography; ED, emergency department; EHR, electronic health record; FFP, fresh-frozen plasma; HE, hematoma expansion; ICH, intracerebral hemorrhage; INR, international normalized ratio; LMWH, low-molecular-weight heparin; MRI, magnetic resonance imaging; PCC, prothrombin complex concentrate; UFH, unfractionated heparin; and VKA, vitamin K antagonist.

*Known or presumed current anticoagulant use at time of ICH defined as follows:
- <24 hours from last dose of oral direct factor Xa inhibitors or oral direct thrombin inhibitors
- INR ≥1.4 with VKA use
- Laboratory evidence of coagulopathy due to LMWH or heparin, (eg, elevated drug-specific anti-Xa),

†Appropriate best available reversal agents include the following:
- For oral direct factor Xa inhibitors (eg, apixaban, rivaroxaban, edoxaban) taken within 24 hours* of ED arrival OR if time of last dose unknown OR elevated drug-specific activity level: andexanet alpha OR 4-factor PCC OR aPCC
- For oral direct thrombin inhibitors (eg, dabigatran) taken within 24 hours* of ED arrival OR if time of last dose unknown OR elevated drug specific activity level: idarucizumab OR PCC or aPCC and/or renal replacement therapy
- For UFH and LMWH with elevated drug-specific anti-Xa level: protamine
- For VKA with an INR ≥1.4: 4-factor PCC with intravenous vitamin K.

Appendix 1. Continued

PM-4: Avoidance of Platelet Transfusion in Patients Taking Antiplatelets

Measure description: Percentage of patients with acute spontaneous ICH being treated with antiplatelet* therapy and not scheduled for emergency surgery who receive a platelet transfusion	
Numerator	Patients who are taking antiplatelets* and receive a platelet transfusion within 24 h of arrival to the hospital (goal, 0%)
Denominator	All patients with acute spontaneous ICH with known or presumed current antiplatelet* use within 7 d of ICH
Denominator exclusions	Patients <18 y of age Received platelet transfusion before hospital arrival or before transfer to the admitting facility Planned emergency neurosurgery (including EVD) or other emergency surgical procedure in which platelet transfusion is deemed necessary for hemostasis Thrombocytopenia with platelet count <100 000 Documentation of other neurological or medical condition in which platelet transfusion may be indicated (eg, massive blood loss requiring transfusion, severe thrombocytopenia, concomitant extracranial life-threatening hemorrhage) Participation in a clinical trial in which platelet transfusion is part of the investigational regimen
Denominator exceptions	Documentation of a medical reason(s) (eg, concomitant extracranial life-threatening bleeding, emergency neurosurgical procedure, or other surgical procedure in which platelets are needed for hemostasis)
Measurement period	From ED arrival through first 24 h of hospital stay
Sources of data	EHR data Administrative data/claims (inpatient claims) Administrative data/claims expanded (multiple sources) Paper medical record Pharmacy records
Attribution	Presenting facility and admission facility
Care setting	Inpatient
Rationale	
A randomized trial of 190 patients with spontaneous ICH who were taking an antiplatelet agent (97% taking aspirin) within 7 d of ICH and who did not have a planned neurosurgical intervention found significantly worse functional outcomes at 3 mo and more adverse events in those who received a platelet transfusion compared with those who did not.[17]	
Clinical recommendation(s)	
2022 AHA/ASA management of spontaneous ICH guideline[7] 1. For patients with spontaneous ICH being treated with aspirin and not scheduled for emergency surgery, platelet transfusions are potentially harmful and should not be administered *(Class 3: Harm; Level of Evidence B-R).*	

AHA indicates American Heart Association; ASA, American Stroke Association; ED, emergency department; EHR, electronic health record; EVD, external ventricular drain; and ICH, intracerebral hemorrhage.

*Antiplatelet use defined as use of one of the following medications within the 7 days prior to presentation: cyclooxygenase (COX) inhibitor (eg, aspirin), adenosine diphosphate (ADP) receptor inhibitor (eg, clopidogrel, ticagrelor) or an adenosine-reuptake inhibitor (dipyridamole).

Appendix 1. Continued

PM-5: Avoidance of Corticosteroids

Measure description: Percentage of patients with acute spontaneous ICH who receive corticosteroids	
Numerator	Patients with acute spontaneous ICH who receive intravenous or oral corticosteroids (goal, 0%)
Denominator	All patients with acute spontaneous ICH
Denominator exclusions	Patients <18 y of age Received corticosteroids before arrival to the admitting hospital Participation in a clinical trial in which corticosteroids are part of the investigational regimen
Denominator exceptions	Documentation of a medical reason(s) (eg, neurological or other medical condition for which corticosteroids may be indicated, including but not limited to brain tumor, cerebral abscess, vasculitis, COPD or asthma exacerbation, cortisol deficiency)
Measurement period	From ED arrival/hospital transfer/direct admission until acute care hospital discharge
Sources of data	EHR data Paper medical record Pharmacy record Prospective flowsheet and retrospective medical record review
Attribution	Presenting facility and admission facility (if applicable)
Care setting	Inpatient
Rationale	
Multiple randomized trials have shown increased complications with lack of benefit when corticosteroids are administered to patients with acute spontaneous ICH.[32–35] However, the use of corticosteroids may be beneficial for patients who have specific indications for their use apart from ICH.	
Clinical recommendation(s)	
2022 AHA/ASA management of spontaneous ICH guideline[7] 1. In patients with spontaneous ICH, corticosteroids should not be administered for treatment of elevated ICP *(Class 3: No Benefit; Level of Evidence B-R).*	

AHA indicates American Heart Association; ASA, American Stroke Association; COPD, chronic obstructive pulmonary disease; ED, emergency department; EHR, electronic health record; ICH, intracerebral hemorrhage; and ICP, intracranial pressure.

