# Supplemental Guide:
# Vascular Neurology

ACGME

May 2021

# TABLE OF CONTENTS

# Milestones Supplemental Guide

This document provides additional guidance and examples for the Vascular Neurology Milestones. This is not designed to indicate any specific requirements for each level, but to provide insight into the thinking of the Milestone Work Group.

Included in this document is the intent of each Milestone and examples of what a Clinical Competency Committee (CCC) might expect to be observed/assessed at each level. Also included are suggested assessment models and tools for each subcompetency, references, and other useful information.

Review this guide with the CCC and faculty members. As the program develops a shared mental model of the Milestones, consider creating an individualized guide (Supplemental Guide Template available) with institution/program-specific examples, assessment tools used by the program, and curricular components.

Additional tools and references, including the Milestones Guidebook, Clinical Competency Committee Guidebook, and Milestones Guidebook for Residents and Fellows, are available on the Resources page of the Milestones section of the ACGME website.

| **Patient Care 1: History**<br>**Overall Intent:** To efficiently obtain a thorough history that addresses the patient's symptoms | |
|---|---|
| **Milestones** | **Examples** |
| **Level 1** *Obtains a complete, relevant, and organized vascular neurology history* | ● History is problem-focused but does not include all the key elements needed to discriminate urgency |
| **Level 2** *Efficiently obtains a relevant and organized vascular neurology history that differentiates stroke from mimics, and that assesses baseline functioning and disability* | ● Obtains a history including exact time of onset and observed deficits in patient with possible stroke |
| **Level 3** *Efficiently obtains a relevant and organized vascular neurology history appropriate to the patient's acuity and the clinical setting (e.g., clinic, emergency room)* | ● Obtains a comprehensive history from a patient during an acute stroke code and obtains information from family and/or witnesses of the event |
| **Level 4** *Consistently obtains a history sufficient to guide the subsequent vascular neurology examination, investigation, and treatment of common and uncommon causes of stroke* | ● Obtains a history from a patient with recurrent small vessel strokes; asks about history of migraine and collects thorough family history to screen for CADASIL |
| **Level 5** *Serves as a role model for obtaining a thorough vascular neurologic history* | ● Is selected by faculty members to demonstrate obtaining a history to medical students and more junior residents |
| Assessment Models or Tools | ● Direct observation<br>● Medical record (chart) audit<br>● Multisource feedback<br>● Simulation |
| Curriculum Mapping | ● |
| Notes or Resources | ● O'Brien MD. Taking a neurological history. *Medicine*. 2004;32(9):1-6. https://www.medicinejournal.co.uk/article/S1357-3039(06)00152-6/pdf. 2021. |

| **Patient Care 2: Vascular Neurologic Exam**<br>**Overall Intent:** To perform an accurate, comprehensive vascular neurologic exam which identifies abnormalities, localizes to the dysfunctional vascular territory, and elucidates possible stroke etiology | |
|---|---|
| **Milestones** | **Examples** |
| **Level 1** *Performs a relevant vascular neurology examination, including administration and scoring the National Institutes of Health Strokes Scale (NIHSS)* | ● Examines a patient during a stroke alert and accurately conducts the National Institutes of Health Strokes Scale |
| **Level 2** *Performs a relevant vascular neurology examination incorporating some additional maneuvers appropriate to the patient and to identify stroke mimics* | ● Includes Hoover's sign in the examination of a patient suspected of having functional leg weakness |
| **Level 3** *Performs a relevant vascular neurology examination incorporating all maneuvers appropriate to the patient's acuity and the clinical setting* | ● Includes a head-impulse-nystagmus-test-of-skew (HINTS) and gait examination in a patient presenting with acute vestibular syndrome within three hours of symptom onset |
| **Level 4** *Consistently and efficiently performs a vascular neurology examination to guide and prioritize subsequent investigation and treatment of common and uncommon causes of stroke* | ● Includes skin examination and identifies livido reticularis indicating Sneddon syndrome in patient with stroke of uncharacterized etiology |
| **Level 5** *Serves as a role model for performing a vascular neurology examination* | ● Demonstrates key exam maneuvers to localize a lesion to the lateral medulla<br>● Identifies and teaches others about skin findings of Fabry's disease |
| Assessment Models or Tools | ● Direct observation<br>● Medical record (chart) audit<br>● Multisource feedback<br>● Simulation |
| Curriculum Mapping | ● |
| Notes or Resources | ● Kattah JC, Talkad AV, Wang DZ, et al. HINTS to diagnose stroke in acute vestibular syndrome. *Stroke*. 2009;40:3504-3510. https://www.ahajournals.org/doi/pdf/10.1161/strokeaha.109.551234. 2021.<br>● National Istitute of Health (NIH). Stroke Scale. https://www.stroke.nih.gov/documents/NIH_Stroke_Scale_508C.pdf. 2021. |

| **Patient Care 3: Acute Stroke Intervention and Management**<br>**Overall Intent:** To evaluate and treat eligible candidates for thrombolytic/endovascular reperfusion therapy | |
|---|---|
| **Milestones** | **Examples** |
| **Level 1** *Treats ischemic stroke patients with intravenous (IV) thrombolysis* | ● Evaluates a straightforward stroke patient and initiates intravenous (IV) thrombolytic treatment appropriately |
| *Identifies eligibility criteria for endovascular recanalization* | ● Describes criteria necessary to be a candidate for endovascular intervention as well as factors which would exclude endovascular intervention |
| *Identifies type and etiology of hemorrhagic stroke* | ● Differentiates subarachnoid, epidural, subdural, and intraparenchymal hemorrhage radiographically<br>● Differentiates deep from lobar hemorrhage and understands the implications on likely cause of hemorrhage |
| **Level 2** *Treats complex patients with ischemic stroke with IV thrombolysis, and manages complications* | ● Manages administration of IV thrombolytics in patients with additional complexity (i.e., stroke in pregnancy, peri-procedural stroke) |
| *Selects candidates for endovascular recanalization and identifies complications* | ● Identifies patients with large vessel occlusion, clinically and radiographically, and appropriately selects those eligible for endovascular intervention |
| *Initiates medical treatment for hemorrhagic stroke and consults with surgical services as needed* | ● Initiates antihypertensive treatment (if indicated) with appropriate blood pressure target depending on type of hemorrhage |
| **Level 3** *Triages and manages multiple patients with ischemic stroke* | ● Responds to, prioritizes, and completes evaluation of multiple simultaneous patients with ischemic stroke |
| *Manages complications of endovascular therapies for acute ischemic stroke* | ● Adjusts blood pressure goals for a patient that experienced reperfusion hemorrhage |
| *Identifies complications of hemorrhagic stroke* | ● Identifies vasospasm in a patient with subarachnoid hemorrhage |
| **Level 4** *Efficiently manages multiple patients with common and uncommon ischemic stroke* | ● Efficiently triages and manages multiple complex patients with acute stroke |
| *Manages complications of hemorrhagic stroke and identifies candidates for invasive intervention* | ● Identifies patient developing obstructive hydrocephalus and contacts neurosurgical colleagues to consider ventriculostomy |

| | |
|---|---|
| **Level 5** *Role models efficient triage and management of ischemic and hemorrhagic strokes*<br><br>*Implements emerging modalities of diagnosis and treatment for ischemic and hemorrhagic stroke* | ● Utilizes MRI or CT perfusion to help guide decision making regarding use of thrombolytics or thrombectomy for wake-up stroke |
| Assessment Models or Tools | ● Case-based discussion<br>● Direct observation<br>● Medical record (chart) audit<br>● Multisource feedback<br>● Simulation |
| Curriculum Mapping | ● |
| Notes or Resources | ● Powers WJ, Rabinstein AA, Ackerson T, et al. Guidelines for the early management of patients with acute ischemic stroke: 2019 update to the 2018 guidelines for the early management of acute ischemic stroke: A guideline for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke.* 2019;50:e344-418. https://www.ahajournals.org/doi/10.1161/STR.0000000000000211. 2021. |

