Stroke and Stroke Rehabilitation
Quality Measurement Set Update

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Contents

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The AMA's, AMA-PCPI's and National Committee for Quality Assurance's significant past efforts and contributions to the development and updating of the Measures is acknowledged. AANI is solely responsible for the review and enhancement ("Maintenance") of the Measures as of July 29, 2014.

AANI encourage use of the Measures by other health care professionals, where appropriate.

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- Measure #9 – Caregiver Nutritional Preferences

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Intravenous Fibrinolytic Treatment Measure Bundle
Acute Stroke Endovascular Treatment Measure Bundle
Endovascular Treatment and Imaging Measure Bundle
Carotid Imaging Measure
Defect Free Acute Inpatient Ischemic Stroke Measure Bundle
Potentially Avoidable Complications Following Stroke
High and Moderate Intensity Statin Following Stroke
Cognitive Impairment Following Stroke
Rehabilitation Services Assessed
Post-Acute Ischemic Stroke Screening and Care
Functional Outcome Assessment for Acute Ischemic Stroke who Received Recanalization Therapy

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Improving Outcome for Patients Following Stroke

Rationale for Measures

The American Academy of Neurology (AAN) assumed stewardship for the AMA – PCPI developed stroke and stroke rehabilitation measures in 2011. In 2015, the AAN evaluated the measurement set for potential updates and seated a work group to update the existing measure set. The AAN partnered with the American College of Radiology (ACR) and American Academy of Physical Medicine and Rehabilitation (AAPMR) to chair this project. This work group was charged with developing measures focused on improving outcomes for patients following stroke. The work group includes representatives from professional associations, patient advocacy organizations, and payers to ensure measures developed included input from all members of the healthcare team and other relevant stakeholders. All members were required to disclose relationships with industry and other entities to avoid actual, potential, or perceived conflicts of interest.

Importance and Prevalence of Stroke

"On average, every 40 seconds, someone in the United States has a stroke, and someone dies of one approximately every 4 minutes."[i] Stroke is the fifth leading cause of death in the US[ii], and for black Americans it is the third leading cause of death.[iii] It is estimated that approximately 795,000 people experience a new or recurrent stroke each year with approximately 610,000 experiencing first events and 185,000 experiencing recurrent stroke events.[iv] One in every 20 deaths in the United States was caused by a stroke in 2011.[v] Stroke is a leading cause of serious long-term disability.[vi]

It is estimated the annual cost for stroke and cardiovascular disease was $320.1 billion with $195.6 billion in direct costs that include hospital services, medications, home health care and professional services and $124.5 billion in indirect costs.[vii] Strokes alone cost the United States $34 billion each year including cost of health care services, medications to treat stroke, and missed days of work.[viii]

Opportunity for Improvement

Strokes occur at any age, and risk increases with age.[ix] Nearly half of older stroke survivors experience moderate to severe disability.[x] The risk of having a stroke varies with race and ethnicity as the risk of having a first stroke is nearly twice as high for blacks than for whites, and blacks are more likely to die following a stroke than are whites[xi] with mortality of blacks 3x that of whites between the ages of 45 to 54 years old.[xii] American Indians, Alaska Natives, and blacks are more likely to have had a stroke than are other groups.[xiii] The CDC has also noted that stroke prevalence increases in the Southeastern portion of the United States.[xiv]

Timely treatment of stroke is vital as patients who arrive for emergency care within 3 hours of first symptoms tend to have less disability 3 months after a stroke than those who received delayed care.[xv]

Additional information on treatment gaps in care and opportunity for improvement are included in the individual measure specifications that follow.

Clinical Evidence Base

A comprehensive search to identify published guidelines, measures, and consensus recommendations in the National Guidelines Clearinghouse, the National Quality Measures Clearinghouse, PubMed, MEDLINE, EMBASE, and the Cochrane Library occurred. The work group consulted the following clinical practice guidelines published since the release of the prior measure set, with the following serving as the base of the measure drafts:

- 2005 Management of Adult Stroke Rehabilitation Care. A Clinical Practice Guideline. [xvi]
- 2008 US Department of Health and Human Services. Treating tobacco use and dependence[xvii]

- 2009 AHA Comprehensive overview of nursing and interdisciplinary care of the acute ischemic stroke patient [xviii]
- 2011 ASGE The role of endoscopy in enteral feeding[xix]
- 2013 AHA/ASA Guidelines for the Early Management of Patients with Acute Ischemic Stroke[xx]
- 2013 ACC/AHA Guideline on the Treatment of Blood Cholesterol to Reduce Atherosclerotic Cardiovascular Risk in Adults[xxi]
- 2014 Guidelines for the Prevention of Stroke in Patients with Stroke and Transient Ischemic Attack[xxii]
- 2014 AHA/ASA Palliative and end-of-life care in stroke [xxiii]
- 2014 AHA/ASA Physical activity and exercise recommendations for stroke survivors [xxiv]
- 2015 AHA/ASA focused update of the 2013 guidelines for the early management of patients with acute ischemic stroke regarding endovascular treatment [xxv]
- 2015 National Lipid Association recommendations for patient-centered management of dyslipidemia: part 1--full report. [xxvi]
- 2015 Canadian Stroke Best Practice Recommendations: Mood, Cognition and Fatigue Following Stroke practice guidelines, update 2015[xxvii]
- 2016 American Diabetes Association. Classification and Diagnosis of Diabetes. [xxviii]
- 2016 AHA/ASA Guidelines for adult stroke rehabilitation and recovery [xxix]

Common Abbreviations and Definitions for the Measurement Set

Below is a list of acronyms utilized in this document. The AAN has a Quality Improvement Glossary, which provides more in depth explanations and is available at aan.com/practice/quality-measures/quality-resources.

- AAN: American Academy of Neurology
- AHA: American Heart Association
- ANH: Artificial Nutrition and Hydration
- ASA: American Stroke Association
- ASCVD: Atherosclerotic Cardiovascular Disease
- CMS: Centers for Medicare & Medicaid Services
- CPR:
- CT: Computed Tomography
- CVD: Cardiovascular Disease
- DM: Diabetes Mellitus
- DNR: Do Not Resuscitate
- DVT: Deep Vein Thrombosis
- EHR: Electronic Health Record
- ET: Endovascular Treatment
- IV: Intravenous
- LDL-C: low density lipoprotein cholesterol
- LKW: Last Known Well time
- MRI: Magnetic Resonance Imaging
- mRS: Modified Rankin Score
- MV: Mechanical Ventilation
- NIH: National Institutes of Health
- NIHSS: NIH Stroke Scale
- NQF: National Quality Forum
- PE: Pulmonary Embolism
- PQRS: Physician Quality Reporting System
- PSD: Post Stroke Depression
- t-PA: Tissue Plasminogen Activator
- TIA: Transient Ischemic Attack
- TICI: Thrombolysis in Cerebral Infarction
- VCI: Vascular Cognitive Impairment
- VKA: Vitamin K Antagonist

For the purposes of these quality measures, any reference to intracranial hemorrhage will include ONLY non-traumatic intraparenchymal hemorrhage and non-traumatic subarachnoid hemorrhage, unless one or the other is specified; it will NOT include subdural or epidural hemorrhages or traumatic intraparenchymal or subarachnoid hemorrhage.

For this document, the work group has defined "Post-Acute Care" as including Long Term Care Hospitals (LTCHs), Skilled Nursing Facilities (SNFs), Inpatient Rehabilitation Facilities (IRFs), and Home Health Agencies (HHAs) as to mirror the CMS's post-acute care specifications.[xxx]

2016 Stroke and Stroke Rehabilitation Measurement Set
The following measures were approved by the work group, including process and outcome measures:

Measure #	Measure Title
	Intravenous Fibrinolytic Treatment Measure Bundle
	Acute Stroke Endovascular Treatment Measure Bundle
	Endovascular Treatment and Imaging Measure Bundle
	Carotid Imaging Measure
	Defect Free Acute Inpatient Ischemic Stroke Measure Bundle
Measure 9	Patient/Caregiver Nutritional Preferences - Updated in 2016
	Potentially Avoidable Complications Following Stroke
	High and Moderate Intensity Statin Following Stroke
	Cognitive Impairment Following Stroke
Measure 6	Rehabilitation Services Assessed –Updated in 2016
	Post-Acute Ischemic Stroke Screening and Care Measure Bundle
	Functional Outcome Assessment Following Recanalization Therapy for Acute Ischemic Stroke

This measurement set includes measure bundles, which are calculated using an all-or-none calculation. All-or-none calculation requires each component be completed to meet measure performance, with equal weighting of components. These bundles are valuable given their patient focus and indication of commitment to the highest quality of care. Providers and practices may find it beneficial to identify which component measures were not satisfied to identify areas of practice where quality improvement can occur. The work group notes that many of these component measures are currently available as independent measures in accountability programs (e.g., NQF #18/PQRS #2326 Controlling High Blood Pressure, NQF #0028/PQRS #226 Preventive Care and Screening: Tobacco Use: Screening and Cessation, etc.). It is not the work group's intent to replace those measures with these bundled measure, but to compliment them providing practices and providers with a summary of overall performance of care on identified topics.

The work group approved an outcome measure evaluating Potentially Avoidable Complications Following Stroke. The work group is releasing the measure for use in quality improvement efforts only at this time. Possible calculation and risk adjustment strategies will be evaluated and tested. Pending the results of this evaluation, additional specifications may be released including specifying the measure for use in accountability programs.

The work group developed and collected public comments on a measure evaluating Advance Care Directive and Surrogate Decision-maker Established Following Stroke. The measure was not further developed as the AAN released the Discussion and Documentation of Advance Directives measures in the Inpatient and Emergency Measurement Set available at: https://www.aan.com/practice/quality-measures/ A separate measure was not needed given the application of the existing measure to stroke populations. Providers and practices are encouraged to adopt this measure for use in stroke populations as warranted.

Retired Stroke and Stroke Rehabilitation Measures

Measures may be retired for several reasons including but not limited to 1) the measure is no longer clinically relevant or supported by current guidelines and evidence, 2) a treatment gap in care no longer remains with clinician performance consistently high, 3) measure harmonization with other measures existing in the field, 4) demonstrated poor reliability, feasibility, or validity following testing, or 5) significant unintended consequences were found.

2011 Stroke and Stroke Rehabilitation Measurement Set	
Measure 1	Deep Vein Thrombosis (DVT) Prophylaxis for Ischemic Stroke or Intracranial Hemorrhage (NQF#0340) – Retired in 2016
Measure 2	Discharged on Antithrombotic Therapy (NQF#0325) – Retired in 2016
Measure 3	Anticoagulant Therapy Prescribed for Atrial Fibrillation at Discharge (NQF# 0241) – Retired in 2016
Measure 4a	Tissue Plasminogen Activator (t-PA) Considered (Paired Measure) – Retired in 2016
Measure 4b	Tissue Plasminogen Activator (t-PA) Initiated (Paired Measure) – Retired in 2016
Measure 5	Screening for Dysphagia (NQF#0243) – Retired in 2016
Measure 6	Rehabilitation Services Ordered (NQF#0244) – Updated in 2016
Measure 7	Avoidance of Intravenous Heparin - Retired in 2011
Measure 8	Computed Tomography (CT) or Magnetic Resonance Imaging (MRI) Reports – Retired in 2016
Measure 9	Artificial Feeding Patient/Caregiver Preferences – Updated in 2016
Measure 10a	Potentially Avoidable Harmful Events: Urinary Tract Infection – Retired in 2016
Measure 10b	Potentially Avoidable Harmful Events: Stage III or Greater Decubiti – Retired in 2016
Measure 10c	Potentially Avoidable Harmful Events: Fall with Fracture or Acute Subdural Hematoma – Retired in 2016
Measure 11	Lipid Management – Retired in 2016
Measure 12	Blood Pressure Control – Retired in 2016
Measure 13	Imaging for Transient Ischemic Attack or Ischemic Stroke – Retired in 2016

The work group reviewed the prior measurement set and voted to retire multiple measures in order to develop bundled or composite measures that would accurately record performance on multiple components in the aggregate. Imaging measures were combined and refined with previous treatment measures. Potentially Avoidable Complications were retired to form a new outcome measure. The work group retired the Lipid Management measure due to a change in the evidence base, and developed a new High Intensity Statin measure.

Other Potential Measures

The work group discussed multiple alternate measures. Ultimately these measures were not included in this update, but the concepts will be retained for future measurement set updates as more evidence may support development or a treatment gap in care at that time. The work group discussed but did *not* approve a Non-Acute Stroke and TIA Imaging Measure nor a measure on Advanced Directives (See above rationale).

The work group prior to meeting discussed development of standalone depression, anxiety, and pain screening measure following stroke. A standalone measure was not developed, but the concept was incorporated into the Post-Acute Ischemic Stroke Screening and Care measure. Multiple depression and

pain measures are available for individuals interested in monitoring performance on these issues, including measures endorsed by the National Quality Forum, which can be reviewed at qualityforum.org.

The work group discussed development of a functional status assessment prior to inpatient discharge following stroke. The work group did not develop as a separate measure would be redundant from the updated rehabilitation measure #6 and lack of agreement on a standard tool to measure given providers have multiple tools used to meet the needs of their patients.

Return to driving following stroke was discussed and it was determined the evidence is not ripe for development at this time. The work group believes further guideline statements, systematic reviews and/or randomized clinical trial data are needed to develop a fully specified measure that could be of use to providers.

A similar discussion occurred surrounding sleep apnea testing following stroke. Sleep apnea is prevalent in patients following stroke and there is a known treatment gap in care. However, a consensus could not be reached on denominator population and what sleep apnea testing should be implemented following stroke. It is hoped further guideline statements, systematic reviews and/or randomized clinical trial data are developed in the coming years to develop a fully specified measure that could be of use to providers.

The work group evaluated development of hemicraniectomy and care preferences following stroke. Ultimately, these concepts were not further developed as a measure was created to address goals of care following stroke. It is believed this measure incorporates these concepts under a broader umbrella measure ensuring treatment goals were addressed.

Technical Specifications Overview
The Work Group developed technical specifications for measures that may include:

- Electronic Health Record (EHR) Data
- Chart Review (for select measures where EHR data cannot be gathered)
- Registry

The AAN is in the process of creating code value sets and the logic required for electronic capture of the quality measures with EHRs, when possible. A listing of the quality data model elements, code value sets, and measure logic (through the CMS Measure Authoring Tool) for each of the measures will be made available at a later date. These technical specifications will be updated as warranted.

The measurement set includes measures that require the use of validated screening or other assessment tools. The Work Group discussed more and less prescriptive ways to select these tools, eventually determining that multiple tools should be offered to allow providers to determine which tool best meets their individual practice needs. A finite list of tools is included so measurement data can be gathered via electronic and registry collection methods. In some cases, tools may be subject to copyright and require licensing fees.

Measure Exclusions Versus Exceptions
A denominator exclusion is a factor supported by the clinical evidence that removes a patient from inclusion *in the measure population*. For example, if the denominator indicates an age range from 0 to 18 years of age, a patient who is 19 years of age would be excluded.

A denominator exception is a condition that should remove the patient, procedure or unit of measurement from the denominator *only if the numerator criteria are not met*. The AAN includes three classes of possible exceptions: medical (e.g., contraindication), patient (e.g., refusal, religious belief), or system

(e.g., resource limitation) reasons. For each measure, the rationale justifying an exception for a medical, patient, or system reason must be clear. The Work Group provided explicit exceptions when applicable, for ease of use in eMeasure development.