Appendix 1. Continued

PM-6: Diagnostic Vascular Imaging for Lobar ICH

Measure description: Percentage of patients with acute spontaneous ICH originating from lobar structures* and age 18 to 70 years who received cerebral vascular imaging† before hospital discharge	
Numerator	All patients between 18 and 70 y of age with acute spontaneous ICH originating from lobar structures* who receive cerebral vascular imaging† before hospital discharge
Denominator	All patients between 18 and 70 y of age with spontaneous acute ICH originating from lobar structures
Denominator exclusions	Patients <18 y of age Patients ≥70 y of age Patients who leave during hospitalization against medical advice Clear documentation for comfort care measures or hospice
Denominator exceptions	Documentation of a patient reason(s) (eg, patient, family, or legally authorized representative refusal) Documentation of another medical reason(s) (eg, unstable for transport to neuroimaging due to hemodynamic instability, need for airway management, management of agitation); contraindication to both CT and MRA (eg, iodinated contrast/gadolinium allergy), contraindication to MRI (eg, claustrophobia, metal, noncompatible pacemaker) Documentation of a health care system reason(s) (eg, national contrast shortage, patients who are transferred to another acute hospital for inpatient care before vascular imaging, documentation of diagnostic vascular imaging at outside hospital before transfer)
Measurement period	Inpatient encounter
Sources of data	EHR data Paper medical record Radiology imaging (eg, PACS)
Attribution	Admission facility
Care setting	Inpatient
Rationale	
ICH cause influences acute management options, prognosis, and future prevention strategies for patients. In patients with lobar ICH, the yield of angiography to identify a macrovascular cause (AVM, aneurysm, dural arteriovenous fistula, cavernoma and cerebral venous thrombosis) of spontaneous ICH may be as high as 65%.[36] CT or MR venography should be included with CTA or MRA when clinical factors or ICH location suggests possible cerebral venous thrombosis.	
Clinical recommendation(s)	
2022 AHA/ASA management of spontaneous ICH guideline[7] 1. In patients with lobar spontaneous ICH and age <70 years, deep/posterior fossa spontaneous ICH and age <45 years, or deep/posterior fossa and age 45 to 70 years without history of hypertension, acute CTA plus consideration of venography is recommended to exclude macrovascular causes or cerebral venous thrombosis *(Class 1; Level of Evidence B-NR).*	

AHA indicates American Heart Association; ASA, American Stroke Association; AVM, arteriovenous malformation; CT, computed tomography; CTA, computed tomography angiography; DSA, digital subtraction angiography; EHR, electronic health record; ICH; intracerebral hemorrhage; MR, magnetic resonance; MRA, magnetic resonance angiography; MRI, magnetic resonance imaging; and PACS, picture archiving and communication system.

*Lobar hemorrhage includes those ICHs originating outside of the caudate, putamen, globus pallidus, thalamus, and posterior fossa.

†Vascular imaging includes CTA, CT venography, MRA, MR venography, or catheter DSA.

Appendix 1. Continued

PM-7: Diagnostic Vascular Imaging for Nonlobar ICH

Measure description: Percentage of patients with deep/posterior fossa* acute spontaneous ICH and age 18 to 45 years or age 45 to 70 years without history of hypertension who received cerebral vascular imaging† before hospital discharge	
Numerator	All patients with deep/posterior fossa acute spontaneous ICH and Age 18 to 45 years Age 45 to 70 years without history of hypertension who receive cerebral vascular imaging† before discharge
Denominator	All patients with deep/posterior fossa spontaneous acute ICH and age 18 to 45 years or age 45 to 70 years without history of hypertension
Denominator exclusions	Patients <18 y of age Patients ≥70 y of age Patients who leave during hospitalization against medical advice Clear documentation for comfort care measures or hospice
Denominator exceptions	Documentation of a patient reason(s) (eg, patient, family, or legally authorized representative refusal) Documentation of another medical reason(s) (eg, unstable for transport to neuroimaging due to hemodynamic instability, need for airway management, management of agitation); contraindication to both CT and MRA (eg, iodinated contrast/gadolinium allergy), contraindication to MRI (eg, claustrophobia, metal, noncompatible pacemaker) Documentation of a health care system reason(s) (eg, national contrast shortage, patients who are transferred to another acute hospital for inpatient care before vascular imaging, documentation of diagnostic evaluation at outside hospital before transfer)
Measurement Period	Inpatient encounter
Sources of data	EHR data Paper medical record Radiology imaging (eg, PACS)
Attribution	Admission facility
Care setting	Inpatient
Rationale	
ICH cause influences acute management options, prognosis, and future prevention strategies for patients. In patients with deep/posterior fossa ICH and age 18 to 45 years or age 45 to 70 years without hypertension, the diagnostic yield for diagnosis of a macrovascular cause (AVM, aneurysm, dural arteriovenous fistula, cavernoma and cerebral venous thrombosis) was 44% to 50% in 1 study.[36] CT or MR venography should be included with CTA or MRA when clinical factors or ICH location suggests possible cerebral venous thrombosis.	
Clinical recommendation(s)	
2022 AHA/ASA management of spontaneous ICH guideline[7] 1. In patients with lobar spontaneous ICH and age <70 years, deep/posterior fossa spontaneous ICH and age <45 years, or deep/posterior fossa and age 45 to 70 years without history of hypertension, acute CTA plus consideration of venography is recommended to exclude macrovascular causes or cerebral venous thrombosis *(Class 1; Level of Evidence B-NR).*	

AHA indicates American Heart Association; ASA, American Stroke Association; AVM, arteriovenous malformation; CT, computed tomography; CTA, computed tomographic angiography; DSA, digital subtraction angiography; EHR, electronic health record; ICH, intracerebral hemorrhage; MR, magnetic resonance; MRA, magnetic resonance angiography; MRI, magnetic resonance imaging; and PACS, picture archiving and communication system.