| **Patient Care 4: Post-Acute Care**<br>**Overall Intent:** To identify and provide appropriate post-stroke care and recovery resources | |
|---|---|
| **Milestones** | **Examples** |
| **Level 1** *Recognizes post-acute care settings for stroke rehabilitation and resources available for each level of care* | ● Refers patients to appropriate rehabilitation services including physical, occupational, and speech therapy |
| *Identifies ancillary services involved in post-stroke care and rehabilitation* | ● Describes the role of physical therapy, occupational therapy, speech-language pathologists, physiatry, case management, and social work |
| **Level 2** *Accurately assesses patient's rehabilitative needs and recommends appropriate post-acute care setting* | ● Refers patient to the appropriate post hospital setting (inpatient rehab, sub-acute rehab, long-term acute care, home) |
| *Engages interdisciplinary team members to facilitate stroke rehabilitation* | ● Discusses disposition and barriers to disposition with care team (nursing, case management, social work) |
| **Level 3** *Identifies and initiates management of post-stroke complications* | ● Recognizes and treats for post-stroke mood or other psychiatric disorders such as depression, spasticity, malnutrition, and epilepsy |
| *Engages in comprehensive care for stroke recovery and secondary prevention* | ● Identifies when to refer a patient for post-stroke management to the interdisciplinary team<br>● Optimizes secondary stroke prevention regimen |
| **Level 4** *Consistently integrates social determinants of health, community resources, and interdisciplinary medical team members into a longitudinal care plan for stroke recovery and secondary prevention* | ● Recognizes need for smoking and alcohol cessation and community resources such as driving evaluation post stroke and discusses these issues with the patient<br>● Refers patients to stroke/ aphasia support groups<br>● Works with the interdisciplinary team to care for patients with ongoing neuropsychiatric issues |
| **Level 5** *Engages in scholarship or quality improvement initiatives with a focus on post-stroke recovery, transitions of care, or patient reintegration into their communities* | ● Develops support group/ resources for post-stroke patients<br>● Develops quality initiative to improve transition to home |
| Assessment Models or Tools | ● Direct observation<br>● Medical record (chart) audit<br>● Multisource feedback |
| Curriculum Mapping | ● |
| Notes or Resources | ● Winstein CJ, Stein J, Arena R, et al. Guidelines for adult stroke rehabilitation and recovery. *Stroke*. 2016;47(6):e98-e169. https://www.ahajournals.org/doi/epub/10.1161/STR.0000000000000098. 2021. |

| **Patient Care 5: Telestroke/Remote Consultation/Consultation**<br>**Overall Intent:** To provide remote acute stroke care using telemedicine technology | |
|---|---|
| **Milestones** | **Examples** |
| **Level 1** *Describes approach to remote consultation by phone or using video conferencing technologies* | ● Describes limitations and opportunities for teleconsultation via voice or video consultation |
| **Level 2** *Efficiently obtains a vascular neurology history to appropriately triage patients* | ● Obtains basic stroke history from the patient or family members or emergency department providers via telephone or video<br>● Manages a consult request from a community hospital for a stroke patient who may need advanced care<br>● Receives telestroke alerts and proceeds to emergently evaluate the patient presenting within the thrombolytic window |
| **Level 3** *Establishes rapport with patient/family, bedside provider, and/or consulting providers effectively* | ● Connects with and uses patient's family members or emergency department providers to obtain history and conduct neurological exam via telemedicine technologies |
| **Level 4** *Conducts stroke consultations using remote consultation technology (emergency room, hospital, or outpatient clinic), and provides assessment, treatment, and management recommendations* | ● Efficiently performs a vascular neurology examination using remote consultation technology<br>● Performs accurate NIHSS with use of telemedicine technology<br>● Accurately identifies candidates for acute treatment using remote consultation technology (thrombolysis, thrombectomy)<br>● Accurately diagnoses and implements evaluation and treatment plan in outpatient televisits<br>● Has presenter who is with the patient walk the patient to assess gait when indicated |
| **Level 5** *Engages in scholarship or quality improvement related to telestroke care* | ● Adapts tele-examination as appropriate for acute stroke assessment and acute stroke intervention decisions<br>● Develops quality initiative to aid efficient interfacility transfers |
| Assessment Models or Tools | ● Direct observation<br>● Medical record (chart) audit<br>● Multisource feedback |
| Curriculum Mapping | ● |
| Notes or Resources | ● Demaerschalk BM, Berg J, Chong BW, et al. American Telemedicine Association: Telestroke guidelines. *Telemed J E Health*. 2017;23(5):376-389. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5802246/. 2021. |

| **Medical Knowledge 1: Localization**<br>**Overall Intent:** To use findings from the history and examination to determine the site of the patient's neurologic dysfunction | |
|---|---|
| **Milestones** | **Examples** |
| **Level 1** *Correlates clinical presentation to specific regions of the nervous system and describes basic vascular neuroanatomy* | ● Describes clinical presentation of stroke corresponding to major vascular territories<br>● Differentiates localization of symptoms to central versus peripheral nervous system<br>● Recognizes a patient presenting with a painful Horner's syndrome may be a dissection |
| **Level 2** *Localizes vascular lesions to specific arterial territories of the nervous system and demonstrates knowledge of vascular anatomic variations and collaterals* | ● Differentiates a cortical stroke versus subcortical infarct<br>● Able to identify vascular anatomy on CT angiography/MR angiography/angiogram<br>● Able to localize infarcts on imaging to specific vascular territory |
| **Level 3** *Efficiently localizes vascular lesions to specific arterial and venous territories of the nervous system and demonstrates knowledge of vascular neuroanatomy of the brain, eye, and spinal cord* | ● Describe features concerning for arterial stroke versus venous infarct<br>● Describes symptoms of spinal cord stroke and identify vascular anatomy relating to spinal cord infarcts<br>● Describe symptoms of central retinal artery occlusion and localize to retinal/ophthalmic/ipsilateral carotid artery |
| **Level 4** *Demonstrates knowledge of vascular neuroanatomy to localize uncommon syndromes of the brain, eye, and spinal cord* | ● Localizes the lesion to the left medial longitudinal fasciculus in the pons in a patient with a left internuclear ophthalmoplegia<br>● Identifies a lateral medullary syndrome |
| **Level 5** *Consistently demonstrates advanced detailed knowledge of vascular neuroanatomy in localizing lesions of the brain, eye, and spinal cord* | ● Identifies the affected region of the sympathetic pathway in a patient with Horner's syndrome |
| Assessment Models or Tools | ● Case-based discussion<br>● Direct observation<br>● Medical record (chart) audit<br>● Simulation |
| Curriculum Mapping | ● |
| Notes or Resources | ● Brazis P, Masdeu JC, Biller J. *Localization in Clinical Neurology.* 7th ed. Philadelphia, PA: Wolters Kluwer; 2016. ISBN:978-1496319128. |

| **Medical Knowledge 2: Formulation**<br>**Overall Intent:** To use information gathered in the history and physical exam, localize the lesion, and generate a relevant differential diagnosis | |
|---|---|
| **Milestones** | **Examples** |
| **Level 1** *Synthesizes information to develop a differential diagnosis* | ● Gathers a history of transient episodes of vision loss and speech disturbance with headaches and develops differential diagnoses of migraine, transient ischemic attack (TIA), and seizures but cannot develop a work-up plan |
| **Level 2** *Efficiently synthesizes information to focus and prioritize the differential diagnosis* | ● Evaluates a patient with expressive aphasia and narrows the initial differential diagnoses of stroke, postictal aphasia, and brain neoplasm based on past medical history of hypertension and hyperlipidemia and carotid disease to ischemic and hemorrhagic stroke |
| **Level 3** *Correlates the clinical presentation with presumed etiology* | ● Evaluates a patient for loss of consciousness; obtains a history of palpitations and light-headedness, without a postictal state and with a normal exam; prioritizes syncope over seizure in the differential diagnosis |
| **Level 4** *Correlates the atypical presentations of common and uncommon vascular lesions of the brain, eye, and spinal cord with presumed etiology* | ● Examines a patient with paraparesis and lower extremity areflexia with a working diagnosis of acute inflammatory demyelinating polyneuropathy; reconsiders the localization to include a spinal cord lesion after the patient develops a sensory level the next day |
| **Level 5** *Serves as a role model for complex diagnostic reasoning* | ● Identifies intravascular lymphoma as the cause of stroke in a patient with a history of atrial fibrillation but recurrent strokes despite full anticoagulation |
| Assessment Models or Tools | ● Direct observation<br>● Medical record (chart) audit<br>● Multisource feedback<br>● Simulation |
| Curriculum Mapping | ● |
| Notes or Resources | ● The Society to Improve Diagnosis in Medicine (SIDM). Assessment of Reasoning Tool. https://www.improvediagnosis.org/art/. 2021.<br>● SIDM. Driver Diagram. https://www.improvediagnosis.org/wp-content/uploads/2018/10/Driver_Diagram_-_July_31_-_M.pdf. 2021.<br>● SIDM. Inter-Professional Consensus Curriculum on Diagnosis and Diagnostic Error. https://www.improvediagnosis.org/consensuscurriculum/. 2021. |