Testing and Implementation of the Measurement Set

The measures in this set are being made available without any prior testing. The AAN encourages testing of this measurement set for feasibility and reliability by organizations or individuals positioned to do so. Select measures will be beta tested once the set has been released, prior to submission to the National Quality Forum for possible endorsement.

2016 Stroke and Stroke Rehabilitation Measure Specifications

Intravenous Fibrinolytic Treatment Measure Bundle

Measure Description	
Percentage of patients aged 18 years and older with a diagnosis of acute ischemic stroke presenting within 4.5 hours from last known well (LKW) who received optimal intravenous fibrinolytic treatment evaluation and management based upon their eligibility for all 5 performance components.	
Measure Specifications	
Numerator Statement	Patients aged 18 years and older with a diagnosis of ischemic stroke presenting within 4.5 hours from LKW and received all 5 evaluation and management treatment components: **Component 1**: NIH Stroke Scale (NIHSS) documented Documentation of NIHSS on presentation, or prior to the initiation of intravenous fibrinolytic treatment **Component 2**: Intravenous fibrinolytic treatment eligibility assessment documented Documentation of eligibility for intravenous fibrinolytic treatment. **Component 3:** Intravenous fibrinolytic treatment documentation Documentation of time to initiation of intravenous fibrinolytic therapy. If not eligible, documentation of appropriate exclusion criteria fulfills this component. **Component 4**: Intravenous fibrinolytic treatment initiated within 60 minutes from presentation (i.e., arrival to ED or discovery of symptoms if in-patient stroke) Initiation of intravenous fibrinolysis treatment less than 60 minutes from presentation o If initiation greater than 60 minutes from presentation, documentation of appropriate reason for delay. See below technical specifications for acceptable and NOT acceptable reasons. o If not patient eligible, documentation of appropriate exclusion criteria fulfills this component. **Component 5**: Non-contrast brain CT or MRI interpreted within 45 minutes from presentation Documentation of CT or MRI brain imaging interpretation within 45 minutes of presentation
Denominator Statement	All acute ischemic stroke patients aged 18 years and older presenting within 4.5 hours from LKW
Denominator Exceptions	Component 4 only • Patients presenting after 3.5 hours from LKW as the 60-minute window to treatment is not available to them. • Patients presenting from outside hospital who already received intravenous fibrinolytic therapy
Exception Justification	An exception is needed as patients presenting after 3.5 hours from LKW may not be eligible for intravenous fibrinolytic therapy as they would potentially fall out of time window for treatment. Patients presenting from outside hospital who already received intravenous fibrinolytic therapy are not appropriate for the current measure given care received impacts timing of measure components.
Supporting Guideline &	**The following clinical recommendation statements are quoted verbatim from the referenced clinical guidelines and represent the evidence base for the measure:**

Other References	Component 1: NIHSS documented • "The use of a stroke rating scale, preferably the NIHSS, is recommended (Class I; Level of Evidence B)." (1) Component 2: Intravenous fibrinolytic treatment eligibility assessment documented • "Intravenous rtPA (0.9 mg/kg, maximum dose 90 mg) is recommended for selected patients who may be treated within 3 hours of onset of ischemic stroke (Class I; Level of Evidence A). Physicians should review the criteria outlined in Tables 10 and11 (which are modeled on those used in the NINDS Trial) to determine the eligibility of the patient."(1) Component 3: Intravenous fibrinolytic treatment documentation • "In patients eligible for intravenous rtPA, benefit of therapy is time dependent, and treatment should be initiated as quickly as possible."(1) Component 4: Intravenous fibrinolytic treatment initiated within 60 minutes from presentation (i.e. arrival to ED or discovery of symptoms if in-patient stroke) • "The door-to-needle time (time of bolus administration) should be within 60 minutes from hospital arrival (Class I; Level of Evidence A)."(1) • "Intravenous rtPA is reasonable in patients whose blood pressure can be lowered safely (to below 185/110 mm Hg) with antihypertensive agents, with the physician assessing the stability of the blood pressure before starting intravenous rtPA (Class I; Level of Evidence B)."(1) Component 5: Non-Contrast Brain CT or MRI Interpreted within 45 minutes from presentation • "Emergency imaging of the brain is recommended before initiating any specific therapy to treat acute ischemic stroke (Class I; Level of Evidence A). In most instances, NECT will provide the necessary information to make decisions about emergency management."(1) • "Either NECT or MRI is recommended before intravenous rtPA administration to exclude ICH (absolute contraindication) and to determine whether CT hypodensity or MRI hyperintensity of ischemia is present (Class I; Level of Evidence A)." (1) • "In intravenous fibrinolysis candidates, the brain imaging study should be interpreted within 45 minutes of patient arrival in the ED by a physician with expertise in reading CT and MRI studies of the brain parenchyma (Class I; Level of Evidence C)." (1)
Relationship to Desired Outcome	Component 1: The NIHSS is a validated tool for assessing the initial stroke severity. An objective, standardized assessment of stroke severity is essential for determining eligibility for thrombolytic therapy, is the main determinant of short-term and long-term prognosis from stroke, and facilitates communication of stroke severity between health care providers. NIHSS assessment should improve patient outcome by enabling other processes of care when appropriate.(2) Component 2: Appropriate selection of patients using validated inclusion and exclusion criteria ensures safe administration of intravenous fibrinolytic therapy.

	Component 3: Excellent outcomes on individual functional measures were more frequent with intravenous fibrinolytic treatment for global disability (40% vs 28%), global outcome (43% vs 32%), activities of daily living (53% vs 38%) and neurological deficit (34% vs 20%) compared with no treatment.(1) Component 4: Mounting evidence suggests that the earlier the time to treatment, the greater the treatment effect of intravenous fibrinolytic therapy Component 5: Timely brain imaging and interpretation is critical to the rapid evaluation and management of patients with ischemic stroke, affecting immediate and long term treatment decisions.
Opportunity for Improvement	A collaborative national quality improvement initiative report showed that the median door to needle time for tPA administration was 77 minutes (IQR 60-98) and door to needle time for tPA administration of 60 minutes or less was only 26.5% of patients, improving to 67 minutes and 41.3% during post intervention period. This improvement was associated with reduced in-hospital mortality, symptomatic intracranial hemorrhage and increased discharge to home.(3) Further improvement in patient outcome is expected with improving door to needle time. Unintended consequences of measure use were evaluated, as there is a potential for stroke mimics to receive inappropriate thrombolytic care. Currently, rapid treatment is justified given the risk of harm is low for those with stroke mimics(4), and potential consequences of not receiving tPA for those who are clinically appropriate. The work group did not create an exception for those receiving intravenous treatment only given current evidence supports improved functional independence when mechanical thrombectomy is combined with standard intravenous thrombolysis.(5) Unintended consequences will continue to be monitored and evaluated during the next update of this stroke measurement set. The work group notes that individual components will occur in emergency department and inpatient care settings and that performance scores will be comprised of total performance across care teams, and not isolated to one area of care.
National Quality Strategy Domains	☐ Patient and Family Engagement ☐ Patient Safety ☐ Care Coordination ☐ Population/Public Health ☐ Efficient Use of Healthcare Resources ☒ Clinical Process/Effectiveness
Harmonization with Existing Measures	The definitions and specifications used in the components of this measure are similar to those collected in the commonly employed stroke measures (i.e., Joint Commission and/or AHA/ASA), ensuring parsimony in data collection strategies. A separate measure is being created to monitor global performance for quality improvement. NQF#2864 CSTK 01: NIHSS Score Performed for Ischemic Stroke Patients. Patients for whom an initial NIHSS score performed prior to acute recanalization therapy and documented or documented within 12 hours of arrival for patients who do not undergo recanalization therapy. Measure modified for use in this measure bundle to focus on documentation of score prior to initiation of treatment.

	NQF#1952 Time to Intravenous Thrombolytic Therapy. AIS patients who receive IV t-PA from time of arrival to initiation (door-to-needle time) of 60 minutes or less. Measure components were mirrored and added to bundled measure. NQF#0437 STK 04: Thrombolytic Therapy. Measure captures proportion of AIS patients who arrive within 2 hours of LKN for whom IV t-PA was initiated within 3 hours. Measure components were mirrored and added to bundled measure. Joint Commission AMI-7 documentation of delay language was mirrored for measure component. NQF #0661 Head CT or MRI Scan Results for AIS or Hemorrhagic Stroke Patients who Received Head CT or MRI Scan Interpretation within 45 minutes of ED Arrival. Measure components were mirrored and added to bundled measure.
Measure Purpose (Check all that apply)	☒ Quality improvement ☒ Accountability
Type of Measure (Check all that apply)	☒Process ☐ Outcome ☐Structure
Level of Measurement (Check all that apply)	☐Individual Provider ☒ Practice ☒ System
Care Setting (Check all that apply)	☒ Emergency Departments ☒ Inpatient ☐Outpatient ☐ Post-Acute Care
Data Source (Check all that apply)	☒ Electronic health record (EHR) data ☐Administrative Data/Claims ☒Chart Review ☒ Registry
Technical Specifications	
Component 4: <u>Reasons for Delay</u> Mirrored from Joint Commission "Reason for Delay in Fibrinolytic Therapy"(6) System reasons for delay are NOT acceptable, regardless of any linkage to the delay in fibrinolysis/reperfusion - Equipment-related - Staff-related - Consultation with other clinician Examples of ACCEPTABLE documentation" - "Hold on fibrinolytics. Will do CAT scan to r/o bleed." - "Patient waiting for family or clergy to arrive – wishes to consult with them before thrombolysis." - "Fibrinolysis delayed due to management of airway, breathing, or circulation emergency before administering fibrinolysis."	
References	

1. Jauch EC, Saver JL, Adams HP Jr, et al.; on behalf of the American Heart Association Stroke Council, Council on Cardiovascular Nursing, Council on Peripheral Vascular Disease, and Council on Clinical Cardiology. Guidelines for the early management of patients with acute ischemic stroke: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2013;44(3):870-947.
2. Smith EE, Saver JL, Alexander DN, et al.; on behalf of the AHA/ASA Stroke Performance Oversight Committee. Clinical performance measures for adults hospitalized with acute ischemic stroke: performance measures for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2014;45(11):3472-3498.
3. Fonarow GC, Zhoa X, Smith EE, et al. Door-to-needle times for tissue plasminogen activator administration and clinical outcomes in acute ischemic stroke before and after a quality improvement initiative. JAMA. 2014; 311(16):1632-1640.
4. Zinkstok SM, Engelter ST, Gensicke H, et al. Safety of thrombolysis in stroke mimics. Stroke. 2013;44:1080-1084.
5. Bracard S, Ducrocq X, Mas JL, et al. Mechanical thrombectomy after intravenous alteplase versus alteplase alone after stroke (THRACE): a randomized controlled trial. Lancet Neurology 2016; 15(11):1138-1147.
6. Joint Commission. Specifications Manual for Joint Commission National Quality Core Measures (2010A1) Available at: https://manual.jointcommission.org/releases/archive/TJC2010B/DataElem0118.html Accessed on September 14, 2016.

Acute Stroke Endovascular Treatment Measure Bundle

Measure Description	
Percentage of patients aged 18 years and older with a diagnosis of ischemic stroke presenting within 6 hours from last known well (LKW) who received optimal endovascular treatment evaluation and management based upon their eligibility for 2 performance components.	
Measure Specifications	
Numerator Statement	Patients aged 18 years and older with a diagnosis of ischemic stroke presenting within 6 hours from LKW and received all the following treatment evaluation and management: **Component 1**: NIHSS Documented Documentation of NIHSS on presentation or prior to initiation of endovascular therapy if administered **Component 2**: Endovascular Treatment Eligibility Assessment Documented Documentation of eligibility for endovascular treatment using a defined inclusion and exclusion criteria AND Documentation of treatment decision within 1 hour of presentation to include the following details: • If not eligible, documentation of appropriate exclusion criteria must be done. • If eligible, documentation of referral for endovascular treatment must be done (referral to an outside endovascular treatment center is acceptable)
Denominator Statement	All acute ischemic stroke patients aged 18 years and older presenting within 6 hours from LKW
Denominator Exceptions	None
Exception Justification	Not applicable
Supporting Guideline & Other References	**The following clinical recommendation statements are quoted verbatim from the referenced clinical guidelines and represent the evidence base for the measure:** Component 1: NIHSS documented • "The use of a stroke rating scale, preferably the NIHSS, is recommended (Class I; Level of Evidence B)."(1) Component 2: Endovascular Treatment Eligibility Assessment Documented • "Intra-arterial treatment requires the patient to be at an experienced stroke center with rapid access to cerebral angiography and qualified interventionalists. An emphasis on expeditious assessment and treatment should be made. Facilities are encouraged to define criteria that can be used to credential individuals who can perform intra-arterial revascularization procedures. Outcomes on all patients should be tracked (Class I; Level of Evidence C)."(1) • "Patients should receive endovascular therapy with a stent retriever if they meet all the following criteria (Class I; Level of Evidence A). [2] a) Prestroke mRS score 0 to 1, b) Acute ischemic stroke receiving intravenous r-tPA within 4.5 hours of onset according to guidelines from professional medical societies, c) Causative occlusion of the ICA or proximal MCA (M1),

	d) Age ≥18 years, e) NIHSS score of ≥6, f) ASPECTS of ≥6, and g) Treatment can be initiated (groin puncture) within 6 hours of symptom onset" • "In carefully selected patients with anterior circulation occlusion who have contraindications to intravenous r-tPA, endovascular therapy with stent retrievers completed within 6 hours of stroke onset is reasonable (Class IIa; Level of Evidence C). Inadequate data are available at this time to determine the clinical efficacy of endovascular therapy with stent retrievers for those patients whose contraindications are time based or not time based (eg, prior stroke, serious head trauma, hemorrhagic coagulopathy, or receiving anticoagulant medications)."(2) • "Patients should be transported rapidly to the closest available certified primary stroke center or comprehensive stroke center or, if no such centers exist, the most appropriate institution that provides emergency stroke care as described in the 2013 guidelines (Class I; Level of Evidence A). In some instances, this may involve air medical transport and hospital bypass."(2) • "Regional systems of stroke care should be developed. These should consist of the following: a) Healthcare facilities that provide initial emergency care, including administration of intravenous r-tPA, such as primary stroke centers, comprehensive stroke centers, and other facilities, and b) Centers capable of performing endovascular stroke treatment with comprehensive periprocedural care, including comprehensive stroke centers and other healthcare facilities, to which rapid transport can be arranged when appropriate (Class I; Level of Evidence A)."(2) • "It may be useful for primary stroke centers and other healthcare facilities that provide initial emergency care, including administration of intravenous r-tPA, to develop the capability of performing emergency noninvasive intracranial vascular imaging to most appropriately select patients for transfer for endovascular intervention and to reduce the time to endovascular treatment (Class IIb; Level of Evidence C)."(2) • "Endovascular therapy requires the patient to be at an experienced stroke center with rapid access to cerebral angiography and qualified neurointerventionalists. Systems should be designed, executed, and monitored to emphasize expeditious assessment and treatment. Outcomes for all patients should be tracked. Facilities are encouraged to define criteria that can be used to credential individuals who can perform safe and timely intra-arterial revascularization procedures (Class I; Level of Evidence E)."(2)
Relationship to Desired Outcome	The NIHSS is a validated tool for assessing the initial stroke severity. An objective, standardized assessment of stroke severity is essential for determining eligibility for thrombolytic therapy, is the main determinant of short-term and long-term prognosis

	from stroke, and facilitates communication of stroke severity between health care providers. In carefully selected patients, rapid endovascular treatment for acute ischemic stroke has been shown to improve patient outcome and reduce mortality.(2) A recent meta-analysis, concluded that for patients with large-vessel ischemic stroke, earlier combined treatment with endovascular therapy and medical therapy compared with medical therapy alone was associated with lower degrees of disability on the mRS at 3 month follow-up with benefit becoming non-significant after 7.3 hours.(3)
Opportunity for Improvement	In patients with proximal vessel occlusion, 60-80% die within 90 days after stroke onset or do not regain functional independence despite intravenous alteplase treatment, (4) due to modest rate of recanalization and reperfusion. Endovascular treatment enables fast recanalization and high reperfusion rates. The work group notes that individual components will occur in emergency department and inpatient care settings and that performance scores will be comprised of total performance across care teams, and not isolated to one area of care.
National Quality Strategy Domains	☐ Patient and Family Engagement ☐ Patient Safety ☐ Care Coordination ☐ Population/Public Health ☐ Efficient Use of Healthcare Resources ☒ Clinical Process/Effectiveness
Harmonization with Existing Measures	The definitions and specifications used in the components of this measure are similar to those collected in the commonly employed stroke measures (i.e., Joint Commission and/or AHA/ASA), ensuring parsimony in data collection strategies. A separate measure is being created to monitor global performance for quality improvement. NQF#2864 CSTK 01: NIHSS Score Performed for Ischemic Stroke Patients. Patients for whom an initial NIHSS score performed prior to acute recanalization therapy and documented or documented within 12 hours of arrival for patients who do not undergo recanalization therapy. Measure modified for use in this measure bundle to focus on documentation of score prior to initiation of treatment.
Measure Purpose (Check all that apply)	☒ Quality improvement ☒ Accountability
Type of Measure (Check all that apply)	☒Process ☐ Outcome ☐ Structure
Level of Measurement (Check all that apply)	☐Individual Provider ☒ Practice ☒ System
Care Setting (Check all that apply)	☒ Emergency Departments ☒ Inpatient ☐Outpatient ☐ Post-Acute Care