*Deep/posterior fossa hemorrhage includes hemorrhage originating in the caudate, putamen, globus pallidus, thalamus, and posterior fossa.

†Vascular imaging includes CTA, CT venography, MRA, MR venography, or catheter DSA.

Appendix 1. Continued

PM-8: DSA for Acute, Spontaneous, Isolated IVH

Measure description: Percentage of patients with acute spontaneous, isolated IVH without detectable parenchymal component or known cause of hemorrhage, regardless of findings on noncatheter angiography (MRA, CTA), who undergo catheter intra-arterial DSA to exclude a macrovascular cause	
Numerator	Patients with acute spontaneous, isolated IVH who undergo DSA
Denominator	All patients with acute spontaneous, isolated IVH without detectable parenchymal component or known cause of hemorrhage (eg, hematological malignancy)
Denominator exclusions	Patients <18 y of age Presence of ICH, SAH, or SDH Patients who are transferred to another acute care hospital Clear documentation for comfort care measures or hospice
Denominator exceptions	Documentation of patient reason(s) (eg, patient, family, or legally authorized representative refusal) Documentation of medical reason(s) (eg, clinically unstable or contraindication to catheter angiography)
Measurement period	Duration of inpatient encounter
Sources of data	EHR data Administrative data/claims (inpatient or outpatient claims) Administrative data/claims expanded (multiple sources) Paper medical record Radiology imaging (eg, PACS)
Attribution	Admission facility
Care setting	Inpatient
Rationale	
Catheter angiography remains the gold standard for detection of macrovascular lesions. The most frequently identified lesions underlying isolated IVHs are AVMs and aneurysms, especially in younger patients.[37–39] Although isolated IVH is rare (≈2.7%–3.1% of ICH), systematic reviews and case series have identified a fairly high rate of underlying pathogenic abnormalities (up to 58.5%)[37] potentially amenable to definitive surgical treatment, thereby affecting rebleed occurrence, morbidity, and mortality.[37,39,40] There are currently insufficient data on the diagnostic yield of CTA or MRA for this purpose to know whether they provide equivalent diagnostic sensitivity to DSA.	
Clinical recommendation(s)	
2022 AHA/ASA management of spontaneous ICH guideline[7] 1. In patients with spontaneous IVH and no detectable parenchymal hemorrhage, catheter intra-arterial DSA is recommended to exclude a macrovascular cause *(Class 1; Level of Evidence B-NR).*	

AHA indicates American Heart Association; ASA, American Stroke Association; AVM, arteriovenous malformation; CT, computed tomography; CTA, computed tomography angiography; DSA, digital subtraction angiography; EHR, electronic health record; ICH, intracerebral hemorrhage; IVH, intraventricular hemorrhage; MRA, magnetic resonance angiography; SAH, subarachnoid hemorrhage; SDH, subdural hemorrhage; and PACS, picture archiving and communications system.

Appendix 1. Continued

PM-9: Patients With Hydrocephalus Transferred

Measure description: Percentage of patients with acute spontaneous ICH or IVH and hydrocephalus who are urgently transferred for definitive hydrocephalus management to a center with neurosurgical capabilities on diagnosis of hydrocephalus by brain CT or MRI	
Numerator	Patients with acute spontaneous ICH or IVH and hydrocephalus (as defined by initial brain CT or MRI radiology report) who are urgently transferred to a center with neurosurgical capabilities able to definitively treat hydrocephalus
Denominator	All patients with acute spontaneous ICH or IVH and hydrocephalus who initially present to a hospital without neurosurgical capabilities
Denominator exclusions	Patients <18 y of age Clear documentation for comfort care measures or hospice Patients who initially present to a center with neurosurgical capabilities for definitive hydrocephalus management
Denominator exceptions	Documentation of a patient reason(s) (eg, patients who leave against medical advice before planned transfer, patients/families/legally authorized representatives who refuse transfer, patients whose goals of care do not include surgical interventions and advanced life-sustaining therapy) Documentation of a medical reason(s) (eg, patients who die before planned transfer)
Measurement period	Encounter
Sources of data	EHR data Administrative data/claims (inpatient claims) Administrative data/claims expanded (multiple sources) Paper medical record Radiology imaging (eg, PACS)
Attribution	Transferring facility without neurosurgical capabilities
Care setting	ED and inpatient
Rationale	
Patients with ICH and clinical hydrocephalus are best cared for at centers with neurosurgical and neurological critical care because they can have clinical deterioration at any time as a result of ongoing CSF production and obstruction from ICH, IVH, and edema. This level of care is associated with improved mortality and length of stay. The highest-risk period for neurological decline is the first 12 h after ICH onset. Therefore, once hydrocephalus is diagnosed radiographically or clinically, urgent transfer is indicated.	
Clinical recommendation(s)	
2022 AHA/ASA management of spontaneous ICH guideline[7] 1. In patients with spontaneous ICH and clinical hydrocephalus, transfer to centers with neurosurgical capabilities for definitive hydrocephalus management (eg, EVD placement and monitoring) is recommended to reduce mortality *(Class 1; Level of Evidence B-NR).*	

AHA indicates American Heart Association; ASA, American Stroke Association; CSF, cerebrospinal fluid; CT, computed tomography; ED, emergency department; EHR, electronic health record; EVD, external ventricular drain; ICH, intracerebral hemorrhage; IVH, intraventricular hemorrhage; MRI, magnetic resonance imaging; and PACS, picture archiving and communication system.