| **Medical Knowledge 3: Multimodal Imaging Vascular Neurology (e.g., Computerized Tomography (CT), Magnetic Resonance (MR), Angiography, Ultrasonography)**<br>**Overall Intent:** To interpret commonly used neuroimaging modalities in the context of a patient's presentation | |
|---|---|
| **Milestones** | **Examples** |
| **Level 1** *Selects imaging protocols based on patient comorbidities and/or provisional diagnosis* | ● Identifies major lobes of the brain and regions of the brain stem on CT and MRI<br>● Identifies large- and medium-size vessels of the head and neck on CT angiography and MR angiography |
| **Level 2** *Identifies normal and critical imaging findings on vascular and brain MR and CT* | ● Distinguishes subdural from epidural hemorrhage<br>● Selects imaging modalities based on comparative risks and benefits, effectiveness, and cost |
| **Level 3** *Identifies subtle abnormalities on brain and vascular imaging* | ● Identifies a hyperdense artery suggestive of large vessel occlusion on CT<br>● Demonstrates knowledge of indications for, and limitations of, anatomic and physiologic imaging studies including CT and MR perfusion |
| **Level 4** *Selects and interprets multimodality imaging to guide treatment* | ● Interprets cortical restricted diffusion as a possible postictal phenomenon in a patient with recent status epilepticus<br>● Interprets carotid ultrasound findings in the context of the neurologic work-up |
| **Level 5** *Interprets emerging imaging modalities for use in patient management* | ● Interprets conventional angiography, transcranial Doppler, MR perfusion/spectroscopy<br>● Interprets cerebral angiogram to diagnose moyamoya |
| Assessment Models or Tools | ● Case-based discussion<br>● Direct observation<br>● Medical record (chart) audit<br>● Multisource feedback<br>● Simulation |
| Curriculum Mapping | ● |
| Notes or Resources | ● Online modules<br>● Osborn AG, Digre KB. *Imaging in Neurology.* 1st ed. Philadelphia, PA: Elsevier; 2016. ISBN:978-0323447812. |

| **Medical Knowledge 4: Diagnostic Investigation in Vascular Neurology**<br>**Overall Intent:** To develop a hypothesis-driven and individualized diagnostic approach | |
|---|---|
| **Milestones** | **Examples** |
| **Level 1** *Demonstrates general knowledge of diagnostic tests in vascular neurology*<br><br>*Recognizes indications and implications of common diagnostic tests* | ● Orders a two-dimensional echocardiogram for a patient with an embolic appearing stroke on MRI |
| **Level 2** *Discusses general diagnostic approach appropriate to clinical presentation*<br><br>*Interprets results of common diagnostic tests* | ● Discusses the risks and benefits of IV contrast in neurologic imaging<br><br>● Reviews CT angiogram to identify large vessel occlusion and carotid stenosis |
| **Level 3** *Individualizes diagnostic approach to the specific patient*<br><br>*Recognizes indications and implications of less common testing* | ● Orders a transesophageal echocardiogram in appropriately selected stroke patients, rather than in every stroke patient<br><br>● Recognizes patent foramen ovale may not be causative in a stroke patient, even when one is present |
| **Level 4** *Discusses diagnostic yield and cost-effectiveness of testing*<br><br>*Interprets results of less common diagnostic testing* | ● Orders a focused genetic panel to identify a cause for stroke in the young<br><br>● Discusses benefits and risks of diagnostic angiogram |
| **Level 5** *Demonstrates advanced knowledge of diagnostic testing and controversies* | ● Understands role and utility of brain biopsy in central nervous system vasculitis |
| Assessment Models or Tools | ● Case based assessment<br>● Direct observation<br>● Medical record (chart) audit<br>● Multisource feedback<br>● Simulation |
| Curriculum Mapping | ● |
| Notes or Resources | ● Online modules<br>● Textbooks |

| **Medical Knowledge 5: Ischemic Stroke**<br>**Overall Intent:** To understand risk factors, pathogenesis, and management of ischemic strokes | |
|---|---|
| **Milestones** | **Examples** |
| **Level 1** *Describes common causes of stroke and typical risk factors for stroke in older adults* | ● Identifies common stroke risk factors in older adults (e.g., hypertension, hyperlipidemia, atrial fibrillation, smoking) |
| *Demonstrates knowledge of thrombolytic treatment for stroke, and possible complications* | ● Describes utility of thrombolytic administration and appropriate patient selection<br>● Describes more common complications of thrombolytic administration (e.g., hemorrhage, angioedema) |
| *Demonstrates knowledge of pharmacologic stroke preventative strategies for common stroke etiologies* | ● Matches pharmacologic interventions for secondary stroke prevention with common stroke etiologies (e.g., small vessel disease, large artery atherosclerosis, atrial fibrillation-related cardioembolism) |
| **Level 2** *Demonstrates knowledge of common causes of stroke in children and young adults* | ● Identifies common causes of stroke in children and young adults (e.g., cervical artery dissection, paradoxical embolus) |
| *Demonstrates knowledge of endovascular treatment for stroke, and possible complications* | ● Describes utility of endovascular interventions and demonstrates appropriate patient selection<br>● Describes common complications of endovascular intervention (e.g., vessel perforation, groin site hematoma) |
| *Demonstrates knowledge of pharmacologic stroke preventative strategies for uncommon stroke etiologies* | ● Matches pharmacologic interventions for secondary stroke prevention in uncommon stroke etiologies (e.g., hypercoagulable conditions, genetic conditions) |
| **Level 3** *Demonstrates knowledge of uncommon causes of stroke in older adults* | ● Identifies uncommon causes of stroke in older adults (e.g., non-atherosclerotic vasculopathy, atrial myxoma) |
| *Demonstrates knowledge of treating patients with stroke and complex comorbidities* | ● Reviews considerations of treating stroke patients with complex comorbidities and/or situations (e.g., pregnancy, peri-operative, spinal cord ischemia) |
| *Demonstrates understanding of the indications and limitations for non-acute surgical interventions to prevent stroke* | ● Explains indications and possible complications of non-acute surgical interventions (e.g., carotid endarterectomy, carotid stenting) for prevention of stroke |
| **Level 4** *Demonstrates sophisticated knowledge of the pathophysiology of acute brain ischemia and ischemic stroke etiologies* | ● Develops and delivers educational sessions for more junior learners reviewing stroke etiologies and the pathophysiology of stroke |

| | |
|---|---|
| *Demonstrates sophisticated knowledge of the pharmacology and physiology of treatment options*<br><br>*Formulates stroke preventative strategies in complex patients or in those with rare causes of stroke* | ● Summarizes secondary stroke prevention strategies and recommends an individualized, comprehensive stroke preventative regimen considering comorbidities and other patient factors |
| **Level 5** *Engages in scholarly activity on ischemic stroke pathophysiology*<br><br>*Engages in scholarly activity on acute management of stroke or secondary stroke prevention strategies* | ● Publishes literature relating to acute ischemic stroke pathophysiology<br><br>● Engages as investigator on secondary stroke prevention clinical trials |
| Assessment Models or Tools | ● Case-based discussion<br>● Direct observation<br>● Medical record (chart) audit<br>● Multisource feedback<br>● Simulation |
| Curriculum Mapping | ● |
| Notes or Resources | ● Grotta JC, Albers GW, Broderick JP, et al. *Stroke: Pathophysiology, Diagnosis, and Management.* 6th ed. Elsevier. 2016. ISBN:978-0323295444.<br>● Kernan WN, Ovbiagele B, Black HR, et al. Guidelines for the prevention of stroke in patients with stroke and transient ischemic attack. *Stroke*. 2014;45:2160-2236. https://www.ahajournals.org/doi/10.1161/str.0000000000000024. 2021. |