Data Source (Check all that apply)	☒ Electronic health record (EHR) data ☐ Administrative Data/Claims ☒ Chart Review ☒ Registry

References

1. Jauch EC, Saver JL, Adams HP Jr, et al.; on behalf of the American Heart Association Stroke Council, Council on Cardiovascular Nursing, Council on Peripheral Vascular Disease, and Council on Clinical Cardiology. Guidelines for the early management of patients with acute ischemic stroke: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2013;44(3):870-947.
2. Powers WJ, Derdeyn CP, Biller J, et al.; on behalf of the American Heart Association Stroke Council. 2015 American Heart Association/American Stroke Association focused update of the 2013 guidelines for the early management of patients with acute ischemic stroke regarding endovascular treatment: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke.* 2015;46:3020–3035.
3. Saver JL, Goyal M, van der Lugt A, et al. Time to Treatment with Endovascular Thrombectomy and Outcomes from Ischemic Stroke: A Meta-analysis. JAMA 2016;316(12):1279-1288.
4. Broderick JP, Palesch YY, Demchuk AM, et al. Endovascular therapy after intravenous t-PA versus t-PA alone for stroke. N Engl J Med. 2013; 368(10):893-903.

Endovascular Treatment and Imaging Measure Bundle

Measure Description	
Percentage of patients aged 18 years and older who received endovascular treatment who met all 6 therapy and imaging components.	
Measure Components	
Numerator Statement	All patients receiving endovascular treatment who received all 6 treatment components: **Component 1:** Non-contrast brain CT or MRI performed and interpreted within 45 minutes of arrival or in-hospital stroke or for patients transferred receipt of imaging (e.g., disc or via remote server/dicom viewer). **Component 2:** Non-contrast brain imaging report or stroke team review directly addresses hemorrhage, mass, acute infarction. **Component 3:** Documented causative intracranial large vessel (artery) occlusion (LVO) on vascular imaging. **Component 4:** Groin puncture within 90 minutes of ED or transfer arrival **Component 5:** Final Thrombolysis in Cerebral Infarction (TICI) score documented **Component 6:** Time to final TICI score documented.
Denominator Statement	All patients aged 18 years and older who received endovascular treatment
Denominator Exceptions	Component 4 Only: • In-hospital stroke events
Exception Justification	An exception is needed for in-hospital stroke events as time from ED or transfer arrival are not present in the medical record for calculation of this component.
Supporting Guideline & Other References	**The following clinical recommendation statements are quoted verbatim from the referenced clinical guidelines and represent the evidence base for the measure:** • "Endovascular therapy requires the patient to be at an experienced stroke center with rapid access to cerebral angiography and qualified neurointerventionalists. Systems should be designed, executed, and monitored to emphasize expeditious assessment and treatment. Outcomes for all patients should be tracked. Facilities are encouraged to define criteria that can be used to credential individuals who can perform safe and timely intra-arterial revascularization procedures (Class I; Level of Evidence E)." (1) • "Emergency imaging of the brain is recommended before any specific treatment for acute stroke is initiated (Class I; Level of Evidence A). In most instances, nonenhanced CT will provide the necessary information to make decisions about emergency management. (Unchanged from the 2013 guideline)"(1)

Relationship to Desired Outcome	Proper patient selection, timely care and satisfactory technical outcome are essential to achieve improved functional status in acute intra-arterial stroke therapy. This metric addresses indications and contraindications to treatment, Timing of key elements of initial imaging evaluation and initiation of invasive treatment, as well as the degree of reperfusion achieved. The measure intent is to streamline IA treatment at neuro-endovascular centers and those referring patients to these centers, thereby reducing the time to endovascular treatment and improve patient outcomes.
Opportunity for Improvement	Randomized trials have documented the utility of endovascular for acute stroke within 6 hours of onset(1), but systems of care to implement this technology are heterogeneous and often ad hoc and poorly developed.(2) This measure bundle requires that patients receive defined elements of care to optimize patient selection, improve timeliness of treatment and achieve the desired procedural results.
National Quality Strategy Domains	☐ Patient and Family Engagement ☐ Patient Safety ☐ Care Coordination ☐ Population/Public Health ☐ Efficient Use of Healthcare Resources ☒ Clinical Process/Effectiveness
Harmonization with Existing Measures	The definitions and specifications used in the components of this measure bundle are similar to those collected in the commonly employed STEMI and intravenous thrombolysis metrics, ensuring parsimony in data collection strategies. A separate measure is being created to monitor global performance for quality improvement. NQF #0661 Head CT or MRI Scan Results for AIS or Hemorrhagic Stroke Patients who Received Head CT or MRI Scan Interpretation within 45 minutes of ED Arrival. Measure components were mirrored and added to bundled measure.
Measure Purpose (Check all that apply)	☒ Quality improvement ☒ Accountability
Type of Measure (Check all that apply)	☒ Process ☐ Outcome ☐ Structure
Level of Measurement (Check all that apply)	☐ Individual Provider ☒ Practice ☒ System
Care Setting (Check all that apply)	☒ Emergency Departments ☒ Inpatient ☐ Outpatient ☐ Post-Acute Care
Data Source (Check all that apply)	☒ Electronic health record (EHR) data ☐ Administrative Data/Claims ☒ Chart Review ☒ Registry
References	
1. Powers WJ, Derdeyn CP, Biller J, et al.; on behalf of the American Heart Association Stroke Council. 2015 American Heart Association/American Stroke Association focused update of the 2013 guidelines	

for the early management of patients with acute ischemic stroke regarding endovascular treatment: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke.* 2015;46:3020–3035.

2. Gropen T, Magdon-Ismail Z, Day D, et al.; on behalf of the NECC Advisory Group. Reginal Implementation of the Stroke Systems of Care Model recommendations of the Northeast Cerebrovascular Consortium. Stroke. 2009;40:1793-1802.

Carotid Imaging Measure

Measure Description	
Percentage of patients aged 18 years and older with symptoms or a diagnosis of transient ischemic attack (TIA) or non-disabling^ ischemic stroke* receiving timely vascular imaging and carotid re-vascularization referral if appropriate.	
Measure Components	
Numerator Statement	Patients aged 18 years and older with symptoms or a diagnosis of transient ischemic attack (TIA) or non-disabling^ ischemic stroke* for whom cross sectional imaging of the cervical cerebral vasculature, which at a minimum includes imaging** of the carotid artery, was performed for patients within 24 hours of inpatient admission or for patients attending an outpatient visit within 2 days. For those patients identified as having symptomatic stenosis between >/=70% and <100% based on the NASCET method, order for referral to carotid re-vascularization practice within 24 hours of imaging result availability. If stenosis is less than 70%, documentation of degree of stenosis fulfills this measure.
Denominator Statement	All patients aged 18 years and older with symptoms or a diagnosis of TIA or non-disabling^ ischemic stroke*
Denominator Exceptions	• Documentation of posterior fossa localization • Patient not a surgical or interventional candidate • Patient has unstable medical condition or contraindication that prevents imaging (e.g., renal failure) • Patient declined/Left AMA
Exception Justification	Exceptions were needed to address patient populations that are inappropriate for surgical and interventional procedures, reducing the likelihood that unnecessary procedures would be performed. Additionally, exceptions were needed to address individuals who could not undergo imaging procedures or declined to undergo treatment.
Supporting Guideline & Other References	**The following clinical recommendation statements are quoted verbatim from the referenced clinical guidelines and represent the evidence base for the measure:** • "Recommendations for Patients With Cerebral Ischemic Symptoms That Have Resolved: 1. Noninvasive imaging of the cervical vessels should be performed routinely as part of the evaluation of patients with suspected TIAs (Class I; Level of Evidence A). (Unchanged from the 2009 TIA scientific statement) 2. Noninvasive imaging by means of CTA or MRA of the intracranial vasculature is recommended to exclude the presence of proximal intracranial stenosis and/or occlusion (Class I; Level of Evidence A) and should be obtained when knowledge of intracranial stenoocclusive disease will alter management. Reliable diagnosis of the presence and degree of intracranial

	stenosis requires the performance of catheter angiography to confirm abnormalities detected with noninvasive testing. (Revised from the 2009 TIA scientific statement) 3. Patients with transient ischemic neurological symptoms should undergo neuroimaging evaluation within 24 hours of symptom onset or as soon as possible in patients with delayed presentations. MRI, including DWI, is the preferred brain diagnostic imaging modality. If MRI is not available, head CT should be performed (Class I; Level of Evidence B)."(1)
Relationship to Desired Outcome	Acute carotid revascularization for symptomatic stenosis greater than 70% is safe and effective and should be performed within 2 weeks of the patient's last symptoms.(2) This modifiable risk factor for stroke predicts high frequency of adverse events soon after initial presentation. Evaluation and prompt referral encourages prompt effective treatment.
Opportunity for Improvement	About half of all recurrent strokes during the 7 days after a TIA occur in the first 24 hours and require emergency assessment including testing for pharmacological and interventional strategies.(3-5) Delays often occur due to lack of perceived urgency. System factors that impede early imaging and referral contribute, as well.(6)
National Quality Strategy Domains	☐ Patient and Family Engagement ☐ Patient Safety ☐ Care Coordination ☐ Population/Public Health ☐ Efficient Use of Healthcare Resources ☒ Clinical Process/Effectiveness
Harmonization with Existing Measures	Not Applicable
Measure Purpose (Check all that apply)	☒ Quality improvement ☒ Accountability
Type of Measure (Check all that apply)	☒ Process ☐ Outcome ☐ Structure
Level of Measurement (Check all that apply)	☒ Individual Provider ☒ Practice ☒ System
Care Setting (Check all that apply)	☒ Emergency Departments ☒ Inpatient ☒ Outpatient ☐ Post-Acute Care
Data Source (Check all that apply)	☒ Electronic health record (EHR) data ☐ Administrative Data/Claims ☒ Chart Review

	☒ Registry

Definitions for Carotid Imaging Measure

^Non-disabling – is defined as any neurological symptom or sign lasting >24 hours but producing no disability of functional significance (Modified Rankin score <3). (Ferguson GG, Eliasziw M, Barr HWK, et al. The North American Symptomatic Carotid Endarterectomy Trial. Stroke 1999; 30:1751-1758.

*TIA or ischemic stroke – acute onset within 7 calendar days

**Imaging is defined as CTA, MRA or Duplex Doppler ultrasonography. This measure requires that the estimate of stenosis included in the report of the imaging study employ a method such as the North American Symptomatic Carotid Endarterectomy Trial (NASCET) method for calculating the degree of stenosis. The NASCET method calculates the degree of stenosis with reference to the lumen of the carotid artery distal to the stenosis.
For duplex imaging studies the reference is indirect, since the degree of stenosis is inferred from velocity parameters and cross referenced to published or self-generated correlations among velocity parameters and results of angiography or other imaging studies which serve as the gold standard. In Doppler ultrasound, the degree of stenosis can be estimated using Doppler parameter of the peak systolic velocity (PSV) of the internal carotid artery (ICA), with concordance of the degree of narrowing of the ICA lumen. Additional Doppler parameters of ICA-to-common carotid artery (CCA) PSV ratio and ICA end-diastolic velocity (EDV) can be used when degree of stenosis is uncertain from ICA PSV. Reference (Grant et al, Society of Radiologists in Ultrasound, 2003).

A short note can be made in the final report, such as:

- "Severe left ICA stenosis of 70-80% by NASCET criteria" or
- "Severe left ICA stenosis of 70-80% by criteria similar to NASCET" or
- "70% stenosis derived by comparing the narrowest segment with the distal luminal diameter as related to the reported measure of arterial narrowing" or

"Severe stenosis of 70-80% — validated velocity measurements with angiographic measurements, velocity criteria are extrapolated from diameter data as defined by the Society of Radiologists in Ultrasound Consensus Conference Radiology 2003; 229;340-346."

References

1. Jauch EC, Saver JL, Adams HP Jr, et al; on behalf of the American Heart Association Stroke Council, Council on Cardiovascular Nursing, Council on Peripheral Vascular Disease, and Council on Clinical Cardiology. Guidelines for the early management of patients with acute ischemic stroke: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2013;44:870–947.
2. Rothwell PM, Eliasziw M, Gutnikov SA, et al; Endarterectomy for symptomatic carotid stenosis in relation to clinical subgroups and timing of surgery. Lancet. 2004;363(9413):915-924.
3. Chandratheva A, Mehta Z, Geraghty OC, et al; on behalf of the Oxford Vascular Study. Population-based study of risk and predictors of stroke in the first few hours after a TIA. Neurology. 2009;72(22):1941-1947.
4. Ois A, Cuadrado-Godia E, Rodriguez-Campello A, et al. High Risk of Early Neurological Recurrence in Symptomatic Carotid Stenosis. Stroke. 2009;40:2727-2731.
5. Marnane M, Ni Chroinin D, Callaly E, et al. Stroke recurrence within the time window recommended for carotid endarterectomy. Neurology. 2011;77(8):738-743.
6. Johansson E, Bjellerup J, and Wester P. Prediction of recurrent stroke with ABCD2 and ABCD3 scores in patients with symptomatic 50-99% carotid stenosis. BMC Neurol. 2014;14:223.