Appendix 1. Continued

PM-10: EVD for clinical hydrocephalus

Measure description: Percentage of patients with acute spontaneous ICH or IVH and clinical hydrocephalus who receive an EVD	
Numerator	Patients who receive an EVD at a center with neurosurgical capabilities able to definitively treat hydrocephalus
denominator	Patients with acute spontaneous ICH or IVH AND clinical hydrocephalus (radiographic evidence of hydrocephalus and a neurological exam (including mental status) that is worse than premorbid baseline (eg, impaired LOC, loss of brainstem reflexes, change in NIHSS or GCS score) at a center with neurosurgical capabilities able to definitively treat hydrocephalus
Denominator exclusions	Patients <18 y of age Patients treated for hydrocephalus in another surgical fashion (minimally invasive surgical ICH/IVH evacuation, suboccipital craniotomy for ICH evacuation) Patients who already have a VP shunt for another reason (prior ICH, IIH) Clear documentation for comfort care measures or hospice established before hospitalization or at time of ICH diagnosis (eg, if ICH was specified as an indication to change goals of care to comfort measures in an established living will)
Denominator exceptions	Documentation of patient reason(s) (eg, patients who leave against medical advice, patients whose goals of care do not include surgical interventions and advanced life-sustaining therapy) Documentation of a medical reason(s) (eg, patients with a coagulopathy that cannot be reversed and risk of hemorrhage with EVD outweighs the benefit of EVD placement)
Measurement period	Encounter
Sources of data	EHR data Administrative data/claims (inpatient or outpatient claims) Administrative data/claims expanded (multiple sources) Paper records
Attribution	Tertiary facility with neurosurgical capabilities
Care setting	Inpatient
Rationale	
Hydrocephalus and IVH are independent predictors of mortality after ICH. Retrospective reviews have shown that EVD placement in patients with IVH and hydrocephalus improves mortality at hospital discharge[41] and is associated with lower 30-d mortality in patients with ICH score 4, ICH volume >11 cm^3, and GCS score <13.[42] In patients with ICH and hydrocephalus, clinical deterioration may occur at any time due to ongoing CSF production and obstruction from ICH, IVH, and edema. Patients with hydrocephalus, even before clinical deterioration, are best cared for at centers with neurosurgical and neurological critical care, with improved mortality, length of stay, and need for mechanical outcomes.	
Clinical recommendation(s)	
2022 AHA/ASA management of spontaneous ICH guideline[7] 1. In patients with spontaneous ICH or IVH and hydrocephalus that is contributing to decreased LOC, ventricular drainage should be performed to reduce mortality *(Class 1; Level of Evidence B-NR).*	

AHA indicates American Heart Association; ASA, American Stroke Association; CSF, cerebrospinal fluid; EHR, electronic health record, EVD, external ventricular drain; GCS, Glascow Coma Scale; ICH, intracerebral hemorrhage; IIH, idiopathic intracranial hypertension; IVH, intraventricular hemorrhage; LOC, level of consciousness; and NIHSS, National Institutes of Health Stroke Scale.

Appendix 1. Continued

PM-11: Surgery for Deteriorating Cerebellar ICH

Measure description: Percentage of patients with acute spontaneous cerebellar ICH who have neurological deterioration from premorbid baseline AND brainstem compression OR obstructive hydrocephalus OR ICH volume ≥15 mL who undergo neurosurgical evacuation of the hemorrhage with or without EVD	
Numerator	Patients who undergo surgical evacuation with or without EVD placement
Denominator	All patients treated at a center with neurosurgical capabilities with acute spontaneous cerebellar ICH and neurological deterioration from premorbid baseline (eg, impaired LOC, loss of brainstem reflexes, change in NIHSS or GCS score) AND one of the following (as noted on radiology brain MRI or CT imaging): 1. Brainstem compression 2. Hydrocephalus 3. Cerebellar ICH volume ≥15 mL
Denominator exclusions	Patients <18 y of age Patients who require transfer to a center with neurosurgical capabilities. Patients evacuated in another surgical fashion (minimally invasive surgery) Clear documentation for comfort care measures or hospice established before hospitalization or at time of ICH diagnosis (eg, if ICH was specified as an indication to change goals of care to comfort measures in an established living will)
Denominator exceptions	Documentation of a patient reason(s) (eg, patients who leave against medical advice, patients/families/legally authorized representatives who refuse surgical intervention, patients whose goals of care do not include surgical interventions and advanced life-sustaining therapy) Documentation of a medical reason(s) (eg, patients with a coagulopathy that cannot be reversed in which the risk of hemorrhage with surgery outweighs the benefit of surgery)
Measurement period	Inpatient encounter
Sources of data	EHR data Administrative data/claims (inpatient or outpatient claims) Administrative data/claims expanded (multiple sources) Radiology imaging (eg, PACS)
Attribution	Tertiary facility with neurosurgical capabilities
Care setting	Inpatient
Rationale	
Patients with large cerebellar ICH and brainstem compression or obstructive hydrocephalus from ventricular compression are at high risk of death. Surgical evacuation of the hematoma with or without EVD can relieve pressure on the brainstem and hydrocephalus, with associated survival benefit at 3 and 12 mo, especially in patients whose hematoma volumes are >15 mL.[43] Placement of an EVD without removal of the hematoma may not be sufficient to relieve pressure on the brainstem and may be harmful.[43,44] In patients with large cerebellar ICH, clinical deterioration may occur at any time due to HE or perihematomal edema leading to brainstem compression and potential ventricular obstruction with acute hydrocephalus. Even before clinical deterioration, these patients are best cared for at centers with neurosurgical and neurological critical care and should be expeditiously transferred.	
Clinical recommendation(s)	
2022 AHA/ASA management of spontaneous ICH guideline[7] 1. For patients with cerebellar ICH who are deteriorating neurologically, have brainstem compression and/or hydrocephalus from ventricular obstruction, or with cerebellar ICH volume ≥15 mL, immediate surgical removal of the hemorrhage with or without EVD is recommended in preference to medical management alone to reduce mortality *(Class 1; Level of Evidence B-NR).*	

AHA indicates American Heart Association; ASA, American Stroke Association; CT, computed tomography; EHR, electronic health record; EVD, external ventricular drain/drainage; GCS, Glascow Coma Scale; HE, hematoma expansion; ICH, intracerebral hemorrhage; LOC, level of consciousness; MRI, magnetic resonance imaging; NIHSS, National Institutes of Health Stroke Scale; and PACS, picture archiving and communication system.