| **Medical Knowledge 6: Intracerebral Hemorrhage**<br>**Overall Intent:** To review risk factors, pathogenesis, and management of intracerebral hemorrhage | |
|---|---|
| **Milestones** | **Examples** |
| **Level 1** *Demonstrates knowledge of the clinical presentation and common causes, and risk factors for intracerebral hemorrhage*<br><br>*Demonstrates knowledge of the importance of emergency intracerebral hemorrhage treatment* | ● Describes hemorrhage causes and risk factors, such as hypertension, cerebral amyloid angiopathy, trauma<br><br>● Describes understanding that hemorrhagic stroke is a medical emergency |
| **Level 2** *Demonstrates knowledge of uncommon causes and acute complications of intracerebral hemorrhage*<br><br>*Demonstrates knowledge of pharmacologic treatments for intracerebral hemorrhage* | ● Describes complications of hemorrhage, including herniation and hydrocephalus<br><br>● Describes use of antihypertensive agents and anticoagulant reversal agents in treatment of intracerebral hemorrhage |
| **Level 3** *Demonstrates knowledge of causes of intracerebral hemorrhage in all patients, including children and young adults*<br><br>*Demonstrates understanding of the indications, complications, and limitations of surgical interventions for intracerebral hemorrhage* | ● Describes vascular anomalies, tumors, moyamoya, and other more common causes of intracerebral hemorrhage in children and young adults<br><br>● Identifies patients' candidacy for surgical interventions for intracerebral hemorrhage and describes general risks and benefits of those interventions |
| **Level 4** *Demonstrates sophisticated knowledge of the pathophysiology of intracerebral hemorrhage*<br><br>*Demonstrates knowledge of the issues related to the treatment of patients with intracerebral hemorrhage and complex comorbidities, and the complexity of assigning prognosis* | ● Explains management and prognosis of intracerebral hemorrhage in complex patients (pregnancy, metastasis, venous stroke) |
| **Level 5** *Engages in scholarly activity on intracerebral hemorrhage* | ● Publishes literature relating to intracerebral hemorrhage<br>● Engages as investigator on hemorrhagic stroke clinical trials |
| Assessment Models or Tools | ● |
| Curriculum Mapping | ● |

| | |
|---|---|
| Notes or Resources | ● Hemphill JC, Greenberg SM, Anderson CS, et al. Guidelines for the Management of Spontaneous Intracerebral Hemorrhage. *Stroke*. 2015;46:2032-2060. https://www.ahajournals.org/doi/10.1161/str.0000000000000069. 2021. |

| **Medical Knowledge 7: Subarachnoid Hemorrhage**<br>**Overall Intent:** To understand the pathogenesis, natural history, and management of subarachanoid hemorrhage | |
|---|---|
| **Milestones** | **Examples** |
| **Level 1** *Demonstrates knowledge of the clinical presentation and common causes of, and risk factors for subarachnoid hemorrhage*<br><br>*Demonstrates knowledge of the importance of emergency treatment for subarachnoid hemorrhage and ruptured aneurysms* | ● Describes the necessity of anticoagulation reversal, vascular imaging, and neurosurgical intervention in the emergent treatment of subarachnoid hemorrhage<br>● Counsels patients on risk factors of subarachnoid hemorrhage such as smoking, hypertension, alcohol use<br><br>● Describes differences in cause and presentation of traumatic and spontaneous subarachnoid hemorrhage |
| **Level 2** *Demonstrates knowledge of uncommon causes and acute/subacute complications of subarachnoid hemorrhage*<br><br>*Demonstrates knowledge of the natural history and management of unruptured aneurysms* | ● Describes presentation and diagnosis of vasospasm, hydrocephalus, delayed cerebral ischemia, and other complications of subarachnoid hemorrhage<br>● Describes risk of aneurysmal rupture, and difference of rupture based on size and other risk factors<br><br>● Accurately calculates Hunt and Hess score |
| **Level 3** *Demonstrates knowledge of causes of subarachnoid hemorrhage in all patients, including children and young adults, and the long-term sequelae of subarachnoid hemorrhage*<br><br>*Demonstrates knowledge of pharmacologic, surgical, and endovascular treatments for subarachnoid hemorrhage* | ● Describes indications for clipping and/or coiling of ruptured and unruptured aneurysms<br>● Describes rates of recurrence for subarachnoid hemorrhage<br><br>● Describes long-term complications such as seizure, headache, depression, and their management |
| **Level 4** *Demonstrates sophisticated knowledge of the pathophysiology of subarachnoid hemorrhage*<br><br>*Demonstrates knowledge of the issues related to the treatment of patients with subarachnoid hemorrhage and complex comorbidities, and the complexity of assigning prognosis* | ● Discusses self-fulfilling prophecy of early prognosis in subarachnoid hemorrhage |

| | |
|---|---|
| **Level 5** *Engages in scholarly activity on subarachnoid hemorrhage* | ● Performs quality improvement (QI), chart review, or independent research advancing care of subarachnoid hemorrhage |
| Assessment Models or Tools | ● |
| Curriculum Mapping | ● |
| Notes or Resources | ● Connolly Jr ES, Rabinstein AA, Carhuapoma JR, et al. Guidelines for the management of aneurysmal subarachnoid hemorrhage. *Stroke*. 2012;43(6):1711-1737. https://www.ahajournals.org/doi/full/10.1161/str.0b013e3182587839. 2021. |

| **Systems-Based Practice 1: Patient Safety**<br>**Overall Intent:** To engage in the analysis and management of patient safety events, including relevant communication with patients, families, and health care professionals | |
|---|---|
| **Milestones** | **Examples** |
| **Level 1** *Demonstrates knowledge of commonly reported patient safety events*<br><br>*Demonstrates knowledge of how to report patient safety events* | ● Identifies that IV alteplase was administered to a patient taking a direct oral anticoagulants, reports the safety event to the supervising physician and stroke coordinator and files a safety report in the hospital electronic safety report system |
| **Level 2** *Identifies system factors that lead to patient safety events*<br><br>*Reports patient safety events through institutional reporting systems* | ● Identifies lack of appropriate sign-out between the emergency department and stroke unit for patients admitted after reperfusion therapy; discusses the findings with the stroke director and coordinator |
| **Level 3** *Participates in analysis of patient safety events*<br><br>*Participates in disclosure of patient safety events to patients and families* | ● Participates in a root cause analysis for a patient with a brainstem stroke and worsening neurological symptoms leading to airway compromise and emergent intubation<br><br>● Participates in disclosure of the medical error to the patient's family |
| **Level 4** *Conducts analysis of patient safety events and offers error prevention strategies*<br><br>*Discloses patient safety events to patients and families* | ● Collaborates in a safety analysis of patients' falls in the stroke unit and provides suggestion to use the bed alarm system to improve processes to enhance patient safety<br><br>● Discloses a medication error to patients/families |
| **Level 5** *Actively engages teams and processes to modify systems to prevent patient safety events*<br><br>*Mentors others in the disclosure of patient safety events* | ● Engages appropriate stakeholders to improve awareness of stroke symptoms and provide education in the hospital and community<br><br>● Leads a simulation for more junior residents in medical error disclosure |
| Assessment Models or Tools | ● Chart audit<br>● Direct observation<br>● Documentation of patient safety project<br>● E-module multiple choice tests<br>● Multisource feedback<br>● Portfolio<br>● Simulation |

| | |
|---|---|
| Curriculum Mapping | ● |
| Notes or Resources | ● Institute of Healthcare Improvement. http://www.ihi.org/Pages/default.aspx. 2021. |

| **Systems-Based Practice 2: Quality Improvement (QI) in Stroke System of Care**<br>**Overall Intent:** To conduct a QI project | |
|---|---|
| **Milestones** | **Examples** |
| **Level 1** *Demonstrates knowledge of basic quality improvement methodologies and stroke center metrics* | ● Receives a report from the hospital QI committee about initiation of antithrombotic regimen in stroke patients within 48 hours and can interpret the findings and compare them to the expected rate by the Joint Commission |
| **Level 2** *Describes local quality improvement initiatives (e.g., door-to-needle times, smoking cessation)* | ● Describes initiatives by the local hospital and emergency medical services to decrease door-to-needle times for tissue plasminogen activator administration in the county |
| **Level 3** *Participates in local quality improvement initiatives* | ● Participates in an ongoing QI project to perform swallow evaluation in all stroke patients within 12 hours after admission, though not involved in the study design<br>● Identifies gaps in patient care and assesses the utility and efficacy of protocols and algorithms for improving stroke processes |
| **Level 4** *Demonstrates the skills required to identify, develop, implement, and analyze a quality improvement project* | ● Designs a QI project that will allow for urgent referrals to be seen in a timely fashion<br>● Presents results of QI initiative during stroke center site survey |
| **Level 5** *Creates, implements, and assesses quality improvement initiatives within the stroke system of care* | ● Analyzes and publishes the findings of a QI project to improve awareness of stroke symptoms within the community |
| Assessment Models or Tools | ● Chart audit<br>● Direct observation<br>● Documentation of QI project<br>● E-module multiple choice tests<br>● Multisource feedback<br>● Portfolio<br>● Simulation |
| Curriculum Mapping | ● |
| Notes or Resources | ● Institute of Healthcare Improvement. http://www.ihi.org/Pages/default.aspx. 2021. |