Defect Free Acute Inpatient Ischemic Stroke Measure Bundle

Measure Description	
Percentage of patients aged 18 years and older with a diagnosis of ischemic stroke OR transient ischemic attack who were admitted to the hospital for inpatient care and received all appropriate intervention for optimal care (i.e., early antithrombotic administered, discharged on antithrombotic, and smoking cessation addressed) prior to discharge.	
Measure Specifications	
Numerator Statement	Patients aged 18 years and older with a diagnosis of ischemic stroke or transient ischemic attack who were admitted to the hospital for inpatient care and received all 3 component interventions: **Component 1:** Early Antithrombotic Antithrombotic therapy received by end of hospital day two OR documentation of medical/patient exception **Component 2:** Discharged on Appropriate Antithrombotic Antithrombotic therapy prescribed at discharge: o Appropriate antithrombotic for patients with stroke AND nonvalvular atrial fibrillation using therapeutic anticoagulation (warfarin, LMWH or direct factor inhibitors as approved by FDA), OR documentation of medical/patient exception, o Appropriate antithrombotic for patients with stroke AND mechanical heart valve or valvular atrial fibrillation using anticoagulation with warfarin OR documentation of medical/patient exception, OR o Appropriate antithrombotic for all other patients with stroke using antiplatelet or therapeutic anticoagulation **Component 3:** Tobacco use management Patients with ischemic stroke who have documentation of active smoking status OR former smoker with quit date less than 1 year from time of assessment provided counseling on the bad effects of tobacco, the benefit of quitting AND at least one of the following: ▪ Referral back to PCP for tobacco cessation support, AND/OR ▪ Referral to tobacco cessation clinic or tobacco dependence telephone quitline, AND/OR ▪ Prescription of tobacco dependence medications including nicotine replacement therapies products, bupropion SR or Varenicline, or any FDA-approved drugs for tobacco dependence therapies or referral to PCP Documentation of never smoker or former smoker with quit date more than a year from time of assessment fulfills this component. Definitions: Antithrombotic therapy - includes FDA approved antiplatelet for secondary stroke prevention (aspirin, combination aspirin/dipyridamole, clopidogrel and ticlopidine) and anticoagulants (warfarin, therapeutic LMWH, direct factor inhibitors) Prescribed - May include prescription given to the patient for antithrombotic therapy at discharge or antithrombotic therapy to be continued after discharge as documented in the discharge medication list.

Denominator Statement	All acute ischemic stroke and transient ischemic attack patients aged 18 years and older admitted for inpatient care.
Denominator Exceptions	For all components • Patients discharged to hospice • Patients who were placed on comfort measures by end of hospital day two • Patient died by end of hospital day two. • Patient enrolled in a clinical trial • Patient declines treatment or discharged against medical advice by end of hospital day two. • Patients with documented contraindication to specific intervention.
Exception Justification	Exceptions are warranted for individuals discharged to hospice, receiving comfort measures, enrolled in clinical trial, and who died as treatment plans required for measure are not clinically appropriate for these populations. Additionally, treatment cannot be provided to those who refuse or leave AMA. Patients with documented contraindication for the specific intervention justifies exception as well.
Supporting Guideline & Other References	**The following clinical recommendation statements are quoted verbatim from the referenced clinical guidelines and represent the evidence base for the measure:** <u>Component 1: Early Antithrombotic</u> • "Oral administration of aspirin (initial dose is 325 mg) within 24–48 h after stroke onset is recommended for treatment of most patients (Class I; Level of Evidence A)."(1) <u>Component 2: Discharged on Appropriate Antithrombotic</u> **Appropriate antithrombotic for patients with AF or mechanical heart valve:** • "VKA [Vitamin K Antagonist] therapy (Class I; Level of Evidence A), apixaban (Class I; Level of Evidence A), and dabigatran (Class I; Level of Evidence B) are all indicated for the prevention of recurrent stroke in patients with nonvalvular AF, whether paroxysmal or permanent. The selection of an antithrombotic agent should be individualized on the basis of risk factors, cost, tolerability, patient preference, potential for drug interactions, and other clinical characteristics, including renal function and time in INR therapeutic range if the patient has been taking VKA therapy."(2) • "Rivaroxaban is reasonable for the prevention of recurrent stroke in patients with nonvalvular AF (Class IIa; Level of Evidence B)."(2) • "For patients with ischemic stroke or TIA and AF who are unable to take oral anticoagulants, aspirin alone is recommended (Class I; Level of Evidence A)."(2) • "The addition of clopidogrel to aspirin therapy, compared with aspirin therapy alone, might be reasonable (Class IIb; Level of Evidence B)."(2) • "For most patients with a stroke or TIA in the setting of AF, it is reasonable to initiate oral anticoagulation within 14 days after the onset of neurological symptoms (Class IIa; Level of Evidence B)."(2) • "In the presence of high risk for hemorrhagic conversion (ie, large infarct, hemorrhagic transformation on initial imaging, uncontrolled hypertension, or hemorrhage tendency), it is reasonable to delay initiation of oral anticoagulation beyond 14 days (Class IIa; Level of Evidence B)."(2)

	• "For patients with ischemic stroke or TIA who have rheumatic mitral valve disease and AF, longterm VKA therapy with an INR target of 2.5 (range, 2.0–3.0) is recommended (Class I; Level of Evidence A)."(2) • "For patients with a mechanical aortic valve and a history of ischemic stroke or TIA before its insertion, VKA therapy is recommended with an INR target of 2.5 (range, 2.0–3.0) (Class I; Level of Evidence B)."(2) • "For patients with a mechanical mitral valve and a history of ischemic stroke or TIA before its insertion, VKA therapy is recommended with an INR target of 3.0 (range, 2.5–3.5) (Class I; Level of Evidence C)."(2) **Appropriate antithrombotic for all other stroke patients:** • "For patients with noncardioembolic ischemic stroke or TIA, the use of antiplatelet agents rather than oral anticoagulation is recommended to reduce the risk of recurrent stroke and other cardiovascular events (Class I; Level of Evidence A)."(2) • "Aspirin (50–325 mg/d) monotherapy (Class I; Level of Evidence A) or the combination of aspirin 25 mg and extended-release dipyridamole 200 mg twice daily (Class I; Level of Evidence B) is indicated as initial therapy after TIA or ischemic stroke for prevention of future stroke."(2) • "Clopidogrel (75 mg) monotherapy is a reasonable option for secondary prevention of stroke in place of aspirin or combination aspirin/dipyridamole (Class IIa; Level of Evidence B). This recommendation also applies to patients who are allergic to aspirin." (2) <u>Component 3: Tobacco use management</u> • "Patients Healthcare providers should strongly advise every patient with stroke or TIA who has smoked in the past year to quit (Class I; Level of Evidence C)." (2) • "It is reasonable to advise patients after TIA or ischemic stroke to avoid environmental (passive) tobacco smoke (Class IIa; Level of Evidence B)." (2) • "Counseling, nicotine products, and oral smoking cessation medications are effective in helping smokers to quit (Class I; Level of Evidence A)." (2) • "It is essential that clinicians and health care delivery systems consistently identify and document tobacco use status and treat every tobacco user seen in a health care setting."(3) • "Individual, group, and telephone counseling are effective, and their effectiveness increases with treatment intensity."(3) • "Numerous effective medications are available for tobacco dependence, and clinicians should encourage their use by all patients attempting to quit smoking—except when medically contraindicated or with specific populations for which there is insufficient evidence of effectiveness (i.e., pregnant women, smokeless tobacco users, light smokers, and adolescents)."(3) • "Counseling and medication are effective when used by themselves for treating tobacco dependence. The combination of counseling and

	medication, however, is more effective than either alone. Thus, clinicians should encourage all individuals making a quit attempt to use both counseling and medication."(3) • "Telephone quitline counseling is effective with diverse populations and has broad reach. Therefore, clinicians and health care delivery systems should both ensure patient access to quitlines and promote quitline use."(3)
Relationship to Desired Outcome	Component 1: The effectiveness of antithrombotic agents in reducing stroke mortality, stroke-related morbidity and recurrence rates has been studied in several large clinical trials. While the use of these agents for patients with acute ischemic stroke and transient ischemic attacks continues to be the subject of study, substantial evidence is available from completed studies. Data at this time suggest that antithrombotic therapy should be administered within 2 days of symptom onset in acute ischemic stroke patients to reduce stroke mortality and morbidity as long as no contraindications exist. Two large trials each demonstrated a nonsignificant trend in reduction in death or disability when treatment with aspirin was begun within 48 h of stroke; when data from the trials were combined, a modest but statistically significant benefit was seen. Component 2: The effectiveness of antithrombotic agents in reducing stroke mortality, stroke-related morbidity and recurrence rates has been studied in several large clinical trials. While the use of these agents for patients with acute ischemic stroke and transient ischemic attacks continues to be the subject of study, substantial evidence is available from completed studies. Data at this time suggest that antithrombotic therapy should be prescribed at discharge following acute ischemic stroke to reduce stroke mortality and morbidity as long as no contraindications exist. For patients with a stroke due to a cardioembolic source (e.g., atrial fibrillation, mechanical heart valve), warfarin is recommended unless contraindicated. In recent years, novel oral anticoagulants (NOACs) have been developed and approved by the U.S. Food and Drug Administration (FDA) for stroke prevention, and may be considered as an alternative to warfarin for select patients. Anticoagulation therapy is not generally recommended for secondary stroke prevention in patients presumed to have a non-cardioembolic stroke. Anticoagulants at doses to prevent venous thromboembolism are insufficient antithrombotic therapy to prevent recurrent ischemic stroke or TIA. Component 3: Cigarette smoking is the single most alterable risk factor contributing to premature morbidity and mortality, accounting for approximately 430,000 deaths in the United States. Smoking nearly doubles the risk of ischemic stroke. Numerous prospective investigations have demonstrated substantial decrease in coronary heart disease mortality for former smokers, and similar rapid decreases in risk with smoking are seen for ischemic stroke. The Framingham Heart Study concluded that smoking made a significant independent contribution to the risk of stroke. Although no randomized controlled trials have been performed, there is very strong consensus that patients who smoke should be counseled to stop smoking to decrease the risk of stroke. Research indicates that patients who receive even brief smoking cessation advice from their physicians are more likely to quit than those receiving no counseling at all. Addressing smoking habits and initiating cessation efforts are reasonable interventions during hospitalization for acute stroke and may promote the patient's medical recovery.

Opportunity for Improvement	A recent study showed that optimal combination of secondary prevention medication after recent non-cardioembolic stroke is noted in only 51% of eligible patients, but is associated with significantly lower risk of stroke, major vascular events and death compared with none or single secondary preventive medication.(4) Individual performance measures on acute inpatient stroke care process have been consistently high since the development of stroke certification by hospitals, some of which has reached a ceiling effect over the years. However, achievement of defect-free care for individual patient remains low, ranging between 21.9% among non-primary stroke center certified hospitals to between 45-52% among stroke center certified hospitals.(5)
National Quality Strategy Domains	☐ Patient and Family Engagement ☐ Patient Safety ☐Care Coordination ☐ Population/Public Health ☐ Efficient Use of Healthcare Resources ☒ Clinical Process/Effectiveness
Harmonization with Existing Measures	The definitions and specifications used in the components of this measure are similar to those collected in the commonly employed stroke measures (i.e., Joint Commission and/or AHA/ASA), ensuring parsimony in data collection strategies. A separate measure is being created to monitor global performance for quality improvement.
Measure Purpose (Check all that apply)	☒ Quality improvement ☒ Accountability
Type of Measure (Check all that apply)	☒Process ☐ Outcome ☐ Structure
Level of Measurement (Check all that apply)	☒ Individual Provider ☒ Practice ☒ System
Care Setting (Check all that apply)	☐ Emergency Departments ☒ Inpatient ☐Outpatient ☐ Post-Acute Care
Data Source (Check all that apply)	☒ Electronic health record (EHR) data ☐Administrative Data/Claims ☒Chart Review ☒ Registry

References

1. Jauch EC, Saver JL, Adams HP Jr, et al; on behalf of the American Heart Association Stroke Council, Council on Cardiovascular Nursing, Council on Peripheral Vascular Disease, and Council on Clinical Cardiology. Guidelines for the early management of patients with acute ischemic stroke: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2013;44:870–947.
2. Kernan WN, Ovbiagele B, Black HR, et al; on behalf of the American Heart Association Stroke Council, Council on Cardiovascular and Stroke Nursing, Council on Clinical Cardiology, and Council on Peripheral Vascular Disease. Guidelines for the prevention of stroke in patients with stroke and transient

ischemic attack: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2014;45:2160-2236.
3. US Department of Health and Human Services. Treating tobacco use and dependence: 2008 Update. Am J Prev Med. 2008;35(2):158-176.
4. Park, J.H. and B. Ovbiagele, Optimal combination secondary prevention drug treatment and stroke outcomes. Neurology, 2015. 84(1): p. 50-56.
5. Johnson, AM, Goldstein LB, Bennett P, et al. Compliance with acute stroke care quality measures in hospitals with and without primary stroke center certification: the North Carolina Stroke Care Collaborative. J Am Heart Assoc, 2014;3(2):e000423.

Current Measure #9: Patient/Caregiver Nutritional Preferences

Measure Description	
Percentage of patients aged 18 years and older with a primary diagnosis of acute ischemic stroke or intracranial hemorrhage who have had a gastrostomy tube placed during the acute inpatient stay, and for whom there is documentation of shared decision making with the patient or the patient's surrogate decision maker, before the procedure was completed, that included discussion of at least two forms of providing nutrition, one of which is oral/natural nutrition.	
Measure Components	
Numerator Statement	Patients aged 18 years and older with a primary diagnosis of acute ischemic stroke or intracranial hemorrhage who have had a gastrostomy tube placed during the inpatient stay, and for whom there is documentation of shared decision making with the patient or the patient's surrogate decision maker, before the procedure was completed, that included discussion of at least two forms of providing nutrition, one of which is oral/natural nutrition **Definitions**: Intracranial hemorrhage – nontraumatic intraparenchymal hemorrhage or nontraumatic subarachnoid hemorrhage. Does not include epidural or subdural hemorrhage or traumatic intracranial hemorrhage. **Shared decision making** – an approach where clinicians and patients communicate together using the best available evidence when faced with the task of making decisions, where patients are supported to deliberate about the possible attributes and consequences of options, to arrive at informed preferences in making a determination about the best action and which respects patient autonomy, where this is desired.
Denominator Statement	All patients aged 18 years and older with a primary diagnosis of acute ischemic stroke and intracranial hemorrhage who have had gastrostomy tube placed during the acute inpatient stay for the treatment of ischemic or hemorrhagic stroke
Denominator Exclusion	Patients with gastrostomy tube prior to admission
Denominator Exceptions	None
Exception Justification	Not Applicable
Supporting Guideline & Other References	**The following clinical recommendation statements are quoted verbatim from the referenced clinical guidelines and represent the evidence base for the measure:** • "We suggest that a variety of factors, including patient preferences, quality of life, and prognosis be addressed with the patient and the family before placement of feeding tubes."(1) • **"**The decision to pursue life-sustaining therapies or procedures, including CPR, intubation and MV [mechanical ventilation], artificial nutrition, or other invasive procedures, should be based on the overall goals of care, taking into account an

	individualized estimate of the overall benefit and risk of each treatment and the preferences and values of the patient (Class I; Level of Evidence B)"(2) • "Patients who cannot take solid food and liquids orally should receive nasogastric, nasoduodenal, or PEG tube feedings to maintain hydration and nutrition while undergoing efforts to restore swallowing (Class I; Level of Evidence B)."(2) • "Patients who elect to not have ANH [Artificial Nutrition and Hydration] based on discussion of the goals of care should be provided with the safest method of natural nutrition and educated about the potential risks and benefits of this approach (Class I; Level of Evidence B)."(2)
Relationship to Desired Outcome	Placement of gastrostomy tube (by either percutaneous endoscopic approach, laparoscopic or open surgical technique) often is used to treat patients who will need prolonged tube feedings. Although this device usually requires less care, complications, including involuntary removal of the tube or peritonitis, may occur. The risk of aspiration pneumonia is not eliminated by the use of a PEG. Early nasogastric (NG) tube feeding resulted in better functional outcome than feeding by PEG.(3) However, many long term facilities may not accept patients with an NG tube as the means of providing nutrition. Shared decision making with patient/caregiver promotes autonomy and allows for patient/caregiver-centered outcome and goals of care.
Opportunity for Improvement	Dysphagia is common after stroke occurring in 27-64% of patients and is associated with a number of complications that affect quality of life and increase mortality.(2) Currently, gastrostomy tube may be the only option for nutritional support in patients who continued to have dysphagia and require long term facility care.
National Quality Strategy Domains	☒ Patient and Family Engagement ☐ Patient Safety ☐ Care Coordination ☐ Population/Public Health ☐ Efficient Use of Healthcare Resources ☐ Clinical Process/Effectiveness
Harmonization with Existing Measures	Not Applicable
Measure Purpose (Check all that apply)	☒ Quality improvement ☒ Accountability
Type of Measure (Check all that apply)	☒ Process ☐ Outcome ☐ Structure
Level of Measurement (Check all that apply)	☒ Individual Provider ☐ Practice ☐ System
Care Setting (Check all that apply)	☐ Emergency Departments ☒ Inpatient ☐ Outpatient ☐ Post-Acute Care