Appendix 1. Continued

PM-12: Specialized Units

Measure description: Percentage of patients with acute spontaneous ICH, who are admitted to an ICU or dedicated stroke unit with physician and nursing neuroscience acute care expertise	
Numerator	Patients admitted to an ICU or dedicated stroke unit with physician and nursing neuroscience acute care expertise
Denominator	All patients with acute spontaneous ICH admitted to an acute care hospital within 24 h of ICH diagnosis (when brain CT or MRI shows ICH)
Denominator exclusions	Patients <18 y of age Patients who leave during hospitalization against medical advice Clear documentation for comfort care or hospice established before hospital arrival or at time of ICH (eg, if ICH was specified as an indication to change goals of care to comfort measures in an established living will) Patients who require a different type of ICU from a neurosciences ICU (eg, recent surgical procedure, LVAD) Chronic hemorrhage (eg, cavernoma, microhemorrhages on MRI, resolving known hemorrhage, petechial hemorrhage from prior ischemic stroke)
Denominator exceptions	Documentation of patient reason(s) (eg, patient or medical surrogate preference contrary to this recommendation such as refusal of transfer to another facility) Documentation of a medical reason(s) (eg, indication for a different type of ICU such as a postoperative patient needing to be in a surgical or cardiac ICU; patient with a small ICH who is otherwise medically stable enough to be cared for in a nonneuroscience ICU or nonstroke unit) Documentation of a health care systems reason(s) (eg, inability of the admitting facility to transfer the patient due to inclement weather precluding air or ground ambulance travel)
Measurement period	Within 24 hours of acute spontaneous ICH diagnosis on brain imaging
Sources of data	EHR data Administrative data/claims (inpatient or outpatient claims) Administrative data/claims expanded (multiple sources) Paper medical record
Attribution	Admission facility
Care setting	Inpatient
Rationale	
People with ICH may be medically and neurologically unstable, especially early in the acute phase of their presentation. Specialized stroke units with physicians, nurses, therapists, and pharmacists with expertise in stroke care improve long-term outcomes and reduce mortality in patients with ICH.[45,46] Caring for patients with ICH in a dedicated neuroscience ICU compared with a general ICU results in lower mortality.[47] Primary and Comprehensive Stroke Center certification is contingent on having a stroke unit.	
Clinical recommendation(s)	
2022 AHA/ASA management of spontaneous ICH guideline[7] 1. In patients with spontaneous ICH, provision of care in a specialized inpatient (eg, stroke) unit with a multidisciplinary team is recommended to improve outcomes and reduce mortality (*Class 1; Level of Evidence A).* 2. In patients with spontaneous ICH, provision of care at centers that can provide the full range of high-acuity care and expertise is recommended to improve outcomes *(Class 1; Level of Evidence B-NR).*	

AHA indicates American Heart Association; ASA, American Stroke Association; CT, computed tomography; EHR, electronic health record; ICH, intracranial hemorrhage; ICU, intensive care unit; LVAD, left ventricular assist device; and MRI, magnetic resonance imaging.

Appendix 1. Continued

PM-13: Dysphagia Screening

Measure description: Percentage of patients with acute spontaneous ICH who pass a dysphagia screening protocol (approved by the institution in which the patient is receiving care) before initiation of oral intake	
Numerator	Patients with acute spontaneous ICH for whom there is documentation of passing a dysphagia screening before oral intake of fluids, nutrition, or medications
Denominator	All patients with acute spontaneous ICH with orders for oral fluids, nutrition, or medications
Denominator exclusions	Patients <18 y of age Length of stay <24 h Patients who leave against medical advice Clear documentation for comfort care measures or hospice established before hospitalization or documented on hospital d 0 (day of ED arrival) or hospital d 1 Patients who die before initiation of oral intake Enrolled in a clinical trial that would affect dysphagia screening
Denominator exceptions	Documentation of patient reason(s) Documentation of a medical reason(s) (eg, intubation, patient was entirely dependent on enteral or parenteral feeding [without oral intake of food, liquids, or medications] before hospitalization)
Measurement period	Time of ICH diagnosis by brain CT or MRI until hospital discharge
Sources of data	EHR data Paper medical record
Attribution	Admission facility
Care setting	Inpatient and ED
Rationale	
Mortality and posthospital risk of aspiration pneumonia are higher for all patients with stroke, specifically patients with ICH with a positive dysphagia screen.[48] Two systemic reviews have shown that early dysphagia screening with formal protocols and speech pathologist swallow assessment leads to reduction in stroke-associated pneumonia and inpatient death.[49,50] Several swallow screening methods have been published in the literature, each with benefits and limitations, without sufficient evidence to recommend a single consensus method.	
Clinical recommendation(s)	
2022 AHA/ASA management of spontaneous ICH guideline[7] 1. In patients with spontaneous ICH, a formal dysphagia screening protocol should be implemented before initiation of oral intake to reduce disability and the risk of pneumonia *(Class 1; Level of Evidence B-NR).*	

AHA indicates American Heart Association; ASA, American Stroke Association; CT, computed tomography; ED, emergency department; EHR, electronic health record; ICH, intracerebral hemorrhage; and MRI, resonance imaging.