| **Systems-Based Practice 3: System Navigation for Patient-Centered Care**<br>**Overall Intent:** To effectively navigate the health care system, including the interdisciplinary team and other care providers, to adapt care to a specific patient population to ensure high-quality patient outcomes | |
|---|---|
| **Milestones** | **Examples** |
| **Level 1** *Demonstrates knowledge of care coordination*<br><br>*Performs safe and effective transitions of care/hand-offs in routine clinical situations*<br><br>*Demonstrates knowledge of population and community health needs and disparities* | ● Identifies the members of the interprofessional team<br><br>● Lists the essential components of an effective sign-out and care transition, including sharing information necessary for successful transitions<br><br>● Identifies components of social determinants of health and how they impact the delivery of patient care |
| **Level 2** *Coordinates care of patients in routine clinical situations effectively using the roles of the interprofessional teams*<br><br>*Performs safe and effective transitions of care/hand-offs in complex clinical situations*<br><br>*Identifies specific population and community health needs and inequities for the local population and community* | ● Contacts social work, nursing, therapy, and pharmacy colleagues to assist in the care of a stroke patient<br><br>● Provides anticipatory guidance to the resident team regarding possible post-thrombolytic or endovascular intervention complications in a stroke patient<br><br>● Identifies patients at risk for specific health outcomes related to health literacy concerns |
| **Level 3** *Coordinates care of patients in complex clinical situations, effectively using the roles of their interprofessional teams*<br><br>*Supervises transitions of care by other team members*<br><br>*Effectively uses local resources to meet the needs of a patient population and community* | ● Coordinates multidisciplinary team-based care for patients requiring acute stroke intervention<br><br>● Supervises more junior residents when patients are transitioned throughout the spectrum of care of a stroke patient |
| **Level 4** *Models effective coordination of patient-centered care among different disciplines and specialties* | ● Leads a multidisciplinary team meeting for a patient with infectious endocarditis to determine treatment course |

| | |
|---|---|
| *Models safe and effective transitions of care/hand-offs within and across health care delivery systems including outpatient settings*<br><br>*Adapts practice to provide for the needs of specific populations* | ● Leads a multidisciplinary discharge conference for the transition of a patient from the hospital to an appropriate discharge disposition<br><br>● Facilitates participation of patients in stroke support groups or other local resources to maximize stroke recovery |
| **Level 5** *Improves quality of transitions of care within and across health care delivery systems to optimize patient outcomes*<br><br>*Leads innovations in adapting practice and systems for populations and communities with health care disparities* | ● Designs a rapid post-stroke discharge follow-up clinic<br>● Designs a TIA clinic facilitating rapid outpatient TIA work-up<br><br>● Designs a curriculum on social determinants of health<br>● Engages in health services research |
| Assessment Models or Tools | ● Direct observation<br>● Medical record (chart) audit<br>● Multisource feedback<br>● Simulation |
| Curriculum Mapping | ● |
| Notes or Resources | ● Centers for Disease Control and Prevention. Population Health Training. https://www.cdc.gov/pophealthtraining/whatis.html. 2021.<br>● Skochelak SE, Hawkins RE, Lawson LE, Starr SR, Borkan JM, Gonzalo JD. *AMA Education Consortium: Health Systems Science.* 1st ed. Philadelphia, PA: Elsevier; 2016. https://commerce.ama-assn.org/store/ui/catalog/productDetail?product_id=prod2780003. 2021. |

| **Systems-Based Practice 4: Physician Role in Health Care Systems**<br>**Overall Intent:** To understand own role in the complex health care system and how to optimize the system to improve patient care and the health system's performance | |
|---|---|
| **Milestones** | **Examples** |
| **Level 1** *Describes basic health care payment systems (e.g., government, private, public, uninsured care) and practice models*<br><br>*Identifies basic knowledge domains for effective transition to practice (e.g., information technology, legal, billing and coding, financial, personnel)* | ● Recognizes the multiple, often competing forces in the health care system<br>● Recognizes there are different payment systems, such as Medicare, Medicaid, Veterans Affairs (the VA), and commercial third-party payers<br><br>● Understands the impact of health plan features, including formularies<br>● Understands proper documentation is required for billing and coding |
| **Level 2** *Delivers patient-centered care considering the patient's economic constraints*<br><br>*Demonstrates use of information technology required for medical practice (e.g., electronic health record, documentation required for billing and coding)* | ● Identifies that late discharges impact bed availability<br>● Completes documentation to obtain approval for prior authorization<br><br>● Applies appropriate coding, with supervision, in compliance with regulations |
| **Level 3** *Engages with patients in shared decision making, informed by each patient's payment models*<br><br>*Consistently demonstrates timely and accurate documentation, including coding and billing requirements* | ● Understands, accesses, and analyzes own performance data<br>● Uses shared decision making and adapts choice of testing depending on the relevant clinical needs<br><br>● Completes notes for patient encounters within timeframe established by the institution |
| **Level 4** *Uses available resources to promote optimal patient care (e.g., community resources, patient assistance resources) considering each patient's payment model*<br><br>*Implements changes in individual practice patterns in response to professional requirements and in preparation for practice* | ● Collaborates with the institution to improve patient assistance resources<br>● Reviews patient's formulary and chooses an appropriate medication that will be covered by insurance or identifies programs to provide financial support for medication coverage<br><br>● Develops a post-residency plan for individual practice or additional education |
| **Level 5** *Advocates for systems change that enhances high-value, efficient, and effective patient care* | ● Improves informed consent process for non-English-speaking patients requiring interpreter services |

| | |
|---|---|
| *Educates others to prepare them for transition to practice* | ● Works with state medical association to advocate for access to neurologic care |
| Assessment Models or Tools | ● Direct observation<br>● Medical record (chart) audit |
| Curriculum Mapping | ● |
| Notes or Resources | ● Agency for Healthcare Research and Quality. Major Physician Measurement Sets. https://www.ahrq.gov/professionals/quality-patient-safety/talkingquality/create/physician/measurementsets.html. 2021.<br>● Dzau VJ, McClellan MB, McGinnis JM, et al. Vital directions for health and health care: priorities from a National Academy of Medicine initiative. *JAMA*. 2017;317(14):1461-1470. https://nam.edu/vital-directions-for-health-health-care-priorities-from-a-national-academy-of-medicine-initiative/. 2021.<br>● The Commonwealth Fund. Health Reform Resource Center. http://www.commonwealthfund.org/interactives-and-data/health-reform-resource-center#/f:@facasubcategoriesfacet63677=[Individual%20and%20Employer%20Responsibility. 2021.<br>● The Kaiser Family Foundation. www.kff.org. 2021. |

| **Practice-Based Learning and Improvement 1: Evidence-Based and Informed Practice**<br>**Overall Intent:** To incorporate evidence from varied sources to optimize patient care, and to critically appraise the sources and analyze conflicting evidence | |
|---|---|
| **Milestones** | **Examples** |
| **Level 1** *Demonstrates how to access and use available evidence and to incorporate patient preferences and values to care for a routine patient* | ● Searches for appropriate evidence-based guidelines for a patient with acute ischemic stroke |
| **Level 2** *Articulates clinical questions and elicits patient preferences and values to guide evidence-based care* | ● Asks about patient preferences for carotid revascularization and searches literature for available options |
| **Level 3** *Locates and applies the best available evidence, integrated with patient preference, to the care of complex patients* | ● Applies evidence for alternate cholesterol-lowering therapy in a patient with stroke who declines statin therapy |
| **Level 4** *Critically appraises and applies evidence, and interprets conflicting evidence to guide care, tailored to the individual patient* | ● Accesses the primary literature to address a unique clinical situation when the evidence is unclear or emerging<br>● Identifies new evidence that challenges current practice and appropriately applies |
| **Level 5** *Coaches others to critically appraise and apply evidence for complex patients, and/or participates in the development of guidelines* | ● Teaches an evidence-based medicine course |
| Assessment Models or Tools | ● Direct observation<br>● Journal club assessment<br>● Presentation |
| Curriculum Mapping | ● |
| Notes or Resources | ● U.S. National Library of Medicine. PubMed Tutorial. https://www.nlm.nih.gov/bsd/disted/pubmedtutorial/cover.html. 2021. |