Data Source (Check all that apply)	☒ Electronic health record (EHR) data ☐ Administrative Data/Claims ☒ Chart Review ☒ Registry

References

1. ASGE Standards of Practice Committee, Jain R, Maple JT, Anderson MA, et al. The role of endoscopy in enteral feeding. Gastrointestinal Endoscopy 2011; 74(1):7-12.
2. Holloway RG, Arnold RM, Creutzfeldt CJ, et al.; on behalf of the American Heart Association Stroke Council, Council on Cardiovascular and Stroke Nursing, and Council on Clinical Cardiology. Palliative and end-of-life care in stroke: a statement for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2014;45(6):1887-1916.
3. Dennis MS, Lewis SC and Warlow C. Effect of timing and method of enteral tube feeding for dysphagic stroke patients (FOOD): a multicentre randomised controlled trial. Lancet. 2005;365(9461):764-772.

Potentially Avoidable Complications Following Stroke

Measure Description	
Percentage of patients aged 18 years and older with a diagnosis of ischemic or hemorrhagic stroke that developed any of the 5 component complications during inpatient stay.* *A lower score is better. 0% is not the goal, but a lower score is better.	
Measure Components	
Numerator Statement	Patients who developed any of the 5 following components during their inpatient stay: **Component 1:** Deep Vein Thrombosis (DVT) or pulmonary embolism (PE)(1) **Component 2:** Aspiration pneumonia(1) **Component 3:** Fall as defined as an unplanned descent to the floor with or without injury (2-4) **Component 4:** Urinary Tract Infection(2) **Component 5:** Stage II or Greater Decubiti(2)
Denominator Statement	All patients aged 18 years and older with a diagnosis of ischemic stroke or intracranial hemorrhage
Denominator Exceptions	For all components, except Falls: • Patients who were placed on palliative/comfort measures during stay before complication occurred (add time element – track performance until decision made to place on palliative measures, then after that decision made no longer score) For DVT and PE Component: • Patients who had an in-hospital stroke, • Patients who died during the hospitalization within 48 hours of admission • DVT developed within 48 hours of admission or present on admission For Aspiration Component: • Diagnosed within 48 hours of the hospitalization or inpatient stroke event • Patients who died during the hospitalization within 48 hours of admission For Falls Component: • None For UTI Component: • In hospital stroke (link to onset of stroke event) within 48 hours, • Patients who died during the hospitalization within 48 hours, • UTI developed within 48 hours of hospitalization or present on admission For Decubitus Ulcer Component: • Inpatient stroke events within 48 hours,

	• Documentation of presence of decubitus ulcer on admission
Exception Justification	An exception was made for all components, except the Falls Component for patients receiving palliative care or comfort measures as the necessary interventions required to prevent these complications often do not align with overall goals of care. As treatment options would be restricted some potentially avoidable complications could not be prevented. Exceptions for patients who had in-hospital stroke events and who died within 48 hours of admission were made for DVT and PE, aspiration, UTI, and decubitis ulcer components. These exceptions are appropriate as strokes may occur in patients being treated on an inpatient unit for other medical comorbidities. It would be difficult to isolate if complications developed prior to or after the inpatient stroke event. Similar to deaths occurring within 48 hours of admission, these events would be impossible to attribute solely to the stroke event. Exceptions for DVT, UTI, and decubitus ulcers being documented upon admission are appropriate as these complications cannot be attributed to the current treatment team and/or provider.
Calculation and Risk Adjustment Strategy	*The AAN is publishing this measure for quality improvement only at this time. Calculation and weighting of individual measure components will be evaluated. Following testing of potential calculations strategies, further specifications will be released, which may include use for accountability programs.*
Supporting Guideline & Other References	**The following clinical recommendation statements are quoted verbatim from the referenced clinical guidelines and represent the evidence base for the measure:** • "Subcutaneous administration of anticoagulants is recommended for treatment of immobilized patients to prevent DVT (Class I; Level of Evidence A)."(1) • "The use of intermittent external compression devices is reasonable for treatment of patients who cannot receive anticoagulants (Class IIa; Level of Evidence B)."(1) • "Assessment of swallowing before starting eating, drinking, or receiving oral medications is recommended (Class I; Level of Evidence B)."(1) • "Patients with suspected pneumonia or UTIs should be treated with appropriate antibiotics (Class I; Level of Evidence A)."(2) • "Early bowel and bladder care should be instituted to prevent complications such as constipation and urinary retention or infection (Class I, Level of Evidence A)." (2) • "Use of indwelling catheters should be avoided if possible because of the risk of UTI (Class I, Level of Evidence A)." (2) • "Frequent turning should be instituted in bedridden patients to prevent skin breakdown (Class I, Level of Evidence A)." (2) • "Use of the Braden Scale in nursing practice can assist in the prediction of stroke patients at high risk of developing pressure ulcers (Class I, Level of Evidence A)."(2) • "Range-of-motion exercises should start in the early phase of acute stroke care once risk has been assessed (Class I, Level of Evidence C)." (2)

	• "Fall precautions should be initiated, and the stroke patient should be told not to ambulate without assistance (Class I, Level of Evidence B)." (2)
Relationship to Desired Outcome	These complications after stroke contribute to both morbidity and mortality for patients. It is anticipated that measuring these complications and outcomes will drive improvement in processes to prevent them.
Opportunity for Improvement	It is anticipated that this measure will drive improvement at a hospital and system level and encourage a multidisciplinary approach involving patients, their families, nursing, clinicians and ancillary staff.
National Quality Strategy Domains	☐ Patient and Family Engagement ☒ Patient Safety ☐ Care Coordination ☐ Population/Public Health ☐ Efficient Use of Healthcare Resources ☐ Clinical Process/Effectiveness
Harmonization with Existing Measures	Not Applicable
Measure Purpose (Check all that apply)	☒ Quality improvement ☐ Accountability
Type of Measure (Check all that apply)	☐ Process ☒ Outcome ☐ Structure
Level of Measurement (Check all that apply)	☐ Individual Provider ☒ Practice ☒ System
Care Setting (Check all that apply)	☐ Emergency Departments ☒ Inpatient ☒ Inpatient Rehabilitation (i.e., IRF) ☐Outpatient ☐ Post-Acute Care
Data Source (Check all that apply)	☒ Electronic health record (EHR) data ☐ Administrative Data/Claims ☒ Chart Review ☒ Registry
References	
1. Jauch EC, Saver JL, Adams HP Jr, et al.; on behalf of the American Heart Association Stroke Council, Council on Cardiovascular Nursing, Council on Peripheral Vascular Disease, and Council on Clinical Cardiology. Guidelines for the early management of patients with acute ischemic stroke: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2013;44(3):870-947. 2. Summers D, Leonard A, Wentworth D, et al.; on behalf of the American Heart Association Council on Cardiovascular Nursing and the Stroke Council. Comprehensive overview of nursing and interdisciplinary care of the acute ischemic stroke patient: a scientific statement from the American Heart Association. Stroke. 2009;40:2911–2944.	

3. Tutuarima JA, van der Meulen JH, de Haan RJ, et al. Risk factors for falls of hospitalized stroke patients. Stroke. 1997;28:297–301.
4. National Database of Nursing Quality Indicators (NDNQI). Guidelines for data collection on the American Nurses Association's National Quality Forum Endorsed Measures. May, 2010. p.21 Available at: http://www.k-hen.com/Portals/16/ANAs%20NQF%20specs.pdf Accessed on June 8, 2016.

High and Moderate Intensity Statin Therapy Following Stroke

Measure Description	
Percentage of patients aged 18 years to 74 years with a diagnosis of acute ischemic stroke or TIA who were prescribed± high intensity statin therapy* and patients aged 75 and older who were prescribed moderate^ or high intensity statin therapy at discharge.	
Measure Components	
Numerator Statement	Patients aged 18 years to 74 years with a diagnosis of acute ischemic stroke or TIA who were prescribed± high intensity statin therapy* and patients aged 75 and older who were prescribed moderate^ or high intensity statin therapy at discharge. **Definitions:** ***High Intensity Statin Therapy**–defined as dose expected to reduce LDL-C by greater than or equal to 50% and includes the following: (1,2) Atorvastatin 40-80mg everyday Rosuvastatin 20-40mg everyday **^Moderate Intensity Statin Therapy** - defined as dose expected to reduce LDL-C by 30-50% and includes the following: (1,2) Atorvastatin 10-20mg everyday Fluvastatin 40mg twice daily Fluvastatin XL 80mg everyday Lovastatin 40mg everyday Pitavastatin 2-4mg everyday Pravastatin 40-80mg everyday Rosuvastatin 5-10mg everyday Simvastatin 20-40mg everyday **±Prescribed** – May include prescription given to the patient for statin therapy at discharge OR statin therapy to be continued after discharge as documented in the discharge medication list
Denominator Statement	All patients aged 18 years and older with a diagnosis of acute ischemic stroke or TIA
Denominator Exceptions	• Documentation of medical reason(s) for not prescribing high intensity statin therapy at discharge: o Contraindication to statin therapy including but not limited to: liver disease, patient taking medication with significant interaction to statin, statin allergy/intolerance o etiology of stroke presumed to be NON-atherosclerotic (e.g. cardioembolic, secondary to dissection/trauma, vasculitis, etc.) AND absence of clinical ASCVD** • Documentation of patient reason(s) for not prescribing high intensity statin therapy at discharge: o Patient expired during hospitalization o patient discharged to hospice or made comfort care

	○ patient left against medical advice ○ patient refused treatment
Exception Justification	A medical reason exception has been included so that clinicians can exclude patients for whom prescribing a statin may not be appropriate. A patient reason exception has been included for patients who may decline receiving a statin. This exception should remove all patients who do not have a stroke due to atherosclerotic etiology. **Clinical Atherosclerotic Cardiovascular Disease (ASCVD) - includes acute coronary syndromes, history of myocardial infarction, stable or unstable angina, coronary or other arterial revascularization, stroke or TIA, or peripheral atherosclerotic arterial disease.(2)
Supporting Guideline & Other References	**The following clinical recommendation statements are quoted verbatim from the referenced clinical guidelines and represent the evidence base for the measure:** • "For patients with ASCVD or diabetes mellitus, consideration should be given to use of moderate- or high-intensity statin therapy, irrespective of baseline atherogenic cholesterol levels (Strength-A, Quality-High)."(1) • "First-line cholesterol-lowering drug therapy, unless contraindicated, is moderate- to high-intensity statin. The statin dosage may be increased or the patient switched to a more efficacious agent, if goal levels of atherogenic cholesterol are not achieved (Strength-A, Quality-High)."(1) • "The appropriate intensity of statin therapy should be initiated or continued: ○ A. Clinical ASCVD ▪ 1. Age ≤ 75 and no safety concerns: High-intensity statin (Class I ; Level of Evidence A) ▪ 2. Age > 75 or safety concerns: Moderate-intensity statin (Class I; Level of Evidence A)"(2) • "Statin therapy with intensive lipid-lowering effects is recommended to reduce risk of stroke and cardiovascular events among patients with ischemic stroke or TIA presumed to be of atherosclerotic origin and an LDL-C level ≥100 mg/dL with or without evidence for other ASCVD (Class I; Level of Evidence B)."(3) • "Statin therapy with intensive lipid-lowering effects is recommended to reduce risk of stroke and cardiovascular events among patients with ischemic stroke or TIA presumed to be of atherosclerotic origin, an LDL-C level <100 mg/dL, and no evidence for other clinical ASCVD (Class I; Level of Evidence C)."(3)
Relationship to Desired Outcome	A large body of evidence exists supporting the use of appropriate intensity statin therapy for secondary prevention in patients with clinical atherosclerotic cardiovascular disease including patients with ischemic stroke due to large artery atherosclerosis, intrinsic small vessel disease as well as in patients with ischemic stroke not directly due to atherosclerosis but with evidence of atherosclerosis in an uninvolved cerebral or noncerebral

	vascular bed.(2) The Stroke Prevention by Aggressive Reduction in Cholesterol Levels (SPARCL) study convincingly demonstrated that intensive lipid lowering therapy using statin medication was associated with significant reduction in the rate of recurrent ischemic stroke and other major coronary events.(4)
Opportunity for Improvement	Patients suffering from ischemic stroke frequently have atherosclerosis of cerebral or noncerebral vascular bed, or have clinical atherosclerotic cardiovascular disease and would benefit from high intensity statin therapy. However, rate of use of high intensity statin therapy is low, ranging from 15.9-20.8% among eligible patients.(5) In a review of Get with the Guideline data, only 1 in 5 patients with a prior TIA/stroke had LDL levels <70 mg/dL indicating further opportunity to improve.(6) This measure represents current best evidence, and will be updated on a regular basis to ensure medication list is consistent with current evidence.
National Quality Strategy Domains	☐ Patient and Family Engagement ☐ Patient Safety ☐Care Coordination ☐ Population/Public Health ☐ Efficient Use of Healthcare Resources ☒ Clinical Process/Effectiveness
Harmonization with Existing Measures	Similar measures exist, including, Lipid Management in Adult and NQF#0439 Discharged on Statin Medication (Joint Commission STK 06), but a separate measure was required to address this denominator population.(7-9) Treatment requirements and guidelines are sufficiently unique that harmonization of denominators was not possible.
Measure Purpose (Check all that apply)	☒ Quality improvement ☒ Accountability
Type of Measure (Check all that apply)	☒ Process ☐ Outcome ☐ Structure
Level of Measurement (Check all that apply)	☒ Individual Provider ☐ Practice ☐ System
Care Setting (Check all that apply)	☐ Emergency Departments ☒ Inpatient ☐Outpatient ☐Post-Acute Care
Data Source (Check all that apply)	☒ Electronic health record (EHR) data ☐Administrative Data/Claims ☒Chart Review ☒ Registry

References

1. Jacobson TA, Ito MK, Maki KC, et al. National lipid association recommendations for patient-centered management of dyslipidemia: part 1--full report. J Clin Lipidol. 2015;9(2):129-169.
2. Stone NJ, Robinson JG, Lichtenstein AH, et al. 2013 ACC/AHA guideline on the treatment of blood cholesterol to reduce atherosclerotic cardiovascular risk in adults: a report of the American College of

Cardiology/ American Heart Association Task Force on Practice Guidelines. Circulation. 2014;129(suppl 2):S1–S45.
3. Kernan WN, Ovbiagele B, Black HR, et al; on behalf of the American Heart Association Stroke Council, Council on Cardiovascular and Stroke Nursing, Council on Clinical Cardiology, and Council on Peripheral Vascular Disease. Guidelines for the prevention of stroke in patients with stroke and transient ischemic attack: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2014;45:2160-2236.
4. Amarenco P, Goldstein LB, Szarek M, et al. Effects of intense low-density lipoprotein cholesterol reduction in patients with stroke or transient ischemic attack: the Stroke Prevention by Aggressive Reduction in Cholesterol Levels (SPARCL) trial. Stroke. 2007;38(12):3198-3204.
5. Cumbler E, Wald H, Bhatt DL, et al., Quality of care and outcomes for in-hospital ischemic stroke: findings from the National Get With The Guidelines-Stroke. Stroke. 2014;45(1):231-238.
6. Saposnik G, Fonarow GC, Pan W, et al. Guideline-directed low-density lipoprotein management in high-risk patients with ischemic stroke: findings from Get with the Guidelines – Stroke 2003 to 2012. Stroke 2014;45(11):3343-3351.
7. Woolley T, Canoniero M, Conroy W, et al. Institute for Clinical Systems Improvement. Lipid Management in Adults. Updated November 2013. Available at: https://www.icsi.org/_asset/qz5ydq/LipidMgmt.pdf. Accessed on May 31, 2016.
8. Smith EE, Saver JL, Alexander DN, et al. Clinical performance measures for adults hospitalized with acute ischemic stroke: performance measures for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2014;45(11):3472-3498.
9. The Joint Commission. Specifications Manual for National Hospital Inpatient Quality Measures Available at: http://www.jointcommission.org/specifications_manual_for_national_hospital_inpatient_quality_measures.aspx. Accessed on May 31, 2016.