Appendix 1. Continued

PM-14: VTE Prophylaxis

Measure description: Percentage of patients with acute spontaneous ICH receiving VTE prophylaxis with pneumatic compression devices within 1 d of ICH diagnosis	
Numerator	Patients who receive VTE prophylaxis using pneumatic compression on the day of admission (d 0=day of ED arrival) or the day after admission (d 1)
Denominator	All patients with acute spontaneous ICH
Denominator exclusions	Patients <18 y of age Length of stay <24 h Patients who leave against medical advice Clear documentation for comfort care measures or hospice established before hospitalization or documented on hospital d 0 (day of ED arrival) or hospital d 1 Patients who already have documented DVT on admission (pneumatic compression devices should not be used in the leg or legs with documented DVT) Patients who are documented as ambulating without assistance within first 24 h after admission Enrolled in a clinical trial that would affect the use of pneumatic compression devices
Denominator exceptions	Documentation of patient reason (s) (eg, patient refusal) Documentation of medical reason(s) (eg, bilateral amputee, poor lower-extremity skin integrity [eg, wound, ulcers, cellulitis], recent thrombosis, severe peripheral artery disease)
Measurement period	Hospital d 0 (day of ED arrival) or d 1
Sources of data	EHR data Administrative data/claims (inpatient or outpatient claims) Administrative data/claims expanded (multiple sources) Paper medical record
Attribution	Admission facility
Care setting	Inpatient
Rationale	
Risk of in-hospital thromboembolic complications for patients with ICH is 7%, likely due to concern about expansion of hematoma and contraindication of chemical prophylaxis.[51] PE from DVT accounts for nearly 10% of deaths after stroke. DVT is common in patients with ICH because of decreased mobility.[52] Pneumatic compression is superior to the use of graduated compression stockings for prevention of VTE in patients with ICH. In CLOTS3, DVT occurrence was decreased with a trend toward reduced mortality if pneumatic compression was started as early as the day of hospital admission.[53]	
Clinical recommendation(s)	
2022 AHA/ASA management of spontaneous ICH guideline[7] 1. In nonambulatory patients with spontaneous ICH, IPC starting on the day of diagnosis is recommended for VTE (DVT and PE) prophylaxis *(Class 1; Level of Evidence B-R).*	

AHA indicates American Heart Association; ASA, American Stroke Association; CLOTS3, Clots in Legs Or Stockings After Stroke 3; DVT, deep vein thrombosis; ED, emergency department; EHR, electronic health record; ICH, intracerebral hemorrhage; IPC, intermittent pneumatic compression; PE, pulmonary embolism; and VTE, venous thromboembolism.

Appendix 1. Continued

PM-15: Long-Term BP Management

Measure description: Percentage of patients with acute spontaneous ICH with hypertension (BP >130/80 mm Hg) who are prescribed an oral or transdermal antihypertensive medication at the time of hospital discharge	
Numerator	Patients with acute spontaneous ICH and hypertension (BP >130/80 mm Hg) before discharge who are prescribed an oral or transdermal antihypertensive medication at the time of hospital discharge
Denominator	Patients with acute spontaneous ICH and hypertension (BP >130/80 mm Hg)
Denominator exclusions	Patients <18 y of age BP <130/80 mm Hg off medications at time of discharge Enrolled in a clinical trial that would affect the use of antihypertensive medications or a specific BP target Documentation of another reason for not prescribing long-term antihypertensive medication Patients who leave during hospitalization against medical advice Patients who die during hospitalization Clear documentation for comfort care measures or hospice Patients who are transferred to another acute hospital for inpatient care
Denominator exceptions	Documentation of patient reason(s) (eg, patient, family, or legally authorized representative refusal) Documentation of medical reason(s)
Measurement period	Hospital discharge
Sources of data	EHR data Administrative data/claims (inpatient claims) Administrative data/claims expanded (multiple sources) Paper medical record Pharmacy records
Attribution	Admission facility
Care setting	Inpatient
Rationale	
Hypertension is the single most important modifiable risk factor for recurrent stroke. Long-term BP control reduces the risk of recurrent ICH, ischemic stroke, and other cardiovascular outcomes. Despite this, a significant proportion of ICH survivors continue to have poorly controlled BP.[54,55] Poor BP control after ICH has been associated with recurrent lobar and nonlobar ICH.[54] Goal BP <130/80 mm Hg is consistent with other guidelines in managing hypertension.[56]	
Clinical recommendation(s)	
2022 AHA/ASA management of spontaneous ICH guideline[7] 1. In patients with spontaneous ICH, BP control is recommended to prevent hemorrhage recurrence (*Class 1; Level of Evidence B-R*).	

AHA indicates American Heart Association; ASA, American Stroke Association; BP, blood pressure; EHR, electronic health record; and ICH, intracerebral hemorrhage.

Appendix 2. Quality Measurement Set Specifications

QM-1: Prehospital Stroke Screen for ICH

Measure description: Percentage of patients with acute spontaneous ICH who were transported by EMS and had a stroke-specific screen performed	
Numerator	Patients with spontaneous ICH transported by EMS who received a stroke-specific screen (eg, Cincinnati Prehospital Stroke Scale, FAST, LAPSS) by EMS in the prehospital setting
Denominator	All patients with acute spontaneous ICH transported by EMS
Denominator exclusions	Patients <18 y of age Interfacility transfer Patients undergoing a noncontrast head CT in the prehospital setting (ie, in a mobile stroke unit) Symptomatic ICH that occurs during inpatient hospitalization (not delayed recognition of admission ICH)
Denominator exceptions	Documentation of a patient reason(s) (eg, patient refusal to participate in stroke screen) Documentation of a medical reason(s) (eg, patient requiring active management of airway or mechanical cardiovascular support during EMS transport)
Measurement period	Encounter
Sources of data	EMS medical record or other database (eg, clinical, administrative, registry)
Attribution	EMS agency
Care setting	Prehospital
Rationale	
The use of stroke-specific scales in the field and prehospital notification are associated with shorter times to stroke diagnosis in the ED[57,58] for all stroke and ICH and reduced time to hospital arrival and stroke unit admission for all patients with stroke.[59] Currently, performing a prehospital stroke screen is the only stroke-specific quality metric established by the National EMS Quality Alliance.[18] Prehospital differentiation between ICH and AIS is limited, and there is not 1 stroke-specific screening tool that can accurately differentiate between hemorrhage and ischemia without neuroimaging. Screening for acute neurological deficits can result in direct transport by EMS to a stroke center. This quality measure harmonizes with the quality measure for AIS given the inability to differentiate between AIS and ICH in the prehospital setting.	
Clinical recommendation(s)	
2022 AHA/ASA management of spontaneous ICH guideline[7] 1. In patients with sudden onset of neurological symptoms or signs attributable to potential spontaneous ICH, use of stroke recognition and severity tools is recommended for dispatch personnel and first responders to identify potential stroke and facilitate rapid transport to reduce time to diagnosis and treatment *(Class 1; Level of Evidence B-R).*	