| **Practice-Based Learning and Improvement 2: Reflective Practice and Commitment to Personal Growth**<br>**Overall Intent:** To seek performance data and develop a learning plan | |
|---|---|
| **Milestones** | **Examples** |
| **Level 1** *Accepts responsibility for personal and professional development by establishing goals* | ● Establishes educational goals |
| *Identifies the factors that contribute to gap(s) between expectations and actual performance* | ● Identifies that lack of experience and review of the literature contributes to performance gaps |
| *Actively seeks opportunities to improve* | ● Seeks feedback from other team members |
| **Level 2** *Demonstrates openness to performance data (feedback and other input) to inform goals* | ● Identifies gaps in diagnostic skills using feedback from others |
| *Analyzes and reflects on the factors that contribute to gap(s) between expectations and actual performance* | ● Seeks opportunity to improve communication skills |
| *Designs and implements a learning plan, with prompting* | ● Meets with mentor to select elective experiences to remedy performance gaps |
| **Level 3** *Seeks performance data sporadically, with adaptability and humility* | ● Takes input from peers/colleagues and supervisors to gain complex insight into personal strengths and weaknesses<br>● Accepts feedback in an appreciative and non-defensive manner |
| *Institutes behavioral change(s) to narrow the gap(s) between expectations and actual performance* | ● Implements a structured reading plan |
| *Independently creates and implements a learning plan* | ● Independently selects elective experiences to remedy performance gaps |
| **Level 4** *Consistently seeks performance data* | ● Establishes a quarterly meeting with a mentor to review continuity clinic performance data |
| *Challenges assumptions and considers alternatives in narrowing the gap(s) between expectations and actual performance* | ● Proposes study sessions or journal club sessions with colleagues on specific topics |

| | |
|---|---|
| *Uses performance data to measure the effectiveness of the learning plan and improves it when necessary* | |
| **Level 5** *Models professionalism by seeking performance data with adaptability and humility*<br><br>*Coaches others on reflective practice*<br><br>*Facilitates the design and implementation of learning plans for others* | ● Discusses personal successes and challenges in performance gaps with residents<br><br>● Counsels others in effective team dynamics<br><br>● Mentors residents in review of performance data and advises on design of learning plan |
| Assessment Models or Tools | ● Direct observation<br>● Multisource feedback<br>● Portfolios<br>● Review of individual learning plans and rotation schedule |
| Curriculum Mapping | ● |
| Notes or Resources | ● Hojat M, Veloski JJ, Gonnella JS. Measurement and correlates of physicians' lifelong learning. *Academic Medicine.* 2009;84(8):1066-1074. https://journals.lww.com/academicmedicine/fulltext/2009/08000/Measurement_and_Correlates_of_Physicians__Lifelong.21.aspx. 2021.<br>● Lockspeiser TM, Schmitter PA, Lane JL, Hanson JL, Rosenberg AA, Park YS. Assessing residents' written learning goals and goal writing skill: validity evidence for the learning goal scoring rubric. *Academic Medicine*. 2013;88(10):1558-1563. https://journals.lww.com/academicmedicine/fulltext/2013/10000/Assessing_Residents__Written_Learning_Goals_and.39.aspx. 2021. |

| **Professionalism 1: Professional Behavior and Ethical Principles**<br>**Overall Intent:** To demonstrate ethical/professional behaviors and use resources to address ethical/ professional conflicts | |
|---|---|
| **Milestones** | **Examples** |
| **Level 1** *Identifies and describes potential triggers for professionalism lapses and how to report them*<br><br>*Demonstrates knowledge of ethical principles related to patient care* | ● Understands that sleep deprivation can be a trigger for a lapse in professionalism<br>● Demonstrates knowledge of system to report breaches of professionalism in own institution<br><br>● Discusses the basic principles underlying ethics and professionalism and how they apply in various situations |
| **Level 2** *Demonstrates insight into professional behavior in routine situations and takes responsibility*<br><br>*Analyzes straightforward situations using ethical principles* | ● Acts professionally in daily interactions<br>● Acknowledges lapses without becoming defensive, making excuses, or blaming others, and takes steps to make amends<br>● Appreciates constructive criticism and takes steps toward improvement<br><br>● Monitors and responds to fatigue, hunger, stress, etc. in self and team members<br>● Applies ethical principles to straightforward informed consent |
| **Level 3** *Demonstrates professional behavior in complex or stressful situations*<br><br>*Analyzes complex situations using ethical principles* | ● Navigates situations while under stress or when there are system barriers<br>● Interacts with consulting providers in a professional manner while managing multiple consultations<br><br>● Applies ethical principles to end-of-life situations |
| **Level 4** *Intervenes to prevent professionalism lapses in oneself and others*<br><br>*Recognizes and uses appropriate resources for managing and resolving ethical dilemmas as needed* | ● Assumes positive intent in evaluating others' perspective<br>● Takes action to help a resident/colleague who is distressed or using substances<br><br>● Requests ethics consult for patients who are unable to make their own decisions and next of kin is not available |
| **Level 5** *Coaches others when their behavior fails to meet professional expectations*<br><br>*Identifies and seeks to address system-level factors that induce or exacerbate ethical problems or impede their resolution* | ● Serves as peer advisor about professional expectations and behavior<br>● Serves as the fellow member of the Institutional Review Board (IRB), ethics, or peer-review committee<br><br>● Identifies and works to resolve institutional policies that contribute to clinician stress |
| Assessment Models or Tools | ● Case-based assessment |

| | |
|---|---|
| | ● Direct observation<br>● Multisource feedback<br>● Simulation |
| Curriculum Mapping | ● |
| Notes or Resources | ● American Medical Association. Ethics. https://www.ama-assn.org/delivering-care/ama-code-medical-ethics. 2021.<br>● Bernat JL. *Ethical Issues in Neurology*. 3rd ed. Philadelphia, PA: Lippincott Williams & Wilkins; 2008. ISBN:978-0781790604.<br>● Bynny RL, Paauw DS, Papadakis MA, Pfeil S. *Medical Professionalism Best Practices: Professionalism in the Modern Era*. Aurora, CO: Alpha Omega Alpha Medical Society; 2017. *Medical Professionalism Best Practices: Professionalism in the Modern Era*. Aurora, CO: Alpha Omega Alpha Medical Society; 2017. http://alphaomegaalpha.org/pdfs/Monograph2018.pdf. 2021.<br>● Levinson W, Ginsburg S, Hafferty FW, Lucey CR. *Understanding Medical Professionalism*. 1st ed. New York, NY: McGraw-Hill Education; 2014. ISBN:978-0071807432. |

| **Professionalism 2: Accountability/Conscientiousness**<br>**Overall Intent:** To take responsibility for their actions and the impact of their behavior on patients and members of the team | |
|---|---|
| **Milestones** | **Examples** |
| **Level 1** *Takes responsibility for failure to complete tasks and responsibilities, identifies potential contributing factors, and describes strategies for ensuring timely task completion in the future*<br><br>*Responds promptly to requests or reminders to complete tasks and responsibilities* | ● Adapts workflow to improve timeliness of note completion<br><br>● Responds promptly to reminders from program administrator to complete work hour logs |
| **Level 2** *Performs tasks and responsibilities in a timely manner with appropriate attention to detail in routine situations*<br><br>*Recognizes situations that may impact one's own ability to complete tasks and responsibilities in a timely manner* | ● Completes and documents safety modules, procedure review, and licensing requirements on time<br>● Completes accurate documentation without copy/paste errors<br><br>● Proactively recognizes it may be difficult to complete a task before going out of town and makes plans accordingly |
| **Level 3** *Performs tasks and responsibilities in a timely manner with appropriate attention to detail in complex or stressful situations*<br><br>*Proactively implements strategies to ensure the needs of patients, teams, and systems are met* | ● Triages multiple telestroke consults and transfer phone calls to provide timely, safe, and comprehensive care<br>● Asks for assistance from faculty members when needed<br><br>● Adopts solutions developed through QI projects<br>● Establishes multidisciplinary rounds to identify and address any patient care needs |
| **Level 4** *Recognizes situations in which one's own behavior may impact others' ability to complete tasks and responsibilities in a timely manner* | ● Demonstrates awareness of others' interdependence upon them in team-based activities<br>● Addresses team issues that impede efficient completion of patient care tasks<br>● Redistributes team workload to ensure equitable balance |
| **Level 5** *Develops or implements strategies to improve system-wide problems and enable oneself and others to complete tasks and responsibilities in a timely fashion* | ● Establishes daily nurse manager meetings to streamline patient discharges<br>● Develops templates to aid in improving timely documentation<br>● Develops order sets to improve efficiency and thoroughness |
| Assessment Models or Tools | ● Compliance with deadlines and timelines<br>● Direct observation<br>● Multisource feedback<br>● Self-evaluations and reflective tools |

| | |
|---|---|
| | ● Simulation |
| Curriculum Mapping | ● |
| Notes or Resources | ● AMA. Ethics. https://www.ama-assn.org/sites/ama-assn.org/files/corp/media-browser/principles-of-medical-ethics.pdf. 2021.<br>● Code of conduct from fellow/resident institutional manual<br>● Expectations of residency program regarding accountability and professionalism |