Cognitive Impairment Screening Following Stroke

Measure Description	
Percentage of stroke patients with documentation indicating validated cognitive screening was completed or attempted.	
Measure Components	
Numerator Statement	All stroke patients with documentation indicating validated cognitive screening* was completed or attempted. *Validated cognitive screening is defined as a validated battery noted in the medical record: Montreal Cognitive Assessment (MOCA)[1,2], Mini-Mental State Examination[1,3], Cognistat (formerly known as Neurobehavioral Cognitive Status Examination (NCSE))[1], Addenbrooke's Cognitive Examination-Revised (ACE-R)[1], Barrow Neurological Institute Screen for Higher Cerebral Functions (BNIS)[1], Brief Cognitive Assessment Tool (BCAT)[4], Brief Cognitive Screening Exam (BCSE)[5], Wechsler Memory Scale (WMS-IV)[6], Repeatable Battery for the Assessment of Neuropsychological Status (RBANS)[7], Telephone Interview for Cognitive Status (TICS)[8] , and appropriate instruments from the NIH Toolbox[9]. *This list of current screening tools is finite to meet data collection requirements for electronic or registry collection and will be revisited during periodic updates of the measure specifications.*
Denominator Statement	All patients aged 18 years and older with a diagnosis of ischemic stroke, non-traumatic spontaneous intracerebral hemorrhage and spontaneous subarachnoid hemorrhage discharged from acute care alive
Denominator Exceptions	• Clinically infeasible to administer a screening. • Patients with a post stroke screen indicating intact cognitive function.
Exception Justification	Patient's medical condition may prevent cognitive screening, rendering the screening meaningless. Patients who have had a post-stroke screen with results indicating intact cognitive function do not need to have testing at additional locations to reduce burden to receiving facility provider and patient.
Supporting Guideline & Other References	**The following clinical recommendation statements are quoted verbatim from the referenced clinical guidelines and represent the evidence base for the measure:** • "Screening for cognitive deficits is recommended for all stroke patients before discharge home."(Class I Level of Evidence B)(10) • "When screening reveals cognitive deficits, a more detailed neuropsychological evaluation to identify areas of cognitive strength and weakness may be beneficial."(Class IIa Level of Evidence C)(10) • "All patients with clinically evident stroke or TIA should be considered at risk for VCI [vascular cognitive impairment] (cognitive impairment) (Evidence Level A)."(11) • "Screening for VCI (cognitive impairments) should be conducted using a validated screening tool, such as the Montreal Cognitive Assessment test (MoCA) (Evidence Level C)."(11)

Relationship to Desired Outcome	"Because physical and cognitive impairments after stroke have independent prognostic implications, evaluation of both domains should be routine in the clinical care of stroke patients."(10) Cognitive impairment are associated with poorer long-term outcomes.(10) Cognitive screening will guide patient and family involvement in their care plans. It is necessary to ensure patients understand medication and care regimens and cognitive screening would identify individuals who are unable to understand complex care plans prior to discharge ensuring proper supports are in place to achieve medication and care compliance.
Opportunity for Improvement	Cognitive impairment following stroke is prevalent affecting more than one-third of stroke survivors at 3 to 12 months following the stroke event.(10) In a follow-up to evaluate adherence to Canadian guidelines recommending cognitive screening following stroke events, it was found in a single institution evaluation that cognitive screening rates could be improved.(12) The work group noted feasibility concerns, and as written this measure is applicable only to inpatient care. The work group noted there is a strong need for patients receiving outpatient care to receive cognitive assessments, and it is encouraged providers complete or attempt screening within 72 hours of admission at each point of transition. Measure was not specified for outpatient given the potential burdens of implementation as patients could transition rapidly through multiple settings. Measure was not specified for post-acute care given the existing Continuity Assessment Record and Evaluation (CARE) requirements.(13)
National Quality Strategy Domains	☐ Patient and Family Engagement ☐ Patient Safety ☐ Care Coordination ☐ Population/Public Health ☐ Efficient Use of Healthcare Resources ☒ Clinical Process/Effectiveness
Harmonization with Existing Measures	Not Applicable
Measure Purpose (Check all that apply)	☒ Quality improvement ☒ Accountability
Type of Measure (Check all that apply)	☒ Process ☐ Outcome ☐ Structure
Level of Measurement (Check all that apply)	☒ Individual Provider ☒ Practice ☒ System
Care Setting (Check all that apply)	☐ Emergency Departments ☒ Inpatient ☐ Outpatient ☐ Post-Acute Care
Data Source (Check all that apply)	☒ Electronic health record (EHR) data ☐Administrative Data/Claims ☒ Chart Review

	☒ Registry

References

1. Burton L, Tyson SF. Screening for Cognitive Impairment After Stroke: A Systematic Review of Psychometric Properties and Clinical Utility. J Rehabil Med 2015;47:193-203.
2. Cumming TB, Bernhardt J, Linden T. The Montreal Cognitive Assessment. Short Cognitive Evaluation in a Large Stroke Trial. Stroke 2011;42:2642-2644.
3. Bour A, Rasquin S, Boreas A, et al. How predictive is the MMSE for cognitive performance after stroke? J Neurol. 2010; 257(4):630-637.
4. Mansbach WE, MacDougall EE, Rosenzweig AS. The Brief Cognitive Assessment Tool (BCAT): a new test emphasizing contextual memory, executive functions, attentional capacity, and the prediction of instrumental activities of daily living. J Clin Exp Neuropsychol 2012;34(2):183-194.
5. Hilsabeck RC, Holdnack JA, Munro Cullum C, et al. Brief Cognitive Status Examination (BCSE): Comparing Diagnostic Utility and Equating Scores to the Mini-Mental State Examination (MMSE). Archives of Clinical Neuropsychology 2015;30(5):458-467.
6. Al-Qazzaz NK, Ali SH, Ahmad SA, et al. Cognitive impairment and memory dysfunction after a stroke diagnosis: a post-stroke memory assessment. Neuropsychiatric Disease and Treatment 2014; 10:1677-1691.
7. Green S, Sinclair E, Rodgers E, et al. The Repeatable Battery for the Assessment of Neuropsychological Status (RBANS) for post-stroke cognitive impairment screening. International Journal of Therapy and Rehabilitation 2013;20(11):536-541.
8. Barber M, Stott DJ. Validity of the Telephone Interview for Cognitive Status (TICS) in post-stroke subjects. Int J Geriatr Psychiatry. 2004;19(1):75-79.
9. Hodes RJ, Insel TR, Landis SC. On behalf of the NIH Blueprint for Neuroscience Research. The NIH Toolbox: Setting a standard for biomedical research. Neurology 2013;80(S3):S1-S92. All NIH Toolbox-related materials are ©2012 Northwestern University and the National Institutes of Health.
10. Winstein CJ, Stein J, Arena R, et al.; on behalf of the American Heart Association Stroke Council, Council on Cardiovascular and Stroke Nursing, Council on Clinical Cardiology, and Council on Quality of Care and Outcomes Research. Guidelines for adult stroke rehabilitation and recovery: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2016;47:e98–e169.
11. Eskes GA, Lanctôt KL, Herrmann N, et al. Canadian Stroke Best Practice Recommendations: Mood, Cognition and Fatigue Following Stroke practice guidelines, update 2015. Int J Stroke. 2015;10(7):1130-1140.
12. McClure JA, Salter K, Foley N, et al. Adherence to Canadian Best Practice Recommendations for Stroke Care: vascular cognitive impairment screening and assessment practices in an Ontario inpatient stroke rehabilitation facility. Top Stroke Rehabil. 2012;19(2):141-148.
13. CMS. CARE Item Set and B-CARE. Available at: https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/Post-Acute-Care-Quality-Initiatives/CARE-Item-Set-and-B-CARE.html Accessed on November 1, 2016.

Current Measure #6: Rehabilitation Services Assessed

Measure Description	
Percentage of patients aged 18 years and older with a diagnosis of ischemic stroke or spontaneous intracerebral hemorrhage or subarachnoid hemorrhage who were assessed for the need for occupational, physical, and/or speech rehabilitation services* at or prior to acute inpatient discharge AND Screening results were used to determine referral recommendation to appropriate next level of care (either outpatient/ambulatory rehab, Long-Term Care Hospital (LTCH), Inpatient Rehabilitation Facility (IRF), Skilled Nursing Facility (SNF), Home Health Agency(HHA) or ambulatory rehabilitation), or documentation that no rehabilitation is necessary.	
Numerator Statement	Patients aged 18 years and older with a diagnosis of ischemic stroke or spontaneous intracerebral hemorrhage or subarachnoid hemorrhage who were assessed for the need for occupational, physical, and/or speech rehabilitation services* at or prior to acute inpatient discharge AND Following assessment, documentation that results were used to recommend appropriate next level of care; either ambulatory or home-based rehabilitation, or referral to LTCH, IRF, SNF, or HHA or documentation that no rehabilitation is necessary *****Rehabilitation Services – Includes services required in order to improve physical, behavioral, and speech functions
Denominator Statement	All patients aged 18 years and older with a diagnosis of ischemic stroke or spontaneous intracerebral hemorrhage or subarachnoid hemorrhage.
Denominator Exceptions	• Patient elected hospice services within 48 hours of admission • Patient documentation indicates no noted rehabilitation needs • Death during acute inpatient • Discharged/transferred to another acute care facility (comprehensive stroke center, another acute hospital). • Patient declined treatment including left AMA
Exception Justification	Exceptions were created to address individuals who would not be appropriate for a rehabilitation referral based on severity of stroke or palliative care plans. Exception is also appropriate for individuals whose clinical presentation does not warrant rehabilitative services. Additionally, an exception was warranted for those who decline these services.
Supporting Guideline & Other References	**The following clinical recommendation statements are quoted verbatim from the referenced clinical guidelines and represent the evidence base for the measure:** • "Organized and coordinated post–acute inpatient rehabilitation care improves outcome. (Level A)"(1) • "It is recommended that stroke patients who are candidates for postacute rehabilitation receive organized, coordinated, interprofessional care."(Class I Level of Evidence A).(2)

	• "It is recommended that stroke survivors who qualify for and have access to IRF care receive treatment in an IRF in preference to a SNF." (Class I Level of Evidence B).(2)
Relationship to Desired Outcome	Evidence supports that assessment of acute stroke patients by rehabilitation professionals can help guide appropriate PAC placement.(3) The choice of rehabilitation venue impacts health care utilization and patient outcomes. Although per diem costs vary by PAC venue, outcomes across select settings with regards to mortality, ED visits, length of inpatient rehabilitation, hospital readmission and functional abilities are not equal when controlling for clinical and demographic variables.(4) Better outcomes are also achieved when higher doses of rehabilitation are provided.(5,6) While this favors settings where rehabilitation treatment is more intense, it needs to be balanced with other considerations including whether inpatient, home-based or ambulatory rehabilitation is most appropriate in any particular case and regulations that guide admission to various venues. Therefore, recommendations for post-acute rehabilitation venue is best made by experts in rehabilitation medicine who have assessed patients with stroke and who are most knowledgeable about requirements of each post-acute care setting, the intensity of services provided at each venue, and where patient outcomes and greatest efficiency of care can most likely be realized.
Opportunity for Improvement	Decisions where stroke patients receive PAC should be made by health care providers familiar with the specific physical, cognitive, psychosocial and behavioral characteristics of the patient and the various requirements and outcomes specific to different PAC venues.
National Quality Strategy Domains	☐ Patient and Family Engagement ☐ Patient Safety ☐ Care Coordination ☐ Population/Public Health ☐ Efficient Use of Healthcare Resources ☒ Clinical Process/Effectiveness
Harmonization with Existing Measures	The work group refined the previous rehabilitation service assessment measure (NQF#0244) to include a component addressing use of assessment to inform next level of care. The Joint Commission has released a similar measure on rehabilitation assessment NQF#0441/STK 10: Assessed for Rehabilitation. A separate measure is needed to ensure assessment results are informing clinical care.
Measure Purpose (Check all that apply)	☒ Quality improvement ☒ Accountability
Type of Measure (Check all that apply)	☒ Process ☐ Outcome ☐ Structure
Level of Measurement (Check all that apply)	☒ Individual Provider ☒ Practice ☒ System
Care Setting (Check all that apply)	☐ Emergency Departments ☒ Inpatient ☐ Outpatient ☐ Post-Acute Care

Data Source (Check all that apply)	☒ Electronic health record (EHR) data ☐Administrative Data/Claims ☒ Chart Review ☒ Registry

References

1. Duncan PW, Zorowitz R, Bates B, et al. Management of Adult Stroke Rehabilitation Care. A Clinical Practice Guideline. Stroke. 2005;36:e100-e143.
2. Winstein CJ, Stein J, Arena R, et al.; on behalf of the American Heart Association Stroke Council, Council on Cardiovascular and Stroke Nursing, Council on Clinical Cardiology, and Council on Quality of Care and Outcomes Research. Guidelines for adult stroke rehabilitation and recovery: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2016;47:e98–e169.
3. Bland MD, Whitsone M, Harris H, et al. Descriptive data analysis examining how standardized assessments are used to guide post-acute discharge recommendation for rehabilitation services after stroke. Phys Ther 2015;95:710-719.
4. Chan L, Sandel ME, Jette AM, et al. Does postacute care site matter? A longitudinal study assessing functional recovery after stroke. Arch Phys Med Rehabil 2013;94(4):622-629.
5. Lohse KR, Lang CE, Boyd LA. Is more better? Using metadata to explore dose-response relationships in stroke rehabilitation. Stroke. 2014;45(7):2053-2058.
6. Veerbeek JM, van Wegen E, van Peppen R, et al. What is the evidence for physical therapy poststroke? A systematic review and meta-analysis. PLoS One. 2014;9(2):e87987.