AHA indicates American Heart Association; AIS, acute ischemic stroke; ASA, American Stroke Association; CT, computed tomography; ED, emergency department; EMS, emergency medical services; FAST, Face, Arm, Speech, Time; ICH, intracerebral hemorrhage; and LAPSS, Los Angeles Prehospital Stroke Screen.

Appendix 2. Continued

QM-2: EMS Prearrival Notification for ICH

Measure description: Percentage of patients with acute spontaneous ICH who were transported by EMS for whom a stroke-specific notification of the receiving hospital by EMS was performed	
Numerator	Patients with acute spontaneous ICH transported by EMS for whom EMS practitioners notified the receiving hospital in advance of hospital arrival that stroke was suspected
Denominator	All patients with acute spontaneous ICH transported by EMS
Denominator exclusions	Patients <18 y of age Interfacility transfer Patients undergoing a noncontrast head CT in the prehospital setting (ie, in a mobile stroke unit)
Denominator exceptions	Documentation of a patient reason(s) (eg, patient refusal to participate in stroke screen) Documentation of a medical reason(s) (eg, patient requiring active management of airway or mechanical cardiovascular support during EMS transport)
Measurement period	Encounter
Sources of data	EMS medical record or other database (eg, clinical, administrative, registry)
Attribution	EMS agency
Care setting	Prehospital
Rationale	
The use of stroke-specific scales in the field and prehospital notification are associated with shorter times to stroke diagnosis in the ED[57,58] for all stroke and ICH and reduced time to hospital arrival and stroke unit admission[61] for all patients with stroke. There is also a mortality benefit associated with stroke prenotification by EMS practitioners. For prenotification to be effective in accelerating time to diagnosis and treatment, the content of the prenotification should include the EMS practitioner's suspicion for the presence of acute stroke (rather than a routine notification that the EMS crew is transporting an undifferentiated patient to the ED). Prehospital differentiation between ICH and AIS is limited, and there is not 1 stroke-specific screening tool that can accurately differentiate between hemorrhage and ischemia without neuroimaging. Screening for acute neurological deficits can result in direct transport by EMS to a stroke center. This quality measure harmonizes with the quality measure for AIS given the inability to differentiate between AIS and ICH in the prehospital setting.	
Clinical recommendation(s)	
2022 AHA/ASA management of spontaneous ICH guideline[7] 1. In patients with potential spontaneous ICH, early notification by EMS staff to the receiving hospital is recommended to improve time to diagnosis and treatment *(Class 1; Level of Evidence B-NR).*	

AHA indicates American Heart Association; AIS, acute ischemic stroke; ASA, American Stroke Association; CT, computed tomography; ED, emergency department; EMS, emergency medical services; and ICH, intracerebral hemorrhage.

Appendix 2. Continued

QM-3: Neurobehavioral Screening

Measure description: Percentage of patients with acute spontaneous ICH who receive structured neurobehavioral screening assessments for both mood disorder (depression/anxiety) and cognitive impairment	
Numerator	Patients with acute spontaneous ICH in whom a structured inventory for both mood disorder (depression/anxiety) and cognitive impairment is administered
denominator	All patients with acute spontaneous ICH
Denominator exclusions	Patients <18 y of age Patients who leave during hospitalization against medical advice Patients who die during hospitalization Clear documentation for comfort care measures or hospice Patients who are transferred to another hospital for acute inpatient care
Denominator exceptions	Documentation of a patient reason(s) (eg, refusal of performance of screening assessment for religious or cultural reasons after demonstration of understanding of risks and benefits) Documentation of a medical reason(s) Documentation of a health care system reason(s)
Measurement period	At discharge or first outpatient appointment
Sources of data	EHR data Paper medical record Retrospective medical review
Attribution	Individual practitioner and facility
Care setting	Inpatient Postacute facility Outpatient
Rationale	
Poststroke depression occurs in 20% to 25% of patients in the first year and persists over time.[62,63] Incidence of dementia in patients with ICH is 33% and increases over time after spontaneous ICH.[64] Neurobehavioral complications of ICH are underrecognized by clinicians, leading to increased disability and mortality.[65–75] There is no optimal screening tool for poststroke neurocognitive assessment. Validated screening tools to evaluate depression and anxiety can lead to improved patient outcomes.[76]	
Clinical recommendation(s)	
2022 AHA/ASA management of spontaneous ICH guideline[7] 1. In patients with spontaneous ICH, administration of depression and anxiety screening tools in the postacute period is recommended to identify patients with poststroke depression and anxiety *(Class 1; Level of Evidence B-NR).* 2. In patients with spontaneous ICH, administration of a cognitive screening tool in the postacute period is useful to identify patients with cognitive impairment and dementia *(Class 1; Level of Evidence B-NR).*	

AHA indicates American Heart Association; ASA, American Stroke Association; EHR, electronic health record; and ICH, intracerebral hemorrhage.