| **Professionalism 3: Well-Being**<br>**Overall Intent:** To develop a plan for personal and professional well-being | |
|---|---|
| **Milestones** | **Examples** |
| **Level 1** *With assistance, recognizes sense of personal and professional well-being* | ● Discusses the impact of burnout on well-being |
| **Level 2** *Independently recognizes status of personal and professional well-being* | ● Knows how to access local mental health resources<br>● Attends institutional lecture on available resources |
| **Level 3** *With assistance, proposes a plan to optimize personal and professional well-being* | ● Works with a mentor to optimize work-life integration |
| **Level 4** *Independently develops a plan to optimize personal and professional well-being* | ● Organizes group outing for co-fellows |
| **Level 5** *Coaches others when emotional responses or limitations in knowledge/skills do not meet professional expectations* | ● Develops a departmental or institutional wellness program<br>● Recognizes burnout in coworkers and helps them with obtaining resources for support |
| Assessment Models or Tools | ● Direct observation<br>● Group interview or discussions for team activities<br>● Individual interview<br>● Institutional online training modules |
| Curriculum Mapping | ● |
| Notes or Resources | ● This subcompetency is not intended to evaluate a fellow's well-being. Rather, the intent is to ensure that each fellow has the fundamental knowledge of factors that impact well-being, the mechanism by which those factors impact well-being, and available resources and tools to improve well-being.<br>● Accreditation Council for Graduate Medical Education. Tools and Resources. https://www.acgme.org/What-We-Do/Initiatives/Physician-Well-Being/Resources. 2021.<br>● Local resources, including Employee Assistance |

| **Interpersonal and Communication Skills 1: Patient- and Family-Centered Communication**<br>**Overall Intent:** To deliberately use language and behaviors to form constructive relationships with patients | |
|---|---|
| **Milestones** | **Examples** |
| **Level 1** *Uses language and non-verbal behavior to demonstrate respect and establish rapport*<br><br>*Identifies the need to individualize communication strategies based on the patient's/patient's family's expectations and understanding* | ● Monitors and controls tone, non-verbal responses, and language to encourage dialogue<br>● Accurately communicates role in the health care system to patients/families<br><br>● Ensures communication is at the appropriate level for a layperson |
| **Level 2** *Establishes a therapeutic relationship in straightforward encounters using active listening and clear language*<br><br>*Communicates compassionately with the patient/patient's family to clarify expectations and verify understanding of the clinical situation* | ● Restates patient perspective when discussing diagnosis and management<br>● Counsels patient with new onset epilepsy about driving restrictions<br><br>● Participates in a family meeting to discuss patient care goals |
| **Level 3** *Establishes a therapeutic relationship in challenging patient encounters*<br><br>*Communicates medical information in the context of the patient's/patient's family's values, uncertainty, and conflict* | ● Effectively counsels a patient with opioid use disorder on pain management strategies<br><br>● Organizes a family meeting to address caregiver expectations for a stroke patient transition to home; reassesses patient and family understanding and anxiety |
| **Level 4** *Easily establishes therapeutic relationships, with attention to the patient's/patient's family's concerns and context, regardless of complexity of the situation*<br><br>*Uses shared decision making to align the patient's/patient's family's values, goals, and preferences with treatment options* | ● Continues to engage family members with disparate goals in the care of a patient with anoxic encephalopathy<br><br>● Recommends a plan to align patient and family goals for patient to remain at home |
| **Level 5** *Mentors others in situational awareness and critical self-reflection to consistently develop positive therapeutic relationships* | ● Leads debriefing after a difficult family meeting<br>● Leads teaching session on conflict resolution |

| | |
|---|---|
| *Role models shared decision making in the context of the patient's/patient's family's values, uncertainty, and conflict* | ● Establishes effective relationships with families after a grievance |
| Assessment Models or Tools | ● Direct observation<br>● Self-assessment including self-reflection exercises<br>● Standardized patients<br>● Structured case discussions |
| Curriculum Mapping | ● |
| Notes or Resources | ● Laidlaw A, Hart J. Communication skills: an essential component of medical curricula. Part I: Assessment of clinical communication: AMEE Guide No. 51. *Med Teach*. 2011;33(1):6-8. https://www.tandfonline.com/doi/full/10.3109/0142159X.2011.531170. 2021.<br>● Symons AB, Swanson A, McGuigan D, Orrange S, Akl EA. A tool for self-assessment of communication skills and professionalism in residents. *BMC Med Educ*. 2009;9:1. https://bmcmededuc.biomedcentral.com/articles/10.1186/1472-6920-9-1. 2021. |

| **Interpersonal and Communication Skills 2: Barrier and Bias Mitigation**<br>**Overall Intent:** To recognize barriers and biases in communication and develop approaches to mitigate them | |
|---|---|
| **Milestones** | **Examples** |
| **Level 1** *Identifies common barriers to effective patient care (e.g., language, disability)* | ● Demonstrates awareness of interpretation services |
| **Level 2** *Identifies complex barriers to effective patient care (e.g., health literacy, cultural differences)* | ● Demonstrates respect for different cultural practices<br>● Provides alternate patient education materials for patients with low health literacy |
| **Level 3** *Recognizes personal biases and mitigates barriers to optimize patient care when prompted* | ● Reflects on assumptions about a patient's sexuality or gender identity |
| **Level 4** *Recognizes personal biases and proactively mitigates barriers to optimize patient care* | ● Identifies socioeconomic factors for patients labeled as "non-compliant" and adapts regimens to improve accessibility |
| **Level 5** *Mentors others on recognition of bias and mitigation of barriers to optimize patient care* | ● Role models self-awareness and reflection around explicit and implicit biases<br>● Develops programs that mitigate barriers to patient education |
| Assessment Models or Tools | ● Direct observation<br>● Self-assessment<br>● Standardized patients<br>● Structured case discussions |
| Curriculum Mapping | ● |
| Notes or Resources | ● Laidlaw A, Hart J. Communication skills: an essential component of medical curricula. Part I: Assessment of clinical communication: AMEE Guide No. 51. *Med Teach*. 2011;33(1):6-8. https://www.tandfonline.com/doi/full/10.3109/0142159X.2011.531170. 2021.<br>● Symons AB, Swanson A, McGuigan D, Orrange S, Akl EA. A tool for self-assessment of communication skills and professionalism in residents. *BMC Med Educ*. 2009;9:1. https://bmcmededuc.biomedcentral.com/articles/10.1186/1472-6920-9-1. 2021. |

| **Interpersonal and Communication Skills 3: Interprofessional and Team Communication**<br>**Overall Intent:** To effectively communicate with the health care team, including consultants, in both straightforward and complex situations | |
|---|---|
| **Milestones** | **Examples** |
| **Level 1** *Respectfully requests a consultation*<br><br>*Recognizes the role of a vascular neurology consultant*<br><br>*Uses language that values all members of the health care team* | ● Shows respect in health care team communications through words and actions<br><br>● Listens to and considers others' points of view, is nonjudgmental and actively engaged |
| **Level 2** *Confirms understanding of consultant recommendations*<br><br>*Respectfully accepts a consultation request*<br><br>*Communicates information effectively with all health care team members* | ● Verifies rationale for recommendations given<br><br>● Accepts all consult requests graciously<br><br>● Uses teach-back strategies to confirm understanding |
| **Level 3** *Clearly and concisely formulates a consultation request*<br><br>*Clearly and concisely responds to a consultation request*<br><br>*Uses active listening to adapt communication style to fit team needs* | ● Clarifies the rationale for ordering a cardiology consultation in a young patient with a stroke and patent foramen ovale<br><br>● Writes recommendations in the chart to clearly communicate rationale and plan<br><br>● Uses verbal and written communication strategies to improve understanding during consultations |
| **Level 4** *Coordinates recommendations from different members of the health care team to optimize patient care*<br><br>*Solicits and communicates feedback to other members of the health care team* | ● Reconciles conflicting recommendations from multiple consulting teams<br><br>● Respectfully provides end of rotation feedback to other members of the team |
| **Level 5** *Role models and facilitates flexible communication strategies that value input from all health care team members, resolving conflict when needed* | ● Organizes and leads a multidisciplinary team meeting to discuss and resolve potentially conflicting points of view on a plan of care |
| Assessment Models or Tools | ● Direct observation |