Post-Acute Ischemic Stroke Screening and Care Measure Bundle

Measure Description	
Percentage of patients aged 18 years and older with a diagnosis of ischemic stroke or transient ischemic attack within the last 3 months that received defect free care based upon their eligibility for all 6 performance measure components.	
Measure Components	
Numerator Statement	All eligible patients who received all 6 measure components: • **Component 1:** Blood Pressure Patients with a blood pressure <140/90 mmHg* OR Patients with a blood pressure ≥140/90 mmHg who were: ▪ prescribed 2 or more anti-hypertensive agents, ▪ referred back to PCP when BP noted to be >140/90 mmHg, OR ▪ medical rationale documented (e.g., severe orthostasis) for more liberal blood pressure management. • **Component 2:** Diabetes Screening o Patient is screened for Diabetes Mellitus with either fasting plasma glucose, HbA1C or oral glucose tolerance test during reporting period • **Component 3:** Appropriate Antithrombotic Patients aged 18 years and older with ischemic stroke on appropriate antithrombotic: o Appropriate antithrombotic for patients with stroke AND nonvalvular atrial fibrillation using therapeutic anticoagulation (warfarin, LMWH or direct factor inhibitors as approved by FDA), OR documentation of medical/patient exception, o Appropriate antithrombotic for patients with stroke AND mechanical heart valve or valvular atrial fibrillation using anticoagulation with warfarin OR documentation of medical/patient exception, OR o Appropriate antithrombotic for all other patients with stroke using antiplatelet or therapeutic anticoagulation o If not on antithrombotic, referral to appropriate provider for antithrombotic management. • **Component 4:** Tobacco Use Management Patients with stroke who have documentation of active smoking status OR former smoker with quit date less than 1 year from time of assessment provided counseling on the bad effects of tobacco, the benefit of quitting AND at least one of the following: ▪ Referral back to PCP for tobacco cessation support, AND/OR ▪ Referral to tobacco cessation clinic or tobacco dependence telephone quitline, AND/OR ▪ Prescription of tobacco dependence medications including nicotine replacement therapies products, bupropion SR or Varenicline, or any FDA-approved drugs for tobacco dependence therapies or referral to PCP Documentation of never smoker or former smoker with quit date more than a year from time of assessment fulfills this component.

	• **Component 5:** Exercise
	  o Patients prescribed or counseled on participating in an exercise program.
	• **Component 6:** Depression
	  o Patient is screened for depression using a validated instrument at least once upon arrival at outpatient care (i.e. Beck Depression Inventory, PHQ-9, Hamilton Rating Scale for Depression)

Denominator Statement	All patients aged 18 years and older with a diagnosis of ischemic stroke or transient ischemic attack (TIA) evaluated within three months on an ambulatory visit
Denominator Exceptions	For all components: • Patient declines treatment and screening • Patient enrolled in a clinical trial • Contraindication documented Additional exceptions for individual components: • Diabetes Screening: None • Appropriate Antithrombotic: None • Tobacco Use Management: None • Exercise: Patients with documented contraindication or physical inability to participate in an exercise program • Depression: Patients with aphasia or other medical condition that precludes use of any validated screening tool
Exception Justification	Exceptions are warranted for individuals enrolled in clinical trial as treatment plans required for measure are not clinically appropriate for these populations interfering with clinical trials. Assessment and treatment cannot be provided to those who refuse or leave AMA. Patients with documented contraindication for the specific intervention justifies exception as well. An exception was created for exercise as medical conditions may prevent meaningful counseling on benefits. An exception was created for depression screening as some patients may not be able to fully engage in screening through a validated tool due to neurological impairments.

Supporting Guideline & Other References	**The following clinical recommendation statements are quoted verbatim from the referenced clinical guidelines and represent the evidence base for the measure:**
	Component 1: Blood Pressure:
	  o "Initiation of BP therapy is indicated for previously untreated patients with ischemic stroke or TIA who, after the first several days, have an established BP ≥140 mm Hg systolic or ≥90 mm Hg diastolic (Class I; Level of Evidence B). Initiation of therapy for patients with BP <140 mm Hg systolic and <90 mm Hg diastolic is of uncertain benefit (Class IIb; Level of Evidence C). (Revised recommendation)"(1)
	  o "Resumption of BP therapy is indicated for previously treated patients with known hypertension for both prevention of recurrent stroke and prevention of other vascular events in those who have had an ischemic stroke or TIA and are beyond the first several days (Class I; Level of Evidence A). (Revised recommendation)"(1)
	  o "Goals for target BP level or reduction from pretreatment baseline are uncertain and should be individualized, but it is reasonable to achieve a systolic pressure <140 mm Hg and a diastolic pressure <90 mm Hg (Class IIa; Level of Evidence B). For patients with a

	recent lacunar stroke, it might be reasonable to target an SBP of <130 mm Hg (Class IIb; Level of Evidence B). (Revised recommendation)"(1) Component 2: Diabetes Mellitus: o "Testing to assess risk for future diabetes in asymptomatic people should be considered in adults of any age who are overweight or obese (BMI ≥25 kg/m^2 or ≥23 kg/m^2 in Asian Americans) and who have one or more additional risk factors for diabetes. B" (2) o "To test for prediabetes, fasting plasma glucose, 2-h plasma glucose after 75-g oral glucose tolerance test, and A1C are equally appropriate. B" (2) o "Testing to detect type 2 diabetes in asymptomatic people should be considered in adults of any age who are overweight or obese (BMI ≥25 kg/m^2 or ≥23 kg/m^2 in Asian Americans) and who have one or more additional risk factors for diabetes. B" (2) o "To test for type 2 diabetes, fasting plasma glucose, 2-h plasma glucose after 75-g oral glucose tolerance test, and A1C are equally appropriate. B" (2) o "Disorders of Glucose Metabolism and DM Recommendations .After a TIA or ischemic stroke, all patients should probably be screened for DM with testing of fasting plasma glucose, HbA1c, or an oral glucose tolerance test. Choice of test and timing should be guided by clinical judgment and recognition that acute illness may temporarily perturb measures of plasma glucose. In general, HbA1c may be more accurate than other screening tests in the immediate postevent period (Class IIa; Level of Evidence C). (New recommendation)"(1) o "Use of existing guidelines from the ADA for glycemic control and cardiovascular risk factor management is recommended for patients with an ischemic stroke or TIA who also have DM or pre-DM (Class I; Level of Evidence B)."(1) Component 3: Appropriate Antithrombotic: Appropriate antithrombotic for patients with AF or mechanical heart valve**:** o "VKA therapy (Class I; Level of Evidence A), apixaban (Class I; Level of Evidence A), and dabigatran (Class I; Level of Evidence B) are all indicated for the prevention of recurrent stroke in patients with nonvalvular AF, whether paroxysmal or permanent. The selection of an antithrombotic agent should be individualized on the basis of risk factors, cost, tolerability, patient preference, potential for drug interactions, and other clinical characteristics, including renal function and time in INR therapeutic range if the patient has been taking VKA therapy."(1) o "Rivaroxaban is reasonable for the prevention of recurrent stroke in patients with nonvalvular AF (Class IIa; Level of Evidence B)."(1) o "For patients with ischemic stroke or TIA and AF who are unable to take oral anticoagulants, aspirin alone is recommended (Class I; Level of Evidence A)."(1)

	○ "The addition of clopidogrel to aspirin therapy, compared with aspirin therapy alone, might be reasonable (Class IIb; Level of Evidence B)."(1) ○ "For most patients with a stroke or TIA in the setting of AF, it is reasonable to initiate oral anticoagulation within 14 days after the onset of neurological symptoms (Class IIa; Level of Evidence B)."(1) ○ "In the presence of high risk for hemorrhagic conversion (ie, large infarct, hemorrhagic transformation on initial imaging, uncontrolled hypertension, or hemorrhage tendency), it is reasonable to delay initiation of oral anticoagulation beyond 14 days (Class IIa; Level of Evidence B)."(1) ○ "For patients with ischemic stroke or TIA who have rheumatic mitral valve disease and AF, longterm VKA therapy with an INR target of 2.5 (range, 2.0–3.0) is recommended (Class I; Level of Evidence A)."(1) ○ "For patients with a mechanical aortic valve and a history of ischemic stroke or TIA before its insertion, VKA therapy is recommended with an INR target of 2.5 (range, 2.0–3.0) (Class I; Level of Evidence B)."(1) ○ "For patients with a mechanical mitral valve and a history of ischemic stroke or TIA before its insertion, VKA therapy is recommended with an INR target of 3.0 (range, 2.5–3.5) (Class I; Level of Evidence C)."(1) Appropriate antithrombotic for all other stroke patients: ○ "For patients with noncardioembolic ischemic stroke or TIA, the use of antiplatelet agents rather than oral anticoagulation is recommended to reduce the risk of recurrent stroke and other cardiovascular events (Class I; Level of Evidence A)."(1) ○ "Aspirin (50–325 mg/d) monotherapy (Class I; Level of Evidence A) or the combination of aspirin 25 mg and extended-release dipyridamole 200 mg twice daily (Class I; Level of Evidence B) is indicated as initial therapy after TIA or ischemic stroke for prevention of future stroke."(1) ○ "Clopidogrel (75 mg) monotherapy is a reasonable option for secondary prevention of stroke in place of aspirin or combination aspirin/dipyridamole (Class IIa; Level of Evidence B). This recommendation also applies to patients who are allergic to aspirin." (1) <u>Component 4: Tobacco Use Management:</u> ○ "Patients Healthcare providers should strongly advise every patient with stroke or TIA who has smoked in the past year to quit (Class I; Level of Evidence C)." (1) ○ "It is reasonable to advise patients after TIA or ischemic stroke to avoid environmental (passive) tobacco smoke (Class IIa; Level of Evidence B)." (1) ○ "Counseling, nicotine products, and oral smoking cessation medications are effective in helping smokers to quit (Class I; Level of Evidence A)." (1)

	○ "It is essential that clinicians and health care delivery systems consistently identify and document tobacco use status and treat every tobacco user seen in a health care setting."(3) ○ "Individual, group, and telephone counseling are effective, and their effectiveness increases with treatment intensity."(3) ○ "Numerous effective medications are available for tobacco dependence, and clinicians should encourage their use by all patients attempting to quit smoking—except when medically contraindicated or with specific populations for which there is insufficient evidence of effectiveness (i.e., pregnant women, smokeless tobacco users, light smokers, and adolescents)."(3) ○ "Counseling and medication are effective when used by themselves for treating tobacco dependence. The combination of counseling and medication, however, is more effective than either alone. Thus, clinicians should encourage all individuals making a quit attempt to use both counseling and medication."(3) ○ "Telephone quitline counseling is effective with diverse populations and has broad reach. Therefore, clinicians and health care delivery systems should both ensure patient access to quitlines and promote quitline use."(3) <u>Component 5: Exercise</u>: ○ "Physical activity and exercise prescription should be incorporated into the management of stroke survivors. The promotion of physical activity in stroke survivors should emphasize low- to moderate-intensity aerobic activity, muscle-strengthening activity, reduction of sedentary behavior, and risk management for secondary prevention of stroke."(4) ○ "After successful screening, an individually tailored exercise program is indicated to enhance cardiorespiratory fitness and to reduce the risk of stroke recurrence." (Class I; Level A (for improved fitness); Level B (for reduction of stroke risk)(5) <u>Component 6: Depression</u>: ○ "All patients with stroke should be screened for depressive symptoms, given the high prevalence of depression poststroke, the need for screening to detect depression, and the strong evidence for treating symptomatic depression poststroke (Evidence Level B)."(6) ○ "Screening should be undertaken using a validated tool to maximize detection of depression (Evidence Level B); table 1A – a summary of suggested validated tools – is available at www.strokebestpractices.ca. ▪ Screening for PSD may take place at various stages throughout the continuum of stroke care, particularly at transition points (Evidence Level C). Repeated screening may be required since the ideal timing for screening for PSD is unclear."(6) ○ "Screening for depressive symptoms should be considered during transition points in care, such as from an inpatient acute setting to an inpatient rehabilitation setting, and or [sic] before return to the community (Evidence Level C)."(6)

	○ "Screening for depressive symptoms should be considered following discharge to the community, at stroke prevention clinic assessments, during follow-up appointments, and during periodic health assessments with primary care practitioners and consulting specialists (Evidence Level C)."(6)
Measure Importance	
Relationship to Desired Outcome	Blood Pressure: Treatment of hypertension is considered to be among the most important interventions for secondary prevention of ischemic stroke. Defined as a systolic blood pressure (SBP) ≥140 mm Hg or a diastolic blood pressure (DBP) ≥90 mm Hg, an estimated 78 million Americans have hypertension. The prevalence among patients with a recent ischemic stroke is ≈70%. The risk for a first ischemic stroke is directly related to blood pressure (BP) starting with an SBP as low as 115 mm Hg. Diabetes Mellitus: Diabetes mellitus, defined by elevated glycemic markers, is a major risk factor for cardiovascular disease (CVD), which is the most common cause of death among adults with diabetes mellitus, underscoring the need for aggressive CVD risk factor management, noting that evidence is lacking that treatment of diabetes specifically reduces risk of recurrent stroke. Antithrombotic Therapy: Appropriate use of antithrombotic therapy reduces the risk of recurrent stroke. Smoking Cessation: Cigarette smoking is an important independent risk factor for first ischemic stroke and contributes to an increased risk for silent brain infarction. It is also associated with a substantially increased risk for stroke recurrence in the elderly, noting that risk for recurrent stroke in younger populations is less well documented. Exercise: Physical inactivity after stroke is highly prevalent. The assessed body of evidence clearly supports the use of exercise training (both aerobic and strength training) for stroke survivors.(5) Exercise training improves functional capacity, the ability to perform activities of daily living, and quality of life, and it reduces the risk for subsequent cardiovascular events.(4) Depression: Poststroke depression impedes recovery and results in worse long-term outcomes. There is need for a system of care that ensures screening for poststroke depression as a standard and consistent component of clinical practice across settings as stroke patients transition from acute care to active rehabilitation and reintegration into their community. Pharmacological treatment has been associated with a reduction of depressive symptomatology.
Opportunity for Improvement	Despite the importance of each of these components it is anticipated that providers can improve quality of care provided by evaluating global performance on care provided following a stroke. The work group notes that individual components may occur across outpatient care team and intent was for provider to meet criteria if care components were coordinated with appropriate specialist or primary care provider.