Appendix 2. Continued

QM-4: Time to BP Target

Measure description: Percentage of patients with acute spontaneous ICH in whom acute BP lowering is initiated within 1 h of hospital arrival and in whom the target BP is reached within 2 h of hospital arrival	
Numerator	Patients with acute spontaneous ICH in whom pharmacological BP lowering is initiated within 1 h of hospital arrival and with the target BP reached within 2 h of hospital arrival
Denominator	All patients with acute spontaneous ICH in whom BP lowering is initiated
Denominator exclusions	Patients <18 or ≥90 y of age Presenting systolic BP <150 or >220 mm Hg Initial GCS score <5 Hematoma volume ≥60 mL[3] Patients transferred from another hospital (Note: First 4 exclusions derive from the ATACH-2 clinical trial[77] from which the data for the AHA ICH guideline recommendation are derived)
Denominator exceptions	Documentation of a medical reason(s) (eg, enrollment in clinical trial specifying BP management, documentation of medical reason why BP lowering should not be initiated)
Measurement period	Encounter
Sources of data	EHR data Paper medical record
Attribution	Admission facility
Care setting	Inpatient
Rationale	
The purpose of this measure would be to encourage rapid but controlled BP lowering in patients with ICH. The text from the 2022 ICH guidelines[7] indicates that the data from 2 h of onset come from a post hoc substudy of a single clinical trial (ATACH-2)[77] and does not provide supporting text for meeting the 1-h postinitiation target. It also does not provide a specific target because the ATACH-2 trial tested 2 different targets and did not find a difference in outcome between these 2 targets. Although time from ICH onset is often not under the control of hospitals and clinicians who receive patients as a primary destination or in transfer, time from arrival to treatment is. Thus, a 60-min window to initiation of BP lowering is used analogous to a door-to-needle time for AIS. Sixty min also allows a slow and steady reduction in BP to reduce large variability, which can worsen functional outcomes in patients with ICH. A specific BP target is not included in this measure. To meet this measure, a hospital must specify a target in the individual patient and meet this patient-specific target.	
Clinical recommendation(s)	
2022 AHA/ASA management of spontaneous ICH guideline[7] 1. In patients with spontaneous ICH in whom acute BP lowering is considered, initiating treatment within 2 h of ICH onset and reaching target within 1 h can be beneficial to reduce the risk of HE and improve functional outcome *(Class 2a; Level of Evidence C-LD).* 2. In patients with spontaneous ICH requiring acute BP lowering, careful titration to ensure continuous smooth and sustained control of BP, avoiding peaks and large variability in SBP, can be beneficial for improving functional outcomes (*Class 2a; Level of Evidence B-NR*).	

AHA indicates American Heart Association; AIS, acute ischemic stroke; ASA, American Stroke Association; ATACH-2, Antihypertensive Treatment of Acute Cerebral Hemorrhage II; BP, blood pressure; EHR, electronic health record; GCS, Glasgow Coma Scale; HE, hematoma expansion; ICH, intracerebral hemorrhage; and SBP, systolic blood pressure.

Appendix 2. Continued

QM-5: Rapid Transfer for EVD

Measure description: Percentage of patients with acute spontaneous ICH or IVH and hydrocephalus who are transferred for definitive hydrocephalus management to a center with neurosurgical capabilities within 90 min of hydrocephalus diagnosis by brain CT or MRI.	
Numerator	Patients with acute spontaneous ICH or IVH and hydrocephalus (as defined by initial brain CT or MRI radiology report) who are transferred to a center with neurosurgical capabilities able to definitively treat hydrocephalus within 90 min of hydrocephalus diagnosis by brain CT or MRI (picture-to-door-out time).
Denominator	All patients with acute spontaneous ICH or IVH and hydrocephalus who initially present to a hospital without neurosurgical capabilities.
Denominator exclusions	Patients <18 y of age Clear documentation for comfort care measures or hospice Patients who initially present to a center with neurosurgical capabilities for definitive hydrocephalus management
Denominator exceptions	Documentation of a patient reason(s) (eg, patients who leave against medical advice before planned transfer, patients/families/legally authorized representatives who refuse transfer, patients whose goals of care do not include surgical interventions and advanced life-sustaining therapy) Documentation of a medical reason(s) (eg, patients who die before planned transfer) Documentation of hospital system reason(s) (eg, documentation that patient was not accepted at transferring facility; inclement weather)
Measurement period	Encounter
Sources of data	EHR data Administrative data/claims (inpatient claims) Administrative data/claims expanded (multiple sources) Paper medical record Radiology imaging (eg, PACS)
Attribution	Transferring facility without neurosurgical capabilities
Care setting	ED and Inpatient
Rationale	
The guidelines do not specify a timeline for which to transfer patients with hydrocephalus. The highest-risk period for neurological decline is the first 12 h after ICH onset. Therefore, once hydrocephalus is diagnosed radiographically or clinically, urgent transfer is indicated. Ninety min was chosen to mirror door-in-door-out recommendations for AIS and to incorporate time needed for to interpret the imaging, call the admitting facility, and arrange transfer by ambulance or air.	
Clinical recommendation(s)	
AHA/ASA management of spontaneous ICH guideline[7] 1. In patients with spontaneous ICH and clinical hydrocephalus, transfer to centers with neurosurgical capabilities for definitive hydrocephalus management (eg, EVD placement and monitoring) is recommended to reduce mortality *(Class 1; Level of Evidence B-NR).*	

AHA indicates American Heart Association; AIS, acute ischemic stroke; ASA, American Stroke Association; CT, computed tomography; ED, emergency department; EHR, electronic health record; EVD, external ventricular drain; ICH, intracerebral hemorrhage; IVH, intraventricular hemorrhage; MRI, magnetic resonance imaging; and PACS, picture archiving and communication system.