| | |
|---|---|
| | ● Medical record (chart) review<br>● Multisource feedback<br>● Simulation |
| Curriculum Mapping | ● |
| Notes or Resources | ● Green M, Parrott T, Crook G. Improving your communication skills. *BMJ.* 2012;344:e357. https://www.bmj.com/content/344/bmj.e357. 2021.<br>● Haig KM, Sutton S, Whittington J. SBAR: a shared mental model for improving communication between clinicians. *Jt Comm J Qual Patient Saf*. 2006;32(3):167-175. https://www.jointcommissionjournal.com/article/S1553-7250(06)32022-3/fulltext. 2021.<br>● Henry SG, Holmboe ES, Frankel RM. Evidence-based competencies for improving communication skills in graduate medical education: a review with suggestions for implementation. *Med Teach*. 2013;35(5):395-403. https://www.tandfonline.com/doi/full/10.3109/0142159X.2013.769677. 2021.<br>● Roth CG, Eldin KW, Padmanabhan V, Freidman EM. Twelve tips for the introduction of emotional intelligence in medical education. *Med Teach.* 2018:1-4. https://www.tandfonline.com/doi/full/10.1080/0142159X.2018.1481499. 2021. |

| **Interpersonal and Communication Skills 4: Communication within Health Care Systems**<br>**Overall Intent:** To communicate effectively and appropriately using a variety of methods | |
|---|---|
| **Milestones** | **Examples** |
| **Level 1** *Documents accurate and up-to-date patient information*<br><br>*Communicates in a way that safeguards patient information* | ● Performs medication reconciliation<br><br>● Protects personal health information when communicating with other members of the health care team |
| **Level 2** *Demonstrates diagnostic reasoning through organized and timely notes*<br><br>*Communicates through appropriate channels as required by institutional policy* | ● Documents in the medical record rationale for obtaining transcranial Dopplers in subarachnoid hemorrhage<br><br>● Only communicates patient information through secured methods |
| **Level 3** *Communicates diagnostic and therapeutic reasoning*<br><br>*Selects optimal mode of communication based on clinical context* | ● Documents in the medical record rationale for angiogram in a patient with complicated vascular anatomy<br><br>● Calls patient directly with urgent lab results instead of sending message in the electronic health record (EHR) |
| **Level 4** *Demonstrates concise, organized written and verbal communication, including anticipatory guidance* | ● Reviews with patient the written contingency plan of when to call emergency medical services after a stroke or TIA |
| **Level 5** *Guides departmental or institutional communication policies and procedures* | ● Teaches colleagues how to improve discharge summaries and other communications |
| Assessment Models or Tools | ● Direct observation<br>● Medical record (chart) review<br>● Multisource feedback<br>● Simulation |
| Curriculum Mapping | ● |
| Notes or Resources | ● Bierman JA, Hufmeyer KK, Liss DT, Weaver AC, Heiman HL. Promoting responsible electronic documentation: validity evidence for a checklist to assess progress notes in the electronic health record. *Teach Learn Med.* 2017;29(4):420-432. https://www.tandfonline.com/doi/full/10.1080/10401334.2017.1303385. 2021.<br>● Haig KM, Sutton S, Whittington J. SBAR: a shared mental model for improving communication between clinicians. *Jt Comm J Qual Patient Saf*. 2006;32(3):167-175. https://www.jointcommissionjournal.com/article/S1553-7250(06)32022-3/fulltext. 2021. |

To help programs transition to the new version of the Milestones, the original Milestones 1.0 have been mapped to the new Milestones 2.0; it is indicated if subcompetencies are similar between versions. These are not exact matches but include some of the same elements. Not all subcompetencies map between versions. Inclusion or exclusion of any subcompetency does not change the educational value or impact on curriculum or assessment.

| Milestones 1.0 | Milestones 2.0 |
|---|---|
| PC1: History | PC1: History |
| PC2: Vascular Neurological Examination | PC2: Vascular Neurological Examination |
| PC3: Ischemic Stroke Reperfusion Treatment and Management | PC3: Acute Stroke Intervention and Management<br>PC5: Telestroke/Remote Consultation/Consultation<br>MK3: Multimodal Imaging in Vascular Neurology |
| PC4: Treatment and Management of Patients with Cerebrovascular Disease | PC3: Acute Stroke Intervention and Management<br>PC4: Post- Acute Care |
| MK1: Localization | MK1: Localization |
| MK2: Formulation | MK2: Formulation |
| MK3: Imaging in Vascular Neurology | MK3: Multimodal Imaging in Vascular Neurology |
| MK4: Diagnostic Investigation in Vascular Neurology | MK4: Diagnostic Investigation in Vascular Neurology |
| MK5: Ischemic Stroke | MK5: Ischemic Stroke |
| MK6: Intracerebral Hemorrhage | MK6: Intracerebral Hemorrhage |
| MK7: Subarachnoid Hemorrhage | MK7: Subarachnoid Hemorrhage |
| SBP1: Cost- and risk/benefit-appropriate practice | SBP4: Physician Role in Health Care Systems |
| SBP2: Work in interprofessional teams to enhance patient safety | SBP1: Patient Safety<br>SBP2: Quality Improvement in Stroke System of Care |
| SBP3: Continuum of Care | SBP3: System Navigation for Patient-Centered Care |
| PBLI1: Self-directed Learning | PBLI2: Reflective Practice and Commitment to Personal Growth |
| PBLI2: Locate, Appraise, and Assimilate Evidence from Scientific Studies Related to the Patient's Health Problems | PBLI1: Evidence-Based in Informed Practice |
| PROF1: Compassion, Integrity, Accountability, and Respect for Self and Others | PROF1: Professional Behavior and Ethical Principles<br>PROF2: Accountability/Conscientiousness<br>ICS2: Barrier and Bias Mitigation |
| PROF2: Knowledge About and Adherence to the Ethical Principles Relevant to the Practice of Medicine | PROF1: Professional Behavior and Ethical Principles |

| | |
|---|---|
| | PROF3: Well-Being |
| ICS1: Relationship Development, Teamwork, and Managing Conflict | ICS1: Patient- and Family-Centered Communication<br>ICS3: Interprofessional and Team Communication |
| ICS2: Information Sharing, Gathering, and Technology | ICS4: Communication within Health Care Systems |

## Available Milestones Resources

*Clinical Competency Committee Guidebook*, updated 2020 - https://www.acgme.org/Portals/0/ACGMEClinicalCompetencyCommitteeGuidebook.pdf?ver=2020-04-16-121941-380

*Clinical Competency Committee Guidebook Executive Summaries*, New 2020 - https://www.acgme.org/What-We-Do/Accreditation/Milestones/Resources - Guidebooks - Clinical Competency Committee Guidebook Executive Summaries

*Milestones Guidebook*, updated 2020 - https://www.acgme.org/Portals/0/MilestonesGuidebook.pdf?ver=2020-06-11-100958-330

*Milestones Guidebook for Residents and Fellows*, updated 2020 - https://www.acgme.org/Portals/0/PDFs/Milestones/MilestonesGuidebookforResidentsFellows.pdf?ver=2020-05-08-150234-750

Milestones for Residents and Fellows PowerPoint, new 2020 -https://www.acgme.org/Residents-and-Fellows/The-ACGME-for-Residents-and-Fellows

Milestones for Residents and Fellows Flyer, new 2020 https://www.acgme.org/Portals/0/PDFs/Milestones/ResidentFlyer.pdf

*Implementation Guidebook*, new 2020 - https://www.acgme.org/Portals/0/Milestones%20Implementation%202020.pdf?ver=2020-05-20-152402-013

*Assessment Guidebook*, new 2020 - https://www.acgme.org/Portals/0/PDFs/Milestones/Guidebooks/AssessmentGuidebook.pdf?ver=2020-11-18-155141-527

*Milestones National Report*, updated each Fall - https://www.acgme.org/Portals/0/PDFs/Milestones/2019MilestonesNationalReportFinal.pdf?ver=2019-09-30-110837-587 (2019)

*Milestones Bibliography*, updated twice each year - https://www.acgme.org/Portals/0/PDFs/Milestones/MilestonesBibliography.pdf?ver=2020-08-19-153536-447

*Developing Faculty Competencies in Assessment* courses - https://www.acgme.org/Meetings-and-Educational-Activities/Other-Educational-Activities/Courses-and-Workshops/Developing-Faculty-Competencies-in-Assessment

Assessment Tool: Direct Observation of Clinical Care (DOCC) - https://dl.acgme.org/pages/assessment

Assessment Tool: Teamwork Effectiveness Assessment Module **(TEAM) -** https://dl.acgme.org/pages/assessment

Learn at ACGME has several courses on Assessment and Milestones - https://dl.acgme.org/