National Quality Strategy Domains	☐ Patient and Family Engagement ☐ Patient Safety ☐ Care Coordination ☐ Population/Public Health ☐ Efficient Use of Healthcare Resources ☒ Clinical Process/Effectiveness
Harmonization with Existing Measures	The definitions and specifications used in the components of this measure are similar to those collected in the commonly employed stroke measures (i.e., CMS, Joint Commission and/or AHA/ASA), ensuring parsimony in data collection strategies. A separate measure is being created to monitor global performance for quality improvement. NQF #18/PQRS #2326 Controlling High Blood Pressure component is similar with additional specification added to allow referral/coordination with Primary Care Provider to meet measure composite. NQF Measure #0057 Comprehensive Diabetes Care: Hemoglobin A1c (HbA1c) testing and #0059 Comprehensive Diabetes Care: Hemoglobin A1c (HbA1c) Poor Control (>9.0%) were modified to include patients in the denominator beyond those diagnosed diabetes mellitus. NQF#0435 and #3042 STK 02: Discharged on Antithrombotic Therapy is similar with additional specification added to allow referral/coordination with appropriate health care provider to meet measure composite. NQF #0028/PQRS #226 Preventive Care and Screening: Tobacco Use: Screening and Cessation is similar with additional specification added to allow referral/coordination with Primary Care Provider to meet measure composite. NQF #0103/PQRS# 325 Adult Major Depressive Disorder: Comprehensive Depression Evaluation: Diagnosis and Severity is a treatment measure for patients with Major Depressive Disorder. NQF #0518 Depression Assessment Conducted is intended for home health services. NQF #0711 Depression Remission at Six Months, NQF #0710 Depression Remission at Twelve Months are treatment measures for patients with depression identified. The work group developed this depression component to capture screening for poststroke depression in the outpatient setting.
Measure Purpose (Check all that apply)	☒ Quality improvement ☒ Accountability
Type of Measure (Check all that apply)	☒ Process ☐ Outcome ☐ Structure
Level of Measurement (Check all that apply)	☒ Individual Provider ☒ Practice ☒ System
Care Setting (Check all that apply)	☐ Emergency Departments ☐ Inpatient ☒ Outpatient ☐ Skilled Nursing Home

Data Source (Check all that apply)	☒ Electronic health record (EHR) data ☐ Administrative Data/Claims ☒ Chart Review ☒ Registry

References

1. Kernan WN, Ovbiagele B, Black HR, et al; on behalf of the American Heart Association Stroke Council, Council on Cardiovascular and Stroke Nursing, Council on Clinical Cardiology, and Council on Peripheral Vascular Disease. Guidelines for the prevention of stroke in patients with stroke and transient ischemic attack: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2014;45:2160-2236.
2. American Diabetes Association. Classification and Diagnosis of Diabetes. Diabetes Care 2016;39(S1):S13-S22.
3. US Department of Health and Human Services. Treating tobacco use and dependence: 2008 Update. Am J Prev Med. 2008;35(2):158-176.
4. Billinger SA, Arena R, Bernhardt J, et al; on behalf of the American Heart Association Stroke Council, Council on Cardiovascular and Stroke Nursing, Council on Lifestyle and Cardiometabolic Health, Council on Epidemiology and Prevention, and Council on Clinical Cardiology. Physical activity and exercise recommendations for stroke survivors: a statement for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2014;45:2532–2553
5. Winstein CJ, Stein J, Arena R, et al.; on behalf of the American Heart Association Stroke Council, Council on Cardiovascular and Stroke Nursing, Council on Clinical Cardiology, and Council on Quality of Care and Outcomes Research. Guidelines for adult stroke rehabilitation and recovery: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2016;47:e98–e169.
6. Eskes GA, Lanctôt KL, Herrmann N, et al. Canadian Stroke Best Practice Recommendations: Mood, Cognition and Fatigue Following Stroke practice guidelines, update 2015. Int J Stroke. 2015;10(7):1130-1140.

Functional Outcome Assessment Following Recanalization Therapy for Acute Ischemic Stroke

Measure Description	
Percentage of patients with Acute Ischemic Stroke who received any acute reperfusion therapy who have a functional outcome assessment documented at 90 days.	
Numerator Statement	Patients with Acute Ischemic Stroke who received IV t-PA, IA t-PA, or mechanical endovascular reperfusion who have a Modified Rankin Score (mRS) administered by trained facility staff at the institution that completed the recanalization treatment documented between day 75 to 105 (90 days +/- 15 days) after intervention obtained via telephone or in-person.
Denominator Statement	All Patients discharged with Acute Ischemic Stroke who received acute reperfusion therapy.
Denominator Exceptions	• Patient lost to follow-up (i.e., 3 phone call attempts at number documented during inpatient stay without response, registered mail sent without response, or home visit attempted without response.) • Patients who had comfort measures documented within 48 hours of admission • Patient declines • mRS score at 90 days (+/-15 days) completed by alternate source and score documented in medical record
Exception Justification	Exceptions were needed to address individuals who refused to complete the assessment or were lost to follow-up. Individuals who were moved to palliative care are not appropriate for comparison in the patient outcome assessment. Individuals who had the mRS previously completed were also removed to reduce duplicative data collection.
Supporting Guideline & Other References	**The following clinical recommendation statements are quoted verbatim from the referenced clinical guidelines and quality metrics represent the evidence base for the measure:** • "Outcomes on all patients should be tracked. Facilities are encouraged to define criteria that can be used to credential individuals who can perform safe and timely intra-arterial revascularization procedures (Class I; Level of Evidence E)."(1) • "This interview could be conducted over the telephone, if necessary. (Class I; Level of Evidence B.)"(2,3)
Relationship to Desired Outcome	"The mRS at 3 months after stroke has become the accepted standard for assessing recovery from ischemic stroke and has been used in numerous recent large randomized clinical trials."(3) The Joint Commission and AHA/ASA have released similar measures to be applied by comprehensive stroke centers.(3,4) This process measure is mirrored on existing mRS measures with expanded care settings. By developing a process measure applying across care settings it is hoped performance on patient outcome benchmarks and comparisons can be developed. The work group will evaluate directly measuring patient stroke outcomes in future updates to this measurement set.
Opportunity for Improvement	"The Modified Rankin Scale (mRS) is the accepted standard for assessing recovery post-stroke. As such, it has become the most widely used clinical outcome measure

	for stroke clinical trials. Scores are used to measure the degree of disability or dependence in activities of daily living. Score reliability and reproducibility are improved through use of a structured interview by a trained evaluator. Interviews may be conducted in-person or over the phone. According to guideline recommendations from the American Heart Association/American Stroke Association, standardized interviews to obtain a mRS score should be conducted for acute ischemic stroke patients treated with IV or IA thrombolytic (t-PA) therapy or mechanical endovascular reperfusion therapy at 3 months (90 days); however, recovery may continue well beyond 3 months for many ischemic stroke patients."(4) Measure intent was to capture this 90 follow-up one time. Individuals who had the mRS previously completed were also removed to reduce duplicative data collection.
National Quality Strategy Domains	☐ Patient and Family Engagement ☐ Patient Safety ☐ Care Coordination ☐ Population/Public Health ☐ Efficient Use of Healthcare Resources ☒ Clinical Process/Effectiveness
Harmonization with Existing Measures	AHA/ASA (3) and Joint Commission(4) have developed and released similar measures. A separate measure was created mirroring NQF#2865 (Joint Commission CSTK-02: Modified Rankin Score (mRS) at 90 Days to expand care settings beyond certified stroke centers with additional exceptions created to reduce duplicative data collection.
Measure Purpose (Check all that apply)	☒ Quality improvement ☒ Accountability
Type of Measure (Check all that apply)	☒ Process ☐ Outcome ☐ Structure
Level of Measurement (Check all that apply)	☐ Individual Provider ☒ Practice ☒ System
Care Setting (Check all that apply)	☐ Emergency Departments ☒ Inpatient ☒ Outpatient ☒ Post-Acute Care
Data Source (Check all that apply)	☒Electronic health record (EHR) data ☐Administrative Data/Claims ☒ Chart Review ☒ Registry
References	
1. Powers WJ, Derdeyn CP, Biller J, et al.; on behalf of the American Heart Association Stroke Council. 2015 American Heart Association/American Stroke Association focused update of the 2013 guidelines for the early management of patients with acute ischemic stroke regarding endovascular treatment: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke.* 2015;46:3020–3035.	

2. Schwamm LH, Audebert HJ, Amarenco P, et al.; on behalf of the American Heart Association Stroke Council; Council on Epidemiology and Prevention; Interdisciplinary Council on Peripheral Vascular Disease; and the Council on Cardiovascular Radiology and Intervention. Recommendations for the implementation of telemedicine within stroke systems of care: a policy statement from the American Heart Association. *Stroke.* 2009;40:2635–2660.
3. Leifer D, Bravata DM, Connors JJ 3rd, et al.; on behalf of the American Heart Association Special Writing Group of the Stroke Council, Atherosclerotic Peripheral Vascular Disease Working Group, Council on Cardiovascular Surgery and Anesthesia, and Council on Cardiovascular Nursing. Metrics for measuring quality of care in comprehensive stroke centers: detailed follow-up to Brain Attack Coalition comprehensive stroke center recommendations: a statement for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke.* 2011;42:e369.
4. The Joint Commission. Disease-specific care certification program. Comprehensive stroke: performance measurement implementation guide. Oakbrook Terrace (IL):The Joint Commission; 2015 Mar. 278 p.

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[i] Mozaffarian D, Benjamin EJ, Go AS, et al. on behalf of the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. Heart disease and stroke statistics—2015 update: a report from the American Heart Association. *Circulation*. 2015;131:e29–e322.
[ii] Kochanek KD, Xu JQ, Murphy SL, Arias E. Mortality in the United States, 2013. NCHS Data Brief, No. 178. Hyattsville, MD: National Center for Health Statistics, Centers for Disease Control and Prevention, US Dept. of Health and Human Services; 2014.
[iii] Heron M. Deaths: Leading causes for 2013. National vital statistics reports: vol 65 no 2. Hyattsville, MD: National Center for Health Statistics. 2016.

[iv] Mozaffarian D, Benjamin EJ, Go AS, et al. on behalf of the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. Heart disease and stroke statistics—2015 update: a report from the American Heart Association. *Circulation*. 2015;131:e29–e322.
[v] Mozaffarian D, Benjamin EJ, Go AS, et al. on behalf of the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. Heart disease and stroke statistics—2015 update: a report from the American Heart Association. *Circulation*. 2015;131:e29–e322.
[vi] Mozaffarian D, Benjamin EJ, Go AS, et al. on behalf of the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. Heart disease and stroke statistics—2015 update: a report from the American Heart Association. *Circulation*. 2015;131:e29–e322.
[vii] Mozaffarian D, Benjamin EJ, Go AS, et al. on behalf of the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. Heart disease and stroke statistics—2015 update: a report from the American Heart Association. *Circulation*. 2015;131:e29–e322.
[viii] Mozaffarian D, Benjamin EJ, Go AS, et al. on behalf of the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. Heart disease and stroke statistics—2015 update: a report from the American Heart Association. *Circulation*. 2015;131:e29–e322.
[ix] Centers for Disease Control. Prevalence of stroke – United States. 2006-2010. MMWR 2012;61(20):379-382.
[x] Kelly-Hayes M, Beiser A, Kase CS, et al. The influence of gender and age on disability following ischemic stroke: the Framingham Study. J Stroke Cerebrovasc Dis 2003;12:119–126.
[xi] Mozaffarian D, Benjamin EJ, Go AS, et al. on behalf of the American Heart Association Statistics Committee and Stroke Statistics Subcommittee. Heart disease and stroke statistics—2015 update: a report from the American Heart Association. *Circulation*. 2015;131:e29–e322.
[xii] Howard G, Moy CS, Howard VJ, et al.; for the REGARDS Investigators. Where to Focus Efforts to Reduce the Black-White Disparity in Stroke Mortality: Incidence Versus Case Fatality? Stroke. Published online before print June 2, 2016. Available at: http://stroke.ahajournals.org/content/early/2016/06/02/STROKEAHA.115.012631.full.pdf+html Accessed on June 8, 2016.
[xiii] Centers for Disease Control. Prevalence of stroke – United States. 2006-2010. MMWR 2012;61(20):379-382.
[xiv] Centers for Disease Control. Prevalence of stroke – United States. 2006-2010. MMWR 2012;61(20):379-382.
[xv] The ATLANTIS, ECASS, and NINDS rt-PA Study Group Investigators. Association of outcome with early stroke treatment: pooled analysis of ATLANTIS, ECASS, and NINDS rt-PA stroke trials. *Lancet*. 2004;363:768–74.
[xvi] Duncan PW, Zorowitz R, Bates B, et al. Management of Adult Stroke Rehabilitation Care. A Clinical Practice Guideline. Stroke. 2005;36:e100-e143.
[xvii] US Department of Health and Human Services. Treating tobacco use and dependence: 2008 Update. Am J Prev Med. 2008;35(2):158-176.
[xviii] Summers D, Leonard A, Wentworth D, et al.; on behalf of the American Heart Association Council on Cardiovascular Nursing and the Stroke Council. Comprehensive overview of nursing and interdisciplinary care of the acute ischemic stroke patient: a scientific statement from the American Heart Association. Stroke. 2009;40:2911–2944.

[xix]ASGE Standards of Practice Committee, Jain R, Maple JT, Anderson MA, et al. The role of endoscopy in enteral feeding. Gastrointestinal Endoscopy 2011; 74(1):7-12.
[xx]Jauch ED, Saver JL, Adams HP, et al. Guidelines for the Early Management of Patients With Acute Ischemic Stroke: A Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association. Stroke. 2013;44:870–947.
[xxi]Stone NJ, Robinson JG, Lichtenstein AH, et al. 2013 ACC/AHA guideline on the treatment of blood cholesterol to reduce atherosclerotic cardiovascular risk in adults: a report of the American College of Cardiology/ American Heart Association Task Force on Practice Guidelines. Circulation. 2014;129(suppl 2):S1–S45.
[xxii]Kernan WN, Ovbiagele B, Black HR, et al. Guidelines for the prevention of stroke in patients with stroke and transient ischemic attack: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2014;45:1-15.
[xxiii] Holloway, RG, Arnold RM, Creutzfeldt CJ, et al.; on behalf of the American Heart Association Stroke Council, Council on Cardiovascular and Stroke Nursing, and Council on Clinical Cardiology. Palliative and end-of-life care in stroke: a statement for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2014;45(6):1887-1916.
[xxiv] Billinger SA, Arena R, Bernhardt J, et al; on behalf of the American Heart Association Stroke Council, Council on Cardiovascular and Stroke Nursing, Council on Lifestyle and Cardiometabolic Health, Council on Epidemiology and Prevention, and Council on Clinical Cardiology. Physical activity and exercise recommendations for stroke survivors: a statement for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2014;45:2532–2553
[xxv] Powers WJ, Derdeyn CP, Biller J, et al.; on behalf of the American Heart Association Stroke Council. 2015 American Heart Association/American Stroke Association focused update of the 2013 guidelines for the early management of patients with acute ischemic stroke regarding endovascular treatment: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke*. 2015;46:3020–3035.
[xxvi] Jacobson TA, Ito MK, Maki KC, et al. National lipid association recommendations for patient-centered management of dyslipidemia: part 1--full report. J Clin Lipidol. 2015;9(2):129-169.
[xxvii] Eskes GA, Lanctôt KL, Herrmann N, et al. Canadian Stroke Best Practice Recommendations: Mood, Cognition and Fatigue Following Stroke practice guidelines, update 2015. Int J Stroke. 2015;10(7):1130-1140.
[xxviii] American Diabetes Association. Classification and Diagnosis of Diabetes. Diabetes Care 2016;39(S1):S13-S22.

[xxix] Winstein CJ, Stein J, Arena R, et al.; on behalf of the American Heart Association Stroke Council, Council on Cardiovascular and Stroke Nursing, Council on Clinical Cardiology, and Council on Quality of Care and Outcomes Research. Guidelines for adult stroke rehabilitation and recovery: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2016;47:e98–e169.
[xxx] CMS. IMPACT Act of 2014 Available at: https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/Post-Acute-Care-Quality-Initiatives/IMPACT-Act-of-2014-and-Cross-Setting-Measures.html Accessed on June 8, 2016,